



Junos[®] OS for EX Series Ethernet Switches

Ethernet Switching Feature Guide for EX4600 Switches

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About the Documentation

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- Supported Platforms on page xiii
- Using the Examples in This Manual on page xiii
- Documentation Conventions on page xv
- Documentation Feedback on page xvii
- Requesting Technical Support on page xvii

Documentation and Release Notes

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Supported Platforms

For the features described in this document, the following platforms are supported:

- EX Series

Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

If the example configuration contains the top level of the hierarchy (or multiple hierarchies), the example is a *full example*. In this case, use the **load merge** command.

If the example configuration does not start at the top level of the hierarchy, the example is a *snippet*. In this case, use the **load merge relative** command. These procedures are described in the following sections.

Merging a Full Example

To merge a full example, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration example into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following configuration to a file and name the file **ex-script.conf**. Copy the **ex-script.conf** file to the **/var/tmp** directory on your routing platform.

```
system {
  scripts {
    commit {
      file ex-script.xml;
    }
  }
}
interfaces {
  fxp0 {
    disable;
    unit 0 {
      family inet {
        address 10.0.0.1/24;
      }
    }
  }
}
```

2. Merge the contents of the file into your routing platform configuration by issuing the **load merge** configuration mode command:

```
[edit]
user@host# load merge /var/tmp/ex-script.conf
load complete
```

Merging a Snippet

To merge a snippet, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration snippet into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following snippet to a file and name the file **ex-script-snippet.conf**. Copy the **ex-script-snippet.conf** file to the **/var/tmp** directory on your routing platform.

```
commit {
  file ex-script-snippet.xml; }
```

2. Move to the hierarchy level that is relevant for this snippet by issuing the following configuration mode command:

```
[edit]
user@host# edit system scripts
[edit system scripts]
```

3. Merge the contents of the file into your routing platform configuration by issuing the **load merge relative** configuration mode command:

```
[edit system scripts]
user@host# load merge relative /var/tmp/ex-script-snippet.conf
load complete
```

For more information about the **load** command, see [CLI Explorer](#).

Documentation Conventions

Table 1 on page xv defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xv defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the configure command: user@host> configure

Table 2: Text and Syntax Conventions (*continued*)

Convention	Description	Examples
Fixed-width text like this	Represents output that appears on the terminal screen.	<code>user@host> show chassis alarms</code> <code>No alarms currently active</code>
<i>Italic text like this</i>	<ul style="list-style-type: none"> Introduces or emphasizes important new terms. Identifies guide names. Identifies RFC and Internet draft titles. 	<ul style="list-style-type: none"> A policy <i>term</i> is a named structure that defines match conditions and actions. <i>Junos OS CLI User Guide</i> RFC 1997, <i>BGP Communities Attribute</i>
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# set system domain-name <i>domain-name</i>
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none"> To configure a stub area, include the stub statement at the [edit protocols ospf area area-id] hierarchy level. The console port is labeled CONSOLE.
< > (angle brackets)	Encloses optional keywords or variables.	stub <default-metric metric>;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	broadcast multicast (string1 string2 string3)
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	rsvp { # Required for dynamic MPLS only
[] (square brackets)	Encloses a variable for which you can substitute one or more values.	community name members [<i>community-ids</i>]
Indentation and braces ({ })	Identifies a level in the configuration hierarchy.	[edit] routing-options { static { route default { nexthop <i>address</i> ; retain; } } }
;(semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none"> In the Logical Interfaces box, select All Interfaces. To cancel the configuration, click Cancel.

Table 2: Text and Syntax Conventions (*continued*)

Convention	Description	Examples
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select Protocols>Ospf .

Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can provide feedback by using either of the following methods:

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- E-mail—Send your comments to techpubs-comments@juniper.net. Include the document or topic name, URL or page number, and software version (if applicable).

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or Partner Support Service support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at <http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf>.
- Product warranties—For product warranty information, visit <http://www.juniper.net/support/warranty/>.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: <http://www.juniper.net/customers/support/>
- Search for known bugs: <http://www2.juniper.net/kb/>
- Find product documentation: <http://www.juniper.net/techpubs/>
- Find solutions and answer questions using our Knowledge Base: <http://kb.juniper.net/>

- Download the latest versions of software and review release notes:
<http://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications:
<http://kb.juniper.net/InfoCenter/>
- Join and participate in the Juniper Networks Community Forum:
<http://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <http://www.juniper.net/cm/>

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: <https://tools.juniper.net/SerialNumberEntitlementSearch/>

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at <http://www.juniper.net/cm/>.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see <http://www.juniper.net/support/requesting-support.html>.

PART 1

Configuring Bridging and VLANs

- [Understanding Bridging and VLANs on page 3](#)
- [Configuring Bridging and VLANs on page 15](#)
- [Configuring Bridging and VLANs \(ELS CLI Only\) on page 33](#)
- [Troubleshooting Bridging and VLANs on page 51](#)

CHAPTER 1

Understanding Bridging and VLANs

- [Layer 2 Learning and Forwarding for VLANs Overview on page 3](#)
- [Understanding Bridging and VLANs on page 4](#)
- [Understanding Integrated Routing and Bridging on page 11](#)
- [Understanding MAC Learning on page 12](#)

Layer 2 Learning and Forwarding for VLANs Overview

When you configure a VLAN, Layer 2 address learning is enabled by default. The VLAN learns unicast media access control (MAC) addresses to avoid flooding the packets to all the ports in the VLAN. Each VLAN creates a source MAC entry in its source and destination MAC tables for each source MAC address learned from packets received on the ports that belong to the VLAN.



NOTE: Traffic is not flooded back onto the interface on which it was received. However, because this “split horizon” occurs at a late stage, the packet statistics displayed by commands such as `show interfaces queue` will include flood traffic.

You can optionally disable MAC learning either for the entire device or for a specific VLAN or logical interface. You can also configure the following Layer 2 learning and forwarding properties:

- Static MAC entries for logical interfaces only
- Limit to the number of MAC addresses learned from a specific logical interface or from all the logical interfaces in a VLAN
- Size of the MAC address table for the VLAN
- MAC accounting for a VLAN

Related Documentation

- [Layer 2 Learning and Forwarding Overview](#)

Understanding Bridging and VLANs

Network switches use Layer 2 bridging protocols to discover the topology of their LAN and to forward traffic toward destinations on the LAN. This topic explains the following concepts regarding bridging and VLANs:

- [History of VLANs on page 4](#)
- [How Bridging of VLAN Traffic Works on page 4](#)
- [Packets Are Either Tagged or Untagged on page 6](#)
- [Switch Interface Modes—Access, Trunk, or Tagged Access on page 6](#)
- [Additional Advantages of Using VLANs on page 8](#)
- [Maximum VLANs and VLAN Members Per Switch on page 9](#)
- [A Default VLAN Is Configured on Most Switches on page 9](#)
- [Assigning Traffic to VLANs on page 10](#)
- [Forwarding VLAN Traffic on page 10](#)
- [VLANs Communicate with Integrated Routing and Bridging Interfaces or Routed VLAN Interfaces on page 11](#)

History of VLANs

Ethernet LANs were originally designed for small, simple networks that primarily carried text. However, over time, the type of data carried by LANs grew to include voice, graphics, and video. This more complex data, when combined with the ever-increasing speed of transmission, eventually became too much of a load for the original Ethernet LAN design. Multiple packet collisions were significantly slowing down the larger LANs.

The IEEE 802.1D-2004 standard helped evolve Ethernet LANs to cope with the higher data and transmission requirements by defining the concept of *transparent bridging* (generally called simply *bridging*). Bridging divides a single physical LAN (now called a single *broadcast domain*) into two or more virtual LANs, or VLANs. Each VLAN is a collection of some of the LAN nodes grouped together to form individual broadcast domains.

When VLANs are grouped logically by function or organization, a significant percentage of data traffic stays within the VLAN. This relieves the load on the LAN because all traffic no longer has to be forwarded to all nodes on the LAN. A VLAN first transmits packets within the VLAN, thereby reducing the number of packets transmitted on the entire LAN. Because packets whose origin and destination are in the same VLAN are forwarded only within the local VLAN, packets that are not destined for the local VLAN are the only ones forwarded to other broadcast domains. This way, bridging and VLANs limit the amount of traffic flowing across the entire LAN by reducing the possible number of collisions and packet retransmissions within VLANs and on the LAN as a whole.

How Bridging of VLAN Traffic Works

Because the objective of the IEEE 802.1D-2004 standard was to reduce traffic and therefore reduce potential transmission collisions for Ethernet, a system was implemented

to reuse information. Instead of having a switch go through a location process every time a frame is sent to a node, the transparent bridging protocol allows a switch to record the location of known nodes. When packets are sent to nodes, those destination node locations are stored in address-lookup tables called *Ethernet switching tables*. Before sending a packet, a switch using bridging first consults the switching tables to see if that node has already been located. If the location of a node is known, the frame is sent directly to that node.

Transparent bridging uses five mechanisms to create and maintain Ethernet switching tables on the switch:

- Learning
- Forwarding
- Flooding
- Filtering
- Aging

The key bridging mechanism used by LANs and VLANs is *learning*. When a switch is first connected to an Ethernet LAN or VLAN, it has no information about other nodes on the network. As packets are sent, the switch learns the embedded MAC addresses of the sending nodes and stores them in the Ethernet switching table, along with two other pieces of information—the interface (or port) on which the traffic was received on the destination node and the time the address was learned.

Learning allows switches to then do *forwarding*. By consulting the Ethernet switching table to see whether the table already contains the frame's destination MAC address, switches save time and resources when forwarding packets to the known MAC addresses. If the Ethernet switching table does not contain an entry for an address, the switch uses flooding to learn that address.

Flooding finds a particular destination MAC address without using the Ethernet switching table. When traffic originates on the switch and the Ethernet switching table does not yet contain the destination MAC address, the switch first floods the traffic to all other interfaces within the VLAN. When the destination node receives the flooded traffic, it can send an acknowledgment packet back to the switch, allowing it to learn the MAC address of the node and add the address to its Ethernet switching table.

Filtering, the fourth bridging mechanism, is how broadcast traffic is limited to the local VLAN whenever possible. As the number of entries in the Ethernet switching table grows, the switch pieces together an increasingly complete picture of the VLAN and the larger LAN—it learns which nodes are in the local VLAN and which are on other network segments. The switch uses this information to filter traffic. Specifically, for traffic whose source and destination MAC addresses are in the local VLAN, filtering prevents the switch from forwarding this traffic to other network segments.

To keep entries in the Ethernet switching table current, the switch uses a fifth bridging mechanism, *aging*. Aging is the reason that the Ethernet switching table entries include timestamps. Each time the switch detects traffic from a MAC address, it updates the timestamp. A timer on the switch periodically checks the timestamp, and if it is older

than a user-configured value, the switch removes the node's MAC address from the Ethernet switching table. This aging process eventually flushes unavailable network nodes out of the Ethernet switching table.

Packets Are Either Tagged or Untagged

When an Ethernet LAN is divided into VLANs, each VLAN is identified by a unique 802.1Q ID. The number of available VLANs and VLAN IDs are listed below:

- On a switch running ELS software, you can configure 4093 VLANs.
- On a switch running non-ELS software, you can configure 4091 VLANs.

Ethernet packets include a tag protocol identifier (TPID) EtherType field, which identifies the protocol being transported. When a device within a VLAN generates a packet, this field includes a value of 0x8100, which indicates that the packet is a VLAN-tagged packet. The packet also has a VLAN ID field that includes the unique 802.1Q ID, which identifies the VLAN to which the packet belongs.

Junos OS switches support the TPID value 0x9100 for Q-in-Q, and switches that run Junos OS that does not support the Enhanced Layer 2 Software (ELS) configuration style also support values of 0x88a8 (Provider Bridging and Shortest Path Bridging).

For a simple network that has only a single VLAN, all packets include a default 802.1Q tag, which is the only VLAN membership that does not mark the packet as tagged. These packets are untagged packets.

Switch Interface Modes—Access, Trunk, or Tagged Access

Ports, or interfaces, on a switch operate in one of three modes:

- Access mode
- Trunk mode
- Tagged-access mode

Access Mode

An interface in access mode connects a switch to a single network device, such as a desktop computer, an IP telephone, a printer, a file server, or a security camera. Access interfaces accept only untagged packets.

By default, when you boot a switch that runs Junos OS that does not support ELS and use the factory default configuration, or when you boot such a switch and do not explicitly configure a port mode, all interfaces on the switch are in access mode and accept only untagged packets from the VLAN named **default**. You can optionally configure another VLAN and use that VLAN instead of **default**.

On a switch that runs Junos OS that supports ELS, the VLAN named **default** is not supported. Therefore, on such switches, you must explicitly configure at least one VLAN, even if your network is simple and you want only one broadcast domain to exist. After you assign an interface to a VLAN, the interface functions in access mode.

For switches that run either type of software, you can also configure a trunk port or interface to accept untagged packets from a user-configured VLAN. For details about this concept (native VLAN), see [“Trunk Mode and Native VLAN” on page 7](#).

Trunk Mode

Trunk mode interfaces are generally used to connect switches to one another. Traffic sent between switches can then consist of packets from multiple VLANs, with those packets multiplexed so that they can be sent over the same physical connection. Trunk interfaces usually accept only tagged packets and use the VLAN ID tag to determine both the packets' VLAN origin and VLAN destination.

On a switch that runs software that does not support ELS, an untagged packet is not recognized on a trunk port unless you configure additional settings on that port.

On a switch that runs Junos OS that supports ELS, a trunk port recognizes untagged control packets for protocols such as the Link Aggregation Control Protocol (LACP) and the Link Layer Discovery Protocol (LLDP). However, the trunk port does not recognize untagged data packets unless you configure additional settings on that port.

In the rare case where you want untagged packets to be recognized by a trunk port on switches that run either type of software, you must configure the single VLAN on a trunk port as a *native VLAN*. For more information about native VLANs, see [“Trunk Mode and Native VLAN” on page 7](#).

Trunk Mode and Native VLAN

On a switch that runs Junos OS that does not support ELS, a trunk port does not recognize packets that do not include VLAN tags, which are also known as untagged packets. On a switch that runs Junos OS that supports ELS, a trunk port recognizes untagged control packets, but it does not recognize untagged data packets. With native VLAN configured, untagged packets that a trunk port normally does not recognize are sent over the trunk interface. In a situation where packets pass from a device, such as an IP phone or printer, to a switch in access mode, and you want those packets sent from the switch over a trunk port, use native VLAN mode. Create a native VLAN by configuring a VLAN ID for it, and specify that the trunk port is a member of the native VLAN.

The switch's trunk port will then treat those packets differently than the other tagged packets. For example, if a trunk port has three VLANs, 10, 20, and 30, assigned to it with VLAN 10 being the native VLAN, packets on VLAN 10 that leave the trunk port on the other end have no 802.1Q header (tag).

There is another native VLAN option for switches that do not support ELS. You can have the switch add and remove tags for untagged packets. To do this, you first configure the single VLAN as a native VLAN on a port attached to a device on the edge. Then, assign a VLAN ID tag to the single native VLAN on the port connected to a device. Last, add the VLAN ID to the trunk port. Now, when the switch receives the untagged packet, it adds the ID you specified and sends and receives the tagged packets on the trunk port configured to accept that VLAN.

Tagged-Access Mode

Only switches that run Junos OS that does not use the ELS configuration style support tagged-access mode. Tagged-access mode accommodates cloud computing, specifically scenarios including virtual machines or virtual computers. Because several virtual computers can be included on one physical server, the packets generated by one server can contain an aggregation of VLAN packets from different virtual machines on that server. To accommodate this situation, tagged-access mode reflects packets back to the physical server on the same downstream port when the destination address of the packet was learned on that downstream port. Packets are also reflected back to the physical server on the downstream port when the destination has not yet been learned. Therefore, the third interface mode, tagged access, has some characteristics of access mode and some characteristics of trunk mode:

- Like access mode, tagged-access mode connects the switch to an access layer device. Unlike access mode, tagged-access mode is capable of accepting VLAN tagged packets.
- Like trunk mode, tagged-access mode accepts VLAN tagged packets from multiple VLANs. Unlike trunk port interfaces, which are connected at the core/distribution layer, tagged-access port interfaces connect devices at the access layer.

Like trunk mode, tagged-access mode also supports native VLAN.



NOTE: Control packets are never reflected back on the downstream port.

Additional Advantages of Using VLANs

In addition to reducing traffic and thereby speeding up the network, VLANs have the following advantages:

- VLANs provide segmentation services traditionally provided by routers in LAN configurations, thereby reducing hardware equipment costs.
- Packets coupled to a VLAN can be reliably identified and sorted into different domains. You can contain broadcasts within parts of the network, thereby freeing up network resources. For example, when a DHCP server is plugged into a switch and starts broadcasting its presence, you can prevent some hosts from accessing it by using VLANs to split up the network.
- For security issues, VLANs provide granular control of the network because each VLAN is identified by a single IP subnetwork. All packets passing in and out of a VLAN are consistently tagged with the VLAN ID of that VLAN, thereby providing easy identification, because a VLAN ID on a packet cannot be altered. (For a switch that runs Junos OS that does not support ELS, we recommend that you avoid using 1 as a VLAN ID, because that ID is a default value.)
- VLANs react quickly to host relocation—this is also due to the persistent VLAN tag on packets.
- On an Ethernet LAN, all network nodes must be physically connected to the same network. In VLANs, the physical location of nodes is not important—you can group

network devices in any way that makes sense for your organization, such as by department or business function, types of network nodes, or physical location.

Maximum VLANs and VLAN Members Per Switch

The number of VLANs supported per switch varies for each switch. Use the configuration-mode command **set vlans *vlan-name* *vlan-id* ?** to determine the maximum number of VLANs allowed on a switch. You cannot exceed this VLAN limit because you have to assign a specific ID number when you create a VLAN—you could overwrite one of the numbers, but you cannot exceed the limit.

You can, however, exceed the recommended VLAN member maximum for a switch.

On a switch that runs Junos OS that does not support the ELS configuration style, the maximum number of VLAN members allowed on the switch is eight times the maximum number of VLANs that the switch supports ($\text{vmember limit} = \text{vlan max} * 8$). If the configuration of the switch exceeds the recommended VLAN member maximum, a warning message appears when you commit the configuration. If you commit the configuration despite the warning, the commit succeeds, but there is a risk of the Ethernet switching process (eswd) failing as a result of memory allocation failure.

On a switch that runs Junos OS that supports ELS, the maximum number of VLAN members allowed on the switch is 24 times the maximum number of VLANs that the switch supports ($\text{vmember limit} = \text{vlan max} * 24$). If the configuration of the switch exceeds the recommended VLAN member maximum, a warning message appears in the system log (syslog).

A QFabric system supports up to 131,008 VLAN members (vmembers) on a single network node group, server node group, or redundant server node group. The number of vmembers is calculated by multiplying the maximum number of VLANs by 32.

For example, to calculate how many interfaces are required to support 4,000 VLANs, divide the maximum number of vmembers (128,000) by the number of configured VLANs (4,000). In this case, 32 interfaces are required.

On network Node groups and server Node groups, you can configure link aggregation groups (LAGs) across multiple interfaces. Each LAG and VLAN combination is considered a vmember.

A Virtual Chassis Fabric supports up to 512,000 vmembers. The number of vmembers is based on the number of VLANs, and the number of interfaces configured in each VLAN.

A Default VLAN Is Configured on Most Switches

Some switches that run Junos OS that do not support the ELS configuration style are preconfigured with a VLAN named **default** that does not tag packets and operates only with untagged packets. On these switches, each interface already belongs to the VLAN named **default** and all traffic uses this VLAN until you configure more VLANs and assign traffic to those VLANs.



NOTE: When a Juniper Networks QFX3500 or QFX3600 switch is interconnected with other switches in a Virtual Chassis configuration, each individual switch that is included as a member of the configuration is identified with a member ID. The member ID functions as an FPC slot number. When you are configuring interfaces for a Virtual Chassis configuration, you specify the appropriate member ID (0 through 9) as the slot element of the interface name. The default factory settings for a Virtual Chassis configuration include FPC 0 as a member of the default VLAN because FPC 0 is configured as part of the ethernet-switching family. In order to include FPC 1 through FPC 9 in the default VLAN, add the ethernet-switching family to the configurations for those interfaces.

Assigning Traffic to VLANs

You can assign traffic on any switch to a particular VLAN by referencing either the interface port of the traffic or the MAC addresses of devices sending traffic.



NOTE: Two logical interfaces that are configured on the same physical interface cannot be mapped to the same VLAN.

Assign VLAN Traffic According to the Interface Port Source

This method is most commonly used to assign traffic to VLANs. In this case, you specify that all traffic received on a particular switch interface is assigned to a specific VLAN. You configure this VLAN assignment when you configure the switch, by using either the VLAN number (called a VLAN ID) or by using the VLAN name, which the switch then translates into a numeric VLAN ID. This method is referred to simply as creating a VLAN because it is the most commonly used method.

Assign VLAN Traffic According to the Source MAC Address

In this case, all traffic received from a specific MAC address is forwarded to a specific egress interface (next hop) on the switch. MAC-based VLANs are either static (named MAC addresses configured one at a time) or dynamic (configured using a RADIUS server).

To configure a static MAC-based VLAN on a switch that supports ELS, see *Adding a Static MAC Address Entry to the Ethernet Switching Table (CLI Procedure)*. To configure a static MAC-based VLAN on a switch that does not support ELS, see *Adding a Static MAC Address Entry to the Ethernet Switching Table (CLI Procedure)*.

Forwarding VLAN Traffic

To pass traffic within a VLAN, the switch uses Layer 2 forwarding protocols, including IEEE 802.1Q spanning-tree protocols.

To pass traffic between two VLANs, the switch uses standard Layer 3 routing protocols, such as static routing, OSPF, and RIP. The same interfaces that support Layer 2 bridging protocols also support Layer 3 routing protocols, providing multilayer switching.

To pass traffic from a single device on an access port to a switch and then pass those packets on a trunk port, use the native mode configuration previously discussed under [“Trunk Mode” on page 7](#).

VLANs Communicate with Integrated Routing and Bridging Interfaces or Routed VLAN Interfaces

Traditionally, switches sent traffic to hosts that were part of the same broadcast domain (VLAN) but routers were needed to route traffic from one broadcast domain to another. Also, only routers performed other Layer 3 functions such as traffic engineering.

Switches that run Junos OS that supports the ELS configuration style perform inter-VLAN routing functions using an integrated routing and bridging (IRB) interface named `irb`, while switches that run Junos OS that does not support ELS perform these functions using a routed VLAN interface (RVI) named `vlan`. These interfaces detect both MAC addresses and IP addresses and route data to Layer 3 interfaces, thereby frequently eliminating the need to have both a switch and a router.

Related Documentation

- *Example: Setting Up Basic Bridging and a VLAN on the QFX Series*
- *Example: Setting Up Bridging with Multiple VLANs*
- *Understanding FCoE*
- *Interfaces Overview*

Understanding Integrated Routing and Bridging

To segment traffic on a LAN into separate broadcast domains, you create separate virtual LANs (VLANs). VLANs limit the amount of traffic flowing across the entire LAN, reducing the possible number of collisions and packet retransmissions within the LAN. For example, you might want to create a VLAN that includes the employees in a department and the resources that they use often, such as printers, servers, and so on.

Of course, you also want to allow these employees to communicate with people and resources in other VLANs. To forward packets between VLANs, you normally you need a router that connects the VLANs. However, you can accomplish this forwarding on a switch without using a router by configuring an integrated routing and bridging (IRB) interface. (These interfaces are also called routed VLAN interfaces, or RVIs). Using this approach reduces complexity and avoids the costs associated with purchasing, installing, managing, powering, and cooling another device.

An IRB is a special type of Layer 3 virtual interface named `vlan`. Like normal Layer 3 interfaces, the `vlan` interface needs a logical unit number with an IP address. In fact, to be useful an IRB needs at least two logical units and two IP addresses—you must create units with addresses in each of the subnets associated with the VLANs between which you want traffic to be routed. That is, if you have two VLANs (for example, VLAN **red** and VLAN **blue**) with corresponding subnets, your IRB must have a logical unit with an address in the subnet for **red** and a logical unit with an address in the subnet for **blue**. The switch automatically creates direct routes to these subnets and uses these routes to forward traffic between VLANs.



NOTE: If you are using a version of Junos OS that supports Enhanced Layer 2 Software (ELS), you can also create a Layer 3 virtual interface named `irb` instead of `vlan`—that is, both statements are supported by ELS

Table 3 on page 12 shows values you might use when configuring an IRB:

Table 3: Sample IRB Values

Property	Settings
VLAN names and tags (IDs)	blue, ID 100 red, ID 200
Subnets associated with VLANs	blue: 192.0.2.0/25 (addresses 192.0.2.1 through 192.0.2.126) red: 192.0.2.128/25 (addresses 192.0.2.129 through 192.0.2.254)
IRB name	interface <code>irb</code>
IRB units and addresses	logical unit 100: 192.0.2.1/25 logical unit 200: 192.0.2.129/25

For the sake of consistency and to avoid confusion, Table 3 on page 12 shows IRB logical unit numbers that match the IDs of the corresponding VLANs. However, you do not have to assign logical unit numbers that match the VLAN IDs—you can use any values for the units. To bind the logical units of the IRB to the appropriate VLANs, you use the `l3-interface` statement.

Because IRBs operate at Layer 3, you can use Layer 3 services such as firewall filters or CoS rewriting with them.

Table 4 on page 12 shows the number of IRBs/RVIs that each QFX platform supports.

Table 4: Number of Supported IRBs/RVIs by Platform

Platform	Number of Supported IRBs/RVIs
QFX3500	1200
QFX3000-G	1024
QFX3000-M	1024

Related Documentation • [Example: Configuring Routing Between VLANs on One Switch on page 24](#)

Understanding MAC Learning

MAC learning is the process of obtaining the MAC addresses of all the nodes on a network.

When a node is first connected to an Ethernet LAN or VLAN, it has no information about the other nodes on the network. As data is sent through the network, data packets include a data frame listing their source and destination MAC addresses. The data frame is forwarded to a target port, which is connected to the second device. The MAC address is learned locally at the target port, which facilitates communications for frames that later enter the target port and contain addresses previously learned from a received frame.

By default, MAC learning is enabled on the QFX Series.

**Related
Documentation**

- [Introduction to the Media Access Control \(MAC\) Layer 2 Sublayer on page 55](#)
- [Overview of Layer 2 Networking on page 56](#)

CHAPTER 2

Configuring Bridging and VLANs

- [Configuring Static ARP Entries on page 15](#)
- [Example: Connecting an Access Switch to a Distribution Switch on page 15](#)
- [Example: Configuring Routing Between VLANs on One Switch on page 24](#)
- [Verifying That MAC Notification Is Working Properly on page 30](#)
- [Verifying That a Series of Tagged VLANs Has Been Created on page 30](#)

Configuring Static ARP Entries

You can create static ARP table entries, which are explicit mappings between IP addresses and MAC addresses.

- To configure a static ARP entry:

```
[edit interfaces interface-name unit logical-unit-number family inet address address]  
user@switch# set arp ip-address (mac | multicast-mac) mac-address
```

The IP address that you specify must be part of the subnet defined in the enclosing **address** statement.

To associate a multicast MAC address with a unicast IP address, use the **multicast-mac** statement.

Specify the MAC address as 6 hexadecimal bytes in one of the following formats:
nnnnn.nnnnn.nnnnn or *nn:nn:nn:nn:nn:nn*; for example, 0011.2233.4455 or 00:11:22:33:44:55.

Related Documentation

- [Understanding Static ARP Entries](#)
- [arp](#)

Example: Connecting an Access Switch to a Distribution Switch

In large local area networks (LANs), you commonly need to aggregate traffic from a number of access switches into a distribution switch.

This example describes how to connect an access switch to a distribution switch:

- [Requirements on page 16](#)
- [Overview and Topology on page 16](#)
- [Configuring the Access Switch on page 17](#)
- [Configuring the Distribution Switch on page 21](#)
- [Verification on page 22](#)

Requirements

This example uses the following hardware and software components:

- For the distribution switch, one EX 4200-24F switch. This model is designed to be used as a distribution switch for aggregation or collapsed core network topologies and in space-constrained data centers. It has twenty-four 1-Gigabit Ethernet fiber SFP ports and an EX-UM-2XFP uplink module with two 10-Gigabit Ethernet XFP ports.
- For the access switch, one EX 3200-24P, which has twenty-four 1-Gigabit Ethernet ports, all of which support Power over Ethernet (PoE), and an uplink module with four 1-Gigabit Ethernet ports.
- Junos OS Release 11.1 or later for the QFX Series

Overview and Topology

In a large office that is spread across several floors or buildings, or in a data center, you commonly aggregate traffic from a number of access switches into a distribution switch. This configuration example shows a simple topology to illustrate how to connect a single access switch to a distribution switch.

In the topology, the LAN is segmented into two VLANs, one for the sales department and the second for the support team. One 1-Gigabit Ethernet port on the access switch's uplink module connects to the distribution switch, to one 1-Gigabit Ethernet port on the distribution switch.

[Table 5 on page 16](#) explains the components of the example topology. The example shows how to configure one of the three access switches. The other access switches could be configured in the same manner.

Table 5: Components of the Topology for Connecting an Access Switch to a Distribution Switch

Property	Settings
Access switch hardware	EX 3200-24P, 24 1-Gigabit Ethernet ports, all PoE-enabled (ge-0/0/0 through ge-0/0/23); one 4-port 1-Gigabit Ethernet uplink module (EX-UM-4SFP)
Distribution switch hardware	EX 4200-24F, 24 1-Gigabit Ethernet fiber SPF ports (ge-0/0/0 through ge-0/0/23); one 2-port 10-Gigabit Ethernet XFP uplink module (EX-UM-4SFP)
VLAN names and tag IDs	sales , tag 100 support , tag 200
VLAN subnets	sales : 192.0.2.0/25 (addresses 192.0.2.1 through 192.0.2.126) support : 192.0.2.128/25 (addresses 192.0.2.129 through 192.0.2.254)

Table 5: Components of the Topology for Connecting an Access Switch to a Distribution Switch (*continued*)

Trunk port interfaces	On the access switch: ge-0/1/0 On the distribution switch: ge-0/0/0
Access port interfaces in VLAN sales (on access switch)	Avaya IP telephones: ge-0/0/3 through ge-0/0/19 Wireless access points: ge-0/0/0 and ge-0/0/1 Printers: ge-0/0/22 and ge-0/0/23 File servers: ge-0/0/20 and ge-0/0/21
Access port interfaces in VLAN support (on access switch)	Avaya IP telephones: ge-0/0/25 through ge-0/0/43 Wireless access points: ge-0/0/24 Printers: ge-0/0/44 and ge-0/0/45 File servers: ge-0/0/46 and ge-0/0/47
Unused interfaces on access switch	ge-0/0/2 and ge-0/0/25

Configuring the Access Switch

To configure the access switch:

CLI Quick Configuration

To quickly configure the access switch, copy the following commands and paste them into the switch terminal window:

```
[edit]
set interfaces ge-0/0/0 unit 0 description "Sales Wireless access point port"
set interfaces ge-0/0/0 unit 0 family ethernet-switching vlan members sales
set interfaces ge-0/0/3 unit 0 description "Sales phone port"
set interfaces ge-0/0/3 unit 0 family ethernet-switching vlan members sales
set interfaces ge-0/0/22 unit 0 description "Sales printer port"
set interfaces ge-0/0/22 unit 0 family ethernet-switching vlan members sales
set interfaces ge-0/0/20 unit 0 description "Sales file server port"
set interfaces ge-0/0/20 unit 0 family ethernet-switching vlan members sales
set interfaces ge-0/0/24 unit 0 description "Support wireless access point port"
set interfaces ge-0/0/24 unit 0 family ethernet-switching vlan members support
set interfaces ge-0/0/26 unit 0 description "Support phone port"
set interfaces ge-0/0/26 unit 0 family ethernet-switching vlan members support
set interfaces ge-0/0/44 unit 0 description "Support printer port"
set interfaces ge-0/0/44 unit 0 family ethernet-switching vlan members support
set interfaces ge-0/0/46 unit 0 description "Support file server port"
set interfaces ge-0/0/46 unit 0 family ethernet-switching vlan members support
set interfaces ge-0/1/0 unit 0 description "Uplink module port connection to distribution switch"
set interfaces ge-0/1/0 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/1/0 unit 0 family ethernet-switching native-vlan-id 1
set interfaces ge-0/1/0 unit 0 family ethernet-switching vlan members [sales support]
set interfaces vlan unit 0 family inet address 192.0.2.1/25
set interfaces vlan unit 1 family inet address 192.0.2.129/25
set vlans sales interface ge-0/0/0.0
set vlans sales interface ge-0/0/3.0
set vlans sales interface ge-0/0/22.0
set vlans sales interface ge-0/0/20.0
set vlans sales l3-interface vlan.0
set vlans sales vlan-id 100
set vlans sales vlan-description "Sales VLAN"
set vlans support interface ge-0/0/24.0
set vlans support interface ge-0/0/26.0
set vlans support interface ge-0/0/44.0
set vlans support interface ge-0/0/46.0
set vlans support vlan-id 200
```

	<pre> set vlans support l3-interface vlan.1 set vlans support vlan-description "Support VLAN" </pre>
Step-by-Step Procedure	<p>To configure the access switch:</p> <ol style="list-style-type: none"> 1. Configure the 1-Gigabit Ethernet interface on the uplink module to be the trunk port that connects to the distribution switch: <pre> [edit interfaces ge-0/1/0 unit 0]user@access-switch# setdescription "Uplink module port connection to distribution switch" user@access-switch# set ethernet-switching port-mode trunk </pre> 2. Specify the VLANs to be aggregated on the trunk port: <pre> [edit interfaces ge-0/1/0 unit 0]user@access-switch# set ethernet-switching vlanmembers [sales support] </pre> 3. Configure the VLAN ID to use for packets that are received with no dot1q tag (untagged packets): <pre> [edit interfaces ge-0/1/0 unit 0]user@access-switch# set ethernet-switching native-vlan-id 1 </pre> 4. Configure the sales VLAN: <pre> [edit vlans sales]user@access-switch# set vlan-description "Sales VLAN" user@access-switch# set vlan-id (VLANs) 100 user@access-switch# set l3-interface (VLAN) vlan.0 </pre> 5. Configure the support VLAN: <pre> [edit vlans support]user@access-switch# set vlan-description "Support VLAN" user@access-switch# set vlan-id (VLANs) 200 user@access-switch# set l3-interface (VLAN) vlan.1 </pre> 6. Create the subnet for the sales broadcast domain: <pre> [edit interfaces]user@access-switch# set vlan unit 0 family inet address 192.0.2.1/25 </pre> 7. Create the subnet for the support broadcast domain: <pre> [edit interfaces]user@access-switch# set vlan unit 1 family inet address 192.0.2.129/25 </pre> 8. Configure the interfaces in the sales VLAN: <pre> [edit interfaces]user@access-switch# set ge-0/0/0 unit 0 description "Sales wireless access point port" user@access-switch# set ge-0/0/0 unit 0 family ethernet-switching vlan members sales user@access-switch# set ge-0/0/3 unit 0 description "Sales phone port" user@access-switch# set ge-0/0/3 unit 0 family ethernet-switching vlan members sales user@access-switch# set ge-0/0/20 unit 0 description "Sales file server port" user@access-switch# set ge-0/0/20 unit 0 family ethernet-switching vlan members sales user@access-switch# set ge-0/0/22 unit 0 description "Sales printer port" user@access-switch# set ge-0/0/22 unit 0 family ethernet-switching vlan members sales </pre> 9. Configure the interfaces in the support VLAN: <pre> [edit interfaces]user@access-switch# set ge-0/0/24 unit 0 description "Support wireless access point port" user@access-switch# set ge-0/0/24 unit 0 family ethernet-switching vlan members support user@access-switch# set ge-0/0/26 unit 0 description "Support phone port" user@access-switch# set ge-0/0/26 unit 0 family ethernet-switching vlan members support user@access-switch# set ge-0/0/44 unit 0 description "Support printer port" user@access-switch# set ge-0/0/44 unit 0 family ethernet-switching vlan members support user@access-switch# set ge-0/0/46 unit 0 description "Support file server port" user@access-switch# set ge-0/0/46 unit 0 family ethernet-switching vlan members support </pre> 10. Configure descriptions and VLAN tag IDs for the sales and support VLANs:

- ```
[edit vlans]user@access-switch# set sales vlan-description "Sales
VLAN"
user@access-switch# set sales vlan-id 100
user@access-switch# set support
vlan-description "Support VLAN"
user@access-switch# set support vlan-id 200
```
11. To route traffic between the sales and support VLANs and associate a Layer 3 interface with each VLAN:
- ```
[edit vlans]user@access-switch# set sales l3-interface vlan.0
user@access-switch# set support l3-interface vlan.1
```

Results Display the results of the configuration:

```
user@access-switch> show
interfaces {
  ge-0/0/0 {
    unit 0 {
      description "Sales wireless access point port";
      family ethernet-switching {
        vlan members sales;
      }
    }
  }
  ge-0/0/3 {
    unit 0 {
      description "Sales phone port";
      family ethernet-switching {
        vlan members sales;
      }
    }
  }
  ge-0/0/20 {
    unit 0 {
      description "Sales file server port";
      family ethernet-switching {
        vlan members sales;
      }
    }
  }
  ge-0/0/22 {
    unit 0 {
      description "Sales printer port";
      family ethernet-switching {
        vlan members sales;
      }
    }
  }
  ge-0/0/24 {
    unit 0 {
      description "Support wireless access point port";
      family ethernet-switching {
        vlan members support;
      }
    }
  }
  ge-0/0/26 {
    unit 0 {
      description "Support phone port";
```

```
        family ethernet-switching {
            vlan members support;
        }
    }
}
ge-0/0/44 {
    unit 0 {
        description "Support printer port";
        family ethernet-switching {
            vlan members sales;
        }
    }
}
ge-0/0/46 {
    unit 0 {
        description "Support file server port";
        family ethernet-switching {
            vlan members support;
        }
    }
}
ge-0/1/0 {
    unit 0 {
        description "Uplink module port connection to distribution switch";
        family ethernet-switching {
            port-mode trunk;
            vlan members [ sales support ];
            native-vlan-id 1;
        }
    }
}
vlan {
    unit 0 {
        family inet address 192.0.2.1/25;
    }
    unit 1 {
        family inet address 192.0.2.129/25;
    }
}
vpls {
    sales {
        vlan-id 100;
        vlan-description "Sales VLAN";
        l3-interface vlan.0;
    }
    support {
        vlan-id 200;
        vlan-description "Support VLAN";
        l3-interface vlan.1;
    }
}
```



TIP: To quickly configure the distribution switch, issue the load merge terminal command, then copy the hierarchy and paste it into the switch terminal window.

Configuring the Distribution Switch

To configure the distribution switch:

CLI Quick Configuration

To quickly configure the distribution switch, copy the following commands and paste them into the switch terminal window:

```
set interfaces ge-0/0/0 description "Connection to access switch"
set interfaces ge-0/0/0 ethernet-switching port-mode trunk
set interfaces ge-0/0/0 ethernet-switching vlan members [ sales support ]
set interfaces ge-0/0/0 ethernet-switching native-vlan-id 1
set interfaces vlan unit 0 family inet address 192.0.2.2/25
set interfaces vlan unit 1 family inet address 192.0.2.130/25
set vlans sales vlan-description "Sales VLAN"
set vlans sales vlan-id 100
set vlans sales l3-interface vlan.0
set vlans support vlan-description "Support VLAN"
set vlans support vlan-id 200
set vlans support l3-interface vlan.1
```

Step-by-Step Procedure

To configure the distribution switch:

1. Configure the interface on the switch to be the trunk port that connects to the access switch:

```
[edit interfaces ge-0/0/0 unit 0]user@distribution-switch# set description "Connection to access switch"
user@distribution-switch# set ethernet-switching port-mode trunk
```
2. Specify the VLANs to be aggregated on the trunk port:

```
[edit interfaces ge-0/0/0 unit 0]user@distribution-switch# set ethernet-switching vlan-members [ sales support ]
```
3. Configure the VLAN ID to use for packets that are received with no dot1q tag (untagged packets):

```
[edit interfaces]user@distribution-switch# set ge-0/0/0 ethernet-switching native-vlan-id 1
```
4. Configure the sales VLAN:

```
[edit vlans sales]user@distribution-switch# set vlan-description "Sales VLAN"
user@distribution-switch# set vlan-id (VLANs) 100
user@distribution-switch# set l3-interface (VLAN) vlan.0
```
5. Configure the support VLAN:

```
[edit vlans support]user@distribution-switch# set vlan-description "Support VLAN"
user@distribution-switch# set vlan-id (VLANs) 200
user@distribution-switch# set l3-interface (VLAN) vlan.1
```
6. Create the subnet for the sales broadcast domain:

```
[edit interfaces]user@distribution-switch# set vlan unit 0 family inet address 192.0.2.2/25
```
7. Create the subnet for the support broadcast domain:

```
[edit interfaces] user@distribution-switch# set vlan unit 1 family inet address
192.0.2.130/25
```

Results Display the results of the configuration:

```
user@distribution-switch> show
interfaces {
  ge-0/0/0 {
    description "Connection to access switch";
    unit 0 {
      family ethernet-switching {
        port-mode trunk;
        vlan members [ sales support ];
        native-vlan-id 1;
      }
    }
  }
  vlan {
    unit 0 {
      family inet address 192.0.2.2/25;
    }
    unit 1 {
      family inet address 192.0.2.130/25;
    }
  }
}
vlangs {
  sales {
    vlan-id 100;
    vlan-description "Sales VLAN";
    l3-interface vlan.0;
  }
  support {
    vlan-id 200;
    vlan-description "Support VLAN";
    l3-interface vlan.1;
  }
}
```



TIP: To quickly configure the distribution switch, issue the **load merge terminal** command, then copy the hierarchy and paste it into the switch terminal window.

Verification

To confirm that the configuration is working properly, perform these tasks:

- [Verifying the VLAN Members and Interfaces on the Access Switch on page 23](#)
- [Verifying the VLAN Members and Interfaces on the Distribution Switch on page 23](#)

Verifying the VLAN Members and Interfaces on the Access Switch

Purpose Verify that the **sales** and **support** have been created on the switch.

Action List all VLANs configured on the switch:

```
user@switch> show vlans
```

Name	Tag	Interfaces
default		ge-0/0/1.0, ge-0/0/2.0, ge-0/0/4.0, ge-0/0/5.0, ge-0/0/6.0, ge-0/0/7.0, ge-0/0/8.0*, ge-0/0/9.0, ge-0/0/10.0, ge-0/0/11.0*, ge-0/0/12.0, ge-0/0/13.0, ge-0/0/14.0, ge-0/0/15.0, ge-0/0/16.0, ge-0/0/17.0, ge-0/0/18.0, ge-0/0/19.0*, ge-0/0/21.0, ge-0/0/23.0, ge-0/0/25.0, ge-0/0/27.0*, ge-0/0/28.0, ge-0/0/29.0, ge-0/0/30.0, ge-0/0/31.0*, ge-0/0/32.0, ge-0/0/33.0, ge-0/0/34.0, ge-0/0/35.0*, ge-0/0/36.0, ge-0/0/37.0, ge-0/0/38.0, ge-0/0/39.0*, ge-0/0/40.0, ge-0/0/41.0, ge-0/0/42.0, ge-0/0/43.0*, ge-0/0/45.0, ge-0/0/47.0, ge-0/1/1.0*, ge-0/1/2.0*, ge-0/1/3.0*
sales	100	ge-0/0/0.0*, ge-0/0/3.0, ge-0/0/20.0, ge-0/0/22.0, ge-0/1/0.0*,
support	200	ge-0/0/24.0*, ge-0/0/26.0, ge-0/0/44.0, ge-0/0/46.0,
mgmt		me0.0*

Meaning The output shows the **sales** and **support** VLANs and the interfaces associated with them.

Verifying the VLAN Members and Interfaces on the Distribution Switch

Purpose Verify that the **sales** and **support** have been created on the switch.

Action List all VLANs configured on the switch:

```
user@switch> show vlans
```

Name	Tag	Interfaces
default		ge-0/0/1.0, ge-0/0/2.0, ge-0/0/3.0, ge-0/0/4.0, ge-0/0/5.0, ge-0/0/6.0, ge-0/0/7.0*, ge-0/0/8.0, ge-0/0/9.0, ge-0/0/10.0*, ge-0/0/11.0, ge-0/0/12.0, ge-0/0/13.0, ge-0/0/14.0, ge-0/0/15.0, ge-0/0/16.0, ge-0/0/17.0, ge-0/0/18.0*, ge-0/0/19.0, ge-0/0/20.0, ge-0/0/21.0, ge-0/0/22.0*, ge-0/0/23.0, ge-0/1/1.0*, ge-0/1/2.0*, ge-0/1/3.0*
sales	100	ge-0/0/0.0*
support	200	ge-0/0/0.0*
mgmt		me0.0*

Meaning The output shows the **sales** and **support** VLANs associated to interface **ge-0/0/0.0**. Interface **ge-0/0/0.0** is the trunk interface connected to the access switch.

Related Documentation

- *Example: Setting Up Basic Bridging and a VLAN on the QFX Series*
- *Example: Setting Up Bridging with Multiple VLANs*
- *Understanding Bridging and VLANs*

Example: Configuring Routing Between VLANs on One Switch

To segment traffic on a LAN into separate broadcast domains, you create separate virtual LANs (VLANs). For example, you might want to create a VLAN that includes the employees in a department and the resources that they use often, such as printers, servers, and so on.

Of course, you also want to allow these employees to communicate with people and resources in other VLANs. To forward packets between VLANs you normally you need a router that connects the VLANs. However, you can accomplish this on a Juniper Networks switch without using a router by configuring an integrated routing and bridging (IRB) interface (also known as a routed VLAN interface—or RVI—in versions of Junos OS that do not support Enhanced Layer 2 Software). Using this approach reduces complexity and avoids the costs associated with purchasing, installing, managing, powering, and cooling another device.

- [Requirements on page 25](#)
- [Overview and Topology on page 25](#)

- [Configure Layer 2 switching for two VLANs on page 26](#)
- [Verification on page 28](#)

Requirements

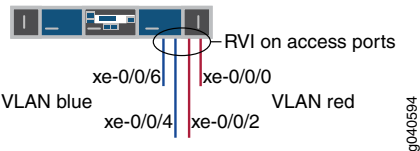
This example uses the following hardware and software components:

- One switch
- Junos OS Release 11.1 or later

Overview and Topology

This example uses an IRB to route traffic between two VLANs on the same switch. The topology is shown in [Figure 1 on page 25](#).

Figure 1: IRB with One Switch



This example shows a simple configuration to illustrate the basic steps for creating two VLANs on a single switch and configuring an IRB to enable routing between the VLANs. One VLAN, called **blue**, is for the sales and marketing group, and a second, called **red**, is for the customer support team. The sales and support groups each have their own file servers and wireless access points. Each VLAN must have a unique name, tag (VLAN ID), and distinct IP subnet. [Table 6 on page 25](#) lists the components of the sample topology.

Table 6: Components of the Multiple VLAN Topology

Property	Settings
VLAN names and tag IDs	blue , ID 100 red , ID 200
Subnets associated with VLANs	blue : 192.0.2.0/25 (addresses 192.0.2.1 through 192.0.2.126) red : 192.0.2.128/25 (addresses 192.0.2.129 through 192.0.2.254)
Interfaces in VLAN blue	Sales server port: xe-0/0/4 Sales wireless access points: xe-0/0/6
Interfaces in VLAN red	Support server port: xe-0/0/0 Support wireless access points: xe-0/0/2
IRB name	interface irb
IRB units and addresses	logical unit 100: 192.0.2.1/25 logical unit 200: 192.0.2.129/25

This configuration example creates two IP subnets, one for the blue VLAN and the second for the red VLAN. The switch bridges traffic within the VLANs. For traffic passing between two VLANs, the switch routes the traffic using an IRB on which you have configured addresses in each IP subnet.

To keep the example simple, the configuration steps show only a few interfaces and VLANs. Use the same configuration procedure to add more interfaces and VLANs. By default, all interfaces are in access mode, so you do not have to configure the port mode.

Configure Layer 2 switching for two VLANs

CLI Quick Configuration To quickly configure Layer 2 switching for the two VLANs (**blue** and **red**) and to quickly configure Layer 3 routing of traffic between the two VLANs, copy the following commands and paste them into the switch terminal window:



NOTE: The following example uses a version of Junos OS that supports Enhanced Layer 2 Software (ELS). When you use ELS, you create a Layer 3 virtual interface named *irb*. If you are using a version of Junos OS that does not support ELS, you create a Layer 3 virtual interface named *vlan*.

```
[edit]
set interfaces xe-0/0/4 unit 0 description "Sales server port"
set interfaces xe-0/0/4 unit 0 family ethernet-switching vlan members blue
set interfaces xe-0/0/6 unit 0 description "Sales wireless access point port"
set interfaces xe-0/0/6 unit 0 family ethernet-switching vlan members blue
set interfaces xe-0/0/0 unit 0 description "Support servers"
set interfaces xe-0/0/0 unit 0 family ethernet-switching vlan members red
set interfaces xe-0/0/2 unit 0 description "Support wireless access point port"
set interfaces xe-0/0/2 unit 0 family ethernet-switching vlan members red
set interfaces irb unit 100 family inet address 192.0.2.1/25
set interfaces irb unit 200 family inet address 192.0.2.129/25
set vlans blue l3-interface irb.100
set vlans blue vlan-id 100
set vlans red vlan-id 200
set vlans red l3-interface irb.200
```

Step-by-Step Procedure To configure the switch interfaces and the VLANs to which they belong:

1. Configure the interface for the sales server in the blue VLAN:


```
[edit interfaces xe-0/0/4 unit 0]
user@switch# set description "Sales server port"
user@switch# set family ethernet-switching vlan members blue
```
2. Configure the interface for the wireless access point in the blue VLAN:


```
[edit interfaces xe-0/0/6 unit 0]
user@switch# set description "Sales wireless access point port"
user@switch# set family ethernet-switching vlan members blue
```
3. Configure the interface for the support server in the red VLAN:


```
[edit interfaces xe-0/0/0 unit 0]
user@switch# set description "Support server port"
user@switch# set family ethernet-switching vlan members red
```
4. Configure the interface for the wireless access point in the red VLAN:

```
[edit interfaces xe-0/0/2 unit 0]
user@switch# set description "Support wireless access point port"
user@switch# set family ethernet-switching vlan members red
```

Step-by-Step Procedure Now create the VLANs and the IRB. The IRB will have logical units in the broadcast domains of both VLANs.

1. Create the red and blue VLANs by configuring the VLAN IDs for them:

```
[edit vlans]
user@switch# set blue vlan-id 100
user@switch# set red vlan-id 200
```

2. Create the interface named **irb** with a logical unit in the sales broadcast domain (blue VLAN):

```
[edit interfaces]
user@switch# set irb unit 100 family inet address 192.0.2.1/25
```

The unit number is arbitrary and does not have to match the VLAN tag ID. However, configuring the unit number to match the VLAN ID can help avoid confusion.

3. Add a logical unit in the support broadcast domain (red VLAN) to the **irb** interface:

```
[edit interfaces]
user@switch# set irb unit 200 family inet address 192.0.2.129/25
```

4. Complete the IRB configuration by binding the red and blue VLANs (Layer 2) with the appropriate logical units of the **irb** interface (Layer 3):

```
[edit vlans]
user@switch# set blue l3-interface irb.100
user@switch# set red l3-interface irb.200
```

Configuration Results Display the results of the configuration:

```
user@switch> show configuration
interfaces {
  xe-0/0/4 {
    unit 0 {
      description "Sales server port";
      family ethernet-switching {
        vlan members blue;
      }
    }
  }
  xe-0/0/6 {
    unit 0 {
      description "Sales wireless access point port";
      family ethernet-switching {
        vlan members blue;
      }
    }
  }
  xe-0/0/0 {
    unit 0 {
      description "Support server port";
      family ethernet-switching {
        vlan members red;
      }
    }
  }
}
```

```
    }  
  }  
  xe-0/0/2 {  
    unit 0 {  
      description "Support wireless access point port";  
      family ethernet-switching {  
        vlan members red;  
      }  
    }  
  }  
  irb {  
    unit 100 {  
      family inet address 192.0.2.1/25;  
    }  
    unit 200 {  
      family inet address 192.0.2.129/25;  
    }  
  }  
}  
vlands {  
  blue {  
    vlan-id 100;  
    interface xe-0/0/4.0;  
    interface xe-0/0/6.0;  
    l3-interface irb 100;  
  }  
  red {  
    vlan-id 200;  
    interface xe-0/0/0.0;  
    interface xe-0/0/2.0;  
    l3-interface irb 200;  
  }  
}
```



TIP: To quickly configure the blue and red VLAN interfaces, issue the `load merge terminal` command, copy the hierarchy, and paste it into the switch terminal window.

Verification

To verify that the **blue** and **red** VLANs have been created and are operating properly, perform these tasks:

- [Verifying That the VLANs Have Been Created and Associated with the Correct Interfaces on page 29](#)
- [Verifying That Traffic Can Be Routed Between the Two VLANs on page 29](#)

Verifying That the VLANs Have Been Created and Associated with the Correct Interfaces

Purpose Verify that the VLANs **blue** and **red** have been created on the switch and that all connected interfaces on the switch are members of the correct VLAN.

Action List all VLANs configured on the switch:

```
user@switch> show vlans
Name      Tag      Interfaces
default   1         xe-0/0/0.0, xe-0/0/2.0, xe-0/0/4.0, xe-0/0/6.0,
blue      100      xe-0/0/4.0, xe-0/0/6,
red       200      xe-0/0/0.0, xe-0/0/2.0, *
mgmt      me0.0*
```

Meaning The **show vlans** command lists all VLANs configured on the switch and which interfaces are members of each VLAN. This command output shows that the **blue** and **red** VLANs have been created. The **blue** VLAN has a tag ID of 100 and is associated with interfaces **xe-0/0/4.0** and **xe-0/0/6.0**. VLAN **red** has a tag ID of 200 and is associated with interfaces **xe-0/0/0.0** and **xe-0/0/2.0**.

Verifying That Traffic Can Be Routed Between the Two VLANs

Purpose Verify routing between the two VLANs.

Action Verify that the IRB logical units are up:

```
user@switch> show interfaces terse
irb.100      up    up    inet    192.0.2.1/25
irb.200      up    up    inet    192.0.2.129/25
```



NOTE: At least one port (access or trunk) with an appropriate VLAN assigned to it must be up for the irb interface to be up.

Verify that switch has created routes that use the IRB logical units:

```
user@switch> show route
192.0.2.0/25    *[Direct/0] 1d 03:26:45
                 > via irb.100
192.0.2.1/32    *[Local/0] 1d 03:26:45
                 Local via irb.100
192.0.2.128/25  *[Direct/0] 1d 03:26:45
                 > via irb.200
192.0.2.129/32  *[Local/0] 1d 03:26:45
                 Local via irb.200
```

List the Layer 3 routes in the switch's Address Resolution Protocol (ARP) table:

```
user@switch> show arp
MAC Address      Address      Name      Flags
```

00:00:0c:06:2c:0d	192.0.2.7	irb.100	None
00:13:e2:50:62:e0	192.0.2.132	irb.200	None

Meaning The output of the **show interfaces** and **show route** commands show that the Layer 3 IRB logical units are working and the switch has used them to create direct routes that it will use to forward traffic between the VLAN subnets. The **show arp** command displays the mappings between the IP addresses and MAC addresses for devices on both **irb.100** (associated with VLAN **blue**) and **irb.200** (associated with VLAN **red**). These two devices can communicate.

Related Documentation

- [Understanding Integrated Routing and Bridging on page 11](#)
- *irb (Interfaces)*
- [I3-interface on page 176](#)

Verifying That MAC Notification Is Working Properly

Purpose Verify that MAC notification is enabled or disabled, and that the MAC notification interval is set to the specified value.

Action To verify that MAC notification is enabled or disabled and also to verify the MAC notification interval setting.

```
user@switch> show ethernet-switching mac-notification
Notification Status: Enabled
Notification Interval: 60
Notifications Sent      : 0
Notifications Table Maxsize : 256
```

Meaning The output in the **Notification Status** field shows that MAC notification is enabled. The output in the **Notification Status** field would display **Disabled** if MAC notification was disabled.

The **Notification Interval** field output shows that the MAC notification interval is set to 60 seconds.

Related Documentation

- *Configuring MAC Notification*
- [Configuring MAC Notification \(CLI Procedure\) on page 41](#)

Verifying That a Series of Tagged VLANs Has Been Created

Purpose Verify that a series of tagged VLANs has been created on the switch.

Action 1. Display the VLANs in the ascending order of their VLAN ID:

```
user@switch> show vlans sort-by tag

Name                Tag      Interfaces
__employee_120__    120
                    xe-0/0/22.0*
```


__employee_121__	121	xe-0/0/22.0*
__employee_122__	122	xe-0/0/22.0*
__employee_123__	123	xe-0/0/22.0*
__employee_124__	124	xe-0/0/22.0*
__employee_125__	125	xe-0/0/22.0*
__employee_126__	126	xe-0/0/22.0*
__employee_127__	127	xe-0/0/22.0*
__employee_128__	128	xe-0/0/22.0*
__employee_129__	129	xe-0/0/22.0*
__employee_130__	130	xe-0/0/22.0*

2. Display the VLANs by the alphabetical order of the VLAN name:

user@switch> **show vlans sort-by name**

Name	Tag	Interfaces
__employee_120__	120	xe-0/0/22.0*
__employee_121__	121	xe-0/0/22.0*
__employee_122__	122	xe-0/0/22.0*
__employee_123__	123	xe-0/0/22.0*
__employee_124__	124	xe-0/0/22.0*
__employee_125__	125	xe-0/0/22.0*
__employee_126__	126	xe-0/0/22.0*
__employee_127__	127	xe-0/0/22.0*
__employee_128__	128	xe-0/0/22.0*
__employee_129__	129	xe-0/0/22.0*
__employee_130__	130	xe-0/0/22.0*

3. Display the VLANs by specifying the VLAN range name (here, the VLAN range name is **employee**):

user@switch> **show vlans employee**

Name	Tag	Interfaces
__employee_120__	120	xe-0/0/22.0*
__employee_121__	121	xe-0/0/22.0*
__employee_122__	122	

```
__employee_123__ 123    xe-0/0/22.0*
__employee_124__ 124    xe-0/0/22.0*
__employee_125__ 125    xe-0/0/22.0*
__employee_126__ 126    xe-0/0/22.0*
__employee_127__ 127    xe-0/0/22.0*
__employee_128__ 128    xe-0/0/22.0*
__employee_129__ 129    xe-0/0/22.0*
__employee_130__ 130    xe-0/0/22.0*
```

Meaning The sample output shows the VLANs configured on the switch. The series of tagged VLANs is displayed: **__employee_120__** through **__employee_130__**. Each of the tagged VLANs is configured on the trunk interface **xe-0/0/22.0**. The asterisk (*) next to the interface name indicates that the interface is **UP**.

When a series of VLANs is created using the **vlan-range** statement, the VLAN names are preceded and followed by a double underscore.

- Related Documentation**
- *Creating a Series of Tagged VLANs*
 - [Creating a Series of Tagged VLANs on page 36](#)

CHAPTER 3

Configuring Bridging and VLANs (ELS CLI Only)

- [Configuring VLANs on page 34](#)
- [Creating a Series of Tagged VLANs on page 36](#)
- [Adding a Static MAC Address Entry to the Ethernet Switching Table \(CLI Procedure\) on page 37](#)
- [Configuring MAC Limiting \(CLI Procedure\) on page 38](#)
- [Configuring MAC Table Aging on page 40](#)
- [Disabling MAC Learning on page 40](#)
- [Configuring MAC Notification \(CLI Procedure\) on page 41](#)
- [Configuring the Native VLAN Identifier \(CLI Procedure\) on page 43](#)
- [Configuring IRB Interfaces on page 44](#)
- [Example: Setting Up Bridging with Multiple VLANs on page 45](#)

Configuring VLANs

Switches use VLANs to make logical groupings of network nodes with their own broadcast domains. You can use VLANs to limit the traffic flowing across the entire LAN and reduce collisions and packet retransmissions.



NOTE: This task supports the Enhanced Layer 2 Software (ELS) configuration style. For ELS details, see *Getting Started with Enhanced Layer 2 Software*. If your switch runs software that does not support ELS, see *Configuring VLANs*.



NOTE: Two logical interfaces that are configured on the same physical interface cannot be mapped to the same VLAN.

For each endpoint on the VLAN, configure the following VLAN parameters on the corresponding interface:

1. Specify the description of the VLAN:

```
[edit interfaces interface-name unit 0]
user@switch# set description vlan-description
```

2. Specify the unique name of the VLAN:



NOTE: Switches that run Junos OS with the ELS configuration style do not support a default VLAN. Therefore, on such switches, you must explicitly configure at least one VLAN, even if your network is simple and you want only one broadcast domain to exist.

```
[edit interfaces interface-name unit 0]
user@switch# set family ethernet-switching vlan members vlan-name
```

3. Create the subnet for the VLAN:

```
[edit interfaces]
user@switch# set vlan unit 0 family inet address ip-address
```

4. Configure the VLAN tag ID or VLAN ID list for the VLAN:

```
[edit vlans]
user@switch# set vlan-name vlan-id vlan-id-number

or
```

```
[edit vlans]
user@switch# set vlan-name vlan-id-list [vlan-ids | vlan-id--vlan-id-]
```

5. Specify a VLAN firewall filter to be applied to incoming or outgoing packets:

```
[edit vlans]
user@switch# set vlan-name filter (input | output) filter-name
```

Related Documentation

- *Example: Setting Up Basic Bridging and a VLAN on the QFX Series*
- [Configuring IRB Interfaces on page 44](#)

- *Creating a Series of Tagged VLANs*
- [Understanding Bridging and VLANs on page 4](#)

Creating a Series of Tagged VLANs

When you divide an Ethernet LAN into multiple VLANs, each VLAN is assigned a unique IEEE 802.1Q tag. This tag is associated with each frame in the VLAN, and the network nodes receiving the traffic can use the tag to identify which VLAN a frame is associated with.

Instead of configuring VLANs and 802.1Q tags one at a time for a trunk interface, you can configure a VLAN range to create a series of tagged VLANs.

When an Ethernet LAN is divided into VLANs, each VLAN is identified by a unique 802.1Q tag. The tag is applied to all frames so that the network nodes receiving the frames can detect which VLAN the frames belong to. Trunk ports, which multiplex traffic among a number of VLANs, use the tag to determine the origin of frames and where to forward them.

For example, you could configure the VLAN **employee** and specify a tag range of **10 through 12**. This creates the following VLANs and tags:

- VLAN **employee-10**, tag 10
- VLAN **employee-11**, tag 11
- VLAN **employee-12**, tag 12

Creating tagged VLANs in a series has the following limitations:

- Layer 3 interfaces do not support this feature.
- Because an access interface can only support one VLAN member, access interfaces also do not support this feature.



NOTE: This task uses Junos OS for Junos OS for QFX3500 and QFX3600 switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Creating a Series of Tagged VLANs*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

To configure a series of tagged VLANs using the CLI (here, the VLAN is **employee**):

1. Configure the series (here, a VLAN series from 120 through 130):

```
[edit]
user@switch# set vlans employee vlan-id-list [ 120-130 ]
```

2. Associate a series of tagged VLANs when you configure an interface in one of two ways:

- Include the name of the series:

```
[edit interfaces]
user@switch# set interfaces xe-0/0/22.0 family ethernet-switching vlanmembers employee
```

- Include the VLAN range:

```
[edit interfaces]
user@switch# set interfaces xe-0/0/22.0 family ethernet-switching vlan members 120-130
```

Associating a series of tagged VLANs to an interface by name or by VLAN range the same result: VLANs **__employee_120__** through **__employee_130__** are created.



NOTE: When a series of VLANs is created using the `vlan-id-list` command, the VLAN names are preceded and followed by a double underscore.

Related Documentation

- [Example: Setting Up Bridging with Multiple VLANs on page 45](#)
- [Understanding Bridging and VLANs on page 4](#)

Adding a Static MAC Address Entry to the Ethernet Switching Table (CLI Procedure)



NOTE: This task uses Junos OS for EX Series switches and Junos OS for QFX3500 and QFX3600 switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Adding a Static MAC Address Entry to the Ethernet Switching Table (CLI Procedure)*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

The Ethernet switching table, also known as the forwarding table, specifies the known locations of VLAN nodes and the addresses of devices within those nodes. There are two ways to populate the Ethernet switching table on a switch. The easiest method is to let the switch update the table with MAC addresses.

The second way to populate the Ethernet switching table is to manually insert addresses into the table. You can do this to reduce flooding and speed up the switch's automatic learning process.

Before configuring a static MAC address, be sure that you have:

- Set up the VLAN. See *Configuring VLANs for EX Series Switches (CLI Procedure)*.

To configure an interface to have a static MAC address:

```
[edit vlans vlan-name switch-options interface interface-name]  
user@switch# set static-mac mac-address
```

Related
Documentation

- *Understanding Bridging and VLANs on EX Series Switches*

Configuring MAC Limiting (CLI Procedure)



.....

NOTE: This task uses Junos OS for EX Series switches and QFX3500 and QFX3600 switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Configuring MAC Limiting (CLI Procedure)*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

.....

This topic describes various ways of configuring a limitation on MAC addresses in packets that are received and forwarded by the switch.

.....



.....

NOTE: On a QFX Series Virtual Chassis, if you include the shutdown option at the [edit vlans *vlan-name* switch-options interface *interface-name* interface-mac-limit packet-action] hierarchy level and issue the commit operation, the system generates a commit error. The system does not generate an error if you include the shutdown option at the [edit switch-options interface *interface-name* interface-mac-limit packet-action] hierarchy level.

.....

The different ways of setting a MAC limit are described in the following sections:

- [Limiting the Number of MAC Addresses Learned by an Interface on page 39](#)
- [Limiting the Number of MAC Addresses Learned by a VLAN on page 39](#)

Limiting the Number of MAC Addresses Learned by an Interface

To secure a port, you can set the maximum number of MAC addresses that can be learned by an interface:

- Set the MAC limit on an interface, and specify an action that the switch takes after the specified limit is exceeded:

```
[edit switch-options]
user@switch# set interface interface-name interface-mac-limit limit packet-action
action
```

After you set a new MAC limit for the interface, the system clears existing entries in the MAC address forwarding table associated with the interface.

Limiting the Number of MAC Addresses Learned by a VLAN

To limit the number of MAC addresses learned by a VLAN, perform both of the following steps:

- Set the maximum number of MAC addresses that can be learned by a VLAN, and specify an action that the switch takes after the specified limit is exceeded:

```
[edit vlans]
user@switch# set vlan-name switch-options mac-table-size limit packet-action
action
```

- Set the maximum number of MAC addresses that can be learned by one or all interfaces in the VLAN, and specify an action that the switch takes after the specified limit is exceeded:

```
[edit vlans]
user@switch# set vlan-name switch-options interface interface-name
interface-mac-limit limit packet-action action
[edit vlans]
user@switch# set vlan-name switch-options interface-mac-limit limit packet-action
action
```



NOTE: If you specify a MAC limit and packet action for all interfaces in the VLAN *and* a specific interface in the VLAN, the MAC limit and packet action specified at the specific interface level takes precedence. Also, at the VLAN interface level, only the drop and drop-and-log options are supported.

After you set new MAC limits for a VLAN by using the **mac-table-size** statement or for interfaces associated with a VLAN by using the **interface-mac-limit** statement, the system clears the corresponding existing entries in the MAC address forwarding table.

- Related Documentation**
- Understanding Bridging and VLANs on EX Series Switches*
 - Configuring Persistent MAC Learning (CLI Procedure)*

Configuring MAC Table Aging

MAC table aging ensures that a switch tracks only active nodes on the network and that it is able to flush out network nodes that are no longer available.

To manage MAC entries more efficiently, you can configure the maximum time that entries can remain in the MAC address table before being deleted.



NOTE: This task uses Junos OS for QFX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

You can use the **global-mac-table-aging-time** command to configure how long entries remain in the Ethernet switching table before expiring, as follows:

```
[edit protocols 12-learning]
user@switch# set global-mac-table-aging-time 200
```



NOTE: This command applies to all VLANs configured for the switch. You cannot configure separate MAC table aging times for specific VLANs.

Related Documentation

- [Understanding Bridging and VLANs on page 4](#)
- [Example: Setting Up Bridging with Multiple VLANs on page 45](#)

Disabling MAC Learning

By default, MAC learning is globally enabled on all node. This topic describes how to disable MAC learning, as well as how to reenable and verify that MAC learning has been enabled or disabled.



NOTE: This task supports the Enhanced Layer 2 Software (ELS) configuration style. For ELS details, see *Getting Started with Enhanced Layer 2 Software*. If your switch runs software that does not support ELS, see *Disabling MAC Learning*.

Disabling dynamic MAC learning prevents a node from learning source and destination MAC addresses.

- To disable MAC learning:

```
[edit vlans vlan-name switch-options interface interface-name]
user@switch# set no-mac-learning
```

- To enable MAC learning:

```
[edit vlans vlan-name switch-options interface interface-name]
user@switch# delete no-mac-learning
```

```
user@switch# deactivate no-mac-learning
```

- To verify the status of MAC learning, view the Ethernet MAC learning statistics in operational mode.

```
user@switch> show ethernet-switching table
Ethernet-switching table: 2 entries, 1 learned
  VLAN      MAC address      Type      Age      Interfaces
  default   *                  Flood     -        All-members
  default   00:1f:12:39:90:80 Learn     29       xe-/0/0.0
```

Related Documentation

- [Understanding MAC Learning on page 12](#)
- [Example: Disabling MAC Learning](#)
- [no-mac-learning on page 185](#)

Configuring MAC Notification (CLI Procedure)



NOTE: This task uses the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Configuring MAC Notification (CLI Procedure)* or *Configuring MAC Notification*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

When a switch learns or unlearns a MAC address, SNMP notifications can be sent to the network management system at regular intervals to record the addition or removal of the MAC address. This process is known as MAC notification.

The MAC notification interval defines how often Simple Network Management Protocol (SNMP) notifications logging the addition or removal of MAC addresses on the switch are sent to the network management system.

MAC notification is disabled by default. When MAC notification is enabled, the default MAC notification interval is 30 seconds.

To enable or disable MAC notification, or to set the MAC notification interval, perform these tasks:

- [Enabling MAC Notification on page 41](#)
- [Disabling MAC Notification on page 42](#)
- [Setting the MAC Notification Interval on page 42](#)

Enabling MAC Notification

MAC notification is disabled by default. You need to perform this procedure to enable MAC notification.

To enable MAC notification on the switch with the default MAC notification interval of 30 seconds:

```
[edit switch-options]
user@switch# set mac-notification
```

To enable MAC notification on the switch with any other MAC notification interval (here, the MAC notification interval is set to 60 seconds):

```
[edit switch-options]
user@switch# set mac-notification notification-interval 60
```

Disabling MAC Notification

MAC notification is disabled by default. Perform this procedure only if MAC notification was previously enabled on your switch.

To disable MAC notification on the switch:

```
[edit switch-options]
user@switch# delete mac-notification
```

To disable MAC notification on a specific interface (here, the interface is ge-0/0/3):

```
[edit switch-options]
user@switch# set interface ge-0/0/3 no-mac-notification
```

Setting the MAC Notification Interval

The default MAC notification interval is 30 seconds. The procedure to change the MAC notification interval to a different interval is identical to the procedure to enable MAC notification on the switch with a nondefault value for the MAC notification interval.

To set the MAC notification interval on the switch (here, the MAC notification interval is set to 5 seconds):

```
[edit switch-options]
user@switch# set mac-notification notification-interval 5
```

Related Documentation

- *Verifying That MAC Notification Is Working Properly*

Configuring the Native VLAN Identifier (CLI Procedure)



NOTE: This task uses Junos OS for EX Series switches and Junos OS for QFX3500 and QFX3600 switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Configuring the Native VLAN Identifier (CLI Procedure)*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

Switches can receive and forward routed or bridged Ethernet frames with 802.1Q VLAN tags. Typically, trunk ports, which connect switches to each other, accept untagged control packets but do not accept untagged data packets. You can enable a trunk port to accept untagged data packets by configuring a native VLAN ID on the interface on which you want the untagged data packets to be received. The logical interface on which untagged packets are to be received must be configured with the same VLAN ID as the native VLAN ID configured on the physical interface.

To configure the native VLAN ID by using the command-line interface (CLI):

1. On the interface on which you want untagged data packets to be received, set the interface mode to **trunk**, which specifies that the interface is in multiple VLANs and can multiplex traffic between different VLANs.:

```
[edit interfaces]
user@switch# set interface-name unit logical-unit-number family
ethernet-switching interface-mode trunk
```

2. Configure the native VLAN ID:

```
[edit interfaces]
user@switch# set interface-name native-vlan-id vlan-id
```

3. Specify that the logical interface that will receive the untagged data packets is a member of the native VLAN:

```
[edit interfaces]
user@switch# set interface-name unit logical-unit-number family
ethernet-switching vlan members vlan-id
```

Related Documentation

- *Understanding Bridging and VLANs on EX Series Switches*
- *Example: Connecting Access Switches to a Distribution Switch*
- *Example: Setting Up Basic Bridging and a VLAN for an EX Series Switch*
- *Example: Setting Up Basic Bridging and a VLAN on the QFX Series*

Configuring IRB Interfaces

Integrated routing and bridging (IRB) interfaces enable a switch to recognize which packets are being sent to local addresses so that they are bridged whenever possible and are routed only when needed. Whenever packets can be switched instead of routed, several layers of processing are eliminated. Switching also reduces the number of address look-ups.



NOTE: In versions of Junos OS that do not support Enhanced Layer 2 Software (ELS), this type of interface is called a routed VLAN interface (RVI).

To configure the routed VLAN interface:

1. Create the VLAN by assigning it a name and a VLAN ID:

```
[edit]
user@switch# set vlans support vlan-id 111
```

2. Assign an interface to the VLAN by specifying the logical interface (with the **unit** statement) and specifying the VLAN name as the member:

```
[edit]
user@switch# set interfaces ge-0/0/18 unit 0 family ethernet-switching vlan members
support
```

3. Create the subnet for the VLAN's broadcast domain:

```
[edit]
user@switch# set interfaces irb unit 111 family inet address 111.111.111.1/24
```

4. Bind a Layer 3 interface with the VLAN:

```
[edit]
user@switch# set vlans support l3-interface irb.111
```



NOTE: If you are using a version of Junos OS that does not support ELS, you create a Layer 3 virtual interface named **vlan**



NOTE: Layer 3 interfaces on trunk ports allow the interface to transfer traffic between multiple VLANs. Within a VLAN, traffic is bridged, while across VLANs, traffic is routed.

You can display the configuration settings:

```
user@switch> show interfaces irb terse
Interface      Admin Link Proto  Local          Remote
vlan           up    up
irb.111        up    up  inet   111.111.111.1/24

user@switch> show vlans
Name      Tag      Interfaces
default                                     None
```

```

employee-vlan 20
                ge-1/0/0.0, ge-1/0/1.0, ge-1/0/2.0
marketing      40
                ge-1/0/10.0, ge-1/0/20.0, ge-1/0/30.0
support        111
                ge-0/0/18.0
mgmt
                bme0.32769, bme0.32771*

user@switch> show ethernet-switching table
Ethernet-switching table: 1 entries, 0 learned
  VLAN      MAC address      Type      Age Interfaces
  support    00:19:e2:50:95:a0 Static      - Router

```

Related Documentation

- [Understanding Integrated Routing and Bridging on page 11](#)

Example: Setting Up Bridging with Multiple VLANs

The QFX Series products use bridging and virtual LANs (VLANs) to connect network devices in a LAN—storage devices, file servers, and other network components—and to segment the LAN into smaller bridging domains.

To segment traffic on a LAN into separate broadcast domains, you create separate virtual LANs (VLANs) on a switch. Each VLAN is a collection of network nodes. When you use VLANs, frames whose origin and destination are in the same VLAN are forwarded only within the local VLAN, and only frames not destined for the local VLAN are forwarded to other broadcast domains. VLANs thus limit the amount of traffic flowing across the entire LAN, reducing the possible number of collisions and packet retransmissions within the LAN.

This example describes how to configure bridging for the QFX Series and how to create two VLANs to segment the LAN:



NOTE: This task supports the Enhanced Layer 2 Software (ELS) configuration style. For ELS details, see *Getting Started with Enhanced Layer 2 Software*. If your switch runs software that does not support ELS, see *Example: Setting Up Bridging with Multiple VLANs*.

- [Requirements on page 45](#)
- [Overview and Topology on page 46](#)
- [Configuration on page 47](#)
- [Verification on page 49](#)

Requirements

This example uses the following hardware and software components:

- A configured and provisioned QFX3500 switch
- Junos OS Release 13.2X50-D15 or later for the QFX Series

Overview and Topology

Switches connect all devices in an office or data center into a single LAN to provide sharing of common resources such as file servers. The default configuration creates a single VLAN, and all traffic on the switch is part of that broadcast domain. Creating separate network segments reduces the span of the broadcast domain and enables you to group related users and network resources without being limited by physical cabling or by the location of a network device in the building or on the LAN.

This example shows a simple configuration to illustrate the basic steps for creating two VLANs on a single switch. One VLAN, called **sales**, is for the sales and marketing group, and a second, called **support**, is for the customer support team. The sales and support groups each have their own dedicated file servers and other resources. For the switch ports to be segmented across the two VLANs, each VLAN must have its own broadcast domain, identified by a unique name and tag (VLAN ID). In addition, each VLAN must be on its own distinct IP subnet.

The topology used in this example consists of a single QFX3500 switch, with a total of 48 10-Gbps Ethernet ports. (For the purposes of this example, the QSFP+ ports Q0-Q3, which are ports xe-0/1/0 through xe-0/1/15, are excluded.)

Table 7: Components of the Multiple VLAN Topology

Property	Settings
Switch hardware	QFX3500 switch configured with 48 10-Gbps Ethernet ports (xe-0/0/0 through xe-0/0/47)
VLAN names and tag IDs	sales , tag 100 support , tag 200
VLAN subnets	sales : 192.0.2.0/25 (addresses 192.0.2.1 through 192.0.2.126) support : 192.0.2.128/25 (addresses 192.0.2.129 through 192.0.2.254)
Interfaces in VLAN sales	File servers: xe-0/0/20 and xe-0/0/21
Interfaces in VLAN support	File servers: xe-0/0/46 and xe-0/0/47
Unused interfaces	xe-0/0/2 and xe-0/0/25

This configuration example creates two IP subnets, one for the sales VLAN and the second for the support VLAN. The switch bridges traffic within a VLAN. For traffic passing between two VLANs, the switch routes the traffic using a Layer 3 routing interface on which you have configured the address of the IP subnet.

To keep the example simple, the configuration steps show only a few devices in each of the VLANs. Use the same configuration procedure to add more LAN devices.

Configuration

CLI Quick Configuration To quickly configure Layer 2 switching for the two VLANs (**sales** and **support**) and to quickly configure Layer 3 routing of traffic between the two VLANs, copy the following commands and paste them into the switch terminal window:

```
[edit]
set interfaces xe-0/0/0 unit 0 family ethernet-switching vlan members sales
set interfaces xe-0/0/3 unit 0 family ethernet-switching vlan members sales
set interfaces xe-0/0/22 unit 0 family ethernet-switching vlan members sales
set interfaces xe-0/0/20 unit 0 description "Sales file server port"
set interfaces xe-0/0/20 unit 0 family ethernet-switching vlan members sales
set interfaces xe-0/0/24 unit 0 family ethernet-switching vlan members support
set interfaces xe-0/0/26 unit 0 family ethernet-switching vlan members support
set interfaces xe-0/0/44 unit 0 family ethernet-switching vlan members support
set interfaces xe-0/0/46 unit 0 description "Support file server port"
set interfaces xe-0/0/46 unit 0 family ethernet-switching vlan members support
set interfaces vlan unit 0 family inet address 192.0.2.0/25
set interfaces vlan unit 1 family inet address 192.0.2.128/25
set vlans sales l3-interface irb.0
set vlans sales vlan-id 100
set vlans support vlan-id 200
set vlans support l3-interface irb.1
```

Step-by-Step Procedure Configure the switch interfaces and the VLANs to which they belong. By default, all interfaces are in access mode, so you do not have to configure the port mode.

1. Configure the interface for the file server in the **sales** VLAN:

```
[edit interfaces xe-0/0/20 unit 0]
user@switch# set description "Sales file server port"
user@switch# set family ethernet-switching vlan members sales
```

2. Configure the interface for the file server in the **support** VLAN:

```
[edit interfaces xe-0/0/46 unit 0]
user@switch# set description "Support file server port"
user@switch# set family ethernet-switching vlan members support
```

3. Create the subnet for the **sales** broadcast domain:

```
[edit interfaces]
user@switch# set vlan unit 0 family inet address 192.0.2.1/25
```

4. Create the subnet for the **support** broadcast domain:

```
[edit interfaces]
user@switch# set vlan unit 1 family inet address 192.0.2.129/25
```

5. Configure the VLAN tag IDs for the **sales** and **support** VLANs:

```
[edit vlans]
user@switch# set sales vlan-id 100
user@switch# set support vlan-id 200
```

6. To route traffic between the **sales** and **support** VLANs, define the interfaces that are members of each VLAN and associate a Layer 3 interface:

```
[edit vlans]
user@switch# set sales l3-interface irb.0
user@switch# set support l3-interface irb.1
```

Configuration Results Display the results of the configuration:

```
user@switch> show configuration
```

```
interfaces {
  xe-0/0/20 {
    unit 0 {
      description "Sales file server port";
      family ethernet-switching {
        vlan members sales;
      }
    }
  }
  xe-0/0/46 {
    unit 0 {
      description "Support file server port";
      family ethernet-switching {
        vlan members support;
      }
    }
  }
  vlans {
    unit 0 {
      family inet address 192.0.2.1/25;
    }
    unit 1 {
      family inet address 192.0.2.129/25;
    }
  }
}
vlans {
  sales {
    vlan-id 100;
    interface xe-0/0/0.0;
    interface xe-0/0/3.0;
    interface xe-0/0/20.0;
    interface xe-0/0/22.0;
    l3-interface irb0;
  }
  support {
    vlan-id 200;
    interface xe-0/0/24.0;
    interface xe-0/0/26.0;
    interface xe-0/0/44.0;
    interface xe-0/0/46.0;
    l3-interface irb1;
  }
}
```



TIP: To quickly configure the sales and support VLAN interfaces, issue the **load merge terminal** command. Then copy the hierarchy and paste it into the switch terminal window.

Verification

Verify that the **sales** and **support** VLANs have been created and are operating properly, perform these tasks:

- [Verifying That the VLANs Have Been Created and Associated with the Correct Interfaces on page 49](#)
- [Verifying That Traffic Is Being Routed Between the Two VLANs on page 49](#)
- [Verifying That Traffic Is Being Switched Between the Two VLANs on page 50](#)

Verifying That the VLANs Have Been Created and Associated with the Correct Interfaces

Purpose Verify that the **sales** and **support** VLANs have been created on the switch and that all connected interfaces on the switch are members of the correct VLAN.

Action To list all VLANs configured on the switch, use the **show vlans** command:

```
user@switch> show vlans
Name      Tag      Interfaces
default
xe-0/0/1.0, xe-0/0/2.0, xe-0/0/4.0, xe-0/0/5.0,
xe-0/0/6.0, xe-0/0/7.0, xe-0/0/8.0, xe-0/0/9.0,
xe-0/0/10.0*, xe-0/0/11.0, xe-0/0/12.0, xe-0/0/13.0*,
xe-0/0/14.0, xe-0/0/15.0, xe-0/0/16.0, xe-0/0/17.0,
xe-0/0/18.0, xe-0/0/19.0, xe-0/0/21.0, xe-0/0/23.0*,
xe-0/0/25.0, xe-0/0/27.0, xe-0/0/28.0, xe-0/0/29.0,
xe-0/0/30.0, xe-0/0/31.0, xe-0/0/32.0, xe-0/0/33.0,
xe-0/0/34.0, xe-0/0/35.0, xe-0/0/36.0, xe-0/0/37.0,
xe-0/0/38.0, xe-0/0/39.0, xe-0/0/40.0, xe-0/0/41.0,
xe-0/0/42.0, xe-0/0/43.0, xe-0/0/45.0, xe-0/0/47.0,
xe-0/1/0.0*, xe-0/1/1.0*, xe-0/1/2.0*, xe-0/1/3.0*

sales      100
xe-0/0/0.0*, xe-0/0/3.0, xe-0/0/20.0, xe-0/0/22.0

support    200
xe-0/0/0.24, xe-0/0/26.0, xe-0/0/44.0, xe-0/0/46.0*

mgmt
me0.0*
```

Meaning The **show vlans** command lists all VLANs configured on the switch and which interfaces are members of each VLAN. This command output shows that the **sales** and **support** VLANs have been created. The **sales** VLAN has a tag ID of 100 and is associated with interfaces **xe-0/0/0.0**, **xe-0/0/3.0**, **xe-0/0/20.0**, and **xe-0/0/22.0**. VLAN **support** has a tag ID of 200 and is associated with interfaces **xe-0/0/24.0**, **xe-0/0/26.0**, **xe-0/0/44.0**, and **xe-0/0/46.0**.

Verifying That Traffic Is Being Routed Between the Two VLANs

Purpose Verify routing between the two VLANs.

Action List the Layer 3 routes in the switch Address Resolution Protocol (ARP) table:

```
user@switch> show arp
```

MAC Address	Address	Name	Flags
00:00:0c:06:2c:0d	192.0.2.3	vlan.0	None
00:13:e2:50:62:e0	192.0.2.11	vlan.1	None

Meaning Sending IP packets on a multiaccess network requires mapping from an IP address to a MAC address (the physical or hardware address). The ARP table displays the mapping between the IP address and MAC address for both **vlan.0** (associated with **sales**) and **vlan.1** (associated with **support**). These VLANs can route traffic to each other.

Verifying That Traffic Is Being Switched Between the Two VLANs

Purpose Verify that learned entries are being added to the Ethernet switching table.

Action List the contents of the Ethernet switching table:

```
user@switch> show ethernet-switching table
```

Ethernet-switching table: 8 entries, 5 learned

VLAN	MAC address	Type	Age	Interfaces
default	*	Flood		- All-members
default	00:00:05:00:00:01	Learn		- xe-0/0/10.0
default	00:00:5e:00:01:09	Learn		- xe-0/0/13.0
default	00:19:e2:50:63:e0	Learn		- xe-0/0/23.0
sales	*	Flood		- All-members
sales	00:00:5e:00:07:09	Learn		- xe-0/0/0.0
support	*	Flood		- All-members
support	00:00:5e:00:01:01	Learn		- xe-0/0/46.0

Meaning The output shows that learned entries for the **sales** and **support** VLANs have been added to the Ethernet switching table, and are associated with interfaces **xe-0/0/0.0** and **xe-0/0/46.0**. Even though the VLANs were associated with more than one interface in the configuration, these interfaces are the only ones that are currently operating.

Related Documentation

- [Example: Setting Up Basic Bridging and a VLAN on the QFX Series](#)
- [Understanding Bridging and VLANs on page 4](#)

Troubleshooting Bridging and VLANs

- [Troubleshooting Ethernet Switching on page 51](#)

Troubleshooting Ethernet Switching

Problem **Description:** Sometimes a MAC address entry in the switch's Ethernet switching table is not updated after the device with that MAC address has been moved from one interface to another on the switch. Typically, the switch does not wait for a MAC address expiration when a MAC move operation occurs. As soon as the switch detects the MAC address on the new interface, it immediately updates the table. Many network devices send a gratuitous ARP packet when switching an IP address from one device to another. The switch updates its ARP cache table after receipt of such gratuitous ARP messages, and then it also updates its Ethernet switching table.

Sometimes silent devices, such as syslog servers or SNMP trap receivers that receive UDP traffic but do not return acknowledgment (ACK) messages to the traffic source, fail to send gratuitous ARP packets when a device moves. If such a move occurs when the system administrator is not available to explicitly clear the affected interfaces by issuing the **clear ethernet-switching table** command, the entry for the moved device in the Ethernet switching table is not updated.

Solution Set up the switch to handle unattended MAC address switchovers.

1. Reduce the system-wide ARP aging timer. (By default, the ARP aging timer is set at 20 minutes. The range of the ARP aging timer is from 1 through 240 minutes.)

```
[edit system arp]
user@switch# set aging-timer 3
```

2. Set the MAC aging timer to the same value as the ARP timer. (By default, the MAC aging timer is set to 300 seconds. The range is 60 to 1,000,000 seconds.)

```
[edit protocols 12-learning]
user@switch# set global-mac-table-aging-time 180
```

The ARP entry and the MAC address entry for the moved device expire within the times specified by the aging timer values. After the entries expire, the switch sends a new ARP message to the IP address of the device. The device responds to the ARP message, thereby refreshing the entries in the switch's ARP cache table and Ethernet switching table.

- Related**
- *arp*
- Documentation**
- [global-mac-table-aging-time on page 202](#)

PART 2

Configuring Layer 2 Networking

- [Understanding Layer 2 Networking on page 55](#)
- [Configuring Layer 2 Networking on page 63](#)

CHAPTER 5

Understanding Layer 2 Networking

- [Introduction to the Media Access Control \(MAC\) Layer 2 Sublayer on page 55](#)
- [Overview of Layer 2 Networking on page 56](#)
- [Understanding Layer 2 Broadcasting on page 58](#)
- [Understanding Unicast on page 59](#)
- [Understanding the Unified Forwarding Table on page 59](#)

Introduction to the Media Access Control (MAC) Layer 2 Sublayer

This topic provides an introduction to the MAC sublayer of the data link layer (Layer 2).

In Layer 2 of a network, the Media Access Control (MAC) sublayer provides addressing and channel access control mechanisms that enable several terminals or network nodes to communicate in a network.

The MAC sublayer acts as an interface between the logical link control (LLC) Ethernet sublayer and Layer 1 (the physical layer). The MAC sublayer emulates a full-duplex logical communication channel in a multipoint network. This channel may provide unicast, multicast, or broadcast communication service. The MAC sublayer uses MAC protocols to prevent collisions.

In Layer 2, multiple devices on the same physical link can uniquely identify one another at the data link layer, by using the MAC addresses that are assigned to all ports on a switch. A MAC algorithm accepts as input a secret key and an arbitrary-length message to be authenticated, and outputs a MAC address.

A MAC address is a 12-digit hexadecimal number (48 bits in long). MAC addresses are usually written in one of these formats:

- MM:MM:MM:SS:SS:SS
- MM-MM-MM-SS-SS-SS

The first half of a MAC address contains the ID number of the adapter manufacturer. These IDs are regulated by an Internet standards body. The second half of a MAC address represents the serial number assigned to the adapter by the manufacturer.

Contrast MAC addressing, which works at Layer 2, with IP addressing, which runs at Layer 3 (networking and routing). One way to remember the difference is that the MAC

addresses apply to a physical or virtual node, whereas IP addresses apply to the software implementation of that node. MAC addresses are typically fixed on a per-node basis, whereas IP addresses change when the node moves from one part of the network to another.

IP networks maintain a mapping between the IP and MAC addresses of a node using the Address Resolution Protocol (ARP) table. DHCP also typically uses MAC addresses when assigning IP addresses to nodes.

- Related Documentation**
- [Overview of Layer 2 Networking on page 56](#)
 - [Understanding MAC Learning on page 12](#)

Overview of Layer 2 Networking

Layer 2, also known as the Data Link Layer, is the second level in the seven-layer OSI reference model for network protocol design. Layer 2 is equivalent to the link layer (the lowest layer) in the TCP/IP network model. Layer 2 is the network layer used to transfer data between adjacent network nodes in a wide area network or between nodes on the same local area network.

A *frame* is a protocol data unit, the smallest unit of bits on a Layer 2 network. Frames are transmitted to and received from devices on the same local area network (LAN). Unlike bits, frames have a defined structure and can be used for error detection, control plane activities and so forth. Not all frames carry user data. The network uses some frames to control the data link itself..

At Layer 2, *unicast* refers to sending frames from one node to a single other node, whereas *multicast* denotes sending traffic from one node to multiple nodes, and *broadcasting* refers to the transmission of frames to all nodes in a network. A *broadcast domain* is a logical division of a network in which all nodes of that network can be reached at Layer 2 by a broadcast.

Segments of a LAN can be linked at the frame level using *bridges*. Bridging creates separate broadcast domains on the LAN, creating VLANs, which are independent logical networks that group together related devices into separate network segments. The grouping of devices on a VLAN is independent of where the devices are physically located in the LAN. Without bridging and VLANs, all devices on the Ethernet LAN are in a single broadcast domain, and all the devices detect all the packets on the LAN.

Forwarding is the relaying of packets from one network segment to another by nodes in the network. On a VLAN, a frame whose origin and destination are in the same VLAN are forwarded only within the local VLAN. A network segment is a portion of a computer network wherein every device communicates using the same physical layer.

Layer 2 contains two sublayers:

- Logical link control (LLC) sublayer, which is responsible for managing communications links and handling frame traffic.

- Media access control (MAC) sublayer, which governs protocol access to the physical network medium. By using the MAC addresses that are assigned to all ports on a switch, multiple devices on the same physical link can uniquely identify one another.

The ports, or interfaces, on a switch operate in either access mode, tagged-access, or trunk mode:

- *Access mode* ports connect to a network device such as a desktop computer, an IP telephone, a printer, a file server, or a security camera. The port itself belongs to a single VLAN. The frames transmitted over an access interface are normal Ethernet frames. By default, all ports on a switch are in access mode.
- *Tagged-Access mode* ports connect to a network device such as a desktop computer, an IP telephone, a printer, a file server, or a security camera. The port itself belongs to a single VLAN. The frames transmitted over an access interface are normal Ethernet frames. By default, all ports on a switch are in access mode. Tagged-access mode accommodates cloud computing, specifically scenarios including virtual machines or virtual computers. Because several virtual computers can be included on one physical server, the packets generated by one server can contain an aggregation of VLAN packets from different virtual machines on that server. To accommodate this situation, tagged-access mode reflects packets back to the physical server on the same downstream port when the destination address of the packet was learned on that downstream port. Packets are also reflected back to the physical server on the downstream port when the destination has not yet been learned. Therefore, the third interface mode, tagged access, has some characteristics of access mode and some characteristics of trunk mode:
- *Trunk mode* ports handle traffic for multiple VLANs, multiplexing the traffic for all those VLANs over the same physical connection. Trunk interfaces are generally used to interconnect switches to other devices or switches.

With native VLAN configured, frames that do not carry VLAN tags are sent over the trunk interface. If you have a situation where packets pass from a device to a switch in access mode, and you want to then send those packets from the switch over a trunk port, use native VLAN mode. Configure the single VLAN on the switch's port (which is in access mode) as a native VLAN. The switch's trunk port will then treat those frames differently than the other tagged packets. For example, if a trunk port has three VLANs, 10, 20, and 30, assigned to it with VLAN 10 being the native VLAN, frames on VLAN 10 that leave the trunk port on the other end have no 802.1Q header (tag). There is another native VLAN option. You can have the switch add and remove tags for untagged packets. To do this, you first configure the single VLAN as a native VLAN on a port attached to a device on the edge. Then, assign a VLAN ID tag to the single native VLAN on the port connected to a device. Last, add the VLAN ID to the trunk port. Now, when the switch receives the untagged packet, it adds the ID you specified and sends and receives the tagged packets on the trunk port configured to accept that VLAN.

Including the sublayers, Layer 2 on the QFX Series supports the following functionality:

- Unicast, multicast, and broadcast traffic.
- Bridging.

- VLAN 802.1Q—Also known as *VLAN tagging*, this protocol allows multiple bridged networks to transparently share the same physical network link by adding VLAN tags to an Ethernet frame.
- Extension of Layer 2 VLANs across multiple switches using Spanning Tree Protocol (STP) prevents looping across the network.
- *MAC learning*, including per-VLAN MAC learning and Layer 2 learning suppression—This process obtains the MAC addresses of all the nodes on a network
- Link aggregation—This process groups of Ethernet interfaces at the physical layer to form a single link layer interface, also known as a *link aggregation group (LAG)* or LAG bundle
- Storm control on the physical port for unicast, multicast, and broadcast
- STP support, including 802.1d, RSTP, MSTP, and Root Guard

**Related
Documentation**

- [Understanding Bridging and VLANs on page 4](#)
- *Understanding Bridging and VLANs*

Understanding Layer 2 Broadcasting

In a Layer 2 network, *broadcasting* refers to sending traffic to all nodes on a network.

Layer 2 broadcast traffic stays within a local area network (LAN) boundary; known as the *broadcast domain*. Layer 2 broadcast traffic is sent to the broadcast domain using a MAC address of FF:FF:FF:FF:FF:FF. Every device in the broadcast domain recognizes this MAC address and passes the broadcast traffic on to other devices in the broadcast domain, if applicable. Broadcasting can be compared to unicasting (sending traffic to a single node) or multicasting (delivering traffic to a group of nodes simultaneously).

Layer 3 broadcast traffic, however, is sent to all devices in a network using a broadcast network address. For example, if your network address is 192.0.0.0, the broadcast network address is 192.255.255.255. In this case, only devices that belong to the 192.0.0.0 network receive the Layer 3 broadcast traffic. Devices that do not belong to this network drop the traffic.

Broadcasting is used in the following situations:

- Address Resolution Protocol (ARP) uses broadcasting to map MAC addresses to IP addresses. ARP dynamically binds the IP address (the logical address) to the correct MAC address. Before IP unicast packets can be sent, ARP discovers the MAC address used by the Ethernet interface where the IP address is configured.
- Dynamic Host Configuration Protocol (DHCP) uses broadcasting to dynamically assign IP addresses to hosts on a network segment or subnet.
- Routing protocols use broadcasting to advertise routes.

Excessive broadcast traffic can sometimes create a broadcast storm. A broadcast storm occurs when messages are broadcast on a network and each message prompts a receiving

node to respond by broadcasting its own messages on the network. This, in turn, prompts further responses that create a snowball effect. The LAN is suddenly flooded with packets, creating unnecessary traffic that leads to poor network performance or even a complete loss of network service.

- Related Documentation**
- [Overview of Layer 2 Networking on page 56](#)
 - [Understanding Storm Control](#)
 - [Understanding Bridging and VLANs](#)
 - [Understanding Bridging and VLANs on page 4](#)

Understanding Unicast

Unicasting is the act of sending data from one node of the network to another. In contrast, multicast transmissions send traffic from one data node to multiple other data nodes.

Unknown unicast traffic consists of unicast frames with unknown destination MAC addresses. By default, the switch floods these unicast frames that are traveling in a VLAN to all interfaces that are members of the VLAN. Forwarding this type of traffic to interfaces on the switch can trigger a security issue. The LAN is suddenly flooded with packets, creating unnecessary traffic that leads to poor network performance or even a complete loss of network service. This is known as a traffic storm.

To prevent a storm, you can disable the flooding of unknown unicast packets to all interfaces by configuring one VLAN or all VLANs to forward any unknown unicast traffic to a specific trunk interface. (This channels the unknown unicast traffic to a single interface.)

- Related Documentation**
- [Overview of Layer 2 Networking on page 56](#)
 - [Understanding Bridging and VLANs on page 4](#)

Understanding the Unified Forwarding Table

- [Using the Unified Forwarding Table to Optimize Address Storage on page 59](#)
- [MAC Address and Host Address Memory Allocation on page 60](#)
- [LPM Table Memory Allocation on page 62](#)

Using the Unified Forwarding Table to Optimize Address Storage

On QFX5100 and EX4600 switches, you can control the allocation of forwarding table memory available to store the following:

- MAC addresses.
- Layer 3 host entries.
- Longest prefix match (LPM) table entries.



NOTE: Starting with Junos OS 13.2X51-D15, you can allocate more memory to store prefixes in the range /65 to /127 range.

This feature gives you the flexibility to configure your switch to match the needs of your particular network environment. For example, you might configure the switch to store more MAC addresses in a Layer 2 network, such as a virtualized network with many servers and virtualized machines. On the other hand, if your switch is located in the routing core of a network or participates in an IP fabric, you probably want to maximize the number of routing table entries it can store. In this case, you would configure it to use the **lpm-profile**, which provides the most longest prefix match table entries.

MAC Address and Host Address Memory Allocation

There are several profiles that allocate memory differently for MAC addresses and host addresses. You configure the mix that best meets your needs by choosing the appropriate profile. [Table 8 on page 60](#) lists the profiles you can choose and the associated maximum values for the MAC address and host table entries on QFX3500, QFX3600, and QFX5100 switches.

Table 8: Unified Forwarding Table Profiles on QFX3500, QFX3600, and QFX5100 Switches

Profile Name	MAC Table	Host Table (unicast and multicast addresses)					
	MAC Addresses	IPv4 unicast	IPv6 unicast	IPv4 (*, G)	IPv4 (S, G)	IPv6 (*, G)	IPv6 (S, G)
l2-profile-one	288K	16K	8K	8K	8K	4K	4K
l2-profile-two	224K	80K	40K	40K	40K	20K	20K
l2-profile-three (default)	160K	144K	72K	72K	72K	36K	36K
l3-profile	96K	208K	104K	104K	104K	52K	52K
lpm-profile	32K	16K	8K	8K	8K	4K	4K
lpm-profile with unicast-in-lpm option	32K	(stored in LPM table)	(stored in LPM table)	8K	8K	4K	4K



NOTE: On QFX5100 and QFX5200 switches, IPv4 and IPv6 host routes with ECMP next hops are stored in the host table. On QFX3500 and QFX3600 switches, these routes are stored in the LPM table.

[Table 9 on page 61](#) lists the profiles you can choose and the associated maximum values for the MAC address and host table entries on QFX5200 switches.

Table 9: Unified Forwarding Table Profiles on QFX5200 Switches

Profile Name	MAC Table	Host Table (unicast and multicast addresses)						
	MAC Addresses	IPv4 unicast	IPv6 unicast	IPv4 (*, G)	IPv4 (S, G)	IPv6 (*, G)	IPv6 (S, G)	Exact-Match
l2-profile-one	136K	8K	4K	4K	4K	2K	2K	0
l2-profile-two	104K	40K	20K	20K	20K	10K	10K	0
l2-profile-three (default)	72K	72K	36K	36K	36K	18K	18K	0
l3-profile	40K	104K	52K	52K	52K	26K	26K	0
exact-match-profile	8K	8K	4K	4K	4K	2K	2K	64K
lpm-profile	8K	8K	4K	4K	4K	2K	2K	0
lpm-profile with unicast-in-lpm option	?	(stored in LPM table)	(stored in LPM table)	?	?	?	?	0

Note that all entries in the host table share the same memory space. If the host table stores the maximum number of entries for any given type, the entire shared table is full and is unable to accommodate *any* entries of any other type. As you can see, different entry types occupy different amounts of memory. For example, an IPv6 unicast address occupies twice as much memory as an IPv4 unicast address, and an IPv6 multicast address occupies four times as much memory as an IPv4 unicast address.

[Table 10 on page 61](#) lists various valid combinations that the host table can store if you use the **l2-profile-one** profile on a QFX5100 switch. Each row in the table represents a case in which the host table is full and cannot accommodate any more entries. .

Table 10: Example Host Table Combinations Using l2-profile-one on a QFX5100 Switch

IPv4 unicast	IPv6 unicast	IPv4 multicast (*, G)	IPv4 multicast (S, G)	IPv6 multicast (*, G)	IPv6 multicast (S, G)
16K	0	0	0	0	0
12K	2K	0	0	0	0
12K	0	2K	2K	0	0
8K	4K	0	0	0	0
4K	2K	2K	2K	0	0
0	4K	0	0	1K	1K

LPM Table Memory Allocation

You configure the memory allocation for LPM table entries differently depending on which version of Junos OS you use. To learn how to configure memory allocation for LPM table entries see [“Configuring the Unified Forwarding Table” on page 63](#). Note that starting with Junos OS 14.1X53-D30 you can free memory in the host table by using the **unicast-in-lpm** option with the **lpm-profile** to store IPv4 and IPv6 unicast addresses in the LPM table instead of the host table. See [“Configuring the lpm-profile With Junos OS Release 14.1x53-D30 and Later” on page 69](#).

Related Documentation

- [Configuring the Unified Forwarding Table on page 63](#)

CHAPTER 6

Configuring Layer 2 Networking

- [Configuring the Unified Forwarding Table on page 63](#)
- [Configuring the Forwarding Mode on page 70](#)

Configuring the Unified Forwarding Table

Traditionally, forwarding tables have been statically defined and have supported only a fixed number of entries for each type of address stored in the tables. The Unified Forwarding Table feature lets you optimize how your switch allocates forwarding-table memory for different types of addresses. You can choose one of five unified forwarding table profiles. Each profile allocates a different maximum amount of memory for Layer 2, Layer 3 host, and longest prefix match (LPM) entries. In addition to selecting a profile, you can also select how much additional memory to allocate for LPM entries.

Two profiles allocate higher percentages of memory to Layer 2 addresses. A third profile allocates a higher percentage of memory to Layer 3 host address, while a fourth profile allocates a higher percentage of memory to LPM entries. There is a default profile configured that allocates an equal amount of memory to Layer 2 and Layer 3 host addresses with the remainder allocated to LPM entries. For a switch in a virtualized network that handles a great deal of Layer 2 traffic, you would choose a profile that allocates a higher percentage of memory to Layer 2 addresses. For a switch that operates in the core of the network, you would choose a profile that allocates a higher percentage of memory to LPM entries.

On QFX5200 Series switches only, you can also configure a custom profile that allows you to partition shared memory banks among the different types of forwarding table entries. These shared memory banks have a total memory equal to 128,000 IPv4 unicast addresses. For more information about configuring the custom profile, see *Example: Configuring a Unified Forwarding Table Custom Profile on QFX Series Switches*.

- [Configuring a Unified Forwarding Table Profile on page 64](#)
- [Configuring the Memory Allocation for Longest Prefix Match Entries on page 65](#)

Configuring a Unified Forwarding Table Profile

To configure a unified forwarding table profile:

Specify a forwarding-table profile.

```
[edit chassis forwarding-options]
user@switch# set profile-name
```

For example, to specify the profile that allocates the highest percentage of memory to Layer 2 traffic:

```
[edit chassis forwarding-options]
user@switch# set l2-profile-one
```



CAUTION: When you configure and commit a profile, the Packet Forwarding Engine automatically restarts and all the data interfaces on the switch go down and come back up (the management interfaces are unaffected).

However, starting with Junos OS Release 14.1X53-D40, 15.1R5, and 16.1R3, Packet Forwarding Engines on switches in a Virtual Chassis or Virtual Chassis Fabric (VCF) do not automatically restart upon configuring a unified forwarding table profile change, to avoid Virtual Chassis or VCF instability after the change propagates to member switches and multiple Packet Forwarding Engines automatically restart at the same time. Instead, a message is displayed at the CLI prompt and logged to the switch's system log to notify you that the profile change does not take effect until the next time you reboot the Virtual Chassis or VCF. We recommend that you plan to make profile changes only when you can perform a Virtual Chassis or VCF system reboot immediately after committing the configuration update. Otherwise, the Virtual Chassis or VCF could become inconsistent if one or more members have a problem and restart with the new configuration before a planned system reboot activates the change on all members.



NOTE: You can configure only one profile for the entire switch.



NOTE: The l2-profile-three is configured by default.



NOTE: If the host table stores the maximum number of entries for any given type, the entire table is full and is unable to accommodate *any* entries of any other type. Keep in mind that an IPv6 unicast address occupies twice as much memory as an IPv4 unicast address, and an IPv6 multicast address occupies four times as much memory as an IPv4 unicast address. For more information about valid combinations of table entries see *Understanding the Unified Forwarding Table*.

Configuring the Memory Allocation for Longest Prefix Match Entries

In addition to choosing a profile, you can further optimize memory allocation for longest prefix match (LPM) entries by configuring how many IPv6 prefixes to store with lengths from /65 through /127. The switch uses LPM entries during address lookup to match addresses to the most-specific (longest) applicable prefix. Prefixes of this type are stored in the space for ternary content addressable memory (TCAM). Changing the default parameters makes this space available for LPM entries. Increasing the amount of memory available for these IPv6 prefixes reduces by the same amount how much memory is available to store IPv4 unicast prefixes and IPv6 prefixes with lengths equal to or less than 64.

The procedures for configuring the LPM table are different, depending on which version of Junos OS you are using. In the initial releases that UFT is supported, Junos OS Releases 3.2x51-D10 and 13.2X52-10, you can only increase the amount of memory allocated to IPv6 prefixes with lengths from /65 through /127 for any profile, except for **lpm-profile**. Starting with Junos OS Release 13.2x51-D15, you can also allocate either less or no memory for IPv6 prefixes with lengths in the range /65 through /127, depending on which profile is configured. For the **lpm-profile**, however, the only change you can make to the default parameters is to allocate no memory for these types of prefixes.

- [Configuring the LPM Table With Junos OS Releases 13.2X51-D10 and 13.2X52-D10 on page 65](#)
- [Configuring the LPM Table With Junos OS Release 13.2x51-D15 and Later on page 66](#)

Configuring the LPM Table With Junos OS Releases 13.2X51-D10 and 13.2X52-D10

In Junos OS Releases 13.2x51-D10 and 13.2X52-D10, by default, the switch allocates memory for 16 IPv6 with prefixes with lengths in the range /65 through /127. You can configure the switch to allocate more memory for IPv6 prefixes with lengths in the range /65 through /127.

To allocate more memory for IPv6 prefixes in the range /65 through /127:

1. Choose a forwarding table profile.

```
[edit chassis forwarding-options]
user@swtitch# set profile-name
```

For example, to specify the profile that allocates the highest percentage of memory to Layer 2 traffic:

```
[edit chassis forwarding-options]
user@swtitch# set l2-profile-one
```

2. Select how much memory to allocate for IPv6 prefixes in the range /65 through 127.

```
[edit chassis forwarding-options profile-name]
user@swtitch# set num-65-127-prefix number
```

For example, to specify to allocate memory for 32 IPv6 prefixes in the range /65 through 127:

```
[edit chassis forwarding-options l2-profile-one]
user@switch# set num-65-127-prefix 2
```



NOTE: When you configure and commit the `num-65-127-prefix number` statement, all the data interfaces on the switch restart. The management interfaces are unaffected.

The `num-65-127-prefix number` statement is not supported on the `lpm-profile`.

Table 11 on page 66 provides examples of valid combinations that the LPM table can store for all profiles except for the `lpm-profile` and `custom-profile`. Once again, each row in the table represents a case in which the table is full and cannot accommodate any more entries.

Table 11: Example LPM Table Combinations Using L2 and L3 profiles With Junos OS 13.2X51-D10 and 13.2X52-D10

num-65-127-prefix Value	IPv4 Entries	IPv6 Entries (Prefix <= 64)	IPv6 Entries (Prefix >= 65)
1 (default)	16K-16	0K	16
1 (default)	0K	8K-16	16
1 (default)	8K-16	4K	16
64	4K	4K	1K
64	2K	5K	1K
64	0K	6K	1K
128	4K	2K	2K
128	2K	3K	2K
128	0K	4K	2K



NOTE:

Configuring the LPM Table With Junos OS Release 13.2x51-D15 and Later

- Configuring Layer 2 and Layer 3 Profiles With Junos OS Release 13.2x51-D15 or Later on page 66
- Configuring the `lpm-profile` With Junos OS Release 13.2x51-D15 and Later on page 68
- Configuring the `lpm-profile` With Junos OS Release 14.1x53-D30 and Later on page 69

Configuring Layer 2 and Layer 3 Profiles With Junos OS Release 13.2x51-D15 or Later

Starting in Junos OS Release 13.2x51-D15, you can configure the switch to allocate forwarding table memory for as many as 4,000 IPv6 prefixes with lengths in the range

/65 through /127 for any profile other than the **lpm-profile** or **custom-profile**. You can also specify to allocate no memory for these IPv6 entries. The default is 1,000 entries for IPv6 prefixes with lengths in the range /65 through /127. Previously, the maximum you could configure was for 2,048 entries for IPv6 prefixes with lengths in the range /65 through /127. The minimum number of entries was previously 16, which was the default.

To specify how much forwarding table memory to allocate for IPv6 prefixes with length in the range /65 through /127:

1. Choose a forwarding table profile.

```
[edit chassis forwarding-options]
user@swtitch# set profile-name
```

For example, to specify the profile that allocates the highest percentage of memory to Layer 2 traffic:

```
[edit chassis forwarding-options]
user@swtitch# set l2-profile-one
```

2. Select how much memory to allocate for IPv6 prefixes in the range /65 through 127.

```
[edit chassis forwarding-options profile-name]
user@swtitch# set num-65-127-prefix number
```

For example, to specify to allocate memory for 2,000 IPv6 prefixes in the range /65 through 127:

```
[edit chassis forwarding-options l2-profile-one]
user@switch# set num-65-127-prefix 2
```

Table 12 on page 67 shows the numbers of entries that you can allocate by using the **num-65-127-prefix** statement starting with Junos OS 13.2X51-D15. Each row represents a case in which the table is full and cannot accommodate any more entries.

Table 12: LPM Table Combinations for L2 and L3 profiles With Junos OS 13.2X51-D15 and Later

num-65-127-prefix Value	IPv4 Entries	IPv6 Entries (Prefix <= 64)	IPv6 Entries (Prefix >= 65)
0	16K	8K	0K
1 (default)	12K	6K	1K
2	8K	4K	2K
3	4K	2K	3K
4	0K	0K	4K



CAUTION: When you configure and commit a profile change with the **num-65-127-prefix** *number* statement, the Packet Forwarding Engine automatically restarts and all the data interfaces on the switch go down and come back up (the management interfaces are unaffected).

However, starting with Junos OS Release 14.1X53-D40, 15.1R5, and 16.1R3, Packet Forwarding Engines on switches in a Virtual Chassis or Virtual Chassis Fabric (VCF) do not automatically restart upon configuring a unified forwarding table profile change, to avoid Virtual Chassis or VCF instability when the change propagates to member switches and multiple Packet Forwarding Engines restart at the same time. Instead, a message is displayed at the CLI prompt and logged to the switch's system log to notify you that the profile change does not take effect until the next time you reboot the Virtual Chassis or VCF. We recommend that you plan to make profile changes only when you can perform a Virtual Chassis or VCF system reboot immediately after committing the configuration update. Otherwise, the Virtual Chassis or VCF could become inconsistent if one or more members have a problem and restart with the new configuration before a planned system reboot activates the change on all members.

*Configuring the **lpm-profile** With Junos OS Release 13.2x51-D15 and Later*

Starting with Junos OS release 13.2x51-D15 you can configure the **lpm-profile** profile not to allocate any memory for IPv6 entries with prefix lengths from /65 through /127. These are the default maximum values allocated for LPM memory for the **lpm-profile** by address type:

- 128K of IPv4 prefixes
- 16K of IPv6 prefixes (all lengths)



NOTE: The memory allocated for each address type represents the maximum default value for all LPM memory.

To configure the **lpm-profile** not to allocate forwarding-table memory for IPv6 entries with prefixes from /65 through /127, thus allocating more memory for IPv4:

Specify to disable forwarding-table memory for IPv6 prefixes with lengths in the range /65 through /127.

```
[edit chassis forwarding-options lpm-profile]
user@switch# set prefix-65-127-disable
```

For example, on the QFX3500, QFX3600, and QFX5100 switches only, if you use the **prefix-65-127-disable** option, each of the following combinations are valid:

- 100K IPv4 and 28K IPv6 /64 or shorter prefixes.
- 64K IPv4 and 64K IPv6 /64 or shorter prefixes.
- 128K IPv4 and 0K IPv6 /64 or shorter prefixes.
- 0K IPv4 and 128K IPv6 /64 or shorter prefixes.



NOTE: On the QFX5200 switches, when you configure the **prefix-65-127-disable** statement, the maximum number of IPv6 entries with prefixes equal to or shorter than 64 is 98,000.

Configuring the **lpm-profile** With Junos OS Release 14.1x53-D30 and Later

Starting in Junos OS Release 15.1x53-D30, you can configure the **lpm-profile** profile to store unicast IPv4 and IPv6 host addresses in the LPM table, thereby freeing memory in the host table. Unicast IPv4 and IPv6 addresses are stored in the LPM table instead of the host table, as shown in [Table 13 on page 69](#) for QFX3500, QFX3600, and QFX5100 switches. You can use this option in conjunction with the option to allocate no memory in the LPM table for IPv6 entries with prefix lengths in the range /65 through /127. Together, these options maximize the amount of memory available for IPv4 unicast entries and IPv6 entries with prefix lengths equal to or less than 64.

Table 13: lpm-profile with unicast-in-lpm Option for QFX3500, QFX3600, and QFX5100 Switches

prefix-65-127-disable	MAC Table	Host Table (multicast addresses)						LPM Table unicast addresses)		
	MAC	IPv4 unicast	IPv6 unicast	IPv4 (*, G)	IPv4 (S, G)	IPv6 (*, G)	IPv6 (S, G)	IPv4 unicast	IPv6 unicast (</65)	IPv6 unicast (>/64)
No	32K	0	0	8K	8K	4K	4K	128K	16K	16K
Yes	32K	0	0	8K	8K	4K	4K	128K	128K	0

Note that all entries in each table share the same memory space. If a table stores the maximum number of entries for any given type, the entire shared table is full and is unable to accommodate any entries of any other type. For example, if you use the **unicast-in-lpm** option and there are 128K IPv4 unicast addresses stored in the LPM table, the entire LPM table is full and no IPv6 addresses can be stored. Similarly, if you use the **unicast-in-lpm** option but do not use the **prefix-65-127-disable** option, and 16K IPv6 addresses with prefixes shorter than /65 are stored, the entire LPM table is full and no additional addresses (IPv4 or IPv6) can be stored.

To configure the **lpm-profile** to store unicast IPv4 entries and IPv6 entries with prefix lengths equal to or less than 64 in the LPM table:

1. Specify the option to store these entries in the LPM table.

```
[edit chassis forwarding-options lpm-profile]
user@switch# set unicast-in-lpm
```

2. (Optional) Specify to allocate no memory for in the LPM table for IPv6 prefixes with length in the range /65 through /127:

```
[edit chassis forwarding-options lpm-profile]
user@switch# set prefix-65-127-disable
```

- Related Documentation**
- *Understanding the Unified Forwarding Table*

Configuring the Forwarding Mode

By default, packets are forwarded using store-and-forward mode. You can configure all the interfaces to use cut-through mode instead.

To enable cut-through switching mode, enter the following statement:

```
[edit forwarding-options]  
user@switch# set cut-through
```

- Related Documentation**
- *cut-through*

PART 3

Configuring Q-in-Q Tunneling

- [Understanding Q-in-Q Tunneling \(ELS CLI Only\) on page 73](#)
- [Configuring Q-in-Q Tunneling \(ELS CLI Only\) on page 79](#)

CHAPTER 7

Understanding Q-in-Q Tunneling (ELS CLI Only)

- [Understanding Q-in-Q Tunneling on page 73](#)

Understanding Q-in-Q Tunneling



NOTE: This topic applies to Junos OS switches with support for the Enhanced Layer 2 Software (ELS) configuration style. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

Q-in-Q tunneling enables service providers on Ethernet access networks to extend a Layer 2 Ethernet connection between two customer sites. Using Q-in-Q tunneling, providers can also segregate or bundle customer traffic into fewer VLANs or different VLANs by adding another layer of 802.1Q tags. Q-in-Q tunneling is useful when customers have overlapping VLAN IDs because customers' VLAN (C-VLAN) tags are prepended by the service-provider VLAN (S-VLAN) tag, which allows you to preserve each customers' VLAN IDs without conflict. The Juniper Networks Junos operating system (Junos OS) implementation of Q-in-Q tunneling supports the IEEE 802.1ad standard.

This topic describes:

- [How Q-in-Q Tunneling Works on page 73](#)
- [How VLAN Translation Works on page 74](#)
- [Sending and Receiving Untagged Packets on page 74](#)
- [Disabling MAC Address Learning on page 75](#)
- [Mapping C-VLANs to S-VLANs on page 75](#)
- [Constraints for Q-in-Q Tunneling and VLAN Translation on page 76](#)

How Q-in-Q Tunneling Works

In Q-in-Q tunneling, as a packet travels from a C-VLAN to an S-VLAN, a service-provider-specific 802.1Q tag is added to the packet. This additional tag is used to segregate traffic into S-VLANs. The original customer 802.1Q tag of the packet is retained and is transmitted transparently, passing through the service provider's network.

As the packet leaves the S-VLAN in the downstream direction, the additional 802.1Q tag is removed.

When Q-in-Q tunneling is enabled, trunk interfaces are assumed to be part of the service provider or data center network. Access interfaces are assumed to be customer-facing and accept both tagged and untagged frames. This topic refers to trunk interfaces as S-VLAN interfaces. This type of interface is also known as a network-to-network interface (NNI). The topic refers to access interfaces as C-VLAN interfaces. This type of interface is also known as a user-network interface (UNI).



NOTE:

An interface can be a member of multiple S-VLANs. You can map one C-VLAN to one S-VLAN (1:1) or many C-VLANs to many S-VLANs (N:N). C-VLAN and S-VLAN tags are unique—for instance, you can have both a C-VLAN tag of 101 and an S-VLAN tag of 101. You can limit the set of accepted customer tags to a range of tags or to discrete values. Class-of-service (CoS) values of C-VLANs are unchanged in the downstream direction. You may copy ingress priority and CoS settings to the S-VLAN.

C-VLAN and S-VLAN interfaces accept priority-tagged packets without any configuration.

How VLAN Translation Works

VLAN translation replaces an incoming C-VLAN tag with an S-VLAN tag instead of adding an additional tag. The C-VLAN tag is therefore lost, so a single-tagged packet is normally untagged when it leaves the S-VLAN (at the other end of the link). If an incoming packet has had Q-in-Q tunneling applied in advance, VLAN translation replaces the outer tag and the inner tag is retained when the packet leaves the S-VLAN at the other end of the link.

To configure VLAN translation, use the *mapping swap* statement at the **[edit vlans interface]** hierarchy level.



NOTE: You can configure VLAN translation on access ports only. You cannot configure it on trunk ports, and you cannot configure Q-in-Q tunneling on the same access port.

Sending and Receiving Untagged Packets

To enable an interface to send and receive untagged packets, you must specify a native VLAN for a physical interface. When the interface receives an untagged packet, it adds the VLAN ID of the native VLAN to the packet and sends the newly tagged packet to the mapped interface.

To specify a native VLAN, use the **native-vlan-id** statement at the **[edit interfaces interface-name]** hierarchy level. The native VLAN ID must match the C-VLAN or S-VLAN ID or be included in the VLAN ID list specified on the logical interface.

For example, on a logical interface for a C-VLAN interface, you might specify a C-VLAN ID list of 100-200. Then, on the C-VLAN physical interface, you could specify a native VLAN ID of 150. This configuration would work because the native VLAN of 150 is included in the C-VLAN ID list of 100-200.

We recommend configuring a native VLAN when using any of the approaches to map C-VLANs to S-VLANs. If you do not configure a native VLAN on an interface, untagged packets received by the interface are discarded. See the Mapping C-VLANs to S-VLANs section in this topic for information about the methods of mapping C-VLANs to S-VLANs.

Disabling MAC Address Learning

In a Q-in-Q deployment, customer packets interfaces are transported without any changes to source and destination MAC addresses. You can disable MAC address learning at the global, interface, and VLAN levels:

- To disable learning globally, disable MAC address learning for the switch.
- To disable learning for an interface, disable MAC address learning for all VLANs of which the specified interface is a member.
- To disable learning for a VLAN, disable MAC address learning for a specified VLAN.

Mapping C-VLANs to S-VLANs

There are three ways to map C-VLANs to S-VLANs:

- [All-in-One Bundling on page 75](#)
- [Many-to-Many Bundling on page 75](#)
- [Mapping a Specific Interface on page 76](#)

If you configure multiple mapping methods, the switch gives priority to mapping a specific interface, then to many-to-many bundling, and last to all-in-one bundling. However, for a particular mapping method, setting up overlapping rules for the same C-VLAN is not supported.

All-in-One Bundling

All-in-one bundling maps all packets from all C-VLAN interfaces to an S-VLAN.

The C-VLAN interface accepts untagged and single-tagged packets. An S-VLAN 802.1Q tag is then added to these packets, and the packets are sent to the S-VLAN interface, which accepts untagged, single-tagged, and double-tagged packets.



NOTE: The C-VLAN and S-VLAN interfaces accept untagged packets provided that the `native-vlan-id` statement is configured on these interfaces.

Many-to-Many Bundling

Many-to-many bundling is used to specify which C-VLANs are mapped to which S-VLANs.

Use many-to-many bundling when you want a subset of the C-VLANs on the access switch to be part of multiple S-VLANs. With many-to-many bundling, the C-VLAN interfaces accept untagged and single-tagged packets. An S-VLAN 802.1Q tag is then added to these packets, and the packets are sent to the S-VLAN interfaces, which accept untagged, single-tagged, and double-tagged packets.



NOTE: The C-VLAN and S-VLAN interfaces accept untagged packets provided that the `native-vlan-id` statement is configured on these interfaces.

Mapping a Specific Interface

Use specific interface mapping when you want to assign an S-VLAN to a specific C-VLAN on an interface. The configuration applies only to the specific interface, not to all access interfaces.

Specific interface mapping has two suboptions: **push** and **swap**. When traffic that is mapped to a specific interface is pushed, the packet retains its original tag as it moves from the C-VLAN to the S-VLAN and an additional S-VLAN tag is added to the packet. When traffic that is mapped to a specific interface is swapped, the incoming tag is replaced with a new VLAN tag. This is sometimes known as VLAN rewriting or VLAN translation.

Typically, this method is used to keep data from different customers separate or to provide individualized treatment of the packets on a certain interface. You might also use this method to map VLAN traffic from different customers to a single S-VLAN.

When using specific interface mapping, the C-VLAN interfaces accept untagged and single-tagged packets, while the S-VLAN interfaces accept untagged, single-tagged, and double-tagged packets.



NOTE: The C-VLAN and S-VLAN interfaces accept untagged packets provided that the `native-vlan-id` statement is configured on these interfaces.

Constraints for Q-in-Q Tunneling and VLAN Translation

Be aware of the following constraints when configuring Q-in-Q tunneling and VLAN translation:

- With releases of Junos OS 13.2X51 previous to 13.2X51-D20, you cannot create a regular VLAN on an interface if you have created an S-VLAN or C-VLAN on that interface for Q-in-Q tunneling. This means that you cannot create an integrated routing and bridging (IRB) interface on that interface because regular VLANs are a required part of IRB configuration. With Junos OS 13.2X51-D25, you can create a regular VLAN on a trunk interface that has an S-VLAN, which means that you can also create an IRB interface on the trunk. In this case, the regular VLAN and S-VLAN on the same trunk interface cannot share the same VLAN ID. Junos OS 13.2X51-D25 does not allow you to create a regular VLAN on an access interface that has a C-VLAN.
- Most access port security features are not supported with Q-in-Q tunneling and VLAN translation.
- Configuring Q-in-Q tunneling and VLAN rewriting/VLAN translation on the same port is not supported.
- You can configure at most one VLAN rewrite/VLAN translation for a given VLAN and interface. For example, you can create no more than one translation for VLAN 100 on interface xe-0/0/0.
- The combined total of VLANs and rules for Q-in-Q tunneling and VLAN translation cannot exceed 6000. For example, you can configure and commit 4000 VLANs and 2000 rules for Q-in-Q tunneling and VLAN translation. However, you cannot configure 4000 VLANs and 2500 rules for Q-in-Q tunneling and VLAN translation. If you try to commit a configuration that exceeds the limit, you see CLI and syslog errors that inform you about the problem.
- MAC addresses are learned from S-VLANs, not C-VLANs.
- Broadcast, unknown unicast, and multicast traffic is forwarded to all members in the S-VLAN.
- The following features are not supported with Q-in-Q tunneling:
 - DHCP relay
 - Fibre Channel over Ethernet
 - IP Source Guard
- The following features are not supported with VLAN rewriting/VLAN translation:
 - Fibre Channel over Ethernet
 - Firewall filter applied to a port or VLAN in the output direction
 - Private VLANs
 - VLAN Spanning Tree Protocol
 - Reflective relay

**Related
Documentation**

- [Configuring Q-in-Q Tunneling on page 79](#)

CHAPTER 8

Configuring Q-in-Q Tunneling (ELS CLI Only)

- [Configuring Q-in-Q Tunneling on page 79](#)
- [Configuring All-in-One Bundling on page 86](#)
- [Configuring Many-to-Many Bundling on page 88](#)
- [Configuring a Specific Interface Mapping with VLAN ID Translation Option on page 91](#)

Configuring Q-in-Q Tunneling

Q-in-Q tunneling and VLAN translation allow service providers to create a Layer 2 Ethernet connection between two customer sites. Providers can segregate different customers' VLAN traffic on a link (for example, if the customers use overlapping VLAN IDs) or bundle different customer VLANs into a single service VLAN. Data centers can use Q-in-Q tunneling and VLAN translation to isolate customer traffic within a single site or to enable customer traffic flows between cloud data centers in different geographic locations.

Q-in-Q tunneling adds a service VLAN tag before the customer's 802.1Q VLAN tags. The Juniper Networks Junos operating system implementation of Q-in-Q tunneling supports the IEEE 802.1ad standard.



NOTE: This task uses a Junos OS release that supports the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Configuring Q-in-Q Tunneling*.

With releases of Junos OS 13.2X51 previous to 13.2X51-D20, you cannot create a regular VLAN on an interface if you have created an S-VLAN or C-VLAN on that interface for Q-in-Q tunneling. This means that you cannot create an integrated routing and bridging (IRB) interface on that interface because regular VLANs are a required part of IRB configuration. With Junos OS 13.2X51-D25, you can create a regular VLAN on a trunk interface that has an S-VLAN, which means that you can also create an IRB interface on the trunk. In this case, the regular VLAN and S-VLAN on the same trunk interface cannot share the same VLAN ID. Junos OS 13.2X51-D25 does not allow you to create a regular VLAN on an access interface that has a C-VLAN.

Before setting up Q-in-Q tunneling, make sure you have created and configured the necessary customer VLANs on the neighboring switches. See *Configuring VLANs*.

- [Using the Different Mapping Methods on page 80](#)
- [Configuring All-in-One Bundling on page 80](#)
- [Configuring Many-to-Many Bundling on page 82](#)
- [Configuring a Specific Interface Mapping with VLAN ID Translation Option on page 84](#)

Using the Different Mapping Methods

Once you have created the required VLANs on the neighboring switches, configure Q-in-Q tunneling using one of the three methods to map customer VLANs (C-VLANs) to service-provider-defined service VLANs (S-VLANs):

- All-in-one bundling maps all packets from all C-VLAN interfaces to an S-VLAN. For information about how to use this method, see [“Configuring All-in-One Bundling” on page 80](#).
- Use many-to-many bundling when you want a subset of the C-VLANs on the access switch to be part of multiple S-VLANs. For information about how to use this method, see [“Configuring Many-to-Many Bundling” on page 82](#).
- Use specific interface mapping when you want to assign an S-VLAN to a specific C-VLAN on an interface. For information about how to use this method, see [“Configuring a Specific Interface Mapping with VLAN ID Translation Option” on page 84](#).

Configuring All-in-One Bundling

You can configure Q-in-Q tunneling using the all-in-one bundling method, which forwards all packets that ingress on a C-VLAN interface to an S-VLAN. (Packets are forwarded to the S-VLAN regardless of whether they are tagged or untagged prior to ingress.) Using this approach saves you the effort of specifying a specific mapping for each C-VLAN.

First configure the S-VLAN and its interface:

1. Assign a logical interface (unit) to be a member of the S-VLAN.

[edit vlans *vlan-name*]

user@switch# **interface *interface-name.unit-number***



NOTE: Do not use logical interface unit 0. You must later bind a VLAN tag ID to the unit you specify in this step, and you cannot bind a VLAN tag ID to unit 0. Also note that you do not create a VLAN ID for the S-VLAN. The ID is created automatically for the appropriate logical interface.

2. Enable the interface to transmit packets with two 802.1Q VLAN tags:

[edit interfaces *interface-name*]

user@switch# **flexible-vlan-tagging**

3. Enable extended VLAN bridge encapsulation on the interface:

[edit interfaces *interface-name*]

```
user@switch# encapsulation extended-vlan-bridge
```

4. Enable the S-VLAN interface to send and receive untagged packets:

```
[edit interfaces interface-name]
```

```
user@switch# native-vlan-id vlan-id
```

5. Bind the logical interface (unit) of the interface that you specified in step 1 to the automatically-created VLAN ID for the S-VLAN:

```
[edit interfaces interface-name unit logical-unit-number]
```

```
user@switch# vlan-id number
```

For example, the following configuration makes xe-0/0/0.10 a member of VLAN 10, enables Q-in-Q tunneling on interface xe-0/0/0, enables xe-0/0/0 to accept untagged packets, and binds the VLAN ID of S-VLAN v10 to a logical interface of xe-0/0/0.

```
set vlans v10 interface xe-0/0/0.10
```

```
set interfaces xe-0/0/0 flexible-vlan-tagging
```

```
set interfaces xe-0/0/0 native-vlan-id 10
```

```
set interfaces xe-0/0/0 encapsulation extended-vlan-bridge
```

```
set interfaces xe-0/0/0 unit 10 vlan-id 10
```

Now configure all-in-one bundling on a C-VLAN interface:

1. Assign a logical interface (unit) of the C-VLAN interface to be a member of the S-VLAN.

```
[edit vlans vlan-name]
```

```
user@switch# interface interface-name.unit-number
```

2. Enable the interface to transmit packets with 802.1Q VLAN tags :

```
[edit interfaces interface-name]
```

```
user@switch# flexible-vlan-tagging
```

3. Enable extended VLAN bridge encapsulation on the interface:

```
[edit interfaces interface-name]
```

```
user@switch# encapsulation extended-vlan-bridge
```

4. Enable the C-VLAN interface to send and receive untagged packets:

```
[edit interfaces interface-name]
```

```
user@switch# native-vlan-id vlan-id
```

5. Configure a logical interface to receive and forward any tagged packet whose VLAN ID tag matches the list of VLAN IDs you specify:

```
[edit interfaces interface-name unit logical-unit-number]
```

```
user@switch# vlan-id-list vlan-id-numbers
```



WARNING: On some EX and QFX Series switches, you can apply no more than eight VLAN identifier lists to a physical interface.

6. Configure the system to add an S-VLAN tag (outer tag) as packets travel from a C-VLAN interface to the S-VLAN:

```
[edit interfaces interface-name unit logical-unit-number]
```

```
user@switch# input-vlan-map push
```

7. Configure the system to remove the S-VLAN tag when packets are forwarded (internally) from the S-VLAN interface to the C-VLAN interface:

```
[edit interfaces interface-name unit logical-unit-number]
```

```
user@switch# output-vlan-map pop
```

For example, the following configuration makes xe-0/0/1.10 a member of S-VLAN v10, enables Q-in-Q tunneling, maps packets from C-VLANs 100 through 200 to S-VLAN 10, and enables xe-0/0/1 to accept untagged packets. If a packet originates in C-VLAN 100 and needs to be sent across the S-VLAN, a tag with VLAN ID 10 is added to the packet. When a packet is forwarded (internally) from the S-VLAN interface to interface xe-0/0/1, the tag with VLAN ID 10 is removed.

```
set vlans v10 interface xe-0/0/1.10
set interfaces xe-0/0/1 flexible-vlan-tagging
set interfaces xe-0/0/1 encapsulation extended-vlan-bridge
set interfaces xe-0/0/1 unit 10 vlan-id-list 100-200
set interfaces xe-0/0/1 native-vlan-id 150
set interfaces xe-0/0/1 unit 10 input-vlan-map push
set interfaces xe-0/0/1 unit 10 output-vlan-map pop
```

Configuring Many-to-Many Bundling

You can configure Q-in-Q tunneling using the many-to-many bundling method, which maps packets from multiple C-VLANs to multiple S-VLANs. This method is convenient for mapping a range of C-VLANs without having to specify each one individually. (You can also use this method to configure only one C-VLAN to be mapped to an S-VLAN.)

First configure the S-VLANs and assign them to an interface:

1. Assign a logical interface (unit) to be a member of one of the S-VLANs. Do not use logical interface unit 0.

[edit vlans *vlan-name*]

user@switch# interface *interface-name.unit-number*



NOTE: Note that you do not create a VLAN ID for the S-VLAN. The ID is created automatically for the appropriate logical interface.

2. Repeat step 1 for the other S-VLANs.
3. Enable the physical interface to transmit packets with two 802.1Q VLAN tags:

[edit interfaces *interface-name*]

user@switch# flexible-vlan-tagging

4. Enable extended VLAN bridge encapsulation on the interface:

[edit interfaces *interface-name*]

user@switch# encapsulation extended-vlan-bridge

5. Enable the S-VLAN interface to send and receive untagged packets:

[edit interfaces *interface-name*]

user@switch# native-vlan-id *vlan-id*

6. Bind one of the logical units of the interface to the VLAN ID for one of the S-VLANs.

[edit interfaces *interface-name* unit *logical-unit-number*]

user@switch# vlan-id *number*

7. Repeat step 6 to bind the automatically-created VLAN IDs for the other S-VLANs to the other logical units of the interface:

For example, the following configuration creates S-VLANs v10 and v30 and associates them with interface xe-0/0/0. It also enables Q-in-Q tunneling, enables xe-0/0/0 to accept untagged packets, and maps incoming C-VLAN packets to S-VLANs v10 and v30.

```
set vlans v10 interface xe-0/0/0.10
set vlans v30 interface xe-0/0/0.30
set interfaces xe-0/0/0 flexible-vlan-tagging
set interfaces xe-0/0/0 native-vlan-id 10
set interfaces xe-0/0/0 encapsulation extended-vlan-bridge
set interfaces xe-0/0/0 unit 10 vlan-id 10
set interfaces xe-0/0/0 unit 30 vlan-id 30
```

To configure the many-to-many bundling method on a C-VLAN interface, perform the following steps for each customer:

1. Assign a logical interface (unit) of one C-VLAN interface to be a member of one S-VLAN.

```
[edit vlans vlan-name]
user@switch# interface interface-name.unit-number
```

2. Repeat step 1 to assign another C-VLAN interface (physical interface) to be a member of another S-VLAN.

3. Enable the interface to transmit packets with 802.1Q VLAN tags:

```
[edit interfaces interface-name]
user@switch# flexible-vlan-tagging
```

4. Enable extended VLAN bridge encapsulation on the interface:

```
[edit interfaces interface-name]
user@switch# encapsulation extended-vlan-bridge
```

5. Enable the C-VLAN interface to send and receive untagged packets:

```
[edit interfaces interface-name]
user@switch# native-vlan-id vlan-id
```

6. For each physical interface, configure a logical interface (unit) to receive and forward any tagged packet whose VLAN ID tag matches the list of VLAN IDs you specify:

```
[edit interfaces interface-name unit logical-unit-number]
user@switch# vlan-id-list vlan-id-numbers
```

To configure only one C-VLAN to be mapped to an S-VLAN, specify only one VLAN ID after *vlan-id-list*.



WARNING: On some EX and QFX Series switches, you can apply no more than eight VLAN identifier list to a physical interface.

7. For each physical interface, configure the system to add an S-VLAN tag (outer tag) as packets travel from the C-VLAN interface to the S-VLAN:

```
[edit interfaces interface-name unit logical-unit-number]
user@switch# input-vlan-map push
```

8. For each physical interface, configure the system to remove the S-VLAN tag when packets are forwarded from the S-VLAN interface to the C-VLAN interface:

```
[edit interfaces interface-name unit logical-unit-number]
user@switch# output-vlan-map pop
```

For example, the following configuration makes xe-0/0/1.10 a member of S-VLAN v10, enables Q-in-Q tunneling, and maps packets from C-VLANs 10 through 20 to S-VLAN 10. The configuration for customer 2 makes xe-0/0/2.30 a member of S-VLAN v30, enables Q-in-Q tunneling, and maps packets from C-VLANs 30 through 40, 50 through 60, and 70 through 80 to S-VLAN 30. Both interfaces are configured to accept untagged packets.

If a packet originates in C-VLAN 10 and needs to be sent over the S-VLAN, a tag with a VLAN ID 10 is added to the packet. If a packet is forwarded internally from the S-VLAN interface to xe-0/0/1.10, the tag with VLAN ID 10 is removed. The same principles apply to the C-VLANs configured on interface xe-0/0/2.



NOTE: Notice that you can use the same tag value for an S-VLAN and C-VLAN. For example, the configuration for customer 1 maps C-VLAN ID 10 to S-VLAN ID 10. C-VLAN and S-VLAN tags use separate name spaces, so this configuration is allowed.

Configuration for customer 1:

```
set vlans v10 interface xe-0/0/1.10
set interfaces xe-0/0/1 flexible-vlan-tagging
set interfaces xe-0/0/1 encapsulation extended-vlan-bridge
set interfaces xe-0/0/1 unit 10 vlan-id-list 10-20
set interfaces xe-0/0/1 native-vlan-id 15
set interfaces xe-0/0/1 unit 10 input-vlan-map push
set interfaces xe-0/0/1 unit 10 output-vlan-map pop
```

Configuration for customer 2:

```
set vlans v30 interface xe-0/0/2.30
set interfaces xe-0/0/2 flexible-vlan-tagging
set interfaces xe-0/0/2 encapsulation extended-vlan-bridge
set interfaces xe-0/0/2 unit 30 vlan-id-list 30-40
set interfaces xe-0/0/2 unit 30 vlan-id-list 50-60
set interfaces xe-0/0/2 unit 30 vlan-id-list 70-80
set interfaces xe-0/0/2 native-vlan-id 75
set interfaces xe-0/0/2 unit 30 input-vlan-map push
set interfaces xe-0/0/2 unit 30 output-vlan-map pop
```

Configuring a Specific Interface Mapping with VLAN ID Translation Option

You can configure Q-in-Q tunneling by mapping packets from a specified C-VLAN to a specified S-VLAN. In addition, you can configure the system to replace a C-VLAN tag with an S-VLAN tag or replace an S-VLAN tag with a C-VLAN tag (instead of double tagging). This is called VLAN translation or VLAN rewriting. VLAN translation is particularly useful if a service provider's Layer 2 network that connects a customer's sites does not support double tagged packets.

When you use VLAN translation, both ends of the link normally must be able to swap the tags appropriately. That is, both ends of the link must be configured to swap the C-VLAN tag for the S-VLAN tag and swap the S-VLAN tag for the C-VLAN tag so that traffic in both directions is tagged appropriately while in transit and after arrival.

First configure the S-VLAN and its interface:

1. Assign a logical interface to be a member of the S-VLAN. Do not use unit 0.

```
[edit vlans vlan-name]  
user@switch# interface interface-name.unit-number
```



NOTE: Note that you do not create a VLAN ID for the S-VLAN. The ID is created automatically for the appropriate logical interface.

2. Enable the interface to transmit packets with 802.1Q VLAN tags:

```
[edit interfaces interface-name]  
user@switch# flexible-vlan-tagging
```

3. Enable the S-VLAN interface to send and receive untagged packets:

```
[edit interfaces interface-name]  
user@switch# native-vlan-id vlan-id
```

4. Enable extended VLAN bridge encapsulation on the interface:

```
[edit interfaces interface-name]  
user@switch# encapsulation extended-vlan-bridge
```

5. Bind the logical interface (unit) of the interface that you specified earlier to the VLAN ID for the S-VLAN:

```
[edit interfaces interface-name unit logical-unit-number]  
user@switch# vlan-id number
```

For example, the following configuration creates S-VLAN v200, makes xe-0/0/0.200 a member of that VLAN, enables Q-in-Q tunneling on interface xe-0/0/0, enables xe-0/0/0 to accept untagged packets, and binds a logical interface of xe-0/0/0 to the VLAN ID of VLAN v200.

```
set vlans v200 interface xe-0/0/0.200  
set interfaces xe-0/0/0 flexible-vlan-tagging  
set interfaces xe-0/0/0 native-vlan-id 10  
set interfaces xe-0/0/0 encapsulation extended-vlan-bridge  
set interfaces xe-0/0/0 unit 200 vlan-id 200
```

Now configure a specific interface mapping with optional VLAN ID translation on the C-VLAN interface:

1. Assign a logical interface of the C-VLAN interface to be a member of the S-VLAN.

```
[edit vlans vlan-name]  
user@switch# interface interface-name.unit-number
```

2. Enable the interface to transmit packets with 802.1Q VLAN tags:

```
[edit interfaces interface-name]  
user@switch# flexible-vlan-tagging
```

3. Enable the C-VLAN interface to send and receive untagged packets:

```
[edit interfaces interface-name]  
user@switch# native-vlan-id vlan-id
```

4. Enable extended VLAN bridge encapsulation on the interface:

```
[edit interfaces interface-name]  
user@switch# encapsulation extended-vlan-bridge
```

5. Configure a logical interface (unit) to receive and forward any tagged packet whose VLAN ID tag matches the VLAN IDs you specify:

```
[edit interfaces interface-name unit logical-unit-number]  
user@switch# vlan-id number
```

6. Configure the system to remove the existing C-VLAN tag and replace it with the S-VLAN tag when packets ingress on the C-VLAN interface and are forwarded to the S-VLAN:

```
[edit interfaces interface-name unit logical-unit-number]  
user@switch# input-vlan-map swap
```

7. Configure the system to remove the existing S-VLAN tag and replace it with the C-VLAN tag when packets are forwarded from the S-VLAN interface to the C-VLAN interface:

```
[edit interfaces interface-name unit logical-unit-number]  
user@switch# output-vlan-map swap
```

8. To configure an S-VLAN and associate it with the appropriate C-VLAN interface:

```
[edit vlans vlan-name]  
user@switch# interface interface-name
```

For example, the following configuration on C-VLAN interface xe-0/0/1 enables Q-in-Q tunneling, enables xe-0/0/1 to accept untagged packets, and maps incoming packets from C-VLAN 150 to logical interface 200, which is a member of S-VLAN 200. Also, when packets egress from C-VLAN interface xe-0/0/1 and travel to the S-VLAN interface, the C-VLAN tag of 150 is removed and replaced with the S-VLAN tag of 200. When packets travel from the S-VLAN interface to the C-VLAN interface, the S-VLAN tag of 200 is removed and replaced with the C-VLAN tag of 150.

```
set vlans v200 interface xe-0/0/1.200  
set interfaces xe-0/0/1 flexible-vlan-tagging  
set interfaces xe-0/0/1 native-vlan-id 10  
set interfaces xe-0/0/1 encapsulation extended-vlan-bridge  
set interfaces xe-0/0/1 unit 200 vlan-id 150  
set interfaces xe-0/0/1 unit 200 output-vlan-map swap  
set interfaces xe-0/0/1 unit 200 input-vlan-map swap
```

Related Documentation

- [Understanding Q-in-Q Tunneling on page 73](#)

Configuring All-in-One Bundling

You can configure Q-in-Q tunneling using the all-in-one bundling method, which forwards all packets that ingress on a C-VLAN interface to an S-VLAN. (Packets are forwarded to the S-VLAN regardless of whether they are tagged or untagged prior to ingress.) Using this approach saves you the effort of specifying a specific mapping for each C-VLAN.

First configure the S-VLAN and its interface:

1. Assign a logical interface (unit) to be a member of the S-VLAN.

```
[edit vlans vlan-name]  
user@switch# interface interface-name.unit-number
```



NOTE: Do not use logical interface unit 0. You must later bind a VLAN tag ID to the unit you specify in this step, and you cannot bind a VLAN tag ID to unit 0. Also note that you do not create a VLAN ID for the S-VLAN. The ID is created automatically for the appropriate logical interface.

2. Enable the interface to transmit packets with two 802.1Q VLAN tags:

```
[edit interfaces interface-name]  
user@switch# flexible-vlan-tagging
```

3. Enable extended VLAN bridge encapsulation on the interface:

```
[edit interfaces interface-name]  
user@switch# encapsulation extended-vlan-bridge
```

4. Enable the S-VLAN interface to send and receive untagged packets:

```
[edit interfaces interface-name]  
user@switch# native-vlan-id vlan-id
```

5. Bind the logical interface (unit) of the interface that you specified in step 1 to the automatically-created VLAN ID for the S-VLAN:

```
[edit interfaces interface-name unit logical-unit-number]  
user@switch# vlan-id number
```

For example, the following configuration makes xe-0/0/0.10 a member of VLAN 10, enables Q-in-Q tunneling on interface xe-0/0/0, enables xe-0/0/0 to accept untagged packets, and binds the VLAN ID of S-VLAN v10 to a logical interface of xe-0/0/0.

```
set vlans v10 interface xe-0/0/0.10  
set interfaces xe-0/0/0 flexible-vlan-tagging  
set interfaces xe-0/0/0 native-vlan-id 10  
set interfaces xe-0/0/0 encapsulation extended-vlan-bridge  
set interfaces xe-0/0/0 unit 10 vlan-id 10
```

Now configure all-in-one bundling on a C-VLAN interface:

1. Assign a logical interface (unit) of the C-VLAN interface to be a member of the S-VLAN.

```
[edit vlans vlan-name]  
user@switch# interface interface-name.unit-number
```

2. Enable the interface to transmit packets with 802.1Q VLAN tags :

```
[edit interfaces interface-name]  
user@switch# flexible-vlan-tagging
```

3. Enable extended VLAN bridge encapsulation on the interface:

```
[edit interfaces interface-name]  
user@switch# encapsulation extended-vlan-bridge
```

4. Enable the C-VLAN interface to send and receive untagged packets:

```
[edit interfaces interface-name]  
user@switch# native-vlan-id vlan-id
```

5. Configure a logical interface to receive and forward any tagged packet whose VLAN ID tag matches the list of VLAN IDs you specify:

```
[edit interfaces interface-name unit logical-unit-number]
user@switch# vlan-id-list vlan-id-numbers
```



WARNING: On some EX and QFX Series switches, you can apply no more than eight VLAN identifier lists to a physical interface.

6. Configure the system to add an S-VLAN tag (outer tag) as packets travel from a C-VLAN interface to the S-VLAN:

```
[edit interfaces interface-name unit logical-unit-number]
user@switch# input-vlan-map push
```

7. Configure the system to remove the S-VLAN tag when packets are forwarded (internally) from the S-VLAN interface to the C-VLAN interface:

```
[edit interfaces interface-name unit logical-unit-number]
user@switch# output-vlan-map pop
```

For example, the following configuration makes xe-0/0/1.10 a member of S-VLAN v10, enables Q-in-Q tunneling, maps packets from C-VLANs 100 through 200 to S-VLAN 10, and enables xe-0/0/1 to accept untagged packets. If a packet originates in C-VLAN 100 and needs to be sent across the S-VLAN, a tag with VLAN ID 10 is added to the packet. When a packet is forwarded (internally) from the S-VLAN interface to interface xe-0/0/1, the tag with VLAN ID 10 is removed.

```
set vlans v10 interface xe-0/0/1.10
set interfaces xe-0/0/1 flexible-vlan-tagging
set interfaces xe-0/0/1 encapsulation extended-vlan-bridge
set interfaces xe-0/0/1 unit 10 vlan-id-list 100-200
set interfaces xe-0/0/1 native-vlan-id 150
set interfaces xe-0/0/1 unit 10 input-vlan-map push
set interfaces xe-0/0/1 unit 10 output-vlan-map pop
```

Related Documentation

- [Understanding Q-in-Q Tunneling on page 73](#)
- [Configuring Many-to-Many Bundling on page 82](#)
- [Configuring a Specific Interface Mapping with VLAN ID Translation Option on page 84](#)

Configuring Many-to-Many Bundling

You can configure Q-in-Q tunneling using the many-to-many bundling method, which maps packets from multiple C-VLANs to multiple S-VLANs. This method is convenient for mapping a range of C-VLANs without having to specify each one individually. (You can also use this method to configure only one C-VLAN to be mapped to an S-VLAN.)

First configure the S-VLANs and assign them to an interface:

1. Assign a logical interface (unit) to be a member of one of the S-VLANs. Do not use logical interface unit 0.

```
[edit vlans vlan-name]
user@switch# interface interface-name.unit-number
```



NOTE: Note that you do not create a VLAN ID for the S-VLAN. The ID is created automatically for the appropriate logical interface.

2. Repeat step 1 for the other S-VLANs.
3. Enable the physical interface to transmit packets with two 802.1Q VLAN tags:

```
[edit interfaces interface-name]
user@switch# flexible-vlan-tagging
```

4. Enable extended VLAN bridge encapsulation on the interface:

```
[edit interfaces interface-name]
user@switch# encapsulation extended-vlan-bridge
```

5. Enable the S-VLAN interface to send and receive untagged packets:

```
[edit interfaces interface-name]
user@switch# native-vlan-id vlan-id
```

6. Bind one of the logical units of the interface to the VLAN ID for one of the S-VLANs.

```
[edit interfaces interface-name unit logical-unit-number]
user@switch# vlan-id number
```

7. Repeat step 6 to bind the automatically-created VLAN IDs for the other S-VLANs to the other logical units of the interface:

For example, the following configuration creates S-VLANs v10 and v30 and associates them with interface xe-0/0/0. It also enables Q-in-Q tunneling, enables xe-0/0/0 to accept untagged packets, and maps incoming C-VLAN packets to S-VLANs v10 and v30.

```
set vlans v10 interface xe-0/0/0.10
set vlans v30 interface xe-0/0/0.30
set interfaces xe-0/0/0 flexible-vlan-tagging
set interfaces xe-0/0/0 native-vlan-id 10
set interfaces xe-0/0/0 encapsulation extended-vlan-bridge
set interfaces xe-0/0/0 unit 10 vlan-id 10
set interfaces xe-0/0/0 unit 30 vlan-id 30
```

To configure the many-to-many bundling method on a C-VLAN interface, perform the following steps for each customer:

1. Assign a logical interface (unit) of one C-VLAN interface to be a member of one S-VLAN.

```
[edit vlans vlan-name]
user@switch# interface interface-name.unit-number
```

2. Repeat step 1 to assign another C-VLAN interface (physical interface) to be a member of another S-VLAN.

3. Enable the interface to transmit packets with 802.1Q VLAN tags:

```
[edit interfaces interface-name]
```

```
user@switch# flexible-vlan-tagging
```

4. Enable extended VLAN bridge encapsulation on the interface:

```
[edit interfaces interface-name]
```

```
user@switch# encapsulation extended-vlan-bridge
```

5. Enable the C-VLAN interface to send and receive untagged packets:

```
[edit interfaces interface-name]
```

```
user@switch# native-vlan-id vlan-id
```

6. For each physical interface, configure a logical interface (unit) to receive and forward any tagged packet whose VLAN ID tag matches the list of VLAN IDs you specify:

```
[edit interfaces interface-name unit logical-unit-number]
```

```
user@switch# vlan-id-list vlan-id-numbers
```

To configure only one C-VLAN to be mapped to an S-VLAN, specify only one VLAN ID after *vlan-id-list*.



WARNING: On some EX and QFX Series switches, you can apply no more than eight VLAN identifier list to a physical interface.

7. For each physical interface, configure the system to add an S-VLAN tag (outer tag) as packets travel from the C-VLAN interface to the S-VLAN:

```
[edit interfaces interface-name unit logical-unit-number]
```

```
user@switch# input-vlan-map push
```

8. For each physical interface, configure the system to remove the S-VLAN tag when packets are forwarded from the S-VLAN interface to the C-VLAN interface:

```
[edit interfaces interface-name unit logical-unit-number]
```

```
user@switch# output-vlan-map pop
```

For example, the following configuration makes xe-0/0/1.10 a member of S-VLAN v10, enables Q-in-Q tunneling, and maps packets from C-VLANs 10 through 20 to S-VLAN 10. The configuration for customer 2 makes xe-0/0/2.30 a member of S-VLAN v30, enables Q-in-Q tunneling, and maps packets from C-VLANs 30 through 40, 50 through 60, and 70 through 80 to S-VLAN 30. Both interfaces are configured to accept untagged packets.

If a packet originates in C-VLAN 10 and needs to be sent over the S-VLAN, a tag with a VLAN ID 10 is added to the packet. If a packet is forwarded internally from the S-VLAN interface to xe-0/0/1.10, the tag with VLAN ID 10 is removed. The same principles apply to the C-VLANs configured on interface xe-0/0/2.



NOTE: Notice that you can use the same tag value for an S-VLAN and C-VLAN. For example, the configuration for customer 1 maps C-VLAN ID 10 to S-VLAN ID 10. C-VLAN and S-VLAN tags use separate name spaces, so this configuration is allowed.

Configuration for customer 1:

```
set vlans v10 interface xe-0/0/1.10
```

```
set interfaces xe-0/0/1 flexible-vlan-tagging
```

```

set interfaces xe-0/0/1 encapsulation extended-vlan-bridge
set interfaces xe-0/0/1 unit 10 vlan-id-list 10-20
set interfaces xe-0/0/1 native-vlan-id 15
set interfaces xe-0/0/1 unit 10 input-vlan-map push
set interfaces xe-0/0/1 unit 10 output-vlan-map pop

```

Configuration for customer 2:

```

set vlans v30 interface xe-0/0/2.30
set interfaces xe-0/0/2 flexible-vlan-tagging
set interfaces xe-0/0/2 encapsulation extended-vlan-bridge
set interfaces xe-0/0/2 unit 30 vlan-id-list 30-40
set interfaces xe-0/0/2 unit 30 vlan-id-list 50-60
set interfaces xe-0/0/2 unit 30 vlan-id-list 70-80
set interfaces xe-0/0/2 native-vlan-id 75
set interfaces xe-0/0/2 unit 30 input-vlan-map push
set interfaces xe-0/0/2 unit 30 output-vlan-map pop

```

Related Documentation

- [Understanding Q-in-Q Tunneling on page 73](#)
- [Configuring All-in-One Bundling on page 80](#)
- [Configuring a Specific Interface Mapping with VLAN ID Translation Option on page 84](#)

Configuring a Specific Interface Mapping with VLAN ID Translation Option

You can configure Q-in-Q tunneling by mapping packets from a specified C-VLAN to a specified S-VLAN. In addition, you can configure the system to replace a C-VLAN tag with an S-VLAN tag or replace an S-VLAN tag with a C-VLAN tag (instead of double tagging). This is called VLAN translation or VLAN rewriting. VLAN translation is particularly useful if a service provider's Layer 2 network that connects a customer's sites does not support double tagged packets.

When you use VLAN translation, both ends of the link normally must be able to swap the tags appropriately. That is, both ends of the link must be configured to swap the C-VLAN tag for the S-VLAN tag and swap the S-VLAN tag for the C-VLAN tag so that traffic in both directions is tagged appropriately while in transit and after arrival.

First configure the S-VLAN and its interface:

1. Assign a logical interface to be a member of the S-VLAN. Do not use unit 0.

```
[edit vlans vlan-name]
```

```
user@switch# interface interface-name.unit-number
```



NOTE: Note that you do not create a VLAN ID for the S-VLAN. The ID is created automatically for the appropriate logical interface.

2. Enable the interface to transmit packets with 802.1Q VLAN tags:

```
[edit interfaces interface-name]
```

```
user@switch# flexible-vlan-tagging
```

3. Enable the S-VLAN interface to send and receive untagged packets:

```
[edit interfaces interface-name]
```

```
user@switch# native-vlan-id vlan-id
```

4. Enable extended VLAN bridge encapsulation on the interface:

```
[edit interfaces interface-name]
```

```
user@switch# encapsulation extended-vlan-bridge
```

5. Bind the logical interface (unit) of the interface that you specified earlier to the VLAN ID for the S-VLAN:

```
[edit interfaces interface-name unit logical-unit-number]
```

```
user@switch# vlan-id number
```

For example, the following configuration creates S-VLAN v200, makes xe-0/0/0.200 a member of that VLAN, enables Q-in-Q tunneling on interface xe-0/0/0, enables xe-0/0/0 to accept untagged packets, and binds a logical interface of xe-0/0/0 to the VLAN ID of VLAN v200.

```
set vlans v200 interface xe-0/0/0.200
```

```
set interfaces xe-0/0/0 flexible-vlan-tagging
```

```
set interfaces xe-0/0/0 native-vlan-id 10
```

```
set interfaces xe-0/0/0 encapsulation extended-vlan-bridge
```

```
set interfaces xe-0/0/0 unit 200 vlan-id 200
```

Now configure a specific interface mapping with optional VLAN ID translation on the C-VLAN interface:

1. Assign a logical interface of the C-VLAN interface to be a member of the S-VLAN.

```
[edit vlans vlan-name]
```

```
user@switch# interface interface-name.unit-number
```

2. Enable the interface to transmit packets with 802.1Q VLAN tags:

```
[edit interfaces interface-name]
```

```
user@switch# flexible-vlan-tagging
```

3. Enable the C-VLAN interface to send and receive untagged packets:

```
[edit interfaces interface-name]
```

```
user@switch# native-vlan-id vlan-id
```

4. Enable extended VLAN bridge encapsulation on the interface:

```
[edit interfaces interface-name]
```

```
user@switch# encapsulation extended-vlan-bridge
```

5. Configure a logical interface (unit) to receive and forward any tagged packet whose VLAN ID tag matches the VLAN IDs you specify:

```
[edit interfaces interface-name unit logical-unit-number]
```

```
user@switch# vlan-id number
```

6. Configure the system to remove the existing C-VLAN tag and replace it with the S-VLAN tag when packets ingress on the C-VLAN interface and are forwarded to the S-VLAN:

```
[edit interfaces interface-name unit logical-unit-number]
```

```
user@switch# input-vlan-map swap
```

7. Configure the system to remove the existing S-VLAN tag and replace it with the C-VLAN tag when packets are forwarded from the S-VLAN interface to the C-VLAN interface:

```
[edit interfaces interface-name unit logical-unit-number]
```

```
user@switch# output-vlan-map swap
```

8. To configure an S-VLAN and associate it with the appropriate C-VLAN interface:

```
[edit vlans vlan-name]
```

```
user@switch# interface interface-name
```

For example, the following configuration on C-VLAN interface xe-0/0/1 enables Q-in-Q tunneling, enables xe-0/0/1 to accept untagged packets, and maps incoming packets from C-VLAN 150 to logical interface 200, which is a member of S-VLAN 200. Also, when packets egress from C-VLAN interface xe-0/0/1 and travel to the S-VLAN interface, the C-VLAN tag of 150 is removed and replaced with the S-VLAN tag of 200. When packets travel from the S-VLAN interface to the C-VLAN interface, the S-VLAN tag of 200 is removed and replaced with the C-VLAN tag of 150.

```
set vlans v200 interface xe-0/0/1.200
set interfaces xe-0/0/1 flexible-vlan-tagging
set interfaces xe-0/0/1 native-vlan-id 10
set interfaces xe-0/0/1 encapsulation extended-vlan-bridge
set interfaces xe-0/0/1 unit 200 vlan-id 150
set interfaces xe-0/0/1 unit 200 output-vlan-map swap
set interfaces xe-0/0/1 unit 200 input-vlan-map swap
```

**Related
Documentation**

- [Understanding Q-in-Q Tunneling on page 73](#)
- [Configuring All-in-One Bundling on page 80](#)
- [Configuring Many-to-Many Bundling on page 82](#)

PART 4

Configuring Proxy ARP

- [Understanding Proxy ARP on page 97](#)
- [Configuring Proxy ARP \(ELS CLI Only\) on page 99](#)

CHAPTER 9

Understanding Proxy ARP

- [Understanding Proxy ARP on page 97](#)

Understanding Proxy ARP

You can configure proxy Address Resolution Protocol (ARP) to enable the switch to respond to ARP queries for network addresses by offering its own Ethernet media access control (MAC) address. With proxy ARP enabled, the switch captures and routes traffic to the intended destination.

Proxy ARP is useful in situations where hosts are on different physical networks and you do not want to use subnet masking. Because ARP broadcasts are not propagated between hosts on different physical networks, hosts will not receive a response to their ARP request if the destination is on a different subnet. Enabling the switch to act as an ARP proxy allows the hosts to transparently communicate with each other through the switch. Proxy ARP can help hosts on a subnet reach remote subnets without your having to configure routing or a default gateway.

- [What Is ARP? on page 97](#)
- [Proxy ARP Overview on page 97](#)
- [Best Practices for Proxy ARP on page 98](#)

What Is ARP?

Ethernet LANs use ARP to map Ethernet MAC addresses to IP addresses. Each device maintains a cache containing a mapping of MAC addresses to IP addresses. The switch maintains this mapping in a cache that it consults when forwarding packets to network devices. If the ARP cache does not contain an entry for the destination device, the host (the DHCP client) broadcasts an ARP request for that device's address and stores the response in the cache.

Proxy ARP Overview

When proxy ARP is enabled, if the switch receives an ARP request for which it has a route to the target (destination) IP address, the switch responds by sending a proxy ARP reply packet containing its own MAC address. The host that sent the ARP request then sends its packets to the switch, which forwards them to the intended host.



NOTE: For security reasons, the source address in an ARP request must be on the same subnet as the interface on which the ARP request is received.

You can configure proxy ARP for each interface. You can also configure proxy ARP for a VLAN by using a routed VLAN interface (RVI).

Two modes of proxy ARP are supported: restricted and unrestricted. Both modes require that the switch have an active route to the destination address of the ARP request.

- **Restricted**—The switch responds to ARP requests in which the physical networks of the source and target are different and does not respond if the source and target IP addresses are on the same subnet. In this mode, hosts on the same subnet communicate without proxy ARP. We recommend that you use this mode on the switch.
- **Unrestricted**—The switch responds to all ARP requests for which it has a route to the destination. This is the default mode (because it is the default mode in Juniper Networks Junos operating system (Junos OS) configurations other than those on the switch). We recommend using restricted mode on the switch.

Best Practices for Proxy ARP

We recommend these best practices for configuring proxy ARP on the switches:

- Set proxy ARP to restricted mode.
- Use restricted mode when configuring proxy ARP on RVIs.
- If you set proxy ARP to unrestricted, disable gratuitous ARP requests on each interface enabled for proxy ARP.

Related Documentation

- *Configuring Proxy ARP*
- *proxy-arp*

Configuring Proxy ARP (ELS CLI Only)

- [Configuring Proxy ARP \(CLI Procedure\) on page 99](#)
- [Verifying That Proxy ARP Is Working Correctly on page 100](#)

Configuring Proxy ARP (CLI Procedure)



NOTE: This task uses Junos OS for EX Series switches and QFX3500 and QFX3600 switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Configuring Proxy ARP (CLI Procedure)* or *Configuring Proxy ARP*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

You can configure proxy Address Resolution Protocol (ARP) on your switch to enable the switch to respond to ARP queries for network addresses by offering its own media access control (MAC) address. With proxy ARP enabled, the switch captures and routes traffic to the intended destination.

To configure proxy ARP on a single interface:

```
[edit interfaces]
user@switch# set interface-name unit logical-unit-number proxy-arp (restricted |
unrestricted)
```



BEST PRACTICE: We recommend that you configure proxy ARP in restricted mode. In restricted mode, the switch does not act as a proxy if the source and target IP addresses are on the same subnet. If you decide to use unrestricted mode, disable gratuitous ARP requests on the interface to avoid a situation wherein the switch's response to a gratuitous ARP request appears to the host to be an indication of an IP conflict.

To configure proxy ARP on an integrated routing and bridging (IRB) interface:

```
[edit interfaces]
user@switch# set irb.logical-unit-number proxy-arp restricted
```

Related Documentation

- [Example: Configuring Proxy ARP on an EX Series Switch](#)
- [Verifying That Proxy ARP Is Working Correctly on page 100](#)

- *Configuring Integrated Routing and Bridging Interfaces (CLI Procedure)*

Verifying That Proxy ARP Is Working Correctly

Purpose Verify that the switch is sending proxy ARP messages.

Action List the system statistics for ARP:

```
user@switch> show system statistics arp
arp:
  90060 datagrams received
  34 ARP requests received
  610 ARP replies received
  2 resolution request received
  0 unrestricted proxy requests
  0 restricted proxy requests
  0 received proxy requests
  0 unrestricted proxy requests not proxied
  0 restricted proxy requests not proxied
  0 datagrams with bogus interface
  0 datagrams with incorrect length
  0 datagrams for non-IP protocol
  0 datagrams with unsupported op code
  0 datagrams with bad protocol address length
  0 datagrams with bad hardware address length
  0 datagrams with multicast source address
  0 datagrams with multicast target address
  0 datagrams with my own hardware address
  0 datagrams for an address not on the interface
  0 datagrams with a broadcast source address
  294 datagrams with source address duplicate to mine
  89113 datagrams which were not for me
  0 packets discarded waiting for resolution
  0 packets sent after waiting for resolution
  309 ARP requests sent
  35 ARP replies sent
  0 requests for memory denied
  0 requests dropped on entry
  0 requests dropped during retry
  0 requests dropped due to interface deletion
  0 requests on unnumbered interfaces
  0 new requests on unnumbered interfaces
  0 replies for from unnumbered interfaces
  0 requests on unnumbered interface with non-subnetted donor
  0 replies from unnumbered interface with non-subnetted donor
```

Meaning The statistics show that two proxy ARP requests were received. The **unrestricted proxy requests not proxied** and **restricted proxy requests not proxied** fields indicate that all the unproxied ARP requests received have been proxied by the switch.

Related Documentation

- *Configuring Proxy ARP*
- [Configuring Proxy ARP \(CLI Procedure\) on page 99](#)

PART 5

Configuring Spanning-Tree Protocols

- [Understanding Spanning-Tree Protocols on page 103](#)
- [Configuring Spanning-Tree Protocols on page 111](#)
- [Configuring Spanning-Tree Protocols \(ELS CLI Only\) on page 165](#)

Understanding Spanning-Tree Protocols

- [Overview of Spanning-Tree Protocols on page 103](#)
- [Understanding MSTP on page 104](#)
- [Understanding RSTP on page 105](#)
- [Understanding VSTP on page 106](#)
- [Understanding BPDU Protection for STP, RSTP, and MSTP on page 107](#)
- [Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on page 108](#)
- [Understanding Root Protection for STP, RSTP, VSTP, and MSTP on page 109](#)

Overview of Spanning-Tree Protocols

QFX Series switches provide Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP), and VLAN Spanning Tree Protocol (VSTP). The default spanning-tree protocol on the QFX Series is RSTP. RSTP provides faster convergence times than STP. However, some legacy networks require the slower convergence times of basic STP.

The STP support provided for the QFX Series includes:

- IEEE 802.1d
- 802.1w RSTP
- 802.1s MSTP

If your network includes IEEE 802.1D 1998 bridges, you can remove RSTP and explicitly configure STP. When you explicitly configure STP, the QFX Series products use the IEEE 802.1D 2004 specification, force version 0. This configuration runs a version of RSTP that is compatible with the classic, basic STP. If you use virtual LANs (VLANs), you should enable VSTP and use it on your network. See [“Understanding VSTP” on page 106](#).

You can use the same operational commands (**show spanning-tree bridge** and **show spanning-tree interface**) to check the status of your spanning-tree configuration, regardless of which spanning-tree protocol has been configured.

STP uses bridge protocol data unit (BPDU) packets to exchange information with other switches. BPDUs send hello packets out at regular intervals to exchange information across bridges and detect loops in a network topology. There are two types of BPDUs:

- Configuration BPDUs—These BPDUs contain configuration information about the transmitting switch and its ports, including switch and port MAC addresses, switch priority, port priority, and port cost.
- Topology change notification (TCN) BPDUs—When a bridge needs to signal a topology change, it starts to send TCNs on its root port. The designated bridge receives the TCN, acknowledges it, and generates another one for its own root port. The process continues until the TCN reaches the root bridge.

STP uses the information provided by the BPDUs to elect a root bridge, identify root ports for each switch, identify designated ports for each physical LAN segment, and prune specific redundant links to create a loop-free tree topology. All leaf devices calculate the best path to the root device and place their ports in blocking or forwarding states based on the best path to the root. The resulting tree topology provides a single active Layer 2 data path between any two end stations.

Understanding Spanning Tree Protocols on a QFabric System

Although there is no need to run STP in a QFabric system, you can connect a QFabric system to another Layer 2 device and use STP. STP traffic can only be processed on network Node groups. Other Node groups, such as redundant server Node groups and server Node groups, discard the STP bridge protocol data units (BPDUs) traffic and disable the interface automatically. Server Node groups only process host-facing protocols, whereas Network Node groups process all supported protocols.

Related Documentation

- [Understanding BPDUs for STP, RSTP, and MSTP on page 107](#)
- [Understanding MSTP on page 104](#)
- [Understanding RSTP on page 105](#)
- [Understanding VSTP on page 106](#)

Understanding MSTP

Although RSTP provides faster convergence time than STP does, it still does not solve a problem inherent in STP: all VLANs within a LAN must share the same spanning tree. To solve this problem, the QFX Series products use Multiple Spanning Tree Protocol (MSTP) to create a loop-free topology in networks with multiple spanning-tree regions.

An MSTP region allows a group of bridges to be modeled as a single bridge. An MSTP region contains multiple spanning-tree instances (MSTIs). MSTIs provide different paths for different VLANs. This functionality facilitates more efficient load sharing across redundant links.

An MSTP region can support up to 64 MSTIs, and each instance can support from 1 through 4094 VLANs.

Related Documentation

- [Overview of Spanning-Tree Protocols on page 103](#)
- [Understanding RSTP on page 105](#)
- [Example: Configuring Network Regions for VLANs with MSTP on page 126](#)

- *Example: Configuring Network Regions for VLANs with MSTP*
- *Configuring MSTP*

Understanding RSTP

Juniper Networks QFX Series products use Rapid Spanning Tree Protocol (RSTP) on the network side of the QFX Series to provide quicker convergence time than the base Spanning Tree Protocol (STP) does. RSTP identifies certain links as point to point. When a point-to-point link fails, the alternate link can transition to the forwarding state, which speeds up convergence.

Although STP provides basic loop prevention functionality, it does not provide fast network convergence when there are topology changes. The STP process to determine network state transitions is slower than the RSTP process because it is timer-based. A device must reinitialize every time a topology change occurs. The device must start in the listening state and transition to the learning state and eventually to a forwarding or blocking state. When default values are used for the maximum age (20 seconds) and forward delay (15 seconds), it takes 50 seconds for the device to converge. RSTP converges faster because it uses a handshake mechanism based on point-to-point links instead of the timer-based process used by STP.

For networks with virtual LANs (VLANs), you can use VLAN Spanning Tree Protocol (VSTP), which takes the paths of each VLAN into account when calculating routes. VSTP uses RSTP by default.

An RSTP domain running from the edge outward on a QFX Series product has the following components:

- A *root port*, which is the “best path” to the root device.
- A *designated port*, which indicates that the switch is the designated bridge for the other switch connecting to this port.
- An *alternate port*, which provides an alternate root port.
- A *backup port*, which provides an alternate designated port.

Port assignments change through messages exchanged throughout the domain. An RSTP device generates configuration messages once per hello time interval. If an RSTP device does not receive a configuration message from its neighbor after an interval of three hello times, it determines that the connection with the neighbor is lost. When a *root port* or a *designated port* fails on a device, the device generates a configuration message with the proposal bit set. Once its neighbor device receives this message, it verifies that this configuration message is valid for that port and starts a *synchronizing* operation to ensure that all of its ports are in sync with the new information.

Similar sets of messages propagate through the network, restoring the connectivity very quickly after a topology change (in a well-designed network that uses RSTP, network convergence can take as little as 0.5 seconds). If a device does not receive an agreement to a proposal message it has sent, it returns to the original IEEE 802.D convention.

RSTP was originally defined in the IEEE 802.1w draft specification and later incorporated into the IEEE 802.1D-2004 specification.

VSTP and RSTP can be configured at the same time. If you configure VSTP and RSTP at the same time and the switch has more than 253 VLANs, VSTP is configured only for the first 253 VLANs. For the remaining VLANs, only RSTP is configured. RSTP and VSTP are the only spanning-tree protocols that can be configured at the same time on the QFX Series.



NOTE: Using the same VLAN for RSTP and VSTP is not supported. For example, if you are configuring a VLAN under VSTP, configuring RSTP with an interface that contains the same VLAN is not supported.

Related Documentation

- [Overview of Spanning-Tree Protocols on page 103](#)
- [Understanding MSTP on page 104](#)
- [Understanding VSTP on page 106](#)
- [Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149](#)
- [Example: Configuring Faster Convergence and Improved Network Stability with RSTP](#)
- [Configuring RSTP \(CLI Procedure\)](#)

Understanding VSTP

VLAN Spanning Tree Protocol (VSTP) enables Juniper Networks switches to run one or more Spanning Tree Protocol (STP) or Rapid Spanning Tree Protocol (RSTP) instances for each VLAN on which VSTP is enabled. For networks with multiple VLANs, VSTP improves intelligent tree spanning by defining best paths within the VLANs instead of within the entire network.

You can configure VSTP for a maximum of 509 VLANs.

VSTP and RSTP can be configured at the same time. If you configure VSTP and RSTP at the same time and the switch has more than 253 VLANs, VSTP is configured only for the first 253 VLANs. For the remaining VLANs, only RSTP is configured. RSTP and VSTP are the only spanning-tree protocols that can be configured at the same time on a switch.



NOTE: We recommend that you enable VSTP on all VLANs that could receive VSTP bridge protocol data units (BPDUs).



NOTE: Using the same VLAN for RSTP and VSTP is not supported. For example, if you are configuring a VLAN under VSTP, configuring RSTP with an interface that contains the same VLAN is not supported.

Related Documentation

- *Example: Configuring VSTP on QFX Series Switches and EX4600 Switches*
- [Overview of Spanning-Tree Protocols on page 103](#)
- [Understanding RSTP on page 105](#)
- *Configuring VSTP (CLI Procedure)*
- [Configuring VLAN Spanning Tree Protocol on page 165](#)

Understanding BPDU Protection for STP, RSTP, and MSTP



NOTE: Using the original CLI, you can disable BPDU protection on interfaces by issuing the **set ethernet-switching-options bpdu-block *interface-name* disable** command.

A Juniper Networks device Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), and Multiple Spanning Tree Protocol (MSTP). Bridge protocol data unit (BPDU) protection can help prevent STP misconfigurations that can lead to network outages.

A loop-free network is supported through the exchange of a special type of frame called a BPDU. Receipt of BPDUs on certain interfaces in an STP, RSTP, VSTP, or MSTP topology, however, can lead to network outages. Enable BPDU protection on those interfaces to prevent these outages.

Peer STP applications running on the device interfaces use BPDUs to communicate. Ultimately, the exchange of BPDUs determines which interfaces block traffic and which interfaces become root ports and forward traffic.

However, a user bridge application running on a device connected to the device can also generate BPDUs. If these BPDUs are picked up by STP applications running on the device, they can trigger STP miscalculations, and those miscalculations can lead to network outages.

Enable BPDU protection on device interfaces connected to user devices or on interfaces on which no BPDUs are expected, such as edge ports. If BPDUs are received on a protected interface, the interface is disabled and stops forwarding frames.

Not only can you configure BPDU protection on a device with a spanning tree, but also on a device without a spanning tree. This type of topology typically consists of a non-STP device connected to an STP device through a trunk interface.

To configure BPDU protection on a device with a spanning tree, include the **bpdu-block-on-edge** statement at the **[edit protocols (stp | mstp | rstp)]** hierarchy level. To configure BPDU protection on a device without a spanning tree, include the **bpdu-block** statement at the **[edit ethernet-switching-options interface *interface-name*]** hierarchy level.

If BPDUs are sent to an interface (indicating that the misconfiguration has been corrected), the interface can be unblocked in one of two ways:

- If the **disable-timeout** statement has been included in the BPDU configuration, the interface automatically returns to service after the timer expires.
- Use the *clear error bpdv interface* operational mode command.

Disabling the BPDU protection configuration does not unblock the interface.

**Related
Documentation**

- [Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on page 108](#)
- [Understanding Root Protection for STP, RSTP, VSTP, and MSTP on page 109](#)
- [Understanding MSTP on page 104](#)
- [Understanding RSTP on page 105](#)
- [Understanding VSTP on page 106](#)

Understanding Loop Protection for STP, RSTP, VSTP, and MSTP

A Juniper Networks device provides Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), and Multiple Spanning Tree Protocol (MSTP). Loop protection increases the efficiency of STP, RSTP, and MSTP by preventing ports from entering a forwarding state that would cause a loop to open in the network.

A loop-free network in spanning-tree topologies is supported through the exchange of a special type of frame called a bridge protocol data unit (BPDU). Peer STP applications running on the device interfaces use BPDUs to communicate. Ultimately, the exchange of BPDUs determines which interfaces block traffic (preventing loops) and which interfaces become root ports and forward traffic.

However, a blocking interface can mistakenly transition to the forwarding state if the interface stops receiving BPDUs from its designated port on the segment. Such a transition error can occur when there is a hardware error on the device or software configuration error between the device and its neighbor.

When loop protection is enabled, the spanning-tree topology detects root ports and blocked ports and ensures that both keep receiving BPDUs. If a loop-protection-enabled interface stops receiving BPDUs from its designated port, it reacts as it would react to a problem with the physical connection on this interface. It does not transition the interface to a forwarding state, but instead transitions it to a loop-inconsistent state. The interface recovers and it transitions back to the spanning-tree blocking state as soon as it receives a BPDU.

We recommend that you enable loop protection on all device interfaces that have a chance of becoming root or designated ports. Loop protection is most effective when enabled in the entire switched network. When you enable loop protection, you must configure at least one action (**alarm**, **block**, or both).

An interface can be configured for either loop protection or root protection, but not for both.

Related Documentation

- [Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on page 117](#)
- [Understanding Root Protection for STP, RSTP, VSTP, and MSTP on page 109](#)
- [Understanding BPDU Protection for STP, RSTP, and MSTP on page 107](#)
- [Understanding MSTP on page 104](#)
- [Understanding RSTP on page 105](#)
- [Overview of Spanning-Tree Protocols on page 103](#)
- [Understanding VSTP on page 106](#)

Understanding Root Protection for STP, RSTP, VSTP, and MSTP

A Juniper Networks device provides Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), and Multiple Spanning Tree Protocol (MSTP). A loop-free network is supported through the exchange of a special type of frame called a bridge protocol data unit (BPDU). Peer STP applications running on the device interfaces use BPDUs to communicate. Ultimately, the exchange of BPDUs determines which interfaces block traffic and which interfaces become root ports and forward traffic.

You can also see BPDUs generated when you run a bridge application on a device attached to the device. This can interfere with root port election, which may sometimes lead to the wrong root port being elected through the above process. Root protection allows you to manually enforce the root bridge placement in the network.

Enable root protection on interfaces that should not receive higher-priority BPDUs from the root bridge and should not be elected as the root port. These interfaces become designated ports and are typically located on an administrative boundary. If the bridge receives more STP BPDUs on a port that has root protection enabled, that port transitions to a root-prevented STP state (inconsistency state), and the interface is blocked. This blocking prevents a bridge that should not be the root bridge from being elected the root bridge. After the bridge stops receiving more STP BPDUs on the interface with root protection, the interface returns to a listening state, followed by a learning state, and ultimately back to a forwarding state. Recovery back to the forwarding state is automatic.

When root protection is enabled on an interface, it is enabled for all the STP instances on that interface. The interface is blocked only for instances for which it receives more BPDUs. Otherwise, it participates in the spanning-tree topology.

An interface can be configured for either root protection or loop protection, but not for both.

Related Documentation

- [Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on page 121](#)

- [Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on page 117](#)
- [Example: Configuring BPDU Protection on STP Interfaces to Prevent STP Miscalculations on page 113](#)
- [Understanding MSTP on page 104](#)
- [Understanding RSTP on page 105](#)
- [Overview of Spanning-Tree Protocols on page 103](#)
- [Understanding VSTP on page 106](#)

CHAPTER 12

Configuring Spanning-Tree Protocols

- [Configuring STP on page 111](#)
- [Unblocking an Interface That Receives BPDUs in Error on page 112](#)
- [Example: Configuring BPDU Protection on STP Interfaces to Prevent STP Miscalculations on page 113](#)
- [Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on page 117](#)
- [Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on page 121](#)
- [Example: Configuring Network Regions for VLANs with MSTP on page 126](#)
- [Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149](#)

Configuring STP

The default spanning-tree protocol on the device is Rapid Spanning Tree Protocol (RSTP). RSTP provides faster convergence times than Spanning Tree Protocol (STP) does. However, some legacy networks require the slower convergence times of basic STP.

If your network includes 802.1D 1998 bridges, you can remove RSTP and explicitly configure STP. When you explicitly configure STP, the device uses the IEEE 802.1D 2004 specification, force version 0. This configuration runs a version of RSTP that is compatible with the classic, basic STP.

To configure STP using the CLI:

1. Delete the RSTP configuration on the interface (here, the interface is **xe-0/0/5**):

```
[edit]
user@switch# delete protocols rstp interface xe-0/0/5
```

2. Configure STP on the interface:

```
[edit]
user@switch# set protocols stp interface xe-0/0/5
```

3. Commit the configuration:

```
[edit]
user@switch# commit
```

- Related Documentation**
- [show spanning-tree bridge on page 322](#)
 - [show spanning-tree interface on page 327](#)
 - [Overview of Spanning-Tree Protocols on page 103](#)

Unblocking an Interface That Receives BPDUs in Error



NOTE: BPDU block protection is disabled on Node devices.

Devices use bridge protocol data unit (BPDU) protection on interfaces to prevent them from receiving BPDUs that could trigger a spanning-tree misconfiguration. If BPDUs are received on a BPDU-protected interface, the interface transitions to a blocking state and stops forwarding frames.

After you fix the misconfiguration that triggered the sending of BPDUs to an interface, you can unblock the interface and return it to service.



NOTE: This task describes how to use both the original CLI and the Enhanced Layer 2 Software (ELS) CLI. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

To unblock an interface after fixing the misconfiguration that triggered the BPDUs and return it to service:

- (Original CLI) Automatically unblock an interface by configuring a timer that expires (here, the interface is **xe-0/0/6**):

```
[edit ethernet-switching-options]
user@switch# set bpdv-block disable-timeout 30 interface xe-0/0/6
```
- (ELS CLI) Automatically unblock an interface by configuring a timer that expires (here, the interface is **xe-0/0/6**):

```
[edit protocols layer2-control]
user@switch# set bpdv-block disable-timeout 30 interface xe-0/0/6
```
- Manually unblock an interface using the operational mode command:

```
user@switch> clear error bpdv interface xe-0/0/6
```
- Verify that the interface has been unblocked using the operational command:

```
user@switch> show ethernet-switching interfaces xe-0/0/6
```

Interface	State	VLAN members	Blocking
xe-0/0/6.0	down	default	unblocked

- Related Documentation**
- [Example: Configuring BPDU Protection on STP Interfaces to Prevent STP Miscalculations on page 113](#)
 - [Understanding BPDU Protection for STP, RSTP, and MSTP on page 107](#)

Example: Configuring BPDU Protection on STP Interfaces to Prevent STP Miscalculations

The QFX Series products provide Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), and Multiple Spanning Tree Protocol (MSTP). Configure BPDU protection on interfaces to prevent them from receiving BPDUs that could result in STP misconfigurations, which could lead to network outages.

This example describes how to configure BPDU protection on access interfaces in QFX Series products in an RSTP topology:

- [Requirements on page 113](#)
- [Overview and Topology on page 113](#)
- [Configuration on page 114](#)
- [Verification on page 115](#)

Requirements

This example uses the following hardware and software components:

- Junos OS Release 11.1 or later for the QFX Series
- Two edged-linked switches in an RSTP topology



NOTE: By default, RSTP is enabled on the QFX Series.

Overview and Topology

A loop-free network is supported through the exchange of a special type of frame called a bridge protocol data unit (BPDU). However, receipt of BPDUs on certain interfaces in an STP, RSTP, or MSTP topology. It can lead to network outages by triggering an STP misconfiguration. To prevent such outages, enable BPDU protection on those interfaces that should not receive BPDUs.

Enable BPDU protection on switch interfaces connected to user devices or on interfaces on which no BPDUs are expected, such as edge ports. If a BPDU is received on a BPDU-protected interface, the interface is disabled and stops forwarding frames.

Two switches are displayed in [Figure 2 on page 114](#). In this example, Switch 1 and Switch 2 are configured for RSTP and create a loop-free topology. The interfaces on Switch 2 are access ports.

This example shows you how to configure interface **xe-0/0/5** and interface **xe-0/0/6** as edge ports and how to configure BPDU protection. When BPDU protection is enabled, the interfaces transition to a blocking state when they receive BPDUs.

Figure 2: BPDU Protection Topology

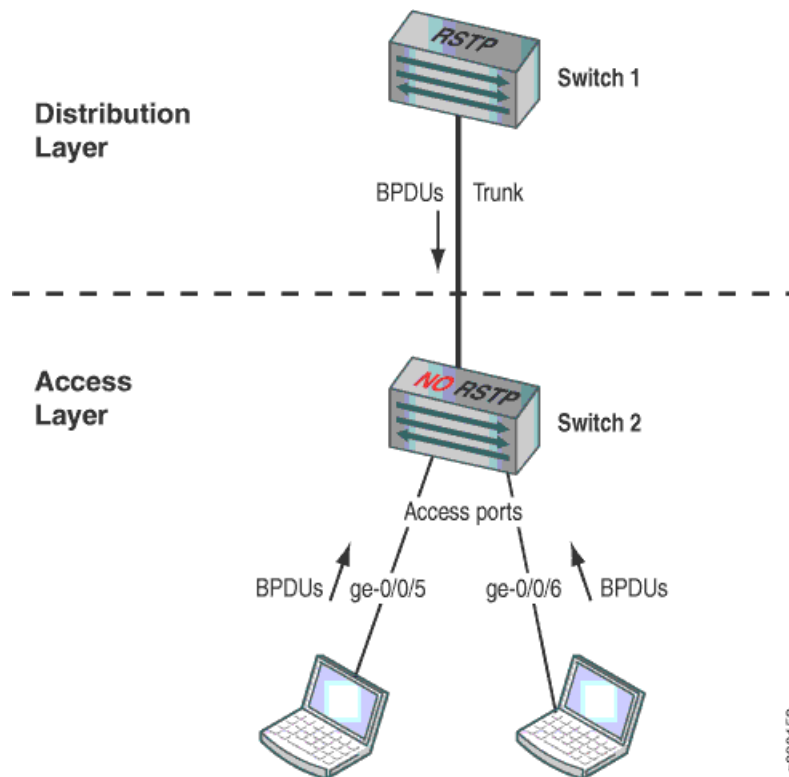


Table 14 on page 114 shows the components that will be configured for BPDU protection.

Table 14: Components of the Topology for Configuring BPDU Protection on the QFX Series

Component	Settings
Switch 1 (Distribution Layer)	Switch 1 is connected to Switch 2 on a trunk interface.
Switch 2 (Access Layer)	Switch 2 has these access ports that require BPDU protection: <ul style="list-style-type: none"> • xe-0/0/5 • xe-0/0/6

This configuration example uses an RSTP topology. You also can configure BPDU protection for STP or MSTP topologies at the `[edit protocols (mstp | stp)]` hierarchy level.

Configuration

CLI Quick Configuration

To quickly configure BPDU protection on Switch 2, copy the following commands and paste them into the switch terminal window:

```
[edit]
set protocols rstp interface xe-0/0/5 edge
set protocols rstp interface xe-0/0/6 edge
set protocols rstp bpdu-block-on-edge
```

- Step-by-Step Procedure** To configure BPDU protection:
1. Configure interface **xe-0/0/5** and interface **xe-0/0/6** on Switch 2 as edge ports:


```
[edit protocols rstp]
user@switch# set interface xe-0/0/5 edge
user@switch# set interface xe-0/0/6 edge
```
 2. Configure BPDU protection on all edge ports:


```
[edit protocols rstp]
user@switch# set bpd-block-on-edge
```

Results Check the results of the configuration:

```
user@switch> show configuration protocols rstp
interface xe-0/0/5.0 {
  edge;
}
interface xe-0/0/6.0 {
  edge;
}
bpd-block-on-edge;
```

Verification

To confirm that the configuration is working properly, perform these tasks:

- [Displaying the Interface State Before BPDU Protection Is Triggered on page 115](#)
- [Verifying That BPDU Protection Is Working Correctly on page 116](#)

Displaying the Interface State Before BPDU Protection Is Triggered

Purpose Before BPDUs are being received from the devices connected to interface **xe-0/0/5** and interface **xe-0/0/6**, confirm the interface state.

Action You can verify the interface state using the **show spanning-tree interface** command:

```
user@switch> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/0.0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/1.0	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/2.0	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/3.0	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/4.0	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/5.0	128:518	128:518	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/6.0	128:519	128:519	32768.0019e2503f00	20000	FWD	DESG

[output truncated]

Meaning The output shows that interface **xe-0/0/5.0** and interface **xe-0/0/6.0** are designated ports in a forwarding state.

Verifying That BPDU Protection Is Working Correctly

Purpose In this example, the devices connected to Switch 2 start sending BPDUs to interface **xe-0/0/5.0** and interface **xe-0/0/6.0**. Verify that BPDU protection is configured on the interfaces.

Action You can verify that BPDU protection is configured on the interfaces by using the **show spanning-tree interface** command:

```
user@switch> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/0.0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/1.0	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/2.0	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/3.0	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/4.0	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/5.0 (Bpdu-Incon)	128:518	128:518	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/6.0 (Bpdu-Incon)	128:519	128:519	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/7.0	128:520	128:1	16384.00aabbcc0348	20000	FWD	ROOT
xe-0/0/8.0	128:521	128:521	32768.0019e2503f00	20000	FWD	DESG

[output truncated]

Meaning When BPDUs are sent from the devices to interface **xe-0/0/5.0** and interface **xe-0/0/6.0** on Switch 2, the output from the operational mode command **show spanning-tree interface** shows that the interfaces have transitioned to a BPDU inconsistent state. The BPDU inconsistent state blocks the interfaces and prevents them from forwarding traffic.

Disabling the BPDU protection configuration on an interface does not unblock the interface. If the **disable-timeout** statement has been included in the BPDU configuration, the interface automatically returns to service after the timer expires. Otherwise, use the operational mode command **clear bpd-error** to unblock the interface.

If the devices connected to Switch 2 send BPDUs to the interfaces again, BPDU protection is triggered once more and the interfaces transition back to the BPDU inconsistent state. In such cases, you need to find and repair the misconfiguration on the devices that is triggering the sending of BPDUs to Switch 2.

- Related Documentation**
- [Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149](#)
 - [Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on page 117](#)
 - [Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on page 121](#)
 - [Understanding BPDU Protection for STP, RSTP, and MSTP on page 107](#)

Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree

The QFX Series products provide Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), and Multiple Spanning Tree Protocol (MSTP). Loop protection increases the efficiency of STP, RSTP, and MSTP by preventing interfaces from moving into a forwarding state that would create a loop in the network.

This example describes how to configure loop protection for an interface for the QFX Series in an RSTP topology:

- [Requirements on page 117](#)
- [Overview and Topology on page 117](#)
- [Configuration on page 119](#)
- [Verification on page 119](#)

Requirements

This example uses the following hardware and software components:

- Junos OS Release 11.1 or later for the QFX Series
- Three switches in an RSTP topology



NOTE: By default, RSTP is enabled for the QFX Series.

Overview and Topology

A loop-free network in spanning-tree topologies is supported through the exchange of a special type of frame called a bridge protocol data unit (BPDU). Peer STP applications running on the switch interfaces use BPDUs to communicate. Ultimately, the exchange of BPDUs determines which interfaces block traffic (preventing loops) and which interfaces become root ports and forward traffic.

A blocking interface can transition to the forwarding state in error if the interface stops receiving BPDUs from its designated port on the segment. Such a transition error can occur when there is a hardware error on the switch or software configuration error between the switch and its neighbor. When this happens, a loop appears in the spanning tree. Loops in a Layer 2 topology cause broadcast, unicast, and multicast frames to continuously circle the looped network. As a switch processes a flood of frames in a looped network, its resources become depleted, and the ultimate result is a network outage.

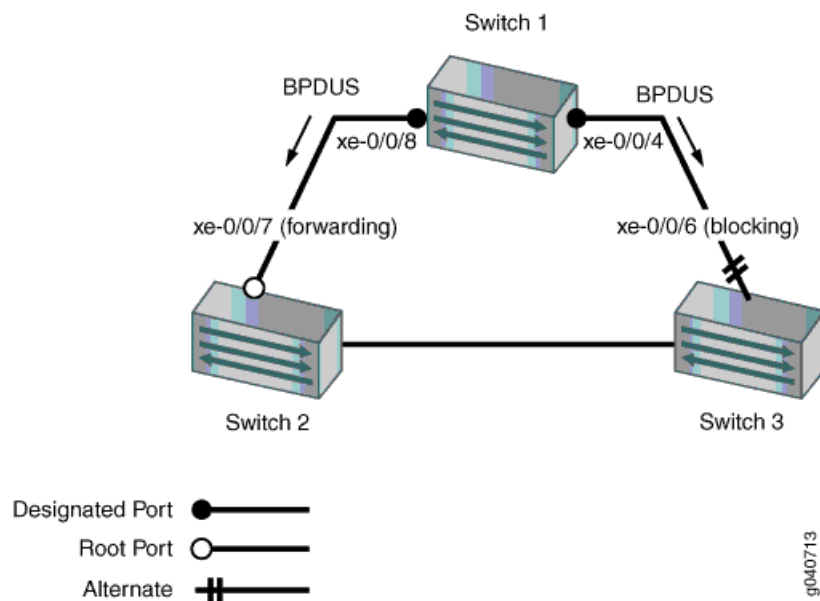


NOTE: An interface can be configured for either loop protection or root protection, but not for both.

Three switches are displayed in [Figure 3 on page 118](#). In this example, they are configured for RSTP and create a loop-free topology. Interface **xe-0/0/6** is blocking traffic between Switch 3 and Switch 1; thus, traffic is forwarded through interface **xe-0/0/7** on Switch 2. BPDUs are being sent from the root bridge on Switch 1 to both of these interfaces.

This example shows how to configure loop protection on interface **xe-0/0/6** to prevent it from transitioning from a blocking state to a forwarding state and creating a loop in the spanning-tree topology.

Figure 3: Network Topology for Loop Protection



[Table 15 on page 118](#) shows the components that will be configured for loop protection.

Table 15: Topology for Configuring Loop Protection on the QFX Series

Components	Settings
Switch 1	Switch 1 is the root bridge.
Switch 2	Switch 2 has the root port xe-0/0/7 .
Switch 3	Switch 3 is connected to Switch 1 through interface xe-0/0/6 .

A spanning-tree topology contains ports that have specific roles:

- The *root port* is responsible for forwarding data to the root bridge.
- The *alternate port* is a standby port for the root port. When a root port goes down, the alternate port becomes the active root port.
- The *designated port* forwards data to the downstream network segment or device.

This configuration example uses an RSTP topology. However, you can also configure loop protection for STP or MSTP topologies at the `[edit protocols (mstp | stp)]` hierarchy level.

Configuration

CLI Quick Configuration	To quickly configure loop protection on interface xe-0/0/6 : [edit] set protocols rstp interface xe-0/0/6 bpdutimeout-action block
Step-by-Step Procedure	To configure loop protection: 1. Configure interface xe-0/0/6 on Switch 3: [edit protocols rstp] user@switch# set interface xe-0/0/6 bpdutimeout-action block
Results	Check the results of the configuration: user@switch> show configuration protocols rstp interface xe-0/0/6.0 { bpdutimeout-action { block; } }

Verification

To confirm that the configuration is working properly, perform these tasks:

- [Displaying the Interface State Before Loop Protection Is Triggered on page 119](#)
- [Verifying That Loop Protection Is Working on an Interface on page 120](#)

Displaying the Interface State Before Loop Protection Is Triggered

Purpose	Before loop protection is triggered on interface xe-0/0/6 , confirm that the interface is blocked.
----------------	---

Action Display the interface state and role before applying root protection:

```
user@switch> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/0.0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/1.0	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/2.0	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/3.0	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/4.0	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/5.0	128:518	128:518	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/6.0	128:519	128:2	16384.00aabbcc0348	20000	BLK	ALT

[output truncated]

Meaning The output from the operational mode command **show spanning-tree interface** shows that **xe-0/0/6.0** is the alternate port and is blocked.

Verifying That Loop Protection Is Working on an Interface

Purpose Verify that the loop protection configuration on interface **xe-0/0/6**. RSTP has been disabled on interface **xe-0/0/4** on Switch 1. This stops BPDUs from being sent to interface **xe-0/0/6** and triggering loop protection on that interface.

Action Display the interface state and role after applying root protection:

```
user@switch> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/0.0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/1.0	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/2.0	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/3.0	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/4.0	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/5.0	128:518	128:518	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/6.0	128:519	128:519	32768.0019e2503f00	20000	BLK	DIS

(Loop-Incon)
[output truncated]

Meaning The operational mode command **show spanning-tree interface** shows that interface **xe-0/0/6.0** has detected that BPDUs are no longer being forwarded to it and has moved into a loop-inconsistent state. The loop-inconsistent state prevents the interface from transitioning to a forwarding state. The interface recovers and transitions back to its original state as soon as it receives BPDUs.

Related Documentation

- [Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149](#)

- [Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on page 121](#)
- [Example: Configuring BPDU Protection on STP Interfaces to Prevent STP Miscalculations on page 113](#)
- [Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on page 108](#)

Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees

QFX Series products provide Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), and Multiple Spanning Tree Protocol (MSTP). Root protection increases the efficiency of STP, RSTP, and MSTP by allowing network administrators to enforce the root bridge placement in the network manually.

This example describes how to configure root protection on an interface for the QFX Series.

- [Requirements on page 121](#)
- [Overview and Topology on page 121](#)
- [Configuration on page 124](#)
- [Verification on page 124](#)

Requirements

This example uses the following hardware and software components:

- Junos OS Release 11.1 or later for the QFX Series
- Four switches in an RSTP topology

Before you configure the interface for root protection, be sure you have:

- RSTP operating on the switches.



NOTE: By default, RSTP is enabled on the QFX Series.

Overview and Topology

Peer STP applications running on switch interfaces exchange a special type of frame called a bridge protocol data unit (BPDU). Switches communicate interface information using BPDUs to create a loop-free topology that ultimately determines the root bridge and which interfaces block or forward traffic in the spanning tree.

You can also see BPDUs generated when you run a bridge application on a device attached to the switch. This can interfere with root port election, which may sometimes lead to the wrong root port being elected through the above process. Root protection allows you to manually enforce the root bridge placement in the network.

To prevent this from happening, enable root protection on interfaces that should not receive more BPDUs from the root bridge and should not be elected as the root port. These interfaces are typically located on an administrative boundary and are designated ports.

When root protection is enabled on an interface:

- The interface is blocked from becoming the root port.
- Root protection is enabled for all STP instances on that interface.
- The interface is blocked only for instances for which it receives more BPDUs. Otherwise, it participates in the spanning-tree topology.



NOTE: An interface can be configured for either root protection or loop protection, but not for both.

Four switches are displayed in [Figure 4 on page 123](#). In this example, they are configured for RSTP and create a loop-free topology. Interface **xe-0/0/7** on Switch 1 is a designated port on an administrative boundary. It connects to Switch 4. Switch 3 is the root bridge. Interface **xe-0/0/6** on Switch 1 is the root port.

This example shows how to configure root protection on interface **xe-0/0/7** to prevent it from transitioning to become the root port.

Figure 4: Network Topology for Root Protection

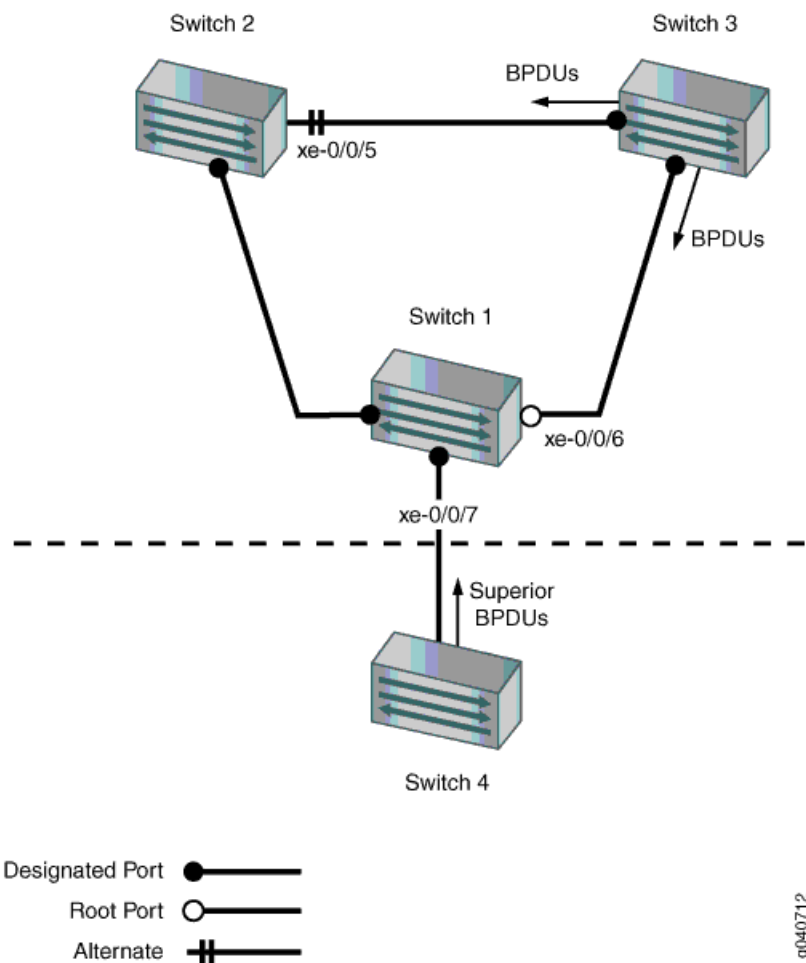


Table 16 on page 123 shows the components that will be configured for root protection.

Table 16: Topology for Configuring Root Protection on the QFX Series

Component	Settings
Switch 1	Switch 1 is connected to Switch 4 through interface xe-0/0/7 .
Switch 2	Switch 2 is connected to Switch 1 and Switch 3. Interface xe-0/0/4 is the alternate port in the RSTP topology.
Switch 3	Switch 3 is the root bridge and is connected to Switch 1 and Switch 2.
Switch 4	Switch 4 is connected to Switch 1. After loop protection is configured on interface xe-0/0/7 , Switch 4 sends more BPDUs that trigger loop protection on interface xe-0/0/7 .

A spanning-tree topology contains ports that have specific roles:

- The *root port* is responsible for forwarding data to the root bridge.

- The *alternate port* is a standby port for the root port. When a root port goes down, the alternate port becomes the active root port.
- The *designated port* forwards data to the downstream network segment or device.

This configuration example uses an RSTP topology. However, you can also configure root protection for STP or MSTP topologies at the `[edit protocols (mstp | stp)]` hierarchy level.

Configuration

CLI Quick Configuration To quickly configure root protection on interface `xe-0/0/7`, copy the following command and paste it into the switch terminal window:

```
[edit]
set protocols rstp interface xe-0/0/7 no-root-port
```

Step-by-Step Procedure To configure root protection:

1. Configure interface `xe-0/0/7`:

```
[edit protocols rstp]
user@switch#
set interface xe-0/0/7 no-root-port
```

Results Check the results of the configuration:

```
user@switch> show configuration protocols rstp
interface xe-0/0/7.0 {
  no-root-port;
}
```

Verification

To confirm that the configuration is working properly, perform these tasks:

- [Displaying the Interface State Before Root Protection Is Triggered on page 124](#)
- [Verifying That Root Protection Is Working on the Interface on page 125](#)

Displaying the Interface State Before Root Protection Is Triggered

Purpose Before root protection is triggered on interface `xe-0/0/7`, confirm the interface state.

Action Confirm the state of the interfaces before root protection is configured:

```
user@switch> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/0.0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/1.0	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/2.0	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/3.0	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/4.0	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/5.0	128:518	128:2	16384.00aabbcc0348	20000	BLK	ALT
xe-0/0/6.0	128:519	128:1	16384.00aabbcc0348	20000	FWD	ROOT
xe-0/0/7.0	128:520	128:520	32768.0019e2503f00	20000	FWD	DESG

[output truncated]

Meaning The output from the operational mode command **show spanning-tree interface** shows that **xe-0/0/7.0** is a designated port in a forwarding state.

Verifying That Root Protection Is Working on the Interface

Purpose A configuration change takes place on Switch 4. A lower bridge priority on Switch 4 causes it to send more BPDUs to interface **xe-0/0/7**. Receipt of more BPDUs on interface **xe-0/0/7** triggers root protection. Verify that root protection is operating on interface **xe-0/0/7**.

Action Verify that root protection has been configured and is operating correctly:

```
user@switch> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/0.0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/1.0	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/2.0	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
xe-0/0/3.0	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/4.0	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
xe-0/0/5.0	128:518	128:2	16384.00aabbcc0348	20000	BLK	ALT
xe-0/0/6.0	128:519	128:1	16384.00aabbcc0348	20000	FWD	ROOT
xe-0/0/7.0	128:520	128:520	32768.0019e2503f00	20000	BLK	DIS

(Root-Incon)
[output truncated]

Meaning The operational mode command **show spanning-tree interface** shows that interface **xe-0/0/7.0** has transitioned to a loop inconsistent state. The loop inconsistent state blocks the interface and prevents it from becoming a candidate for the root port. When the root bridge no longer receives more STP BPDUs from the interface, the interface recovers and transitions back to a forwarding state. Recovery is automatic.

- Related Documentation**
- [Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149](#)
 - [Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on page 117](#)
 - [Example: Configuring BPDU Protection on STP Interfaces to Prevent STP Miscalculations on page 113](#)
 - [Understanding Root Protection for STP, RSTP, VSTP, and MSTP on page 109](#)

Example: Configuring Network Regions for VLANs with MSTP

Multiple Spanning Tree Protocol (MSTP) is used to create a loop-free topology in networks using multiple spanning-tree regions, each region containing multiple spanning-tree instances (MSTIs). MSTIs provide different paths for different VLANs. This functionality facilitates more efficient load sharing across redundant links.

You can create up to 64 MSTI instances for QFX Series products, and each MSTI supports up to 4094 VLANs.

This example describes how to configure MSTP on four QFX3500 switches:

- [Requirements on page 126](#)
- [Overview and Topology on page 126](#)
- [Configuring MSTP on Switch 1 on page 129](#)
- [Configuring MSTP on Switch 2 on page 132](#)
- [Configuring MSTP on Switch 3 on page 135](#)
- [Configuring MSTP on Switch 4 on page 138](#)
- [Verification on page 141](#)

Requirements

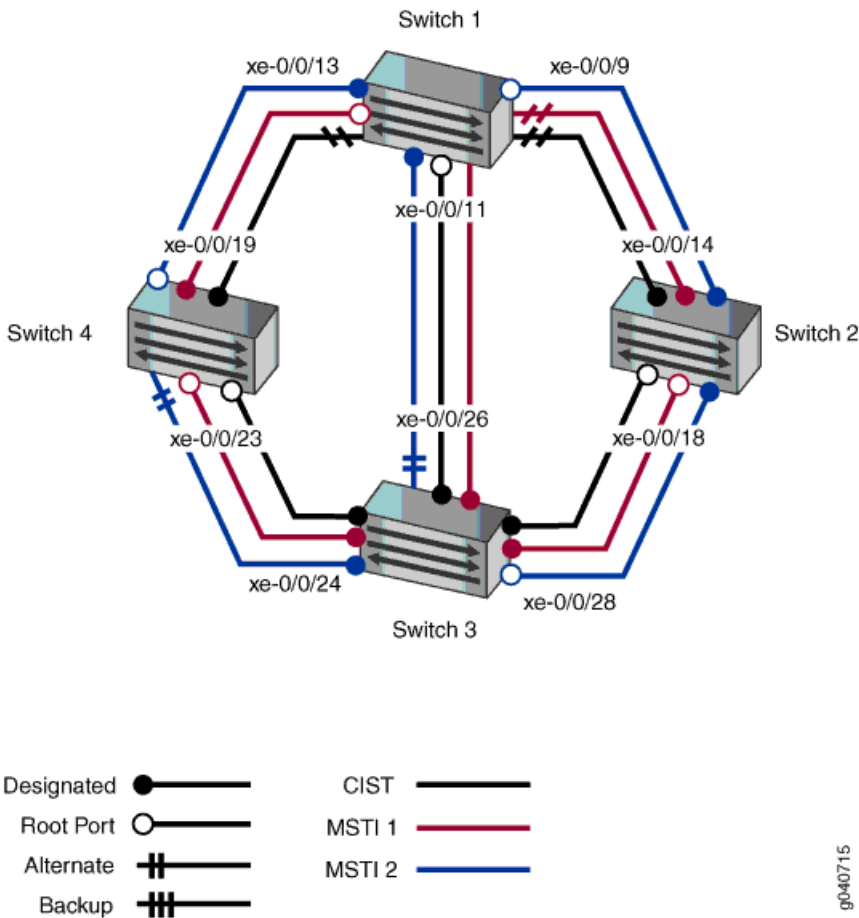
This example uses the following hardware and software components:

- Junos OS Release 11.1 for the QFX3500 switches
- Four QFX3500 switches

Overview and Topology

When the number of VLANs grows in a network, MSTP provides a more faster way of creating a loop-free topology using MSTIs. Each MSTI in the spanning-tree domain maintains its own tree. Each tree can be mapped to different links, utilizing bandwidth that would be unavailable to a single tree. MSTIs reduce demand on system resources.

Figure 5: Network Topology for MSTP



The interfaces shown in [Table 17 on page 127](#) will be configured for MSTP.



NOTE: You can configure MSTP on logical or physical interfaces. This example shows MSTP configured on logical interfaces.

Table 17: Topology for Configuring MSTP on the QFX Series

Components	Settings
Switch 1	The following ports on Switch 1 are connected in this way: <ul style="list-style-type: none">• xe-0/0/9 is connected to Switch 2• xe-0/0/13 is connected to Switch 4• xe-0/0/11 is connected to Switch 3
Switch 2	The following ports on Switch 2 are connected in this way: <ul style="list-style-type: none">• xe-0/0/14 is connected to Switch 1• xe-0/0/18 is connected to Switch 3

Table 17: Topology for Configuring MSTP on the QFX Series (*continued*)

Components	Settings
Switch 3	<p>The following ports on Switch 3 are connected in this way:</p> <ul style="list-style-type: none"> • xe-0/0/26 is connected to Switch 1 • xe-0/0/28 is connected to Switch 2 • xe-0/0/24 is connected to Switch 4
Switch 4	<p>The following ports on Switch 4 are connected in this way:</p> <ul style="list-style-type: none"> • xe-0/0/19 is connected to Switch 1 • xe-0/0/23 is connected to Switch 3
VLAN names and tag IDs	sales-vlan , tag 10 engineering-vlan , tag 20 publications-vlan , tag 30 support-vlan , tag 40
MSTIs	1 2

The topology in [Figure 5 on page 127](#) shows a Common Internal Spanning Tree (CIST). The CIST is a single spanning tree connecting all devices in the network. The switch with the highest priority is elected as the root bridge of the CIST.

Also in an MSTP topology are ports that have specific roles:

- The *root port* is responsible for forwarding data to the root bridge.
- The *alternate port* is a standby port for the root port. When a root port goes down, the alternate port becomes the active root port.
- The *designated port* forwards data to the downstream network segment or device.
- The *backup port* is a backup port for the designated port. When a designated port goes down, the backup port becomes the active designated port and starts forwarding data.

In this example, one MSTP region, **region1**, contains Switch 1, Switch 2, Switch 3, and Switch 4. Within the region, four VLANs are created:

- The **sales-vlan** supports sales traffic and has a VLAN tag identifier of 10.
- The **engineering-vlan** supports data traffic and has a VLAN tag identifier of 20.
- The **publications-vlan** supports publications VLAN traffic (for supplicants that fail 802.1X authentication) and has a VLAN tag identifier of 30.
- The **support-vlan** supports video traffic and has a VLAN tag identifier of 40.

The VLANs are associated with specific interfaces on each of the four switches. Two MSTIs, 1 and 2, are then associated with the VLAN tag identifiers, and some MSTP parameters, such as cost, are configured on each switch.

Configuring MSTP on Switch 1

CLI Quick Configuration To quickly configure interfaces and MSTP on Switch 1, copy the following commands and paste them into the switch terminal window:



NOTE: If you are configuring MSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the interface-mode statement instead of the port-mode statement. The port-mode statement has been replaced with the interface-mode statement.

```
[edit]
set vlans sales-vlan description "Sales VLAN"
set vlans sales-vlan vlan-id 10
set vlans engineering-vlan description "Engineering VLAN"
set vlans engineering-vlan vlan-id 20
set vlans publications-vlan description "Publications VLAN"
set vlans publications-vlan vlan-id 30
set vlans support-vlan description "Support VLAN"
set vlans support-vlan vlan-id 40
set interfaces xe-0/0/13 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/9 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/11 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/13 unit 0 family ethernet-switching port-mode trunk
set interfaces xe-0/0/9 unit 0 family ethernet-switching port-mode trunk
set interfaces xe-0/0/11 unit 0 family ethernet-switching port-mode trunk
set protocols mstp configuration-name region1
set protocols mstp bridge-priority 16k
set protocols mstp interface xe-0/0/13.0 cost 1000
set protocols mstp interface xe-0/0/13.0 mode point-to-point
set protocols mstp interface xe-0/0/9.0 cost 1000
set protocols mstp interface xe-0/0/9.0 mode point-to-point
set protocols mstp interface xe-0/0/11.0 cost 1000
set protocols mstp interface xe-0/0/11.0 mode point-to-point
set protocols mstp msti 1 bridge-priority 16k
set protocols mstp msti 1 vlan [10 20]
set protocols mstp msti 1 interface xe-0/0/11.0 cost 4000
set protocols mstp msti 2 bridge-priority 8k
set protocols mstp msti 2 vlan [30 40]
```

Step-by-Step Procedure To configure interfaces and MSTP on Switch 1:

1. Configure the VLANs `sales-vlan`, `engineering-vlan`, `publications-vlan`, and `support-vlan`:

```
[edit vlans]
user@switch1# set sales-vlan description "Sales VLAN"
user@switch1# set sales-vlan vlan-id 10
user@switch1# set engineering-vlan description "Engineering VLAN"
user@switch1# set engineering-vlan vlan-id 20
user@switch1# set publications-vlan description "Publications VLAN"
user@switch1# set publications-vlan vlan-id 30
user@switch1# set support-vlan description "Support VLAN"
user@switch1# set publications-vlan vlan-id 40
```

2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:

```
[edit interfaces]
user@switch1# set xe-0/0/13 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch1# set xe-0/0/9 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch1# set xe-0/0/11 unit 0 family ethernet-switching vlan members [10 20 30 40]
```

3. Configure the port mode for the interfaces:



NOTE: If you are configuring MSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the interface-mode statement instead of the port-mode statement. The port-mode statement has been replaced with the interface-mode statement.

```
[edit interfaces]
user@switch1# set xe-0/0/13 unit 0 family ethernet-switching port-mode trunk
user@switch1# set xe-0/0/9 unit 0 family ethernet-switching port-mode trunk
user@switch1# set xe-0/0/11 unit 0 family ethernet-switching port-mode trunk
```

4. Configure MSTP on the switch, including the two MSTIs:

```
[edit protocols]
user@switch1# mstp configuration-name region1
user@switch1# mstp bridge-priority 16k
user@switch1# mstp interface xe-0/0/13.0 cost 1000
user@switch1# mstp interface xe-0/0/13.0 mode point-to-point
user@switch1# mstp interface xe-0/0/9.0 cost 1000
user@switch1# mstp interface xe-0/0/9.0 mode point-to-point
user@switch1# mstp interface xe-0/0/11.0 cost 4000
user@switch1# mstp interface xe-0/0/11.0 mode point-to-point
user@switch1# mstp msti 1 bridge-priority 16k
user@switch1# mstp msti 1 vlan [10 20]
user@switch1# mstp msti 1 interface xe-0/0/11.0 cost 4000
user@switch1# mstp msti 2 bridge-priority 8k
user@switch1# mstp msti 2 vlan [30 40]
```

Results Check the results of the configuration:

```
user@switch1> show configuration
interfaces {
  xe-0/0/13 {
    unit 0 {
      family ethernet-switching {
        port-mode trunk;
        vlan {
          members 10;
          members 20;
          members 30;
          members 40;
        }
      }
    }
  }
  xe-0/0/9 {
    unit 0 {
      family ethernet-switching {
```

```

        port-mode trunk;
        vlan {
            members 10;
            members 20;
            members 30;
            members 40;
        }
    }
}
xe-0/0/11 {
    unit 0 {
        family ethernet-switching {
            port-mode trunk;
            vlan {
                members 10;
                members 20;
                members 30;
                members 40;
            }
        }
    }
}
}
protocols {
    mstp {
        configuration-name region1;
        bridge-priority 16k;
        interface xe-0/0/13.0 {
            cost 1000;
            mode point-to-point;
        }
        interface xe-0/0/9.0 {
            cost 1000;
            mode point-to-point;
        }
        interface xe-0/0/11.0 {
            cost 4000;
            mode point-to-point;
        }
    }
    msti 1 {
        bridge-priority 16k;
        vlan [ 10 20 ];
        interface xe-0/0/11.0 {
            cost 4000;
        }
    }
    msti 2 {
        bridge-priority 8k;
        vlan [ 30 40 ];
    }
}
vllans {
    sales-vlan {
        vlan-id 10;
    }
}

```

```
engineering-vlan {  
    vlan-id 20;  
}  
publications-vlan {  
    vlan-id 30;  
}  
support-vlan {  
    vlan-id 40;  
}  
}
```

Configuring MSTP on Switch 2

CLI Quick Configuration To quickly configure interfaces and MSTP on Switch 2, copy the following commands and paste them into the switch terminal window:



NOTE: If you are configuring MSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the interface-mode statement instead of the port-mode statement. The port-mode statement has been replaced with the interface-mode statement.

```
[edit]  
set vlans sales-vlan description "Sales VLAN"  
set vlans sales-vlan vlan-id 10  
set vlans engineering-vlan description "Engineering VLAN"  
set vlans engineering-vlan vlan-id 20  
set vlans publications-vlan description "Publications VLAN"  
set vlans publications-vlan vlan-id 30  
set vlans support-vlan description "Support VLAN"  
set vlans support-vlan vlan-id 40  
set interfaces xe-0/0/14 unit 0 family ethernet-switching vlan members [10 20 30 40]  
set interfaces xe-0/0/18 unit 0 family ethernet-switching vlan members [10 20 30 40]  
set interfaces xe-0/0/14 unit 0 family ethernet-switching port-mode trunk  
set interfaces xe-0/0/18 unit 0 family ethernet-switching port-mode trunk  
set protocols mstp configuration-name region1  
set protocols mstp bridge-priority 32k  
set protocols mstp interface xe-0/0/14.0 cost 1000  
set protocols mstp interface xe-0/0/14.0 mode point-to-point  
set protocols mstp interface xe-0/0/18.0 cost 1000  
set protocols mstp interface xe-0/0/18.0 mode point-to-point  
set protocols mstp msti 1 bridge-priority 32k  
set protocols mstp msti 1 vlan [10 20]  
set protocols mstp msti 2 bridge-priority 4k  
set protocols mstp msti 2 vlan [30 40]
```

Step-by-Step Procedure To configure interfaces and MSTP on Switch 2:

1. Configure the VLANs `sales-vlan`, `engineering-vlan`, `publications-vlan`, and `support-vlan`:

```
[edit vlans]
user@switch2# set sales-vlan description "Sales VLAN"
user@switch2# set sales-vlan vlan-id 10
user@switch2# set engineering-vlan description "Engineering VLAN"
user@switch2# set engineering-vlan vlan-id 20
user@switch2# set publications-vlan description "Publications VLAN"
user@switch2# set publications-vlan vlan-id 30
user@switch2# set support-vlan vlan-description "Support VLAN"
user@switch2# set publications-vlan vlan-id 40
```

2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:

```
[edit interfaces]
user@switch2# set xe-0/0/14 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch2# set xe-0/0/18 unit 0 family ethernet-switching vlan members [10 20 30 40]
```

3. Configure the port mode for the interfaces:



NOTE: If you are configuring MSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the interface-mode statement instead of the port-mode statement. The port-mode statement has been replaced with the interface-mode statement.

```
[edit interfaces]
user@switch2# set xe-0/0/14 unit 0 family ethernet-switching port-mode trunk
user@switch2# set xe-0/0/18 unit 0 family ethernet-switching port-mode trunk
```

4. Configure MSTP on the switch, including the two MSTIs:

```
[edit protocols]
user@switch2# mstp configuration-name region1
user@switch2# mstp bridge-priority 32k
user@switch2# mstp interface xe-0/0/14.0 cost 1000
user@switch2# mstp interface xe-0/0/14.0 mode point-to-point
user@switch2# mstp interface xe-0/0/18.0 cost 1000
user@switch2# mstp interface xe-0/0/18.0 mode point-to-point
user@switch2# mstp interface all cost 1000
user@switch2# mstp msti 1 bridge-priority 32k
user@switch2# mstp msti 1 vlan [10 20]
user@switch2# mstp msti 2 bridge-priority 4k
user@switch2# mstp msti 2 vlan [30 40]
```

Results Check the results of the configuration:

```
user@switch2> show configuration
interfaces {
  xe-0/0/14 {
    unit 0 {
      family ethernet-switching {
        port-mode trunk;
        vlan {
```

```
        members 10;
        members 20;
        members 30;
        members 40;
    }
}
}
xe-0/0/18 {
    unit 0 {
        family ethernet-switching {
            port-mode trunk;
            vlan {
                members 10;
                members 20;
                members 30;
                members 40;
            }
        }
    }
}
}
protocols {
    mstp {
        configuration-name region1;
        bridge-priority 32k;
        interface xe-0/0/14.0 {
            cost 1000;
            mode point-to-point;
        }
        interface xe-0/0/18.0 {
            cost 1000;
            mode point-to-point;
        }
        msti 1 {
            bridge-priority 32k;
            vlan [ 10 20 ];
        }
        msti 2 {
            bridge-priority 4k;
            vlan [ 30 40 ];
        }
    }
}
vlands {
    sales-vlan {
        vlan-id 10;
    }
    engineering-vlan {
        vlan-id 20;
    }
    publications-vlan {
        vlan-id 30;
    }
    support-vlan {
        vlan-id 40;
    }
}
```



```
}
}
```

Configuring MSTP on Switch 3

CLI Quick Configuration To quickly configure interfaces and MSTP on Switch 3, copy the following commands and paste them into the switch terminal window:



NOTE: If you are configuring MSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the `interface-mode` statement instead of the `port-mode` statement. The `port-mode` statement has been replaced with the `interface-mode` statement.

```
[edit]
set vlans sales-vlan description "Sales VLAN"
set vlans sales-vlan vlan-id 10
set vlans engineering-vlan description "Engineering VLAN"
set vlans engineering-vlan vlan-id 20
set vlans publications-vlan description "Publications VLAN"
set vlans publications-vlan vlan-id 30
set vlans support-vlan description "Support VLAN"
set vlans support-vlan vlan-id 40
set interfaces xe-0/0/26 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/28 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/24 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/26 unit 0 family ethernet-switching port-mode trunk
set interfaces xe-0/0/28 unit 0 family ethernet-switching port-mode trunk
set interfaces xe-0/0/24 unit 0 family ethernet-switching port-mode trunk
set protocols mstp configuration-name region1
set protocols mstp bridge-priority 8k
set protocols mstp interface xe-0/0/26.0 cost 1000
set protocols mstp interface xe-0/0/26.0 mode point-to-point
set protocols mstp interface xe-0/0/28.0 cost 1000
set protocols mstp interface xe-0/0/28.0 mode point-to-point
set protocols mstp interface xe-0/0/24.0 cost 1000
set protocols mstp interface xe-0/0/24.0 mode point-to-point
set protocols mstp msti 1 bridge-priority 4k
set protocols mstp msti 1 vlan [10 20]
set protocols mstp msti 2 bridge-priority 16k
set protocols mstp msti 2 vlan [30 40]
```

Step-by-Step Procedure To configure interfaces and MSTP on Switch 3:

1. Configure the VLANs `sales-vlan`, `engineering-vlan`, `publications-vlan`, and `support-vlan`:

```
[edit vlans]
user@switch3# set sales-vlan description "Sales VLAN"
user@switch3# set sales-vlan vlan-id 10
user@switch3# set engineering-vlan description "Engineering VLAN"
user@switch3# set engineering-vlan vlan-id 20
user@switch3# set publications-vlan description "Publications VLAN"
user@switch3# set publications-vlan vlan-id 30
user@switch3# set support-vlan description "Support VLAN"
user@switch3# set publications-vlan vlan-id 40
```

2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:

```
[edit interfaces]
user@switch3# set xe-0/0/26 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch3# set xe-0/0/28 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch3# set xe-0/0/24 unit 0 family ethernet-switching vlan members [10 20 30 40]
```

3. Configure the port mode for the interfaces:



NOTE: If you are configuring MSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the interface-mode statement instead of the port-mode statement. The port-mode statement has been replaced with the interface-mode statement.

```
[edit interfaces]
user@switch3# set xe-0/0/26 unit 0 family ethernet-switching port-mode trunk
user@switch3# set xe-0/0/28 unit 0 family ethernet-switching port-mode trunk
user@switch3# set xe-0/0/24 unit 0 family ethernet-switching port-mode trunk
```

4. Configure MSTP on the switch, including the two MSTIs:

```
[edit protocols]
user@switch3# mstp configuration-name region1
user@switch3# mstp bridge-priority 8k
user@switch3# mstp interface xe-0/0/26.0 cost 1000
user@switch3# mstp interface xe-0/0/26.0 mode point-to-point
user@switch3# mstp interface xe-0/0/28.0 cost 1000
user@switch3# mstp interface xe-0/0/28.0 mode point-to-point
user@switch3# mstp interface xe-0/0/24.0 cost 1000
user@switch3# mstp interface xe-0/0/24.0 mode point-to-point
user@switch3# mstp interface all cost 1000
user@switch3# mstp msti 1 bridge-priority 4k
user@switch3# mstp msti 1 vlan [10 20]
user@switch3# mstp msti 2 bridge-priority 16k
user@switch3# mstp msti 2 vlan [30 40]
```

Results Check the results of the configuration:

```
user@switch3> show configuration
interfaces {
  xe-0/0/26 {
    unit 0 {
      family ethernet-switching {
        port-mode trunk;
        vlan {
          members 10;
          members 20;
          members 30;
          members 40;
        }
      }
    }
  }
}
```

```

xe-0/0/28 {
  unit 0 {
    family ethernet-switching {
      port-mode trunk;
      vlan {
        members 10;
        members 20;
        members 30;
        members 40;
      }
    }
  }
}
xe-0/0/24 {
  unit 0 {
    family ethernet-switching {
      port-mode trunk;
      vlan {
        members 10;
        members 20;
        members 30;
        members 40;
      }
    }
  }
}
}
}
protocols {
  mstp {
    configuration-name region1;
    bridge-priority 8k;
    interface xe-0/0/26.0 {
      cost 1000;
      mode point-to-point;
    }
    interface xe-0/0/28.0 {
      cost 1000;
      mode point-to-point;
    }
    interface xe-0/0/24.0 {
      cost 1000;
      mode point-to-point;
    }
    msti 1 {
      bridge-priority 4k;
      vlan [ 10 20 ];
    }
    msti 2 {
      bridge-priority 16k;
      vlan [ 30 40 ];
    }
  }
}
vlands {
  sales-vlan {

```

```

        vlan-id 10;
    }
    engineering-vlan {
        vlan-id 20;
    }
    publications-vlan {
        vlan-id 30;
    }
    support-vlan {
        vlan-id 40;
    }
}

```

Configuring MSTP on Switch 4

CLI Quick Configuration To quickly configure interfaces and MSTP on Switch 4, copy the following commands and paste them into the switch terminal window:



NOTE: If you are configuring MSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the interface-mode statement instead of the port-mode statement. The port-mode statement has been replaced with the interface-mode statement.

```

[edit]
set vlans sales-vlan description "Sales VLAN"
set vlans sales-vlan vlan-id 10
set vlans engineering-vlan description "Engineering VLAN"
set vlans engineering-vlan vlan-id 20
set vlans publications-vlan description "Publications VLAN"
set vlans publications-vlan vlan-id 30
set vlans support-vlan description "Support VLAN"
set vlans support-vlan vlan-id 40
set interfaces xe-0/0/23 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/19 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/23 unit 0 family ethernet-switching port-mode trunk
set interfaces xe-0/0/19 unit 0 family ethernet-switching port-mode trunk
set protocols mstp configuration-name region1
set protocols mstp bridge-priority 16k
set protocols mstp interface xe-0/0/23.0 cost 1000
set protocols mstp interface xe-0/0/23.0 mode point-to-point
set protocols mstp interface xe-0/0/19.0 cost 1000
set protocols mstp interface xe-0/0/19.0 mode point-to-point
set protocols mstp msti 1 bridge-priority 16k
set protocols mstp msti 1 vlan [10 20]
set protocols mstp msti 2 bridge-priority 32k
set protocols mstp msti 2 vlan [30 40]

```

Step-by-Step Procedure To configure interfaces and MSTP on Switch 4:

1. Configure the VLANs `sales-vlan`, `engineering-vlan`, `publications-vlan`, and `support-vlan`:

```
[edit vlans]
user@switch4# set sales-vlan description "Sales VLAN"
user@switch4# set sales-vlan vlan-id 10
user@switch4# set engineering-vlan description "Engineering VLAN"
user@switch4# set engineering-vlan vlan-id 20
user@switch4# set publications-vlan description "Publications VLAN"
user@switch4# set publications-vlan vlan-id 30
user@switch4# set support-vlan description "Support VLAN"
user@switch4# set publications-vlan vlan-id 40
```

2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:

```
[edit interfaces]
user@switch4# set xe-0/0/23 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch4# set xe-0/0/19 unit 0 family ethernet-switching vlan members [10 20 30 40]
```

3. Configure the port mode for the interfaces:



NOTE: If you are configuring MSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the interface-mode statement instead of the port-mode statement. The port-mode statement has been replaced with the interface-mode statement.

```
[edit interfaces]
user@switch4# set ge-0/0/23 unit 0 family ethernet-switching port-mode trunk
user@switch4# set ge-0/0/19 unit 0 family ethernet-switching port-mode trunk
```

4. Configure MSTP on the switch, including the two MSTIs:

```
[edit protocols]
user@switch4# mstp configuration-name region1
user@switch4# mstp bridge-priority 16k
user@switch4# mstp interface all cost 1000
user@switch4# mstp interface xe-0/0/23.0 cost 1000
user@switch4# mstp interface xe-0/0/23.0 mode point-to-point
user@switch4# mstp interface xe-0/0/19.0 cost 1000
user@switch4# mstp interface xe-0/0/19.0 mode point-to-point
user@switch4# mstp msti 1 bridge-priority 16k
user@switch4# mstp msti 1 vlan [10 20]
user@switch4# mstp msti 2 bridge-priority 32k
user@switch4# mstp msti 2 vlan [30 40]
```

Results Check the results of the configuration:

```
user@switch4> show configuration
interfaces {
  xe-0/0/23 {
    unit 0 {
      family ethernet-switching {
        port-mode trunk;
        vlan {
```

```
        members 10;
        members 20;
        members 30;
        members 40;
    }
}
}
xe-0/0/19 {
    unit 0 {
        family ethernet-switching {
            port-mode trunk;
            vlan {
                members 10;
                members 20;
                members 30;
                members 40;
            }
        }
    }
}
}
protocols {
    mstp {
        configuration-name region1;
        bridge-priority 16k;
        interface xe-0/0/23.0 {
            cost 1000;
            mode point-to-point;
        }
        interface xe-0/0/19.0 {
            cost 1000;
            mode point-to-point;
        }
        msti 1 {
            bridge-priority 16k;
            vlan [ 10 20 ];
        }
        msti 2 {
            bridge-priority 32k;
            vlan [ 30 40 ];
        }
    }
}
vlands {
    sales-vlan {
        vlan-id 10;
    }
    engineering-vlan {
        vlan-id 20;
    }
    publications-vlan {
        vlan-id 30;
    }
    support-vlan {
        vlan-id 40;
    }
}
```

```
}  
}
```

Verification

To confirm that the configuration is working properly, perform these tasks:

- [Verifying MSTP Configuration on Switch 1 on page 141](#)
- [Verifying MSTP Configuration on Switch 2 on page 143](#)
- [Verifying MSTP Configuration on Switch 3 on page 145](#)
- [Verifying MSTP Configuration on Switch 4 on page 147](#)

Verifying MSTP Configuration on Switch 1

Purpose Verify the MSTP configuration on Switch 1.

Action Use the operational mode commands:

```
user@switch1> show spanning-tree interface
```

```
Spanning tree interface parameters for instance 0
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/13.0	128:527	128:525	16384.0019e25040e0	1000	FWD	ROOT
xe-0/0/9.0	128:529	128:513	32768.0019e2503d20	1000	BLK	ALT
xe-0/0/11.0	128:531	128:513	8192.0019e25051e0	4000	BLK	ALT

```
Spanning tree interface parameters for instance 1
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/13.0	128:527	128:525	16385.0019e25040e0	1000	FWD	ROOT
xe-0/0/9.0	128:529	128:513	32769.0019e2503d20	1000	BLK	ALT
xe-0/0/11.0	128:531	128:513	4097.0019e25051e0	4000	BLK	ALT

```
Spanning tree interface parameters for instance 2
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/13.0	128:527	128:527	8194.0019e25044e0	1000	FWD	DESG
xe-0/0/9.0	128:529	128:513	4098.0019e2503d20	1000	FWD	ROOT
xe-0/0/11.0	128:531	128:531	8194.0019e25044e0	1000	FWD	DESG

```
user@switch1> show spanning-tree bridge
```

```
STP bridge parameters
```

```
Context ID : 0
Enabled protocol : MSTP
```

```
STP bridge parameters for CIST
```

```
Root ID : 8192.00:19:e2:50:51:e0
Root cost : 0
Root port : xe-0/0/13.0
CIST regional root : 8192.00:19:e2:50:51:e0
CIST internal root cost : 2000
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Hop count : 18
Message age : 0
Number of topology changes : 3
Time since last topology change : 921 seconds
Local parameters
  Bridge ID : 16384.00:19:e2:50:44:e0
  Extended system ID : 0
  Internal instance ID : 0
```

```
STP bridge parameters for MSTI 1
```

```
MSTI regional root : 4097.00:19:e2:50:51:e0
Root cost : 2000
Root port : xe-0/0/13.0
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Hop count : 18
Local parameters
  Bridge ID : 16385.00:19:e2:50:44:e0
```



```
Extended system ID          : 0
Internal instance ID        : 1

STP bridge parameters for MSTI 2
MSTI regional root          : 4098.00:19:e2:50:3d:20
Root cost                    : 1000
Root port                    : xe-0/0/9.0
Hello time                   : 2 seconds
Maximum age                  : 20 seconds
Forward delay                : 15 seconds
Hop count                    : 19
Local parameters
  Bridge ID                  : 8194.00:19:e2:50:44:e0
  Extended system ID         : 0
  Internal instance ID       : 2
```

Meaning The operational mode command **show spanning-tree interface** displays spanning-tree domain information such as the designated port and the port roles.

The operational mode command **show spanning-tree bridge** displays the spanning-tree domain information at either the bridge level or the interface level. If the optional interface name is omitted, all interfaces in the spanning-tree domain are displayed.

Verifying MSTP Configuration on Switch 2

Purpose Verify the MSTP configuration on Switch 2.

Action Use the operational mode commands:

```
user@switch2> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/14.0	128:513	128:513	32768.0019e2503d20	1000	FWD	DESC
xe-0/0/18.0	128:519	128:515	8192.0019e25051e0	1000	FWD	ROOT

Spanning tree interface parameters for instance 1

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/14.0	128:513	128:513	32769.0019e2503d20	1000	FWD	DESC
xe-0/0/18.0	128:519	128:515	4097.0019e25051e0	1000	FWD	ROOT

Spanning tree interface parameters for instance 2

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/14.0	128:513	128:513	4098.0019e2503d20	1000	FWD	DESC
xe-0/0/18.0	128:519	128:519	4098.0019e2503d20	1000	FWD	DESC

```
user@switch2> show spanning-tree bridge
```

STP bridge parameters

```
Context ID : 0
Enabled protocol : MSTP
```

STP bridge parameters for CIST

```
Root ID : 8192.00:19:e2:50:51:e0
Root cost : 0
Root port : xe-0/0/18.0
CIST regional root : 8192.00:19:e2:50:51:e0
CIST internal root cost : 1000
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Hop count : 19
Message age : 0
Number of topology changes : 1
Time since last topology change : 782 seconds
Local parameters
  Bridge ID : 32768.00:19:e2:50:3d:20
  Extended system ID : 0
  Internal instance ID : 0
```

STP bridge parameters for MSTI 1

```
MSTI regional root : 4097.00:19:e2:50:51:e0
Root cost : 1000
Root port : xe-0/0/18.0
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Hop count : 19
Local parameters
  Bridge ID : 32769.00:19:e2:50:3d:20
```

```
Extended system ID      : 0
Internal instance ID    : 1

STP bridge parameters for MSTI 2
MSTI regional root      : 4098.00:19:e2:50:3d:20
Hello time              : 2 seconds
Maximum age             : 20 seconds
Forward delay           : 15 seconds
Local parameters
  Bridge ID             : 4098.00:19:e2:50:3d:20
  Extended system ID    : 0
  Internal instance ID  : 2
```

Meaning The operational mode command **show spanning-tree interface** displays spanning-tree domain information such as the designated port and the port roles.

The operational mode command **show spanning-tree bridge** displays the spanning-tree domain information at either the bridge level or the interface level. If the optional interface name is omitted, all interfaces in the spanning-tree domain are displayed.

Verifying MSTP Configuration on Switch 3

Purpose Verify the MSTP configuration on Switch 3.

Action Use the operational mode commands:

```
user@switch3> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/26.0	128:513	128:513	8192.0019e25051e0	1000	FWD	DESC
xe-0/0/28.0	128:515	128:515	8192.0019e25051e0	1000	FWD	DESC
xe-0/0/24.0	128:517	128:517	8192.0019e25051e0	1000	FWD	DESC

Spanning tree interface parameters for instance 1

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/26.0	128:513	128:513	4097.0019e25051e0	1000	FWD	DESC
xe-0/0/28.0	128:515	128:515	4097.0019e25051e0	1000	FWD	DESC
xe-0/0/24.0	128:517	128:517	4097.0019e25051e0	1000	FWD	DESC

Spanning tree interface parameters for instance 2

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/26.0	128:513	128:531	8194.0019e25044e0	1000	BLK	ALT
xe-0/0/28.0	128:515	128:519	4098.0019e2503d20	1000	FWD	ROOT
xe-0/0/24.0	128:517	128:517	16386.0019e25051e0	1000	FWD	DESC

```
user@switch3> show spanning-tree bridge
```

STP bridge parameters

```
Context ID : 0
Enabled protocol : MSTP
```

STP bridge parameters for CIST

```
Root ID : 8192.00:19:e2:50:51:e0
CIST regional root : 8192.00:19:e2:50:51:e0
CIST internal root cost : 0
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Number of topology changes : 3
Time since last topology change : 843 seconds
Local parameters
  Bridge ID : 8192.00:19:e2:50:51:e0
  Extended system ID : 0
  Internal instance ID : 0
```

STP bridge parameters for MSTI 1

```
MSTI regional root : 4097.00:19:e2:50:51:e0
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Local parameters
  Bridge ID : 4097.00:19:e2:50:51:e0
  Extended system ID : 0
  Internal instance ID : 1
```

STP bridge parameters for MSTI 2

```
MSTI regional root : 4098.00:19:e2:50:3d:20
```

```
Root cost           : 1000
Root port           : xe-0/0/28.0
Hello time          : 2 seconds
Maximum age         : 20 seconds
Forward delay       : 15 seconds
Hop count           : 19
Local parameters
  Bridge ID         : 16386.00:19:e2:50:51:e0
  Extended system ID : 0
  Internal instance ID : 2
```

Meaning The operational mode command **show spanning-tree interface** displays spanning-tree domain information such as the designated port and the port roles.

The operational mode command **show spanning-tree bridge** displays the spanning-tree domain information at either the bridge level or the interface level. If the optional interface name is omitted, all interfaces in the spanning-tree domain are displayed.

Verifying MSTP Configuration on Switch 4

Purpose Verify the MSTP configuration on Switch 4.

Action Use the operational mode commands:

```
user@switch4> show spanning-tree interface
```

```
Spanning tree interface parameters for instance 0
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/23.0	128:523	128:517	8192.0019e25051e0	1000	FWD	ROOT
xe-0/0/19.0	128:525	128:525	16384.0019e25040e0	1000	FWD	DESG

```
Spanning tree interface parameters for instance 1
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/23.0	128:523	128:517	4097.0019e25051e0	1000	FWD	ROOT
xe-0/0/19.0	128:525	128:525	16385.0019e25040e0	1000	FWD	DESG

```
Spanning tree interface parameters for instance 2
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-0/0/23.0	128:523	128:517	16386.0019e25051e0	1000	BLK	ALT
xe-0/0/19.0	128:525	128:527	8194.0019e25044e0	1000	FWD	ROOT

```
user@switch4> show spanning-tree bridge
```

```
STP bridge parameters
```

```
Context ID : 0
Enabled protocol : MSTP
```

```
STP bridge parameters for CIST
```

```
Root ID : 8192.00:19:e2:50:51:e0
Root cost : 0
Root port : xe-0/0/23.0
CIST regional root : 8192.00:19:e2:50:51:e0
CIST internal root cost : 1000
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Hop count : 19
Message age : 0
Number of topology changes : 4
Time since last topology change : 887 seconds
Local parameters
  Bridge ID : 16384.00:19:e2:50:40:e0
  Extended system ID : 0
  Internal instance ID : 0
```

```
STP bridge parameters for MSTI 1
```

```
MSTI regional root : 4097.00:19:e2:50:51:e0
Root cost : 1000
Root port : xe-0/0/23.0
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Hop count : 19
Local parameters
  Bridge ID : 16385.00:19:e2:50:40:e0
  Extended system ID : 0
```

```

Internal instance ID           : 1

STP bridge parameters for MSTI 2
MSTI regional root            : 4098.00:19:e2:50:3d:20
Root cost                      : 2000
Root port                     : xe-0/0/19.0
Hello time                    : 2 seconds
Maximum age                   : 20 seconds
Forward delay                 : 15 seconds
Hop count                     : 18
Local parameters
  Bridge ID                   : 32770.00:19:e2:50:40:e0
  Extended system ID         : 0
  Internal instance ID       : 2

```

Meaning The operational mode command **show spanning-tree interface** displays spanning-tree domain information such as the designated port and the port roles.

The operational mode command **show spanning-tree bridge** displays the spanning-tree domain information at either the bridge level or the interface level. If the optional interface name is omitted, all interfaces in the spanning-tree domain are displayed.

- Related Documentation**
- [Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149](#)
 - [Understanding MSTP on page 104](#)

Example: Configuring Faster Convergence and Improving Network Stability with RSTP

The QFX Series products use Rapid Spanning Tree Protocol (RSTP) to provide a loop-free topology. RSTP identifies certain links as point to point. When a point-to-point link fails, the alternate link can transition to the forwarding state. RSTP provides quicker reconvergence time than original STP because it uses protocol handshake messages rather than fixed timeouts. Eliminating the need to wait for timers to expire makes RSTP more efficient than STP.

This example describes how to configure RSTP on four QFX3500 switches:

- [Requirements on page 149](#)
- [Overview and Topology on page 150](#)
- [Configuring RSTP on Switch 1 on page 151](#)
- [Configuring RSTP on Switch 2 on page 154](#)
- [Configuring RSTP on Switch 3 on page 156](#)
- [Configuring RSTP on Switch 4 on page 159](#)
- [Verification on page 161](#)

Requirements

This example uses the following hardware and software components:

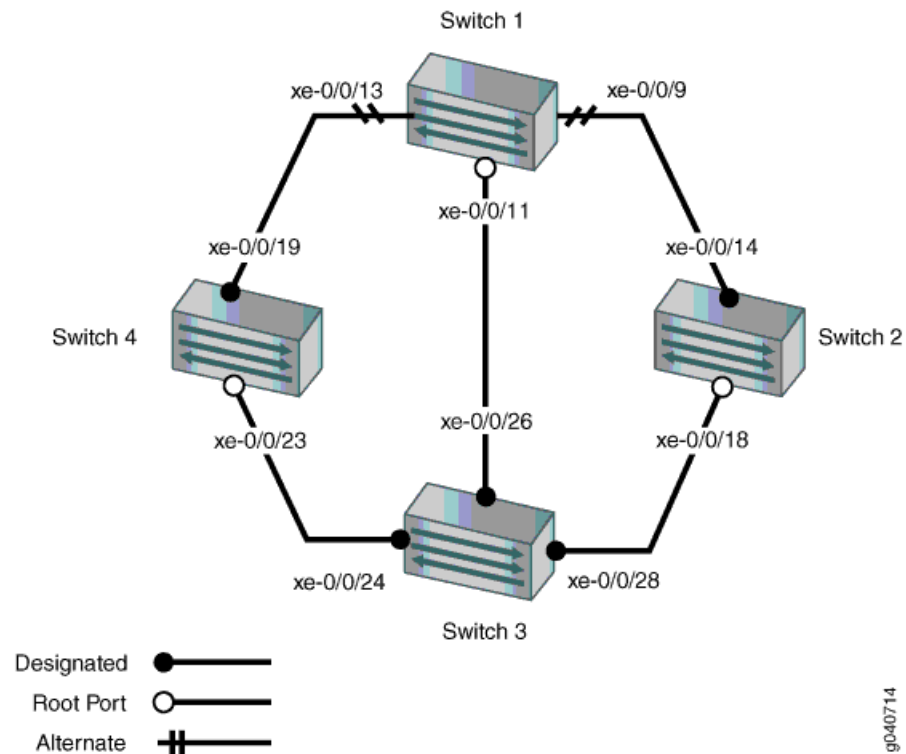
- Junos OS Release 11.1 for the QFX3500 switches

- Four QFX3500 switches

Overview and Topology

In this example, QFX3500 switches are connected in the topology displayed in [Figure 6 on page 150](#) to create a loop-free topology.

Figure 6: Network Topology for RSTP



The interfaces shown in [Table 18 on page 150](#) will be configured for RSTP.



NOTE: You can configure RSTP on logical or physical interfaces. This example shows RSTP configured on logical interfaces.

Table 18: Topology for Configuring RSTP on the QFX Series

Components	Settings
Switch 1	<p>The following ports on Switch 1 are connected in this way:</p> <ul style="list-style-type: none"> • xe-0/0/9 is connected to Switch 2 • xe-0/0/13 is connected to Switch 4 • xe-0/0/11 is connected to Switch 3

Table 18: Topology for Configuring RSTP on the QFX Series (*continued*)

Components	Settings
Switch 2	<p>The following ports on Switch 2 are connected in this way:</p> <ul style="list-style-type: none"> • xe-0/0/14 is connected to Switch 1 • xe-0/0/18 is connected to Switch 3
Switch 3	<p>The following ports on Switch 3 are connected in this way:</p> <ul style="list-style-type: none"> • xe-0/0/26 is connected to Switch 1 • xe-0/0/28 is connected to Switch 2 • xe-0/0/24 is connected to Switch 4
Switch 4	<p>The following ports on Switch 4 are connected in this way:</p> <ul style="list-style-type: none"> • xe-0/0/19 is connected to Switch 1 • xe-0/0/23 is connected to Switch 3
VLAN names and tag IDs	<p>sales-vlan, tag 10 engineering-vlan, tag 20 publications-vlan, tag 30 support-vlan, tag 40</p>

This configuration example creates a loop-free topology between four switches using RSTP.

An RSTP topology contains ports that have specific roles:

- The *root port* is responsible for forwarding data to the root bridge.
- The *alternate port* is a standby port for the root port. When a root port goes down, the alternate port becomes the active root port.
- The *designated port* forwards data to the downstream network segment or device.
- The *backup port* is a backup port for the designated port. When a designated port goes down, the backup port becomes the active designated port and starts forwarding data.

Configuring RSTP on Switch 1

CLI Quick Configuration To quickly configure interfaces and RSTP on Switch 1, copy the following commands and paste them into the switch terminal window:



NOTE: If you are configuring RSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the **interface-mode** statement instead of the **port-mode** statement. The **port-mode** statement has been replaced with the **interface-mode** statement.

```
[edit]
set vlans sales-vlan description "Sales VLAN"
```

```

set vlans sales-vlan vlan-id 10
set vlans engineering-vlan description "Engineering VLAN"
set vlans engineering-vlan vlan-id 20
set vlans publications-vlan description "Publications VLAN"
set vlans publications-vlan vlan-id 30
set vlans support-vlan description "Support VLAN"
set vlans support-vlan vlan-id 40
set interfaces xe-0/0/13 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/9 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/11 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/13 unit 0 family ethernet-switching port-mode trunk
set interfaces xe-0/0/9 unit 0 family ethernet-switching port-mode trunk
set interfaces xe-0/0/11 unit 0 family ethernet-switching port-mode trunk
set protocols rstp bridge-priority 16k
set protocols rstp interface xe-0/0/13.0 cost 1000
set protocols rstp interface xe-0/0/13.0 mode point-to-point
set protocols rstp interface xe-0/0/9.0 cost 1000
set protocols rstp interface xe-0/0/9.0 mode point-to-point
set protocols rstp interface xe-0/0/11.0 cost 1000
set protocols rstp interface xe-0/0/11.0 mode point-to-point

```

Step-by-Step Procedure

To configure interfaces and RSTP on Switch 1:

1. Configure the VLANs `sales-vlan`, `engineering-vlan` and `publications-vlan`, and `support-vlan`:


```

[edit vlans]
user@switch1# set sales-vlan description "Sales VLAN"
user@switch1# set sales-vlan vlan-id 10
user@switch1# set engineering-vlan description "Engineering VLAN"
user@switch1# set engineering-vlan vlan-id 20
user@switch1# set publications-vlan description "Publications VLAN"
user@switch1# set publications-vlan vlan-id 30

```
2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:


```

[edit interfaces]
user@switch1# set xe-0/0/13 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch1# set xe-0/0/9 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch1# set xe-0/0/11 unit 0 family ethernet-switching vlan members [10 20 30 40]

```
3. Configure the port mode for the interfaces:



NOTE: If you are configuring RSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the `interface-mode` statement instead of the `port-mode` statement. The `port-mode` statement has been replaced with the `interface-mode` statement.

- ```

[edit interfaces]
user@switch1# set xe-0/0/13 unit 0 family ethernet-switching port-mode trunk
user@switch1# set xe-0/0/9 unit 0 family ethernet-switching port-mode trunk
user@switch1# set xe-0/0/11 unit 0 family ethernet-switching port-mode trunk

```
4. Configure RSTP on the switch:

```
[edit protocols]
user@switch1# rstp bridge-priority 16k
user@switch1# rstp interface xe-0/0/13.0 cost 1000
user@switch1# rstp interface xe-0/0/13.0 mode point-to-point
user@switch1# rstp interface xe-0/0/9.0 cost 1000
user@switch1# rstp interface xe-0/0/9.0 mode point-to-point
user@switch1# rstp interface xe-0/0/11.0 cost 1000
user@switch1# rstp interface xe-0/0/11.0 mode point-to-point
```

**Results** Check the results of the configuration:

```
user@switch1> show configuration
interfaces {
 xe-0/0/13 {
 unit 0 {
 family ethernet-switching {
 port-mode trunk;
 vlan {
 members [10 20 30 40];
 }
 }
 }
 }
 xe-0/0/9 {
 unit 0 {
 family ethernet-switching {
 port-mode trunk;
 vlan {
 members [10 20 30 40];
 }
 }
 }
 }
 xe-0/0/11 {
 unit 0 {
 family ethernet-switching {
 port-mode trunk;
 vlan {
 members [10 20 30 40];
 }
 }
 }
 }
}
protocols {
 rstp {
 bridge-priority 16k;
 interface xe-0/0/13.0 {
 cost 1000;
 mode point-to-point;
 }
 interface xe-0/0/9.0 {
 cost 1000;
 mode point-to-point;
 }
 interface xe-0/0/11.0 {
```

```

 cost 1000;
 mode point-to-point;
 }
}
}
vlands {
 sales-vlan {
 vlan-id 10;
 }
 engineering-vlan {
 vlan-id 20;
 }
 publications-vlan {
 vlan-id 30;
 }
 support-vlan {
 vlan-id 40;
 }
}

```

## Configuring RSTP on Switch 2

**CLI Quick Configuration** To quickly configure interfaces and RSTP on Switch 2, copy the following commands and paste them into the switch terminal window:



**NOTE:** If you are configuring RSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the `interface-mode` statement instead of the `port-mode` statement. The `port-mode` statement has been replaced with the `interface-mode` statement.

```

[edit]
set vlans sales-vlan description "Sales VLAN"
set vlans sales-vlan vlan-id 10
set vlans engineering-vlan description "Engineering VLAN"
set vlans engineering-vlan vlan-id 20
set vlans publications-vlan description "Publications VLAN"
set vlans publications-vlan vlan-id 30
set vlans support-vlan description "Support VLAN"
set vlans support-vlan vlan-id 40
set interfaces xe-0/0/14 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/18 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/14 unit 0 family ethernet-switching port-mode trunk
set interfaces xe-0/0/18 unit 0 family ethernet-switching port-mode trunk
set protocols rstp bridge-priority 32k
set protocols rstp interface xe-0/0/14.0 cost 1000
set protocols rstp interface xe-0/0/14.0 mode point-to-point
set protocols rstp interface xe-0/0/18.0 cost 1000
set protocols rstp interface xe-0/0/18.0 mode point-to-point

```

**Step-by-Step Procedure** To configure interfaces and RSTP on Switch 2:

1. Configure the VLANs **sales-vlan**, **engineering-vlan** and **publications-vlan**, and **support-vlan**:

```
[edit vlans]
user@switch2# set sales-vlan description "Sales VLAN"
user@switch2# set sales-vlan vlan-id 10
user@switch2# set engineering-vlan description "Engineering VLAN"
user@switch2# set engineering-vlan vlan-id 20
user@switch2# set publications-vlan description "Publications VLAN"
user@switch2# set publications-vlan vlan-id 30
user@switch2# set support-vlan vlan-description "Support VLAN"
user@switch2# set publications-vlan vlan-id 40
```

2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:

```
[edit interfaces]
user@switch2# set xe-0/0/14 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch2# set xe-0/0/18 unit 0 family ethernet-switching vlan members [10 20 30 40]
```

3. Configure the port mode for the interfaces:



**NOTE:** If you are configuring RSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the **interface-mode** statement instead of the **port-mode** statement. The **port-mode** statement has been replaced with the **interface-mode** statement.

```
[edit interfaces]
user@switch2# set xe-0/0/14 unit 0 family ethernet-switching port-mode trunk
user@switch2# set xe-0/0/18 unit 0 family ethernet-switching port-mode trunk
```

4. Configure RSTP on the switch:

```
[edit protocols]
user@switch2# rstp bridge-priority 32k
user@switch2# rstp interface xe-0/0/14.0 cost 1000
user@switch2# rstp interface xe-0/0/14.0 mode point-to-point
user@switch2# rstp interface xe-0/0/18.0 cost 1000
user@switch2# rstp interface xe-0/0/18.0 mode point-to-point
```

**Results** Check the results of the configuration:

```
user@switch2> show configuration
interfaces {
 xe-0/0/14 {
 unit 0 {
 family ethernet-switching {
 port-mode trunk;
 vlan {
 members [10 20 30 40];
 }
 }
 }
 }
}
```

```
xe-0/0/18 {
 unit 0 {
 family ethernet-switching {
 port-mode trunk;
 vlan {
 members [10 20 30 40];
 }
 }
 }
}
protocols {
 rstp {
 bridge-priority 32k;
 interface xe-0/0/14.0 {
 cost 1000;
 mode point-to-point;
 }
 interface xe-0/0/18.0 {
 cost 1000;
 mode point-to-point;
 }
 }
}
vlands {
 sales-vlan {
 vlan-id 10;
 }
 engineering-vlan {
 vlan-id 20;
 }
 publications-vlan {
 vlan-id 30;
 }
 support-vlan {
 vlan-id 40;
 }
}
```

### Configuring RSTP on Switch 3

**CLI Quick Configuration** To quickly configure interfaces and RSTP on Switch 3, copy the following commands and paste them into the switch terminal window:



**NOTE:** If you are configuring RSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the `interface-mode` statement instead of the `port-mode` statement. The `port-mode` statement has been replaced with the `interface-mode` statement.

[edit]  
set vlands sales-vlan description "Sales VLAN"

```

set vlans sales-vlan vlan-id 10
set vlans engineering-vlan description "Engineering VLAN"
set vlans engineering-vlan vlan-id 20
set vlans publications-vlan description "Publications VLAN"
set vlans publications-vlan vlan-id 30
set vlans support-vlan description "Support VLAN"
set vlans support-vlan vlan-id 40
set interfaces xe-0/0/26 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/28 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/24 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/26 unit 0 family ethernet-switching port-mode trunk
set interfaces xe-0/0/28 unit 0 family ethernet-switching port-mode trunk
set interfaces xe-0/0/24 unit 0 family ethernet-switching port-mode trunk
set protocols rstp bridge-priority 8k
set protocols rstp interface xe-0/0/26.0 cost 1000
set protocols rstp interface xe-0/0/26.0 mode point-to-point
set protocols rstp interface xe-0/0/28.0 cost 1000
set protocols rstp interface xe-0/0/28.0 mode point-to-point
set protocols rstp interface xe-0/0/24.0 cost 1000
set protocols rstp interface xe-0/0/24.0 mode point-to-point

```

### Step-by-Step Procedure

To configure interfaces and RSTP on Switch 3:

1. Configure the VLANs `sales-vlan`, `engineering-vlan`, `publications-vlan`, and `support-vlan`:

```

[edit vlans]
user@switch3# set sales-vlan description "Sales VLAN"
user@switch3# set sales-vlan vlan-id 10
user@switch3# set engineering-vlan description "Engineering VLAN"
user@switch3# set engineering-vlan vlan-id 20
user@switch3# set publications-vlan description "Publications VLAN"
user@switch3# set publications-vlan vlan-id 30
user@switch3# set support-vlan description "Support VLAN"
user@switch3# set publications-vlan vlan-id 40

```

2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:

```

[edit interfaces]
user@switch3# set xe-0/0/26 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch3# set xe-0/0/28 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch3# set xe-0/0/24 unit 0 family ethernet-switching vlan members [10 20 30 40]

```

3. Configure the port mode for the interfaces:



**NOTE:** If you are configuring RSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the `interface-mode` statement instead of the `port-mode` statement. The `port-mode` statement has been replaced with the `interface-mode` statement.

```

[edit interfaces]
user@switch3# set xe-0/0/26 unit 0 family ethernet-switching port-mode trunk
user@switch3# set xe-0/0/28 unit 0 family ethernet-switching port-mode trunk
user@switch3# set xe-0/0/24 unit 0 family ethernet-switching port-mode trunk

```

4. Configure RSTP on the switch:

```
[edit protocols]
user@switch3# rstp bridge-priority 8k
user@switch3# rstp interface xe-0/0/26.0 cost 1000
user@switch3# rstp interface xe-0/0/26.0 mode point-to-point
user@switch3# rstp interface xe-0/0/28.0 cost 1000
user@switch3# rstp interface xe-0/0/28.0 mode point-to-point
user@switch3# rstp interface xe-0/0/24.0 cost 1000
user@switch3# rstp interface xe-0/0/24.0 mode point-to-point
```

**Results** Check the results of the configuration:

```
user@switch3> show configuration
interfaces {
 xe-0/0/26 {
 unit 0 {
 family ethernet-switching {
 port-mode trunk;
 vlan {
 members [10 20 30 40];
 }
 }
 }
 }
 xe-0/0/28 {
 unit 0 {
 family ethernet-switching {
 port-mode trunk;
 vlan {
 members [10 20 30 40];
 }
 }
 }
 }
 xe-0/0/24 {
 unit 0 {
 family ethernet-switching {
 port-mode trunk;
 vlan {
 members [10 20 30 40];
 }
 }
 }
 }
}
protocols {
 rstp {
 bridge-priority 8k;
 interface xe-0/0/26.0 {
 cost 1000;
 mode point-to-point;
 }
 interface xe-0/0/28.0 {
 cost 1000;
 mode point-to-point;
 }
 }
}
```



```

 interface xe-0/0/24.0 {
 cost 1000;
 mode point-to-point;
 }
 }
 bridge-priority 8k;
}
}
vlangs {
 sales-vlan {
 vlan-id 10;
 }
 engineering-vlan {
 vlan-id 20;
 }
 publications-vlan {
 vlan-id 30;
 }
 support-vlan {
 vlan-id 40;
 }
}
}

```

## Configuring RSTP on Switch 4

**CLI Quick Configuration** To quickly configure interfaces and RSTP on Switch 4, copy the following commands and paste them into the switch terminal window:



**NOTE:** If you are configuring RSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the interface-mode statement instead of the port-mode statement. The port-mode statement has been replaced with the interface-mode statement.

```

[edit]
set vlans sales-vlan description "Sales VLAN"
set vlans sales-vlan vlan-id 10
set vlans engineering-vlan description "Engineering VLAN"
set vlans engineering-vlan vlan-id 20
set vlans publications-vlan description "Publications VLAN"
set vlans publications-vlan vlan-id 30
set vlans support-vlan description "Support VLAN"
set vlans support-vlan vlan-id 40
set interfaces xe-0/0/23 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/19 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces xe-0/0/23 unit 0 family ethernet-switching port-mode trunk
set interfaces xe-0/0/19 unit 0 family ethernet-switching port-mode trunk
set protocols rstp bridge-priority 16k
set protocols rstp interface xe-0/0/23.0 cost 1000
set protocols rstp interface xe-0/0/23.0 mode point-to-point
set protocols rstp interface xe-0/0/19.0 cost 1000
set protocols rstp interface xe-0/0/19.0 mode point-to-point

```

**Step-by-Step Procedure** To configure interfaces and RSTP on Switch 4:

1. Configure the VLANs `sales-vlan`, `engineering-vlan`, `publications-vlan`, and `support-vlan`:

```
[edit vlans]
user@switch4# set sales-vlan description "Sales VLAN"
user@switch4# set sales-vlan vlan-id 10
user@switch4# set engineering-vlan description "Engineering VLAN"
user@switch4# set engineering-vlan vlan-id 20
user@switch4# set publications-vlan description "Publications VLAN"
user@switch4# set publications-vlan vlan-id 30
user@switch4# set support-vlan description "Support VLAN"
user@switch4# set publications-vlan vlan-id 40
```

2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:

```
[edit interfaces]
user@switch4# set xe-0/0/23 unit 0 family ethernet-switching vlan members [10 20 30 40]
user@switch4# set xe-0/0/19 unit 0 family ethernet-switching vlan members [10 20 30 40]
```

3. Configure the port mode for the interfaces:



**NOTE:** If you are configuring RSTP on devices that support the Enhanced Layer 2 Switching (ELS) CLI, use the `interface-mode` statement instead of the `port-mode` statement. The `port-mode` statement has been replaced with the `interface-mode` statement.

```
[edit interfaces]
user@switch4# set xe-0/0/23 unit 0 family ethernet-switching port-mode trunk
user@switch4# set xe-0/0/19 unit 0 family ethernet-switching port-mode trunk
```

4. Configure RSTP on the switch:

```
[edit protocols]
user@switch4# rstp bridge-priority 16k
user@switch4# rstp interface all cost 1000
user@switch4# rstp interface xe-0/0/23.0 cost 1000
user@switch4# rstp interface xe-0/0/23.0 mode point-to-point
user@switch4# rstp interface xe-0/0/19.0 cost 1000
user@switch4# rstp interface xe-0/0/19.0 mode point-to-point
```

**Results** Check the results of the configuration:

```
user@switch4> show configuration
interfaces {
 xe-0/0/23 {
 unit 0 {
 family ethernet-switching {
 port-mode trunk;
 vlan {
 members [10 20 30 40];
 }
 }
 }
 }
}
```

```

xe-0/0/19 {
 unit 0 {
 family ethernet-switching {
 port-mode trunk;
 vlan {
 members [10 20 30 40];
 }
 }
 }
}
}
protocols {
 rstp {
 bridge-priority 16k;
 interface xe-0/0/23.0 {
 cost 1000;
 mode point-to-point;
 }
 interface xe-0/0/19.0 {
 cost 1000;
 mode point-to-point;
 }
 }
}
}
vlands {
 sales-vlan {
 vlan-id 10;
 }
 engineering-vlan {
 vlan-id 20;
 }
 publications-vlan {
 vlan-id 30;
 }
 support-vlan {
 vlan-id 40;
 }
}
}

```

## Verification

To confirm that the configuration is working properly, perform these tasks:

- [Verifying RSTP Configuration on Switch 1 on page 161](#)
- [Verifying RSTP Configuration on Switch 2 on page 162](#)
- [Verifying RSTP Configuration on Switch 3 on page 162](#)
- [Verifying RSTP Configuration on Switch 4 on page 163](#)

### Verifying RSTP Configuration on Switch 1

**Purpose** Verify that the RSTP configuration on Switch 1 is correct.

**Action** In operational mode, issue the **show spanning-tree interface** command:

```
user@switch1> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

| Interface   | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-------------|---------|-----------------------|-------------------------|--------------|-------|------|
| xe-0/0/13.0 | 128:527 | 128:525               | 16384.0019e25040e0      | 1000         | BLK   | ALT  |
| xe-0/0/9.0  | 128:529 | 128:513               | 32768.0019e2503d20      | 1000         | BLK   | ALT  |
| xe-0/0/11.0 | 128:531 | 128:513               | 8192.0019e25051e0       | 1000         | FWD   | ROOT |

**Meaning** See the topology in [Figure 6 on page 150](#). The operational mode command **show spanning-tree interface** shows that **xe-0/0/13.0** is in a forwarding state. The other interfaces on Switch 1 are blocked.

---

### Verifying RSTP Configuration on Switch 2

---

**Purpose** Verify that the RSTP configuration on Switch 2 is correct.

**Action** In operational mode issue the **show spanning-tree interface** command:

```
user@switch2> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

| Interface   | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-------------|---------|-----------------------|-------------------------|--------------|-------|------|
| xe-0/0/14.0 | 128:513 | 128:513               | 32768.0019e2503d20      | 1000         | BLK   | DESC |
| xe-0/0/18.0 | 128:519 | 128:515               | 8192.0019e25051e0       | 1000         | FWD   | ROOT |

**Meaning** See the topology in [Figure 6 on page 150](#). The operational mode command **show spanning-tree interface** shows that interface **xe-0/0/18.0** is in a forwarding state and the root port. The other interface on Switch 2 is blocked.

---

### Verifying RSTP Configuration on Switch 3

---

**Purpose** Verify that the RSTP configuration on Switch 3 is correct.

**Action** In operational mode, issue the **show spanning-tree interface** command:

```
user@switch3> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

| Interface   | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-------------|---------|-----------------------|-------------------------|--------------|-------|------|
| xe-0/0/26.0 | 128:513 | 128:513               | 8192.0019e25051e0       | 1000         | FWD   | DESC |
| xe-0/0/28.0 | 128:515 | 128:515               | 8192.0019e25051e0       | 1000         | FWD   | DESC |
| xe-0/0/24.0 | 128:517 | 128:517               | 8192.0019e25051e0       | 1000         | FWD   | DESC |

**Meaning** See the topology in [Figure 6 on page 150](#). The operational mode command **show spanning-tree interface** shows that no interface is the root interface.

### Verifying RSTP Configuration on Switch 4

**Purpose** Verify the RSTP configuration on Switch 4.

**Action** In operational mode, issue the **show spanning-tree interface** command:

```
user@switch4> show spanning-tree interface
```

Spanning tree interface parameters for instance 0

| Interface   | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-------------|---------|-----------------------|-------------------------|--------------|-------|------|
| xe-0/0/23.0 | 128:523 | 128:517               | 8192.0019e25051e0       | 1000         | FWD   | ROOT |
| xe-0/0/19.0 | 128:525 | 128:525               | 16384.0019e25040e0      | 1000         | FWD   | DESC |

**Meaning** See the topology in [Figure 6 on page 150](#). The operational mode command **show spanning-tree interface** shows that interface **xe-0/0/23.0** is the root interface and is in the forwarding state.

**Related Documentation**

- [Example: Configuring Network Regions for VLANs with MSTP on page 126](#)
- [Understanding RSTP on page 105](#)



# Configuring Spanning-Tree Protocols (ELS CLI Only)

- [Configuring VLAN Spanning Tree Protocol on page 165](#)

## Configuring VLAN Spanning Tree Protocol

---

You can configure the VLAN Spanning Tree Protocol (VSTP) under the following hierarchy levels:



**NOTE:** This task supports the Enhanced Layer 2 Software (ELS) configuration style.

- **[edit *logical-systems logical-system-name protocols*]**
- **[edit *logical-systems logical-system-name routing-instances routing-instance-name protocols*]**
- **[edit *protocols*]**
- **[edit *routing-instances routing-instance-name protocols*]**

The routing instance type can be either **virtual-switch** or **layer2-control**.

To configure the VLAN Spanning Tree Protocol:

1. Enable VSTP as the version of spanning-tree protocol to be configured:

```
[edit]
user@host@ edit ... protocols (STP Type) vstp
```

2. (Optional) For compatibility with older bridges that do not support VSTP, you can run force VSTP to run as the original IEEE 802.1D Spanning Tree Protocol (STP) version:

```
[edit ... protocols vstp]
user@host# set force-version stp
```



**NOTE:** If VSTP has been forced to run as the original STP version, you can revert back to VSTP by first removing the *force-version* statement from the configuration and then entering the *clear spanning-tree protocol-migration* configuration mode command.

3. Configure the interfaces that participate in the VSTP instance.

a. Enable configuration of the interface:

```
[edit ... protocols vstp]
user@host# edit interface interface-name
```

b. Configure the interface priority:

```
[edit ... protocols vstp interface interface-name]
user@host# set priority interface-priority
```

c. (Optional) By default, the interface link cost is determined by the link speed. You can configure the interface link cost to control which bridge is the designated bridge and which port is the designated port:

```
[edit ... protocols vstp interface interface-name]
user@host# set cost interface-link-cost
```

d. Configure the interface link mode to identify point-to-point links:

```
[edit ... protocols vstp interface interface-name]
user@host# set mode (p2p | shared)
```

Specify **p2p** if the link is point to point. Specify **shared** if the link is a shared media.

e. (Optional) Configure the interface as an edge port:

```
[edit ... protocols vstp interface interface-name]
user@host# set edge
```

Edge ports do not expect to receive bridge protocol data unit (BPDU) packets. If a BPDU packet is received for an edge port, the port becomes a non-edge port.

You can also enable BPDU root protection for all spanning-tree protocol instances on the interface. BPDU root protect ensures the port is the spanning-tree designated port. If the port receives superior BPDU packets, root protect moves this port to a root-prevented spanning-tree state. For configuration details, see *Checking the Status of Spanning-Tree Instance Interfaces*.

4. Enable configuration of a VLAN instance:

```
[edit ... protocols vstp]
user@host# edit vlan vlan-id
```

5. Configure the bridge priority:

```
[edit ... protocols vstp vlan vlan-id]
user@host# set bridge-priority bridge-priority
```

For more information, see *Bridge Priority for Election of Root Bridge and Designated Bridge*.



## 6. Configure hello BPDU timers.

- a. Configure the maximum expected arrival time of hello BPDUs:

```
[edit ... protocols vstp vlan vlan-id]
user@host# set max-age seconds
```

- b. Configure the time interval at which the root bridge transmits configuration BPDUs:

```
[edit ... protocols vstp vlan vlan-id]
user@host# set hello-time seconds
```

7. (Optional) By default, the bridge port remains in the listening and learning states for 15 seconds before transitioning to the forwarding state. You can specify a delay from 4 through 20 seconds instead:

```
[edit ... protocols vstp vlan vlan-id]
user@host# set forward-delay seconds
```

8. Configure the interfaces that participate in the VSTP instance.

- a. Enable configuration of the interface:

```
[edit ... protocols vstp vlan vlan-id]
user@host# edit interface interface-name
```

- b. Configure the interface priority:

```
[edit ... protocols vstp vlan vlan-id interface interface-name]
user@host# set priority interface-priority
```

- c. (Optional) By default, the interface link cost is determined by the link speed. You can configure the interface link cost to control which bridge is the designated bridge and which port is the designated port:

```
[edit ... protocols vstp vlan vlan-id interface interface-name]
user@host# set cost interface-link-cost
```

- d. Configure the interface link mode to identify point-to-point links:

```
[edit ... protocols vstp vlan vlan-id interface interface-name]
user@host# set mode (p2p | shared)
```

Specify **p2p** if the link is point to point. Specify **shared** if the link is a shared media.

- e. (Optional) Configure the interface as an edge port:

```
[edit ... protocols vstp vlan vlan-id interface interface-name]
user@host# set edge
```

Edge ports do not expect to receive bridge protocol data unit (BPDU) packets. If a BPDU packet is received for an edge port, the port becomes a non-edge port.

You can also enable BPDU root protection for all spanning-tree protocol instances on the interface. BPDU root protect ensures the port is the spanning-tree designated port. If the port receives superior BPDU packets, root protect moves this port to a root-prevented spanning-tree state. For configuration details, see *Checking the Status of Spanning-Tree Instance Interfaces*.

9. Verify the VSTP configuration:

```
[edit]
... { # Optional logical system and/or routing instance
 protocols (STP Type) {
 vstp {
```

```
force-version stp; # Optional.
interface interface-name {
 priority interface-priority;
 cost interface-link-cost; # Optional.
 mode (p2p | shared);
 edge; # Optional.
}
vlan vlan-id {
 bridge-priority bridge-priority;
 max-age seconds;
 hello-time seconds;
 forward-delay seconds; # Optional.
 interface interface-name {
 priority interface-priority;
 cost interface-link-cost; # Optional.
 mode (p2p | shared);
 edge; # Optional.
 }
}
}
```

- Related Documentation**
- *Spanning-Tree Protocols Supported*
  - *RSTP or VSTP Forced to Run as IEEE 802.1D STP*
  - *Reverting to RSTP or VSTP from Forced IEEE 802.1D STP*
  - *Understanding VPLS Multihomed Layer 2 Ring and MPLS Infrastructure*
  - *Understanding VPLS Multihomed Layer 2 Ring and MPLS Infrastructure Topology*

## PART 6

# Configuration Statements and Operational Commands

- [Configuration Statements \(Bridging and VLANs\) on page 171](#)
- [Configuration Statements \(Bridging and VLANs\) \(ELS CLI Only\) on page 191](#)
- [Configuration Statements \(Layer 2 Networking\) on page 217](#)
- [Configuration Statements \(Q-in-Q Tunneling\) \(ELS CLI Only\) on page 225](#)
- [Configuration Statements \(Spanning Tree Protocols\) on page 235](#)
- [Operational Commands \(Bridging and VLANs\) on page 283](#)
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- [Operational Commands \(Spanning-Tree Protocols\) on page 319](#)



## CHAPTER 14

# Configuration Statements (Bridging and VLANs)

- [description \(VLAN\) on page 172](#)
- [filter \(VLANs\) on page 173](#)
- [forwarding-options on page 174](#)
- [interface \(VLANs\) on page 175](#)
- [l3-interface \(VLAN\) on page 176](#)
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- [vlan-tagging on page 189](#)

## description (VLAN)

---

|                                 |                                                                                                                                                                                                                                                |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>description text-description;</code>                                                                                                                                                                                                     |
| <b>Hierarchy Level</b>          | [edit vlans <i>vlan-name</i> ]                                                                                                                                                                                                                 |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                              |
| <b>Description</b>              | Provide a textual description for the VLAN. The text has no effect on the operation of the VLAN or switch.                                                                                                                                     |
| <b>Options</b>                  | <b><i>text-description</i></b> —Text to describe the interface. It can contain letters, numbers, and hyphens (-) and can be up to 255 characters long. If the text includes spaces, enclose the entire text in quotation marks.                |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                            |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>Example: Setting Up Basic Bridging and a VLAN on the QFX Series</i></li><li>• <a href="#">Understanding Bridging and VLANs on page 4</a></li><li>• <a href="#">show vlans on page 308</a></li></ul> |

## filter (VLANs)

---

|                                 |                                                                                                                                                                                                                                                                                                    |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>filter (input   output) <i>filter-name</i>;</code>                                                                                                                                                                                                                                           |
| <b>Hierarchy Level</b>          | <code>[edit vlans <i>vlan-name</i>],</code><br><code>[edit vlans <i>vlan-name</i> forwarding-options]</code>                                                                                                                                                                                       |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.<br>Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.                                                                                                                                                  |
| <b>Description</b>              | Apply a firewall filter to traffic entering or exiting a VLAN.                                                                                                                                                                                                                                     |
| <b>Default</b>                  | All incoming traffic is accepted unmodified to a VLAN, and all outgoing traffic is sent unmodified from a VLAN.                                                                                                                                                                                    |
| <b>Options</b>                  | <p><b><i>filter-name</i></b>—Name of a firewall filter defined at the <code>[edit firewall family <i>family-name</i> filter]</code> hierarchy level.</p> <p><b>input</b>—Apply a firewall filter to VLAN ingress traffic.</p> <p><b>output</b>—Apply a firewall filter to VLAN egress traffic.</p> |
| <b>Required Privilege Level</b> | <p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <i>Configuring Firewall Filters</i></li> <li>• <i>Overview of Firewall Filters</i></li> </ul>                                                                                                                                                             |

## forwarding-options

```
Syntax forwarding-options {
 dhcp-security {
 arp-inspection;
 group group-name {
 interface interface-name {
 static-ip ip-address {
 mac mac-address;
 }
 }
 }
 overrides {
 no-option82;
 (trusted | untrusted);
 }
 }
 ip-source-guard;
 no-dhcp-snooping;
 option-82 {
 circuit-id {
 prefix {
 host-name;
 logical-system-name;
 routing-instance-name;
 }
 use-interface-description (device | logical);
 use-vlan-id;
 }
 remote-id {
 host-name hostname;
 use-interface-description (device | logical);
 use-string string;
 }
 vendor-id {
 use-string string;
 }
 }
}
filter {
 input filter-name;
 output filter-name;
}
flood {
 input filter-name;
}
```

**Hierarchy Level** [edit],  
[edit bridge-domains *bridge-domain-name*],  
[edit vlans *vlan-name*]

**Release Information** Statement introduced before Junos OS Release 7.4.  
Statement introduced in Junos OS Release 11.3 for QFX Series switches.



|                                 |                                                                                                                                                                                                                                                                         |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | <p>Hierarchy level <b>[edit vlans <i>vlan-name</i>]</b> introduced in Junos OS Release 13.2X50-D10 for EX Series switches.</p> <p>Hierarchy level <b>[edit bridge-domains <i>bridge-domain-name</i>]</b> introduced in Junos OS Release 14.1 for MX Series routers.</p> |
| <b>Description</b>              | <p>Configure traffic forwarding.</p> <p>The statements are explained separately.</p>                                                                                                                                                                                    |
| <b>Required Privilege Level</b> | <p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>                                                                                                                                      |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <i>Configuring Traffic Forwarding and Monitoring</i></li> <li>• <i>[edit forwarding-options] Hierarchy Level</i></li> </ul>                                                                                                    |

## interface (VLANs)

|                                 |                                                                                                                                                                                                                   |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>interface <i>interface-name</i> {   mapping (native (push   swap)   tag (push   swap)); }</pre>                                                                                                              |
| <b>Hierarchy Level</b>          | <b>[edit vlans <i>vlan-name</i>]</b>                                                                                                                                                                              |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                 |
| <b>Description</b>              | For a specific VLAN, configure an interface.                                                                                                                                                                      |
| <b>Options</b>                  | <p><b><i>interface-name</i></b>—Name of the interface.</p> <p>The remaining statement is explained separately.</p>                                                                                                |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                    |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <i>Example: Setting Up Basic Bridging and a VLAN on the QFX Series</i></li> <li>• <i>Configuring VLANs</i></li> <li>• <i>Understanding Bridging and VLANs</i></li> </ul> |

## l3-interface (VLAN)

---

|                            |                                                                                                                                                                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <code>l3-interface (vlan.logical-interface-number   irb.logical-interface-number);</code>                                                                                                                                           |
| <b>Hierarchy Level</b>     | <code>[edit vlans vlan-name]</code>                                                                                                                                                                                                 |
| <b>Release Information</b> | Statement introduced in Junos OS Release 11.1 for the QFX Series.<br><code>irb</code> option introduced in Junos OS Release 13.2 for the QFX Series.                                                                                |
| <b>Description</b>         | Associate a Layer 3 interface with the VLAN. Configure Layer 3 interfaces on trunk ports to allow the interface to transfer traffic between VLANs. Traffic between VLANs must be routed, which requires a common Layer 3 interface. |
| <b>Default</b>             | No Layer 3 (routing) interface is associated with the VLAN.                                                                                                                                                                         |
| <b>Options</b>             | <code>vlan.logical-interface-number</code> —Number of the logical interface. Use the <b>unit</b> number that you used when you created the <code>vlan</code> interface with a <code>set interfaces vlan unit</code> statement.      |



**NOTE:** Use this statement with versions of Junos OS that do not support Enhanced Layer 2 Software (ELS).

---

`irb.logical-interface-number`—Logical interface defined with a `set interfaces irb` statement.

---



**NOTE:** Use this statement with versions of Junos OS that support Enhanced Layer 2 Software (ELS).

---

|                                 |                                                                                                                     |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration. |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------|

- |                              |                                                                                                                                                                   |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Related Documentation</b> | <ul style="list-style-type: none"><li>• <a href="#">show ethernet-switching interfaces on page 286</a></li><li>• <a href="#">show vlans on page 308</a></li></ul> |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## mac (Static MAC-Based VLANs)

|                                 |                                                                                                                                              |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>mac mac-address {<br/>    next-hop interface-name;<br/>}</code>                                                                        |
| <b>Hierarchy Level</b>          | [edit ethernet-switching-options static vlan <i>vlan-name</i> ]                                                                              |
| <b>Description</b>              | Specify the MAC address to add to the Ethernet switching table.<br><br>The remaining statement is explained separately.                      |
| <b>Options</b>                  | <i>mac-address</i> —MAC address                                                                                                              |
| <b>Required Privilege Level</b> | system—To view this statement in the configuration.<br>system-control—To add this statement to the configuration.                            |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <i>Adding a Static MAC Address Entry to the Ethernet Switching Table (CLI Procedure)</i></li> </ul> |

## mac-limit

|                            |                                                                                  |
|----------------------------|----------------------------------------------------------------------------------|
| <b>Syntax</b>              | <code>mac-limit number;</code>                                                   |
| <b>Hierarchy Level</b>     | [edit vlans <i>vlan-name</i> ]                                                   |
| <b>Release Information</b> | Statement introduced in Junos OS Release 11.1 for the QFX Series.                |
| <b>Description</b>         | Configure the number of MAC addresses allowed on a VLAN.                         |
| <b>Default</b>             | MAC limit is disabled.                                                           |
| <b>Options</b>             | <i>number</i> —Maximum number of MAC addresses.<br><b>Range:</b> 1 through 32768 |



**NOTE:** This statement is not supported on QFabric systems.

|                                 |                                                                                                                                                                                                                                                                               |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                           |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">show vlans on page 308</a></li> <li>• <i>Example: Setting Up Basic Bridging and a VLAN on the QFX Series</i></li> <li>• <i>Configuring MAC Table Aging</i></li> <li>• <i>Understanding Bridging and VLANs</i></li> </ul> |

## mac-notification

---

|                                 |                                                                                                                                                                                                                                                                     |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>mac-notification {<br/>    notification-interval <i>seconds</i>;<br/>}</pre>                                                                                                                                                                                   |
| <b>Hierarchy Level</b>          | [edit ethernet-switching-options]<br>[edit switch-options]                                                                                                                                                                                                          |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.<br>Hierarchy level <b>[edit switch-options]</b> added in Junos OS Release 14.1X53-D10 for EX Series and QFX Series.                                                                               |
| <b>Description</b>              | <p>Enable MAC notification for a switch. If you configure this statement without setting a notification interval, MAC notification is enabled with the default MAC notification interval of 30 seconds.</p> <p>The remaining statement is explained separately.</p> |
| <b>Default</b>                  | MAC notification is disabled by default.                                                                                                                                                                                                                            |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>Configuring MAC Notification</i></li><li>• <a href="#">Configuring MAC Notification (CLI Procedure) on page 41</a></li></ul>                                                                                             |

## mac-statistics

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | mac-statistics;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Hierarchy Level</b>          | <p>[edit bridge-domains <i>bridge-domain-name</i> bridge-options],</p> <p>[edit logical-systems <i>logical-system-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> switch-options],</p> <p>[edit logical-systems <i>logical-system-name</i> switch-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> switch-options],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols evpn],</p> <p>[edit switch-options],</p> <p>[edit switch-options],</p> <p>[edit vlans <i>vlan-name</i> switch-options]</p> |
| <b>Release Information</b>      | <p>Statement introduced in Junos OS Release 8.4.</p> <p>Support for the <b>switch-options</b> statement added in Junos OS Release 9.2.</p> <p>Support for top-level configuration for the <b>virtual-switch</b> type of routing instance added in Junos OS Release 9.2. In Junos OS Release 9.1 and earlier, the routing instances hierarchy supported this statement only for a VPLS instance or a bridge domain configured within a virtual switch.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p> <p>[edit switch-options] and [edit vlans <i>vlan-name</i> switch-options] hierarchy levels introduced in Junos OS Release 12.3R2 for EX Series switches.</p> <p>Support for EVPNs added in Junos OS Release 13.2 for MX 3D Series routers.</p> <p>[edit switch-options] and [edit vlans <i>vlan-name</i> switch-options] hierarchy levels introduced in Junos OS Release 13.2 for the QFX Series.</p>                          |
| <b>Description</b>              | (MX Series routers, EX Series switches, and QFX Series only) For bridge domains or VLANs, enable MAC accounting either for a specific bridge domain or VLAN, or for a set of bridge domains or VLANs associated with a Layer 2 trunk port.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Default</b>                  | disabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <i>Understanding Layer 2 Learning and Forwarding for Bridge Domains</i></li> <li>• <a href="#">Layer 2 Learning and Forwarding for VLANs Overview on page 3</a></li> <li>• <i>Understanding Layer 2 Learning and Forwarding for Bridge Domains Functioning as Switches with Layer 2 Trunk Ports</i></li> <li>• <i>Layer 2 Learning and Forwarding for VLANs Acting as a Switch for a Layer 2 Trunk Port</i></li> <li>• <i>Configuring EVPN Routing Instances</i></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                       |

- *Configuring EVPN Routing Instances on EX9200 Switches*

## mac-table-size

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <code>mac-table-size <i>limit</i> {<br/>    packet-action drop;<br/>}</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hierarchy Level</b>     | <p>[edit bridge-domains <i>bridge-domain-name</i> bridge-options],<br/> [edit logical-systems <i>logical-system-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options],<br/> [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options],<br/> [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> switch-options],<br/> [edit logical-systems <i>logical-system-name</i> switch-options],<br/> [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options],<br/> [edit routing-instances <i>routing-instance-name</i> switch-options],<br/> [edit switch-options],<br/> [edit switch-options],<br/> [edit vlans <i>vlan-name</i> switch-options]</p> |
| <b>Release Information</b> | <p>Statement introduced in Junos OS Release 8.4.</p> <p>Support for the <b>switch-options</b> statement added in Junos OS Release 9.2.</p> <p>Support for top-level configuration for the <b>virtual-switch</b> type of routing instance added in Junos OS Release 9.2. In Junos OS Release 9.1 and earlier, the routing instances hierarchy supported this statement only for a VPLS instance or a bridge domain configured within a virtual switch.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p> <p><b>[edit switch-options]</b> and <b>[edit vlans <i>vlan-name</i> switch-options]</b> hierarchy levels introduced in Junos OS Release 12.3R2 for EX Series switches.</p> <p>Support at the <b>[edit vlans <i>vlan-name</i> switch-options]</b> hierarchy level introduced in Junos OS Release 13.2 for the QFX Series.</p>    |
| <b>Description</b>         | Modify the size of the MAC address table for the bridge domain or VLAN, a set of bridge domains or VLANs associated with a trunk port, or a virtual switch. The default is 5120 MAC addresses.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |



**NOTE:** For multichassis link aggregation (MC-LAG) peers in active-active mode, configuring the **mac-table-size** statement or changing the **mac-table-size** configuration when traffic is flowing can cause the MAC entries to be out of synchronization between the two MC-LAG peers, which might result in flooding. To avoid flooding, you must either halt traffic forwarding and then configure the **mac-table-size** statement or use the **commit at** configuration statement to commit the changes at the same time in both the peer nodes.

Alternatively, if flooding does occur, you can clear the bridge MAC table on both the routers by using the **clear bridge mac-table** command. Running this command ensures that the MAC entries are re-learned and in synchronization between both the peers.

**Options** *limit*—Specify the maximum number of addresses in the MAC address table.

**Range:** 16 through 1,048,575 MAC addresses

**Default:** 5120 MAC addresses There is no default MAC address limit for the **mac-table-size** statement at the **[edit switch-options]** hierarchy level. The number of MAC addresses that can be learned is only limited by the platform, 65,535 MAC addresses for EX Series switches and 1,048,575 MAC addresses for other devices.

The remaining statement is explained separately.

**Required Privilege** routing—To view this statement in the configuration.

**Level** routing-control—To add this statement to the configuration.

**Related  
Documentation**

- *Understanding Layer 2 Learning and Forwarding for Bridge Domains*
- [Layer 2 Learning and Forwarding for VLANs Overview on page 3](#)
- *Understanding Layer 2 Learning and Forwarding for Bridge Domains Functioning as Switches with Layer 2 Trunk Ports*
- *Layer 2 Learning and Forwarding for VLANs Acting as a Switch for a Layer 2 Trunk Port*



## members

|                            |                                                                                      |
|----------------------------|--------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <code>members [(all   <i>names</i>   <i>vlan-ids</i>)];</code>                       |
| <b>Hierarchy Level</b>     | [edit interfaces <i>interface-name</i> unit 0 family ethernet-switching vlan]        |
| <b>Release Information</b> | Statement introduced in Junos OS Release 11.1 for the QFX Series.                    |
| <b>Description</b>         | For trunk interfaces, configure the VLANs for which the interface can carry traffic. |



**TIP:** To display a list of all configured VLANs on the system, including VLANs that are configured but not committed, type ? after `vlan` or `vlan`s in your configuration mode command line. Note that only one VLAN is displayed for a VLAN range.

|                |                                                                                                                                                                                                                              |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Options</b> | <b>all</b> —Specify that this trunk interface be a member of all the VLANs that are configured on this switch. When a new VLAN is configured on the switch, this trunk interface automatically becomes a member of the VLAN. |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



**NOTE:** Each VLAN that is configured must have a specified VLAN ID when you attempt to commit the configuration; otherwise, the configuration commit fails. Also, `all` cannot be the name of a VLAN on the switch.

***names***—Names of one or more VLANs.

***vlan-ids***—Numeric identifiers of one or more VLANs.

|                                 |                                                                                                                                                 |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Required Privilege Level</b> | <code>routing</code> —To view this statement in the configuration.<br><code>routing-control</code> —To add this statement to the configuration. |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|

|                              |                                                                                                                                                                                                                                                                                                                                       |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Related Documentation</b> | <ul style="list-style-type: none"> <li>• <a href="#">Example: Setting Up Basic Bridging and a VLAN on the QFX Series</a></li> <li>• <a href="#">Understanding Bridging and VLANs on page 4</a></li> <li>• <a href="#">show ethernet-switching interfaces on page 286</a></li> <li>• <a href="#">show vlans on page 308</a></li> </ul> |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## native-vlan-id

---

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>native-vlan-id <i>vlan-id</i>;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Hierarchy Level</b>          | For platforms without ELS:<br><br><code>[edit interfaces <i>interface-name</i> unit 0 family ethernet-switching],</code><br><br>For platforms with ELS:<br><br><code>[edit interfaces <i>interface-name</i>]</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b>              | <p>Configure the VLAN identifier to associate with untagged packets received on the interface. The logical interface on which untagged packets are received must be configured with the same VLAN ID as the native VLAN ID configured on the physical interface. To configure the logical interface, include the <b>vlan-id</b> statement (matching the <b>native-vlan-id</b> statement on the physical interface) at the <code>[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i>]</code> hierarchy level.</p> <p>When the <b>native-vlan-id</b> statement is combined with the <b>interface-mode</b> statement, untagged packets are accepted and forwarded within the bridge domain or VLAN that is configured with the matching VLAN ID.</p> <p>When the <b>native-vlan-id</b> statement is combined with the <b>flexible-vlan-tagging</b> statement, untagged packets are accepted on the interfaces that are configured for Q-in-Q tunneling.</p> <p>.</p> |
| <b>Options</b>                  | <p><b>vlan-id</b>—Numeric identifier of the VLAN.</p> <p><b>Range:</b> 1 through 4094</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Junos OS Network Interfaces Configuration Guide</a></li><li>•</li><li>• <a href="#">show ethernet-switching interfaces on page 286</a></li><li>• <a href="#">show vlans on page 308</a></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

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## no-mac-learning

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|                                 |                                                                                                                                                                                          |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>no-mac-learning <i>limit</i>;</code>                                                                                                                                               |
| <b>Hierarchy Level</b>          | For platforms without ELS:<br><br>[edit ethernet-switching-options interfaces <i>interface-name</i> ]<br><br>For platforms with ELS:<br><br>[edit vlans <i>vlan-name</i> switch-options] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                        |
| <b>Description</b>              | Disable MAC address learning for the specified interface. Disabling MAC address learning on an interface disables learning for all the VLANs of which that interface is a member.        |
| <b>Default</b>                  | MAC learning is enabled.                                                                                                                                                                 |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing—control—To add this statement to the configuration.                                                                      |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>•</li></ul>                                                                                                                                        |

## notification-interval

---

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | notification-interval <i>seconds</i> ;                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hierarchy Level</b>          | [edit ethernet-switching-options mac-notification]<br>[edit switch-options mac-notification]                                                                                                                                                                                                                                                                                                                                          |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.<br>Hierarchy level <b>[edit switch-options]</b> added in Junos OS Release 14.1X53-D10 for EX Series and QFX Series.                                                                                                                                                                                                                                                 |
| <b>Description</b>              | <p>Configure the MAC notification interval for a switch.</p> <p>The MAC notification interval is the amount of time the switch waits before sending learned or unlearned MAC address SNMP notifications to the network management server. For instance, if the MAC notification interval is set to 10, all of the MAC address addition and removal SNMP notifications are sent to the network management system every 10 seconds.</p> |
| <b>Options</b>                  | <p><b>seconds</b>—The MAC notification interval, in seconds.</p> <p><b>Range:</b> 1 through 60</p> <p><b>Default:</b> 30</p>                                                                                                                                                                                                                                                                                                          |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>Configuring MAC Notification</i></li><li>• <a href="#">Configuring MAC Notification (CLI Procedure) on page 41</a></li></ul>                                                                                                                                                                                                                                                               |

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## static (Static MAC-Based VLANs)

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|                                 |                                                                                                                                                      |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>static {<br/>  vlan <i>vlan-name</i> {<br/>    mac <i>mac-address</i> {<br/>      next-hop <i>interface-name</i>;<br/>    }<br/>  }<br/>}</pre> |
| <b>Hierarchy Level</b>          | [edit ethernet-switching-options]                                                                                                                    |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for EX Series switches.                                                                                |
| <b>Description</b>              | <p>Specify VLAN and MAC addresses to add to the Ethernet switching table.</p> <p>The remaining statements are explained separately.</p>              |
| <b>Required Privilege Level</b> | <p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>                         |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>Adding a Static MAC Address Entry to the Ethernet Switching Table (CLI Procedure)</i></li></ul>           |

## vlan-id (VLANs)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>vlan-id <i>number</i>;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Hierarchy Level</b>          | <p>For platforms without ELS:</p> <pre>[edit vlans <i>vlan-name</i> <i>vlan-range</i>]</pre> <p>For platforms without ELS and with ELS:</p> <pre>[edit vlans <i>vlan-name</i>]</pre> <p>For ELS platforms only:</p> <pre>[edit interfaces <i>interface-name</i> unit <i>number</i>]<br/>[edit vlans <i>vlan-name</i> <i>vlan-id-list</i>]</pre>                                                                                                                                                                                                                                |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>              | Configure an 802.1Q tag to apply to all traffic that originates on the VLAN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Default</b>                  | <p>On a QFX3500 and QFX3500 switch, if you use the default factory configuration, all traffic originating on the VLAN is untagged and has a VLAN identifier of 1. The number zero is reserved for priority tagging and the number 4093 is also reserved.</p> <p>On a QFX5100 switch, if you use the default factory configuration, all traffic originating on the VLAN is untagged and has a VLAN identifier of 1. The number zero is reserved for priority tagging and the number 4093 is also reserved.</p>                                                                  |
|                                 | <div> <b>NOTE:</b> You can only create up to 4090 VLANs on a QFX5100 switch. If you create more than 4090 VLANs, the interfaces associated with the extra VLANs are not displayed in the <code>show vlans</code> command output. For example, if you create 4094 VLANs, the extra VLANs will not have interfaces associated with the VLANs. The order in which you configure the extra VLANs determines which interfaces are missing from the <code>show vlans</code> command output.</div> |
| <b>Options</b>                  | <p><i>number</i> —VLAN tag identifier.</p> <p><b>Range:</b> 0 through 4093.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>Example: Setting Up Bridging with Multiple VLANs</i></li><li>• <i>Understanding Bridging and VLANs</i></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                    |

## vlan-tagging

---

|                                 |                                                                                                                           |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | vlan-tagging;                                                                                                             |
| <b>Hierarchy Level</b>          | [edit interfaces <i>interface-name</i> ]<br>[edit interfaces interface-range <i>interface-range-name</i> ]                |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.3 for the QFX Series.                                                         |
| <b>Description</b>              | Enable VLAN tagging. The platform receives and forwards single-tag frames with 802.1Q VLAN tags.                          |
| <b>Default</b>                  | VLAN tagging is disabled by default.                                                                                      |
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>vlan-id</i></li><li>• <i>Configuring a Layer 3 Logical Interface</i></li></ul> |





## CHAPTER 15

# Configuration Statements (Bridging and VLANs) (ELS CLI Only)

- [dhcp-relay on page 192](#)
- [forwarding-options on page 197](#)
- [global-mac-table-aging-time on page 202](#)
- [interface-mac-limit on page 203](#)
- [interface-mode on page 205](#)
- [packet-action on page 207](#)
- [service-id on page 209](#)
- [switch-options on page 210](#)
- [static-mac on page 211](#)
- [vlan-id-list on page 212](#)
- [vlan-rewrite on page 213](#)
- [vlans on page 214](#)

## dhcp-relay

```

Syntax dhcp-relay {
 active-server-group server-group-name;
 authentication {
 password password-string;
 username-include {
 circuit-type;
 delimiter delimiter-character;
 domain-name domain-name-string;
 interface-name;
 logical-system-name;
 mac-address;
 option-60;
 option-82 <circuit-id> <remote-id>;
 routing-instance-name;
 user-prefix user-prefix-string;
 }
 }
 }
 dhcpv6 {
 active-server-group server-group-name;
 authentication {
 password password-string;
 username-include {
 circuit-type;
 client-id;
 delimiter delimiter-character;
 domain-name domain-name-string;
 interface-name;
 logical-system-name;
 relay-agent-interface-id;
 relay-agent-remote-id;
 relay-agent-subscriber-id;
 routing-instance-name;
 user-prefix user-prefix-string;
 }
 }
 dynamic-profile profile-name {
 aggregate-clients (merge | replace);
 use-primary primary-profile-name;
 }
 }
}
group group-name {
 active-server-group server-group-name;
 authentication {
 ...
 }
 dynamic-profile profile-name {
 ...
 }
 interface interface-name {
 exclude;
 liveness-detection {
 failure-action (clear-binding | clear-binding-if-interface-up | log-only);
 }
 }
}

```

```

method {
 bfd {
 version (0 | 1 | automatic);
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 detection-time {
 threshold milliseconds;
 }
 session-mode(automatic | multihop | singlehop);
 holddown-interval milliseconds;
 }
}
overrides {
 ...
}
service-profile dynamic-profile-name;
trace;
upto upto-interface-name;
}
service-profile dynamic-profile-name;
}
overrides {
 ...
}
relay-agent-interface-id {
 ...
}
service-profile dynamic-profile-name;
liveness-detection {
 failure-action (clear-binding | clear-binding-if-interface-up | log-only);
 method {
 bfd {
 version (0 | 1 | automatic);
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 detection-time {
 threshold milliseconds;
 }
 session-mode(automatic | multihop | singlehop);
 holddown-interval milliseconds;
 }
 }
}
}

```

```

overrides {
 allow-snooped-clients;
 interface-client-limit number;
 no-allow-snooped-clients;
 no-bind-on-request;
 send-release-on-delete;
}
relay-agent-interface-id {
 prefix prefix;
 use-interface-description (logical | device);
}
server-group {
 server-group-name {
 server-ip-address;
 }
}
dynamic-profile profile-name {
 aggregate-clients (merge | replace);
 use-primary primary-profile-name;
}
forward-snooped-clients (all-interfaces | configured-interfaces |
 non-configured-interfaces);
group group-name {
 active-server-group server-group-name;
 authentication {
 ...
 }
}
dynamic-profile profile-name {
 ...
}
interface interface-name {
 exclude;
 liveness-detection {
 failure-action (clear-binding | clear-binding-if-interface-up | log-only);
 method {
 bfd {
 version (0 | 1 | automatic);
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 detection-time {
 threshold milliseconds;
 }
 session-mode (automatic | multihop | singlehop);
 holddown-interval milliseconds;
 }
 }
 }
}
overrides {
 ...
}

```

```

 service-profile dynamic-profile-name;
 trace;
 upto upto-interface-name;
 }
 overrides {
 ...
 }
 relay-option-82 {
 ...
 }
 service-profile dynamic-profile-name;
}
liveness-detection {
 failure-action (clear-binding | clear-binding-if-interface-up | log-only);
 method {
 bfd {
 version (0 | 1 | automatic);
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 detection-time {
 threshold milliseconds;
 }
 session-mode (automatic | multihop | singlehop);
 holddown-interval milliseconds;
 }
 }
}
overrides {
 allow-snooped-clients;
 always-write-giaddr;
 always-write-option-82;
 client-discover-match <option60-and-option82>;
 disable-relay;
 interface-client-limit number;
 layer2-unicast-replies;
 no-allow-snooped-clients;
 no-bind-on-request;
 proxy-mode;
 replace-ip-source-with;
 send-release-on-delete;
 trust-option-82;
}
relay-option-82 {
 circuit-id {
 prefix prefix;
 use-interface-description (logical | device);
 }
}
server-group {
 server-group-name {

```

```
 server-ip-address;
 }
}
service-profile dynamic-profile-name;
}
```

**Hierarchy Level** [edit forwarding-options],  
[edit vlans forwarding-options]

**Release Information** Statement introduced in Junos OS Release 11.3 for the QFX Series.

**Description** Configure extended Dynamic Host Configuration Protocol (DHCP) relay and DHCPv6 relay options on the switch and enable the switch to function as a DHCP relay agent. A DHCP relay agent forwards DHCP request and reply packets between a DHCP client and a DHCP server.

DHCP relay supports the attachment of dynamic profiles and also interacts with the local AAA Service Framework to use back-end authentication servers, such as RADIUS, to provide subscriber authentication. You can attach dynamic profiles and configure authentication support on a global basis or for a specific group of interfaces.

The extended DHCP and DHCPv6 relay agent options configured with the **dhcp-relay** and **dhcpv6** statements are incompatible with the DHCP/BOOTP relay agent options configured with the **bootp** statement. As a result, the extended DHCP or DHCPv6 relay agent and the DHCP/BOOTP relay agent cannot both be enabled on the router at the same time.

The remaining statements are explained separately.

**Required Privilege Level** interface—To view this statement in the configuration.  
interface-control—To add this statement to the configuration.

**Related Documentation**

- *Configuring DHCP and BOOTP*

## forwarding-options

```
Syntax forwarding-options {
 dhcp-relay {
 active-server-group server-group-name;
 authentication {
 password password-string;
 username-include {
 circuit-type;
 delimiter delimiter-character;
 domain-name domain-name-string;
 interface-name;
 logical-system-name;
 mac-address;
 option-60;
 option-82 <circuit-id> <remote-id>;
 routing-instance-name;
 user-prefix user-prefix-string;
 }
 }
 }
 dhcpv6 {
 active-server-group server-group-name;
 authentication {
 password password-string;
 username-include {
 circuit-type;
 client-id;
 delimiter delimiter-character;
 domain-name domain-name-string;
 interface-name;
 logical-system-name;
 relay-agent-interface-id;
 relay-agent-remote-id;
 relay-agent-subscriber-id;
 routing-instance-name;
 user-prefix user-prefix-string;
 }
 }
 }
 dynamic-profile profile-name {
 aggregate-clients (merge | replace);
 use-primary primary-profile-name;
 }
 group group-name {
 active-server-group server-group-name;
 authentication {
 ...
 }
 dynamic-profile profile-name {
 ...
 }
 }
 interface interface-name {
 exclude;
 liveness-detection {
 failure-action (clear-binding | clear-binding-if-interface-up | log-only);
 }
 }
}
```

```

method {
 bfd {
 version (0 | 1 | automatic);
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 detection-time {
 threshold milliseconds;
 }
 session-mode(automatic | multihop | singlehop);
 holddown-interval milliseconds;
 }
}
overrides {
 ...
}
service-profile dynamic-profile-name;
trace;
upto upto-interface-name;
}
service-profile dynamic-profile-name;
}
overrides {
 ...
}
relay-agent-interface-id {
 ...
}
service-profile dynamic-profile-name;
liveness-detection {
 failure-action (clear-binding | clear-binding-if-interface-up | log-only);
 method {
 bfd {
 version (0 | 1 | automatic);
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 detection-time {
 threshold milliseconds;
 }
 session-mode(automatic | multihop | singlehop);
 holddown-interval milliseconds;
 }
 }
}
}

```



```

overrides {
 allow-snooped-clients;
 interface-client-limit number;
 no-allow-snooped-clients;
 no-bind-on-request;
 send-release-on-delete;
}
relay-agent-interface-id {
 prefix prefix;
 use-interface-description (logical | device);
}
server-group {
 server-group-name {
 server-ip-address;
 }
}
dynamic-profile profile-name {
 aggregate-clients (merge | replace);
 use-primary primary-profile-name;
}
forward-snooped-clients (all-interfaces | configured-interfaces |
non-configured-interfaces);
group group-name {
 active-server-group server-group-name;
 authentication {
 ...
 }
}
dynamic-profile profile-name {
 ...
}
interface interface-name {
 exclude;
 liveness-detection {
 failure-action (clear-binding | clear-binding-if-interface-up | log-only);
 method {
 bfd {
 version (0 | 1 | automatic);
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 detection-time {
 threshold milliseconds;
 }
 }
 session-mode (automatic | multihop | singlehop);
 holddown-interval milliseconds;
 }
 }
}
overrides {
 ...
}

```

```
 service-profile dynamic-profile-name;
 trace;
 upto upto-interface-name;
 }
 overrides {
 ...
 }
 relay-option-60 {
 ...
 }
 relay-option-82 {
 ...
 }
 service-profile dynamic-profile-name;
}
liveness-detection {
 failure-action (clear-binding | clear-binding-if-interface-up | log-only);
 method {
 bfd {
 version (0 | 1 | automatic);
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 detection-time {
 threshold milliseconds;
 }
 session-mode (automatic | multihop | singlehop);
 holddown-interval milliseconds;
 }
 }
}
overrides {
 allow-snooped-clients;
 always-write-giaddr;
 always-write-option-82;
 client-discover-match <option60-and-option82>;
 disable-relay;
 interface-client-limit number;
 layer2-unicast-replies;
 no-allow-snooped-clients;
 no-bind-on-request;
 proxy-mode;
 replace-ip-source-with;
 send-release-on-delete;
 trust-option-82;
}
relay-option-82 {
 circuit-id {
 prefix prefix;
 use-interface-description (logical | device);
 }
}
```

```

 }
 server-group {
 server-group-name {
 server-ip-address;
 }
 }
 service-profile dynamic-profile-name;
}
dhcp-security {
 arp-inspection;
 group group-name {
 interface interface-name {
 static-ip ip-address {
 mac mac-address;
 }
 }
 overrides {
 no-option82;
 trusted;
 untrusted;
 }
 }
}
ip-source-guard;
no-dhcp-snooping;
option-82 {
 circuit-id {
 prefix {
 host-name;
 logical-system-name;
 routing-instance-name;
 }
 use-interface-description (device | logical);
 use-vlan-id;
 }
 remote-id {
 host-name hostname;
 use-interface-description (device | logical);
 use-string string;
 }
 vendor-id {
 use-string string;
 }
}
}
fip-security {
 examine-vn2vf;
 examine-vn2vn {
 beacon-period milliseconds;
 }
 fc-map fc-map-value;
 interface interface-name {
 (fcoe-trusted | no-fcoe-trusted;)
 }
}
}
}

```

|                                 |                                                                                                                             |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Hierarchy Level</b>          | [edit]<br>[edit vlans]                                                                                                      |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.<br>Statement introduced in Junos OS Release 11.3 for QFX Series switches. |
| <b>Description</b>              | Configure traffic forwarding.<br><br>The statements are explained separately.                                               |
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.     |

---

## global-mac-table-aging-time

---

|                                 |                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | global-mac-table-aging-time <i>seconds</i> ;                                                                                                                                                                                          |
| <b>Hierarchy Level</b>          | [edit protocols l2-learning]                                                                                                                                                                                                          |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.2.<br>Support for logical systems added in Junos OS Release 9.6.                                                                                                                           |
| <b>Description</b>              | Configure the timeout interval for entries in the MAC table.                                                                                                                                                                          |
| <b>Default</b>                  | 300 seconds                                                                                                                                                                                                                           |
| <b>Options</b>                  | <b>seconds</b> —Time elapsed before MAC table entries are timed out and entries are deleted from the table.<br><b>Range:</b> For MX Series routers: 10 through 1 million; for EX Series and QFX Series switches: 60 through 1 million |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>Configuring the MAC Table Timeout Interval</i></li><li>• <i>Configuring MAC Table Aging (CLI Procedure)</i></li><li>• <a href="#">Configuring MAC Table Aging on page 40</a></li></ul>     |

## interface-mac-limit

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <pre>interface-mac-limit <i>limit</i> {     <b>packet-action</b> drop; }</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Hierarchy Level</b>     | <p>[edit bridge-domains <i>bridge-domain-name</i> bridge-options],<br/>         [edit bridge-domains <i>bridge-domain-name</i> bridge-options interface <i>interface-name</i>],<br/>         [edit logical-systems <i>logical-system-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options],<br/>         [edit logical-systems <i>logical-system-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options interface <i>interface-name</i>],<br/>         [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options],<br/>         [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options interface <i>interface-name</i>],<br/>         [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> switch-options],<br/>         [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> switch-options interface <i>interface-name</i>],<br/>         [edit logical-systems <i>logical-system-name</i> switch-options],<br/>         [edit logical-systems <i>logical-system-name</i> switch-options interface <i>interface-name</i>],<br/>         [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options],<br/>         [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> bridge-options interface <i>interface-name</i>],<br/>         [edit routing-instances <i>routing-instance-name</i> switch-options],<br/>         [edit routing-instances <i>routing-instance-name</i> switch-options interface <i>interface-name</i>],<br/>         [edit switch-options],<br/>         [edit switch-options interface <i>interface-name</i>],<br/>         [edit switch-options interface <i>interface-name</i>],<br/>         [edit vlans <i>vlan-name</i> switch-options],<br/>         [edit vlans <i>vlan-name</i> switch-options interface <i>interface-name</i>]</p> |
| <b>Release Information</b> | <p>Statement introduced in Junos OS Release 8.4.</p> <p>Support for the <b>switch-options</b> statement added in Junos OS Release 9.2.</p> <p>Support for top-level configuration for the <b>virtual-switch</b> type of routing instance added in Junos OS Release 9.2. In Junos OS Release 9.1 and earlier, the routing instances hierarchy supported this statement only for a VPLS instance or a bridge domain configured within a virtual switch.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p> <p>[edit switch-options], [edit switch-options interface <i>interface-name</i>], [edit vlans <i>vlan-name</i> switch-options], and [edit vlans <i>vlan-name</i> switch-options interface <i>interface-name</i>] hierarchy levels introduced in Junos OS Release 12.3R2 for EX Series switches.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b>         | <p>Configure a limit to the number of MAC addresses that can be learned from a bridge domain, VLAN, virtual switch, or set of bridge domains or VLANs.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |



**NOTE:** For multichassis link aggregation (MC-LAG) peers in active-active mode, configuring the `interface-mac-limit` statement or changing the `interface-mac-limit` configuration when traffic is flowing can cause the MAC entries to be out of synchronization between the two MC-LAG peers, which might result in flooding. To avoid flooding, you must either halt traffic forwarding and then configure the `interface-mac-limit` statement or use the `commit at configuration` statement to commit the changes at the same time in both the peer nodes.

Alternatively, if flooding does occur, you can clear the bridge MAC table on both the routers or switches by using the `clear bridge mac-table` command. Running this command ensures that the MAC entries are re-learned and in synchronization between both the peers.

---

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Default</b>                  | For an access port, the default MAC limit is 1024 MAC addresses. For a trunk port, the default MAC limit is 8192 MAC addresses.                                                                                                                                                                                                                                                                                                                                                       |
| <b>Options</b>                  | <b>limit</b> —Maximum number of MAC addresses learned from an interface.<br><b>Range:</b> 1 through 524287 MAC addresses per interface<br><br>The remaining statement is explained separately.                                                                                                                                                                                                                                                                                        |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Understanding Layer 2 Learning and Forwarding for Bridge Domains</a></li><li>• <a href="#">Layer 2 Learning and Forwarding for VLANs Overview on page 3</a></li><li>• <a href="#">Understanding Layer 2 Learning and Forwarding for Bridge Domains Functioning as Switches with Layer 2 Trunk Ports</a></li><li>• <a href="#">Layer 2 Learning and Forwarding for VLANs Acting as a Switch for a Layer 2 Trunk Port</a></li></ul> |

## interface-mode

|                            |                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <code>interface-mode (access   trunk &lt;inter-switch-link&gt;);</code>                                                                                                                                                                                                                                                                                                               |
| <b>Hierarchy Level</b>     | [edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> family bridge],<br>[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> family ethernet-switching],<br>[edit logical-systems <i>logical-system-name</i> interfaces <i>interface-name</i> unit <i>logical-unit-number</i> family bridge]                                                      |
| <b>Release Information</b> | Statement introduced in Junos OS Release 9.2.<br>Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.<br>Statement introduced in Junos OS Release 13.2 for the QFX Series.<br>Statement introduced in Junos OS Release 15.1.<br><b>inter-switch-link</b> option introduced in Junos OS Release 14.2 for MX240, MX480, and MX960 routers in enhanced LAN mode. |

### Description



**NOTE:** This statement supports the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *port-mode*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

(QFX Series 3500 and 3600 standalone switches)—Determine whether the logical interface accepts or discards packets based on VLAN tags. Specify the **trunk** option to accept packets with a VLAN ID that matches the list of VLAN IDs specified in the **vlan-id** or **vlan-id-list** statement, then forward the packet within the bridge domain or VLAN configured with the matching VLAN ID. Specify the **access** option to accept packets with no VLAN ID, then forward the packet within the bridge domain or VLAN configured with the VLAN ID that matches the VLAN ID specified in the **vlan-id** statement.



**NOTE:** On MX Series routers, if you want IGMP snooping to be functional for a bridge domain, then you should not configure **interface-mode** and **irb** for that bridge. Such a configuration commit succeeds, but IGMP snooping is not functional, and a message informing the same is displayed. For more information, see *Configuring a Trunk Interface on a Bridge Network*.

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Options</b> | <p><b>access</b>—Configure a logical interface to accept untagged packets. Specify the VLAN to which this interface belongs using the <b>vlan-id</b> statement.</p> <p><b>trunk</b>—Configure a single logical interface to accept packets tagged with any VLAN ID specified with the <b>vlan-id</b> or <b>vlan-id-list</b> statement.</p> <p><b>trunk inter-switch-link</b>—For a private VLAN, configure the InterSwitch Link protocol (ISL) on a trunk port of the primary VLAN in order to connect the switches composing the PVLAN to each other. You do not need to configure an ISL when a PVLAN is configured</p> |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

on a single switch. This configuration specifies whether the particular interface assumes the role of interswitch link for the PVLAN domains of which it is a member. This option is supported only on MX240, MX480, and MX960 routers in enhanced LAN mode.

|                                 |                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.                                                                                                                                                                                                                                             |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>Configuring Access Mode on a Logical Interface</i></li><li>• <i>Configuring a Logical Interface for Trunk Mode</i></li><li>• <i>Example: Connecting Access Switches to a Distribution Switch</i></li><li>• <i>Tunnel Services Overview</i></li><li>• <i>Configuring Tunnel Interfaces on MX Series Routers</i></li></ul> |



## packet-action

**Syntax** `packet-action action;`

**Hierarchy Level** [edit bridge-domains *bridge-domain-name* bridge-options interface *interface-name* **interface-mac-limit** *limit*],  
 [edit bridge-domains *bridge-domain-name* bridge-options **interface-mac-limit** *limit*],  
 [edit logical-systems *logical-system-name* bridge-domains *bridge-domain-name* bridge-options interface *interface-name* **interface-mac-limit** *limit*],  
 [edit logical-systems *logical-system-name* bridge-domains *bridge-domain-name* bridge-options **interface-mac-limit** *limit*],  
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* bridge-domains *bridge-domain-name* bridge-options interface *interface-name* **interface-mac-limit** *limit*],  
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* bridge-domains *bridge-domain-name* bridge-options **interface-mac-limit** *limit*],  
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* switch-options interface *interface-name* **interface-mac-limit** *limit*],  
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* switch-options **interface-mac-limit** *limit*],  
 [edit logical-systems *logical-system-name* switch-options **interface-mac-limit** *limit*],  
 [edit protocols l2-learning global-mac-limit *limit*],  
 [edit routing-instances *routing-instance-name* bridge-domains *bridge-domain-name* bridge-options interface *interface-name* **interface-mac-limit** *limit*],  
 [edit routing-instances *routing-instance-name* bridge-domains *bridge-domain-name* bridge-options **interface-mac-limit** *limit*],  
 [edit routing-instances *routing-instance-name* protocols evpn interface-mac-limit (VPLS)],  
 [edit routing-instances *routing-instance-name* protocols evpn interface *interface-name* interface-mac-limit (VPLS)],  
 [edit routing-instances *routing-instance-name* protocols evpn mac-table-size *limit*],  
 [edit routing-instances *routing-instance-name* switch-options interface *interface-name* **interface-mac-limit** *limit*],  
 [edit routing-instances *routing-instance-name* switch-options **interface-mac-limit** *limit*],  
 [edit switch-options interface *interface-name* **interface-mac-limit** *limit*],  
 [edit switch-options **interface-mac-limit** *limit*],  
 [edit switch-options interface *interface-name* **interface-mac-limit** *limit*],  
 [edit switch-options **interface-mac-limit** *limit*],  
 [edit switch-options **mac-table-size** *limit*],  
 [edit switch-options interface *interface-name* **interface-mac-limit** *limit*],  
 [edit vlans *vlan-name* switch-options interface *interface-name* **interface-mac-limit** *limit*],  
 [edit vlans *vlan-name* switch-options **interface-mac-limit** *limit*],  
 [edit vlans *vlan-name* switch-options **mac-table-size** *limit*],  
 [edit vlans *vlan-name* switch-options **interface-mac-limit** *limit*],  
 [edit vlans *vlan-name* switch-options interface *interface-name* **interface-mac-limit** *limit*],  
 [edit vlans *vlan-name* switch-options **mac-table-size** *limit*]

**Release Information** Statement introduced in Junos OS Release 8.4.  
 Support for the **switch-options** statement added in Junos OS Release 9.2.  
 Support for top-level configuration for the **virtual-switch** type of routing instance added in Junos OS Release 9.2. In Junos OS Release 9.1 and earlier, the routing instances hierarchy supported this statement only for a VPLS instance or a bridge domain configured within a virtual switch.

Support for logical systems added in Junos OS Release 9.6.

[edit switch-options interface *interface-name* interface-mac-limit *limit*], [edit switch-options interface-mac-limit *limit*], [edit switch-options mac-table-size *limit*], [edit vlans *vlan-name* switch-options interface *interface-name* interface-mac-limit *limit*], [edit vlans *vlan-name* switch-options interface-mac-limit *limit*], and [edit vlans *vlan-name* switch-options mac-table-size *limit*] hierarchy levels introduced in Junos OS Release 12.3R2 for EX Series switches.

Support for EVPNs introduced in Junos OS Release 13.2 on MX Series 3D Universal Edge Routers.

Support at the [edit switch-options interface *interface-name* interface-mac-limit *limit*] hierarchy level and hierarchy levels under [edit vlans *vlan-name*] introduced in Junos OS Release 13.2X50-D10 for EX Series switches and Junos OS Release 13.2 for the QFX Series.

**Description** Specify the action taken when packets with new source MAC addresses are received after the MAC address limit is reached. If this statement is not configured, packets with new source MAC addresses are forwarded by default.

**Default**



**NOTE:** On a QFX Series Virtual Chassis, if you include the shutdown option at the [edit vlans *vlan-name* switch-options interface *interface-name* interface-mac-limit packet-action] hierarchy level and issue the commit operation, the system generates a commit error. The system does not generate an error if you include the shutdown option at the [edit switch-options interface *interface-name* interface-mac-limit packet-action] hierarchy level.

Disabled. The default is for packets for new source MAC addresses to be forwarded after the MAC address limit is reached.

**Options**

- drop**—Drop packets with new source MAC addresses, and do not learn the new source MAC addresses.
- drop-and-log**—(EX Series switches and QFX Series only) Drop packets with new source MAC addresses, and generate an alarm, an SNMP trap, or a system log entry.
- log**—(EX Series switches and QFX Series only) Hold packets with new source MAC addresses, and generate an alarm, an SNMP trap, or a system log entry.
- none**—(EX Series switches and QFX Series only) Forward packets with new source MAC addresses, and learn the new source MAC address.
- shutdown**—(EX Series switches and QFX Series only) Disable the specified interface, and generate an alarm, an SNMP trap, or a system log entry.

**Required Privilege Level**

- routing—To view this statement in the configuration.
- routing-control—To add this statement to the configuration.

|                              |                                                                                                                            |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>Related Documentation</b> | • <i>Configuring EVPN Routing Instances</i>                                                                                |
|                              | • <i>Configuring EVPN Routing Instances on EX9200 Switches</i>                                                             |
|                              | • <a href="#">Configuring MAC Limiting (CLI Procedure) on page 38</a>                                                      |
|                              | • <i>Configuring Persistent MAC Learning (CLI Procedure)</i>                                                               |
|                              | • <i>Understanding Layer 2 Learning and Forwarding for Bridge Domains</i>                                                  |
|                              | • <a href="#">Layer 2 Learning and Forwarding for VLANs Overview on page 3</a>                                             |
|                              | • <i>Understanding Layer 2 Learning and Forwarding for Bridge Domains Functioning as Switches with Layer 2 Trunk Ports</i> |
|                              | • <a href="#">Layer 2 Learning and Forwarding for VLANs Overview on page 3</a>                                             |
|                              | • <i>Layer 2 Learning and Forwarding for VLANs Acting as a Switch for a Layer 2 Trunk Port</i>                             |

## service-id

---

|                                 |                                                                                                                                                                    |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>service-id number;</code>                                                                                                                                    |
| <b>Hierarchy Level</b>          | [edit switch-options]<br>[edit vlans <i>vlan-name</i> ]                                                                                                            |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 12.3R2 for EX Series switches and MX Series routers.<br>Statement introduced in Junos OS Release 13.2 for the QFX Series. |
| <b>Description</b>              | Specify a service identifier for each multichassis aggregated Ethernet interface that belongs to a link aggregation group (LAG).                                   |
| <b>Options</b>                  | <b>number</b> —A number that identifies a particular service.<br><b>Range:</b> 1 through 65535                                                                     |
| <b>Required Privilege Level</b> | system—To view this statement in the configuration.<br>system control—To add this statement to the configuration.                                                  |



## switch-options

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre> switch-options {   interface <i>interface-name</i> {     interface-mac-limit <i>limit</i> {       packet-action drop;     }     no-mac-learning;     static-mac <i>static-mac-address</i> {       vlan-id <i>number</i>;     }   }   interface-mac-limit <i>limit</i> {     packet-action drop;   }   mac-statistics;   mac-table-size <i>limit</i> {     packet-action drop;   }   no-mac-learning;   service-id <i>number</i>;   vtep-source-interface } </pre> |
| <b>Hierarchy Level</b>          | <pre> [edit <i>number</i>], [edit vlans <i>vlan--name</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> vlans   <i>vlan-name</i>], [edit routing-instances <i>routing-instance-name</i> vlans <i>vlan-name</i>] </pre>                                                                                                                                                                                              |
| <b>Release Information</b>      | <p>Statement introduced in Junos OS Release 12.3R2 for EX Series switches and MX Series routers.</p> <p>Statement introduced in Junos OS Release 13.2 for the QFX Series.</p>                                                                                                                                                                                                                                                                                           |
| <b>Description</b>              | <p>Configure Layer 2 learning and forwarding properties for a VLAN or a virtual switch.</p> <p>The remaining statements are explained separately.</p>                                                                                                                                                                                                                                                                                                                   |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                          |

## static-mac

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | static-mac <i>mac-address</i> {<br>vlan-id <i>number</i> ;<br>}                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Hierarchy Level</b>          | [edit bridge-domains <i>bridge-domain-name</i> bridge-options interface <i>interface-name</i> ],<br>[edit logical-systems <i>logical-system-name</i> bridge-domains <i>bridge-domain-name</i><br>bridge-options interface <i>interface-name</i> ],<br>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i><br>bridge-domains <i>bridge-domain-name</i> bridge-options interface <i>interface-name</i> ],<br>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i><br>bridge-options interface <i>interface-name</i> ],<br>[edit routing-instances <i>routing-instance-name</i> protocols evpn interface <i>interface-name</i> ]<br>[edit vlans <i>vlan-name</i> switch-options interface <i>interface-name</i> ] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 8.4.<br>Support for logical systems added in Junos OS Release 9.6.<br>[edit vlans <i>vlan-name</i> switch-options interface <i>interface name</i> ] hierarchy level introduced in Junos OS Release 12.3R2 for EX Series switches.<br>Support for EVPNs added in Junos OS Release 13.2 for MX 3D Series routers. The <b>vlan-id</b> option is not available for EVPNs.<br>[edit vlans <i>vlan-name</i> switch-options interface <i>interface name</i> ] hierarchy level introduced in Junos OS Release 13.2 for the QFX Series.                                                                                                                                                                                                                             |
| <b>Description</b>              | Configure a static MAC address for a logical interface in a bridge domain or VLAN.<br><br>The <b>vlan-id</b> option can be specified for <b>static-macs</b> only if <b>vlan-id all</b> is configured for the bridging domain or VLAN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Options</b>                  | <b>mac-address</b> —MAC address<br><br><b>vlan-id <i>number</i></b> —(Optional) VLAN identifier to associate with static MAC address.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <i>Configuring EVPN Routing Instances</i></li> <li>• <i>Understanding Layer 2 Learning and Forwarding for Bridge Domains</i></li> <li>• <a href="#">Layer 2 Learning and Forwarding for VLANs Overview on page 3</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## vlan-id-list

|                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                                                                                                                                                                                                                               | <code>vlan-id-list [ <i>vlan-id-numbers</i> ];</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Hierarchy Level</b>                                                                                                                                                                                                                      | <p>[edit bridge-domains <i>bridge-domain-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> bridge-domains <i>bridge-domain-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i>],</p> <p>[edit interfaces <i>interface-name</i> unit 0],</p> <p>[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i>],</p> <p>[edit vlans <i>vlan-name</i>]</p>                                                                                                                                                                                                                                       |
| <b>Release Information</b>                                                                                                                                                                                                                  | <p>Statement introduced in Junos OS Release 9.4.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p> <p>Statement introduced in Junos OS Release 12.3R2 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 13.2 for the QFX Series.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b>                                                                                                                                                                                                                          | <p>Specify a VLAN identifier list to use for a bridge domain or VLAN in trunk mode.</p> <p>Specify the <b>trunk</b> option in the <b>interface-mode</b> statement to accept packets with a VLAN ID that matches the list of VLAN IDs specified in the <b>vlan-id-list</b> statement to forward the packet within the bridge domain or VLAN configured with the matching VLAN ID. Specify the <b>access</b> option to accept packets with no VLAN ID to forward the packet within the bridge domain or VLAN configured with the VLAN ID that matches the VLAN ID specified in the <b>vlan-id</b> statement.</p> <p>This statement also enables you to bind a logical interface to a list of VLAN IDs, thereby configuring the logical interface to receive and forward a frame with a tag that matches the specified VLAN ID list.</p> |
| <div>  <p><b>WARNING:</b> On some EX and QFX Series switches, you can apply no more than eight VLAN identifier lists to a physical interface.</p> </div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Options</b>                                                                                                                                                                                                                              | <p><b><i>vlan-id-numbers</i></b>—Valid VLAN identifiers. You can combine individual numbers with range lists by including a hyphen.</p> <p><b>Range:</b> 0 through 4095</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <div>  <p><b>NOTE:</b> On EX Series switches and the QFX Series, the range is 0 through 4094.</p> </div>                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Required Privilege Level</b>                                                                                                                                                                                                             | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

- Related Documentation**
- *Configuring a Bridge Domain*
  - *Configuring a VLAN*
  - *Configuring VLAN Identifiers for Bridge Domains and VPLS Routing Instances*
  - *Configuring VLAN Identifiers for VLANs and VPLS Routing Instances*

## vlan-rewrite

|                                 |                                                                                                                                                                                                                                                   |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | vlan-rewrite translate (200 500   201 501)                                                                                                                                                                                                        |
| <b>Hierarchy Level</b>          | [edit interfaces <i>interface-name</i> unit <i>number</i> family bridge interface-mode trunk]<br>[edit interfaces <i>interface-name</i> unit <i>number</i> family ethernet-switching interface-mode trunk]                                        |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 9.4.<br>Statement introduced in Junos OS Release 12.3R2 for EX Series switches.<br>Statement introduced in Junos OS Release 13.2 for the QFX Series.                                                     |
| <b>Description</b>              | Translates an incoming VLAN to a bridge-domain VLAN, corresponding counter translation at egress. Supports translation of VLAN 200 to VLAN 500 and VLAN 201 to VLAN 501. Other valid VLANs pass through without translation.                      |
| <b>Options</b>                  | <b>translate 200 500</b> —Translates incoming packets with VLAN 200 to 500.<br><br><b>translate 201 501</b> —Translates incoming packets with VLAN 201 to 501.<br><br><b>translate 202 502</b> —Translates incoming packets with VLAN 202 to 502. |
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.                                                                                                                           |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <i>Rewriting a VLAN Tag and Adding a New Tag</i></li> </ul>                                                                                                                                              |

## vlan

```

Syntax vlans {
 vlan-name {
 description text-description;
 domain-type bridge;
 forwarding-options {
 dhcp-security {
 arp-inspection;
 group group-name {
 interface interface-name {
 static-ip ip-address {
 mac mac-address;
 }
 }
 }
 overrides {
 no-option82;
 trusted;
 untrusted;
 }
 }
 }
 ip-source-guard;
 no-dhcp-snooping;
 option-82 {
 circuit-id {
 prefix {
 host-name;
 logical-system-name;
 routing-instance-name;
 }
 use-interface-description (device | logical);
 use-vlan-id;
 }
 remote-id {
 host-name hostname;
 use-interface-description (device | logical);
 use-string string;
 }
 vendor-id {
 use-string string;
 }
 }
 }
 }
 fip-security {
 examine-vn2vf;
 examine-vn2vn {
 beacon-period milliseconds;
 }
 fc-map fc-map-value;
 interface interface-name {
 (fcoe-trusted | no-fcoe-trusted;)
 }
 }
}

```



```

l3-interface irb.logical-unit-number;
multicast-snooping-options {
 flood-groups [group-names];
 forwarding-cache {
 threshold {
 reuse threshold;
 suppress threshold;
 }
 }
 graceful-restart {
 disable;
 restart-duration duration;
 }
 host-outbound-traffic {
 dot1p bits;
 forwarding-class forwarding-class;
 }
 multichassis-lag-replicate-state;
 nexthop-hold-time time;
 options {
 syslog {
 level level;
 mark interval;
 upto level;
 }
 }
 traceoptions {
 file filename {
 files number;
 no-world-readable;
 size file-size;
 world-readable;
 }
 flag flag {
 disable;
 }
 }
}
switch-options {
 interface interface-name {
 interface-mac-limit limit {
 packet-action action;
 }
 static-mac mac-address;
 }
 interface-mac-limit limit {
 packet-action action;
 }
 mac-move-limit limit {
 packet-action action;
 }
 mac-table-size limit {
 packet-action drop;
 }
 no-mac-learning;
}

```

```
 }
 vlan-id number;
 vlan-id-list [vlan-id | vlan-id-vlan-id];
 vlan-tags
 inner value;
 outer value;
 }
 vxlan {
 ingress-node-replication
 ovsdb-managed
 }
 }
}
```

**Hierarchy Level**    [\[edit\]](#)

**Release Information**    Statement introduced in Junos OS Release 13.2 for the QFX Series.  
Statements for private VLANs and Q-in-Q tunneling introduced in Junos OS Release 12.1 for the QFX Series.

**Description**    Configure VLAN properties on the QFX Series.

**Default**    If you use the default factory configuration, all switch interfaces become part of the VLAN default.

**Options**    *vlan-name*—Name of the VLAN. The name can contain letters, numbers, hyphens (-), and periods (.) and can be up to 255 characters long.

The remaining statements are described separately.

**Required Privilege Level**    routing—To view this statement in the configuration.  
routing-control—To add this statement to the configuration.

**Related Documentation**

- [Understanding Bridging and VLANs on page 4](#)
- [Configuring VLANs on page 34](#)

## CHAPTER 16

# Configuration Statements (Layer 2 Networking)

- [forwarding-options \(chassis\) on page 218](#)
- [num-65-127-prefix on page 222](#)
- [prefix-65-127-disable on page 223](#)

## forwarding-options (chassis)

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <pre>forwarding options <i>profile-name</i> {     num-65-127-prefix <i>number</i>; }</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Syntax</b>              | <pre>forwarding-options lpm-profile {     prefix-65-127-disable;     unicast-in-lpm; }</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Syntax</b>              | <pre>forwarding-options custom-profile {     l2-entries   l3-entries   lpm-entries {         num-banks <i>number</i>;     } }</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hierarchy Level</b>     | [edit chassis]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Release Information</b> | <p>Statement introduced in Junos OS Release 13.2.</p> <p><b>custom-profile</b> option introduced in Junos OS Release 15.1x53-D30 for QFX5200 Series switches only.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b>         | <p>Configure a unified forwarding table profile to allocate the amount of memory available for the following:</p> <ul style="list-style-type: none"> <li>• MAC addresses.</li> <li>• Layer 3 host entries.</li> <li>• Longest prefix match table entries.</li> </ul> <p>This feature enables you to select a profile that optimizes the amount of memory available for various types of forwarding-table entries based on the needs of your network. For example, for a switch that handles a great deal of Layer 2 traffic, such as a virtualized network with many servers and virtualized machines, you would choose the <b>l2-profile-one</b>, which allocates the highest amount of memory to MAC addresses.</p> <p>You configure the memory allocation for LPM table entries differently, depending on whether you using Junos OS Release 13.2X51-D10 or Junos OS Release 13.2X51-D15 and later. For more information about configuring memory allocation for LPM table entries, see <a href="#">“Configuring the Unified Forwarding Table” on page 63</a>.</p> <p>The <b>num-65-127-prefix <i>number</i></b> statement is not supported on the <b>custom-profile</b> and the <b>lpm-profile</b>. The <b>prefix-65-127-disable</b> and <b>unicast-in-lpm</b> statements are supported only on the <b>lpm-profile</b>.</p> <p>When you commit a configuration with a forwarding table profile change, the Packet Forwarding Engine automatically restarts to apply the new parameters, which brings the data interfaces down and then up again.</p> <p>However, starting with Junos OS Release 14.1X53-D40, 15.1R5, and 16.1R3, upon configuring and committing a unified forwarding table profile change in a Virtual Chassis or Virtual</p> |

Chassis Fabric (VCF), the Packet Forwarding Engine in member switches does not automatically restart. This behavior avoids having Virtual Chassis or VCF instability and a prolonged convergence period if a profile change is propagated to member switches and multiple Packet Forwarding Engines all restart at the same time. Instead, when you initially commit a profile configuration change, the message **Reboot required for configuration to take effect** is displayed at the master switch CLI prompt, notifying you that the profile change does not take effect until the next time you restart the Virtual Chassis or VCF. The profile configuration change is propagated to member switches that support this feature, and a reminder that a reboot is required to apply this pending configuration change appears in the system log of the master switch and applicable member switches. You then enable the profile change during a planned downtime period using the **request system reboot** command, which quickly establishes a stable Virtual Chassis or VCF with the new configuration.



**NOTE:** You should plan to make unified forwarding table profile changes only when you are ready to perform a Virtual Chassis or VCF system reboot *immediately* after committing the configuration update. Otherwise, in the intervening period between committing the configuration change and rebooting the Virtual Chassis or VCF, the system can become inconsistent if a member experiences a problem and restarts. In that case, the new configuration takes effect on the member that was restarted, while the change is not yet activated on all the other members.

---

**Options** **profile-name**—name of the profile to use for memory allocation in the unified forwarding table. [Table 19 on page 220](#) lists the profiles you can choose that have set values and the associated values for each type of entry.

On QFX5200 Series switches only, you can also select **custom-profile**. This profile enables you to allocate from one to four banks of shared hash memory to a specific type of forwarding-table entry. Each shared hash memory bank can store a maximum of the equivalent of 32,000 IPv4 unicast addresses.

**Table 19: Unified Forwarding Table Profiles**

| Profile Name                      | MAC Table     | Host Table (unicast and multicast addresses) |              |             |             |             |             |
|-----------------------------------|---------------|----------------------------------------------|--------------|-------------|-------------|-------------|-------------|
|                                   | MAC Addresses | IPv4 unicast                                 | IPv6 unicast | IPv4 (*, G) | IPv4 (S, G) | IPv6 (*, G) | IPv6 (S, G) |
| <b>l2-profile-one</b>             | 288K          | 16K                                          | 8K           | 8K          | 8K          | 4K          | 4K          |
| <b>l2-profile-two</b>             | 224K          | 80K                                          | 40K          | 40K         | 40K         | 20K         | 20K         |
| <b>l2-profile-three (default)</b> | 160K          | 144K                                         | 72K          | 72K         | 72K         | 36K         | 36K         |
| <b>l3-profile</b>                 | 96K           | 208K                                         | 104K         | 104K        | 104K        | 52K         | 52K         |
| <b>lpm-profile*</b>               | 32K           | 16K                                          | 8K           | 8K          | 8K          | 4K          | 4K          |

\* This profile supports only IPv4 in Junos OS Release 13.2X51-D10. Starting in Junos OS Release 13.2X51-D15, the **lpm-profile** supports IPv4 and IPv6 entries.



**NOTE:** If the host stores the maximum number of entries for any given type, the entire table is full and is unable to accommodate *any* entries of any other type. For information about valid combinations of table entries see [“Understanding the Unified Forwarding Table” on page 59](#).

**l2-entries | l3-entries | lpm-entries—(custom-profile only)** Select a type of forwarding-table entry—Layer 2, Layer 3, or LPM—to allocate a specific number of shared memory banks. You configure the amount of memory to allocate for each type of entry separately.

**num-banks number—(custom-profile only)** Specify the number of shared memory banks to allocate for a specific type of forwarding-table entry. Each shared memory bank stores the equivalent of 32,000 IPv4 unicast addresses.

**Range:** 0 through 4.





**NOTE:** There are four shared memory banks, which can be allocated flexibly among the three types of forwarding-table entries. To allocate no shared memory for a particular entry type, specify the number 0. When

you commit the configuration, the system issues a commit check to ensure that you have not configured more than four memory banks. You do not have to configure all four shared memory banks. By default, each entry type is allocated the equivalent of 32,000 IPv4 unicast addresses in shared memory.

---



|                              |                                                                                                                                                                                                            |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Required Privilege</b>    | interface—To view this statement in the configuration.                                                                                                                                                     |
| <b>Level</b>                 | interface-control—To add this statement to the configuration.                                                                                                                                              |
| <b>Related Documentation</b> | <ul style="list-style-type: none"><li>• <i>Understanding the Unified Forwarding Table</i></li><li>• <i>Example: Configuring a Unified Forwarding Table Custom Profile on QFX Series Switches</i></li></ul> |

## num-65-127-prefix

|                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                                                                                                                                                                                                                                                                                                                                   | num-65-127-prefix <i>number</i> ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Hierarchy Level</b>                                                                                                                                                                                                                                                                                                                          | [edit chassis <b>forwarding-options</b> <i>profile-name</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Release Information</b>                                                                                                                                                                                                                                                                                                                      | Statement introduced in Junos OS Release 13.2 for QFX Series switches.<br>Support for QFX5200 Series switches introduced in Junos OS Release 15.1x53-D30.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b>                                                                                                                                                                                                                                                                                                                              | For the Unified Forwarding Table (UFT) feature, specify how much forwarding table memory to allocate for IPv6 entries with prefix lengths in the range of /65 through /127. The ability to allocate flexibly the memory for IPv6 entries with prefixes in this range extends the use of this memory space to accommodate the appropriate mix of longest prefix match (LPM) entries that best suits your network. The LPM table stores IPv4 unicast prefixes, IPv6 prefixes with lengths equal to or less than 64, and IPv6 prefixes with lengths from 65 through 127. With this option, you can increase, decrease, or allocate no memory for IPv6 prefixes with lengths from 65 through 127, depending on which version of Junos OS you are using. |
| <div>  <p><b>NOTE:</b> This statement is supported only for the following forwarding table memory profiles: l2-profile-one, l2-profile-three, l2-profile-two, and l3-profile. Do not use this statement with the custom-profile or thelpm-profile.</p> </div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <div>  <p><b>NOTE:</b> The values you can configure are different depending on the version of Junos OS you are using.</p> </div>                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Options</b>                                                                                                                                                                                                                                                                                                                                  | <p><b>number</b>—Specify a numerical value.</p> <p><b>Range:</b> (Junos OS Release 13.2x51-D10 only) 1 through 128. Each increment represents 16 IPv6 prefixes with lengths in the range of /65 through /127, for a total maximum of 2,058 prefixes (16 x 128 = 2,048).</p> <p><b>Default:</b> 1 (16 IPv6 prefixes with lengths in the range of /65 through /127).</p> <p><b>Range:</b> (Junos OS Release 13.2x51-D15 or later) 0 through 4. Each increment allocates memory for 1,000 IPv6 prefixes with lengths in the range of /65 through /127, for a maximum of 4,000 such IPv6 prefixes.</p> <p><b>Default:</b> 1 (1,000 IPv6 prefixes with lengths in the range of /65 through /127).</p>                                                    |
| <b>Required Privilege Level</b>                                                                                                                                                                                                                                                                                                                 | <p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Related Documentation</b>                                                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring the Unified Forwarding Table on page 63</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |



## prefix-65-127-disable

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | prefix-65-127-disable;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Hierarchy Level</b>          | [edit chassis <a href="#">forwarding-options</a> lpm-profile]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 13.2X51-D15 for QFX Series switches.<br>Support introduced in Junos OS Release 15.1x53-D30 for QFX5200 Series switches.                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b>              | <p>For the Unified Forwarding Table (UFT) feature, specify not to allocate any memory for IPv6 prefixes with lengths in the range /65 through /127 for for longest-prefix-match (LPM) entries. Doing so increases the memory available for LPM entries for IPv4 unicast prefixes and IPv6 prefixes with lengths equal to or less than 64.</p> <p>In an environment where the switch is being used in the core of the network, for example, it might not need to store IPv6 prefixes with lengths in the range /65 through /127. IPv6 prefixes of this type are not typically used in the core.</p> |
|                                 | <p> <b>NOTE:</b> On the QFX3500, QFX3600, and QFX5100 switches, when you configure this statement, the maximum number of LPM IPv6 entries with prefix lengths equal to or less than 64 increases to 128,000. On the QFX5200 switch, when you configure this statement, the maximum number of IPv6 entries with prefix lengths equal to or less 64 that are allocated in the LPM table increases to 98,0000.</p>                                                                                                   |
|                                 | <p> <b>NOTE:</b> This statement is supported only with the lpm-profile. No other profile is supported.</p>                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Options</b>                  | <b>None</b> —This statement has no options.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Configuring the Unified Forwarding Table on page 63</a></li> <li>• <i>Understanding the Unified Forwarding Table</i></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                               |



## CHAPTER 17

# Configuration Statements (Q-in-Q Tunneling) (ELS CLI Only)


- [flexible-vlan-tagging on page 226](#)
- [input-vlan-map on page 227](#)
- [native-vlan-id on page 228](#)
- [output-vlan-map \(Gigabit Ethernet IQ and 10-Gigabit Ethernet with SFPP\) on page 229](#)
- [pop on page 230](#)
- [push on page 231](#)
- [swap on page 232](#)
- [vlan-id-list on page 233](#)

## flexible-vlan-tagging


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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | flexible-vlan-tagging;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hierarchy Level</b>          | [edit interfaces aex],<br>[edit interfaces ge- <i>fpc/pic/port</i> ],<br>[edit interfaces et- <i>fpc/pic/port</i> ],<br>[edit interfaces ps0],<br>[edit interfaces xe- <i>fpc/pic/port</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 8.1.<br>Support for aggregated Ethernet added in Junos OS Release 9.0.<br>Statement introduced in Junos OS Release 12.1x48 for PTX Series Packet Transport Routers.<br>Statement introduced in Junos OS Release 13.2X50-D15 for EX Series switches.<br>Statement introduced in Junos OS Release 13.2X51-D20 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>              | Support simultaneous transmission of 802.1Q VLAN single-tag and dual-tag frames on logical interfaces on the same Ethernet port, and on pseudowire logical interfaces.<br><br>This statement is supported on M Series and T Series routers, for Fast Ethernet and Gigabit Ethernet interfaces only on Gigabit Ethernet IQ2 and IQ2-E, IQ, and IQE PICs, and for aggregated Ethernet interfaces with member links in IQ2, IQ2-E, and IQ PICs or in MX Series DPCs, or on Ethernet interfaces for PTX Series Packet Transport Routers or 100-Gigabit Ethernet Type 5 PIC with CFP. This statement is supported on Gigabit Ethernet, 10-Gigabit Ethernet, 40-Gigabit Ethernet, and aggregated Ethernet interfaces on EX Series switches. |
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>Configuring Mixed Tagging</i></li><li>• <i>Configuring Flexible VLAN Tagging on PTX Series Packet Transport Routers</i></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## input-vlan-map

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <pre>input-vlan-map {   (pop   pop-pop   pop-swap   push   push-push   swap   swap-push   swap-swap);   inner-tag-protocol-id <i>tpid</i>;   inner-vlan-id <i>number</i>;   tag-protocol-id <i>tpid</i>;   vlan-id <i>number</i>; }</pre>                                                                                                                                    |
| <b>Hierarchy Level</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <pre>[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i>], [edit logical-systems <i>logical-system-name</i> interfaces <i>interface-name</i> unit <i>logical-unit-number</i>]</pre>                                                                                                                                                                       |
| <b>Release Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>Statement introduced before Junos OS Release 7.4.</p> <p><b>pop-pop</b>, <b>pop-swap</b>, <b>push-push</b>, <b>swap-push</b>, and <b>swap-swap</b> statements introduced in Junos OS Release 8.1.</p> <p>Statement introduced in Junos OS Release 13.2X50-D15 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 13.2X51-D20 for the QFX Series.</p> |
| <b>Description</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p>For Gigabit Ethernet IQ, 10-Gigabit Ethernet SFPP interfaces, 100-Gigabit Ethernet Type 5 PIC with CFP only as well as Gigabit Ethernet, 10-Gigabit Ethernet, 40-Gigabit Ethernet, and aggregated Ethernet interfaces, define the rewrite profile to be applied to incoming frames on this logical interface.</p> <p>The statements are explained separately.</p>         |
| <div style="display: flex; align-items: flex-start;"> <div style="flex: 1; text-align: center; margin-right: 10px;">  </div> <div> <p><b>NOTE:</b> Connectivity fault management (CFM) sessions for all interfaces in which <b>input-vlan-map</b> is configured are supported only if the interface also has an explicit configuration for <b>output-vlan-map</b> as <b>output-vlan-map pop</b>. See <a href="#">output-vlan-map (Gigabit Ethernet IQ and 10-Gigabit Ethernet with SFPP)</a>. This configuration is required for all the interfaces in the topology even when the CFM session is on that interface or on a different interface in the data path of the same topology.</p> </div> </div> |                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Required Privilege Level</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                           |
| <b>Related Documentation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>• <i>Stacking a VLAN Tag</i></li> <li>• <a href="#">output-vlan-map (Gigabit Ethernet IQ and 10-Gigabit Ethernet with SFPP)</a> on page 229</li> <li>• <i>Configuring Q-in-Q Tunneling (CLI Procedure)</i></li> </ul>                                                                                                                 |

## native-vlan-id

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <code>native-vlan-id <i>number</i>;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Hierarchy Level</b>     | [edit interfaces <i>ge-fpc/pic/port</i> ],<br>[edit interfaces <i>interface-name</i> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Release Information</b> | Statement introduced in Junos OS Release 8.3.<br>Statement introduced in Junos OS Release 12.2 for ACX Series Universal Access Routers.<br>Statement introduced in Junos OS Release 12.3R2 for EX Series switches.<br>Statement introduced in Junos OS Release 13.2X51-D20 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b>         | <p>Configure mixed tagging support for untagged packets on a port for the following:</p> <ul style="list-style-type: none"> <li>• M Series routers with Gigabit Ethernet IQ PICs with SFP and Gigabit Ethernet IQ2 PICs with SFP configured for 802.1Q flexible VLAN tagging</li> <li>• MX Series routers with Gigabit Ethernet DPCs and MICs, Tri-Rate Ethernet DPCs and MICs, and 10-Gigabit Ethernet DPCs and MICs and MPCs configured for 802.1Q flexible VLAN tagging</li> <li>• T4000 routers with 100-Gigabit Ethernet Type 5 PIC with CFP</li> <li>• EX Series switches with Gigabit Ethernet, 10-Gigabit Ethernet, 40-Gigabit Ethernet, and aggregated Ethernet interfaces</li> </ul> <p>When the <b>native-vlan-id</b> statement is included with the <b>flexible-vlan-tagging</b> statement, untagged packets are accepted on the same mixed VLAN-tagged port.</p> |
|                            | <p> <b>NOTE:</b> The logical interface on which untagged packets are received must be configured with the same VLAN ID as the native VLAN ID configured on the physical interface, otherwise the untagged packets are dropped.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                            | <p>To configure the logical interface, include the <b>vlan-id</b> statement (matching the <b>native-vlan-id</b> statement on the physical interface) at the [edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i>] hierarchy level.</p> <p>When the <b>native-vlan-id</b> statement is included with the <b>interface-mode</b> statement, untagged packets are accepted and forwarded within the bridge domain or VLAN that is configured with the matching VLAN ID.</p>                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Default</b>             | By default, the untagged packets are dropped. That is, if you do not configure the <b>native-vlan-id</b> option, the untagged packets are dropped.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Options</b>             | <p><b>number</b>—VLAN ID number.</p> <p><b>Range:</b> (ACX Series routers and EX Series switches) 0 through 4094.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

**Required Privilege Level** interface—To view this statement in the configuration.  
interface-control—To add this statement to the configuration.

**Related Documentation**

- *Configuring Mixed Tagging Support for Untagged Packets*
- *Configuring Access Mode on a Logical Interface*
- [Configuring the Native VLAN Identifier \(CLI Procedure\) on page 43](#)
- *Understanding Bridging and VLANs on EX Series Switches*
- [flexible-vlan-tagging on page 226](#)
- *Understanding Q-in-Q Tunneling on EX Series Switches*

## output-vlan-map (Gigabit Ethernet IQ and 10-Gigabit Ethernet with SFPP)

**Syntax** `output-vlan-map {  
    (pop | pop-pop | pop-swap | push | push-push | swap | swap-push | swap-swap);  
    inner-tag-protocol-id tpid;  
    inner-vlan-id number;  
    tag-protocol-id tpid;  
    vlan-id number;  
}`

**Hierarchy Level** [edit interfaces *interface-name* unit *logical-unit-number*],  
[edit logical-systems *logical-system-name* interfaces *interface-name* unit *logical-unit-number*]

**Release Information** Statement introduced before Junos OS Release 7.4.  
**pop-pop**, **pop-swap**, **push-push**, **swap-push**, and **swap-swap** statements added in Junos OS Release 8.1.

**Description** For Gigabit Ethernet IQ and 10-Port 10-Gigabit Ethernet SFPP interfaces only, define the rewrite operation to be applied to outgoing frames on this logical interface.


The statements are explained separately.

**Required Privilege Level** interface—To view this statement in the configuration.  
interface-control—To add this statement to the configuration.

**Related Documentation**


- *Stacking and Rewriting Gigabit Ethernet VLAN Tags*
- [input-vlan-map on page 227](#)

## pop

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | pop;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Hierarchy Level</b>          | [edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <b>input-vlan-map</b> ],<br>[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <b>output-vlan-map</b> ],<br>[edit logical-systems <i>logical-system-name</i> interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <b>input-vlan-map</b> ],<br>[edit logical-systems <i>logical-system-name</i> interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <b>output-vlan-map</b> ]                                                                                                                                                                                                                                                        |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.<br>Statement introduced in Junos OS Release 12.3R2 for EX Series switches.<br>Statement introduced in Junos OS Release 13.2X51-D20 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Description</b>              | <p> <b>NOTE:</b> On EX4300 switches, <b>pop</b> is not supported at the [edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <b>input-vlan-map</b>] hierarchy level.</p> <p>For Gigabit Ethernet IQ, 10-Gigabit Ethernet IQ2, and IQ2-E interfaces; 10-Gigabit Ethernet LAN/WAN PIC; aggregated Ethernet interfaces using Gigabit Ethernet IQ interfaces; 100-Gigabit Ethernet Type 5 PIC with CFP; and Gigabit Ethernet, 10-Gigabit Ethernet, 40-Gigabit Ethernet, and aggregated Ethernet interfaces, specify the VLAN rewrite operation to remove a VLAN tag from the top of the VLAN tag stack. The outer VLAN tag of the frame is removed.</p> |
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <i>Removing a VLAN Tag</i></li> <li>• <i>Configuring Q-in-Q Tunneling (CLI Procedure)</i></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |



## push



|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | push;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Hierarchy Level</b>          | [edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <a href="#">input-vlan-map</a> ],<br>[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <a href="#">output-vlan-map</a> ],<br>[edit logical-systems <i>logical-system-name</i> interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <a href="#">input-vlan-map</a> ],<br>[edit logical-systems <i>logical-system-name</i> interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <a href="#">output-vlan-map</a> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.<br>Statement introduced in Junos OS Release 12.3R2 for EX Series switches.<br>Statement introduced in Junos OS Release 13.2X51-D20 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b>              | <p> <b>NOTE:</b> On EX4300 switches, <b>push</b> is not supported at the [edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <a href="#">output-vlan-map</a>] hierarchy level.</p> <p>Specify the VLAN rewrite operation to add a new VLAN tag to the top of the VLAN stack. An outer VLAN tag is pushed in front of the existing VLAN tag.</p> <p>You can use this statement on Gigabit Ethernet IQ and 10-Gigabit Ethernet IQ2 and IQ2-E interfaces; 10-Gigabit Ethernet LAN/WAN PIC; aggregated Ethernet interfaces using Gigabit Ethernet IQ interfaces; 100-Gigabit Ethernet Type 5 PIC with CFP; and Gigabit Ethernet, 10-Gigabit Ethernet, 40-Gigabit Ethernet, and aggregated Ethernet interfaces.</p> <p>If you include the <b>push</b> statement in the configuration, you must also include the <a href="#">pop</a> statement at the [edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <a href="#">output-vlan-map</a>] hierarchy level.</p> |
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>Stacking a VLAN Tag</li> <li>Configuring Q-in-Q Tunneling (CLI Procedure)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## swap

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | swap;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Hierarchy Level</b>          | [edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <b>input-vlan-map</b> ],<br>[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <b>output-vlan-map</b> ],<br>[edit logical-systems <i>logical-system-name</i> interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <b>input-vlan-map</b> ],<br>[edit logical-systems <i>logical-system-name</i> interfaces <i>interface-name</i> unit <i>logical-unit-number</i> <b>output-vlan-map</b> ]                                                                                                  |
| <b>Release Information</b>      | Statement introduced before Junos OS Release 7.4.<br>Statement introduced in Junos OS Release 12.3R2 for EX Series switches.<br>Statement introduced in Junos OS Release 13.2X51-D20 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b>              | <p>Specify the VLAN rewrite operation to replace a VLAN tag. The outer VLAN tag of the frame is overwritten with the user-specified VLAN tag information.</p> <p>On MX Series routers, you can enter this statement on Gigabit Ethernet IQ and 10-Gigabit Ethernet IQ2 and IQ2-E interfaces, 10-Gigabit Ethernet LAN/WAN PIC, aggregated Ethernet using Gigabit Ethernet IQ interfaces, and 100-Gigabit Ethernet Type 5 PIC with CFP. On EX Series switches, you can enter this statement on Gigabit Ethernet, 10-Gigabit Ethernet, 40-Gigabit Ethernet, and aggregated Ethernet interfaces.</p> |
| <b>Required Privilege Level</b> | interface—To view this statement in the configuration.<br>interface-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>Rewriting the VLAN Tag on Tagged Frames</i></li><li>• <i>Configuring Q-in-Q Tunneling (CLI Procedure)</i></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## vlan-id-list

|                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                                                                                                                                                                                                                               | <code>vlan-id-list [ <i>vlan-id-numbers</i> ];</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Hierarchy Level</b>                                                                                                                                                                                                                      | <p>[edit bridge-domains <i>bridge-domain-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> bridge-domains <i>bridge-domain-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i>],</p> <p>[edit interfaces <i>interface-name</i> unit 0],</p> <p>[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i>],</p> <p>[edit vlans <i>vlan-name</i>]</p>                                                                                                                                                                                                                                       |
| <b>Release Information</b>                                                                                                                                                                                                                  | <p>Statement introduced in Junos OS Release 9.4.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p> <p>Statement introduced in Junos OS Release 12.3R2 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 13.2 for the QFX Series.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b>                                                                                                                                                                                                                          | <p>Specify a VLAN identifier list to use for a bridge domain or VLAN in trunk mode.</p> <p>Specify the <b>trunk</b> option in the <b>interface-mode</b> statement to accept packets with a VLAN ID that matches the list of VLAN IDs specified in the <b>vlan-id-list</b> statement to forward the packet within the bridge domain or VLAN configured with the matching VLAN ID. Specify the <b>access</b> option to accept packets with no VLAN ID to forward the packet within the bridge domain or VLAN configured with the VLAN ID that matches the VLAN ID specified in the <b>vlan-id</b> statement.</p> <p>This statement also enables you to bind a logical interface to a list of VLAN IDs, thereby configuring the logical interface to receive and forward a frame with a tag that matches the specified VLAN ID list.</p> |
| <div>  <p><b>WARNING:</b> On some EX and QFX Series switches, you can apply no more than eight VLAN identifier lists to a physical interface.</p> </div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Options</b>                                                                                                                                                                                                                              | <p><b><i>vlan-id-numbers</i></b>—Valid VLAN identifiers. You can combine individual numbers with range lists by including a hyphen.</p> <p><b>Range:</b> 0 through 4095</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <div>  <p><b>NOTE:</b> On EX Series switches and the QFX Series, the range is 0 through 4094.</p> </div>                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Required Privilege Level</b>                                                                                                                                                                                                             | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

- Related Documentation**
- *Configuring a Bridge Domain*
  - *Configuring a VLAN*
  - *Configuring VLAN Identifiers for Bridge Domains and VPLS Routing Instances*
  - *Configuring VLAN Identifiers for VLANs and VPLS Routing Instances*

## CHAPTER 18

# Configuration Statements (Spanning Tree Protocols)

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## alarm (STP)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>alarm;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp interface</a> (all   <i>interface-name</i> ) <a href="#">bpdu-timeout-action</a> ],<br>[edit protocols <a href="#">rstp interface</a> (all   <i>interface-name</i> ) <a href="#">bpdu-timeout-action</a> ],<br>[edit protocols <a href="#">stp interface</a> (all   <i>interface-name</i> ) <a href="#">bpdu-timeout-action</a> ],<br>[edit protocols <a href="#">vstp vlan</a> <i>vlan-id</i> <a href="#">interface</a> (all   <i>interface-name</i> ) <a href="#">bpdu-timeout-action</a> ]                                                                                                                                                                                      |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b>              | For interfaces configured for loop protection, configure the software to generate a message to be sent to the system log file to record the loop-protection event.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP</a> on page 126</li><li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP</a> on page 149</li><li>• <a href="#">Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree</a> on page 117</li><li>• <a href="#">Understanding Loop Protection for STP, RSTP, VSTP, and MSTP</a> on page 108</li><li>• <a href="#">Understanding VSTP</a> on page 106</li><li>• <a href="#">show spanning-tree bridge</a> on page 322</li><li>• <a href="#">show spanning-tree interface</a></li></ul> |

## block

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | block;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Hierarchy Level</b>          | [edit protocols mstp (Spanning Trees) <a href="#">interface</a> (all   <i>interface-name</i> ) <a href="#">bpdu-timeout-action</a> ],<br>[edit protocols <a href="#">rstp interface</a> (all   <i>interface-name</i> ) <a href="#">bpdu-timeout-action</a> ],<br>[edit protocols <a href="#">stp interface</a> (all   <i>interface-name</i> ) <a href="#">bpdu-timeout-action</a> ],<br>[edit protocols <a href="#">vstp vlan <i>vlan-id</i> interface</a> (all   <i>interface-name</i> ) <a href="#">bpdu-timeout-action</a> ]                                                                                                                                                                                             |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Description</b>              | Configure loop protection on a specific interface.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li> <li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li> <li>• <a href="#">Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on page 117</a></li> <li>• <a href="#">Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on page 108</a></li> <li>• <a href="#">Understanding VSTP on page 106</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface</a></li> </ul> |

## bpdu-block

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**Syntax**    `bpdu-block {  
              interface (all | [interface-name]);  
              disable-timeout timeout;  
          }`

- Hierarchy Level**
- For platforms with ELS CLI:  
    [\[edit protocols layer2-control\]](#)
  - For platforms with Original CLI:  
    [\[edit ethernet-switching-options\]](#)

**Release Information**    Statement introduced in Junos OS Release 11.1 for the QFX Series.

**Description**    Configure BPDU protection on an interface. If the interface receives BPDUs, it is disabled.



**NOTE:** BPDU block protection is disabled on Node devices.

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The statements are explained separately.

**Required Privilege Level**    routing—To view this statement in the configuration.  
                                  routing-control—To add this statement to the configuration.

- Related Documentation**
- [Example: Configuring Network Regions for VLANs with MSTP on page 126](#)
  - [Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149](#)
  - [Unblocking an Interface That Receives BPDUs in Error on page 112](#)
  - [clear bpdu-error on page 320](#)
  - [show spanning-tree bridge on page 322](#)
  - [show spanning-tree interface](#)



## bpdu-block-on-edge

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | bpdu-block-on-edge;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp</a> ],<br>[edit protocols <a href="#">rstp</a> ],<br>[edit protocols <a href="#">vstp</a> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b>              | Configure bridge protocol data unit (BPDU) protection on all edge ports of a switch.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Understanding VSTP on page 106</a></li><li>• <a href="#">Example: Configuring BPDU Protection on STP Interfaces to Prevent STP Miscalculations on page 113</a></li><li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li><li>• <a href="#">clear bpdu-error on page 320</a></li><li>• <a href="#">show spanning-tree bridge on page 322</a></li><li>• <a href="#">show spanning-tree interface</a></li></ul> |

## bpdu-timeout-action

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>bpdu-timeout-action {<br/>    alarm;<br/>    block;<br/>}</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">rstp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">stp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">vstp vlan <i>vlan-id</i> interface</a> (all   <i>interface-name</i> )]                                                                                                                                                                                                                                                                                                                                                          |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Description</b>              | <p>Configure the BPDU timeout action on a specific interface. You must configure at least one action (<b>alarm</b>, <b>block</b>, or both).</p> <p>The remaining statements are explained separately.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li><li>• <a href="#">Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on page 117</a></li><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li><li>• <a href="#">Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on page 108</a></li><li>• <a href="#">Understanding VSTP on page 106</a></li><li>• <a href="#">show spanning-tree bridge on page 322</a></li><li>• <a href="#">show spanning-tree interface</a></li></ul> |

## bridge-priority

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>bridge-priority <i>priority</i>;</code>                                                                                                                                                                                                                                                                                                                                         |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp</a> ],<br>[edit protocols <a href="#">mstp</a> <i>msti-id</i> ],<br>[edit protocols <a href="#">rstp</a> ],<br>[edit protocols <a href="#">stp</a> ],<br>[edit protocols <a href="#">vstp</a> <i>vlan</i> <i>vlan-id</i> ]                                                                                                                           |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>              | Configure the bridge priority. The bridge priority determines which bridge is elected as the root bridge. If two bridges have the same path cost to the root bridge, the bridge priority determines which bridge becomes the designated bridge for a LAN segment.                                                                                                                     |
| <b>Options</b>                  | <b><i>priority</i></b> —Bridge priority. It can be set only in increments of 4096.<br><b>Range:</b> 0 through 61,440<br><b>Default:</b> 32,768                                                                                                                                                                                                                                        |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li> <li>• <a href="#">Understanding MSTP on page 104</a></li> <li>• <a href="#">Understanding VSTP on page 106</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface</a></li> </ul> |

## configuration-name (MSTP)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | configuration-name <i>configuration-name</i> ;                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp</a> ]                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>              | Specify the configuration name. The configuration name is the MSTP region name carried in the MSTP BPDUs.                                                                                                                                                                                                                                                                                                                             |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li><li>• <a href="#">Understanding MSTP on page 104</a></li><li>• <a href="#">show spanning-tree bridge on page 322</a></li><li>• <i>show spanning-tree interface</i></li></ul> |

## cost (STP)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>cost cost;</code>                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">mstp msti msti-id interface interface-name</a> ],<br>[edit protocols rstp (Spanning Trees) <a href="#">interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">stp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">vstp vlan vlan-id interface</a> (all   <i>interface-name</i> )] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>              | For Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), or Multiple Spanning Tree Protocol (MSTP), configure the link cost to control which bridge is the designated bridge and which interface is the designated interface.                                                                                                                                                                       |
| <b>Default</b>                  | Link cost is determined by the link speed.                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Options</b>                  | <b>cost</b> —Link cost associated with the port.<br><b>Range:</b> 1 through 200,000,000                                                                                                                                                                                                                                                                                                                                                               |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Understanding MSTP on page 104</a></li> <li>• <a href="#">Overview of Spanning-Tree Protocols on page 103</a></li> <li>• <a href="#">Understanding VSTP on page 106</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface</a></li> </ul>                                                                                      |

## disable (STP)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | disable;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp</a> ],<br>[edit protocols <a href="#">mstp</a> <a href="#">interface</a> <i>interface-name</i> ],<br>[edit protocols <a href="#">mstp</a> <a href="#">msti</a> <i>msti-id</i> <a href="#">vlan</a> ( <i>vlan-id</i>   <i>vlan-name</i> ) <a href="#">interface</a> <i>interface-name</i> ],<br>[edit protocols <a href="#">rstp</a> ],<br>[edit protocols <a href="#">rstp</a> <a href="#">interface</a> <i>interface-name</i> ],<br>[edit protocols <a href="#">stp</a> ],<br>[edit protocols <a href="#">stp</a> <a href="#">interface</a> <i>interface-name</i> ],<br>[edit protocols <a href="#">vstp</a> ],<br>[edit protocols <a href="#">vstp</a> <a href="#">vlan</a> <i>vlan-id</i> <a href="#">interface</a> (all   <i>interface-name</i> )] |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Description</b>              | Disable STP, MSTP, RSTP, or VSTP on the switch or on a specific interface.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li><li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li><li>• <a href="#">Understanding MSTP on page 104</a></li><li>• <a href="#">Overview of Spanning-Tree Protocols on page 103</a></li><li>• <a href="#">Understanding VSTP on page 106</a></li><li>• <a href="#">show spanning-tree bridge on page 322</a></li><li>• <a href="#">show spanning-tree interface</a></li></ul>                                                                                                                                                                                                       |

## disable-timeout (BPDU)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>disable-timeout <i>timeout</i>;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Hierarchy Level</b>          | [edit ethernet-switching-options <a href="#">bpdu-block</a> ]<br>[edit protocols layer2-control <a href="#">bpdu-block</a> ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b>              | For interfaces configured for BPDU protection, specify the amount of time an interface receiving BPDUs is disabled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Default</b>                  | The disable timeout is not enabled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Options</b>                  | <b><i>timeout</i>:</b> Length of time, in seconds, that the interface receiving BPDUs is disabled. Once the timeout expires, the interface is brought back into service.<br><b>Range:</b> 10 through 3600 seconds                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li> <li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li> <li>• <a href="#">Example: Configuring BPDU Protection on STP Interfaces to Prevent STP Miscalculations on page 113</a></li> <li>• <a href="#">Understanding BPDU Protection for STP, RSTP, and MSTP on page 107</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface on page 327</a></li> </ul> |

## edge (STP)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | edge;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">mstp msti</a> <i>msti-id</i> <a href="#">interface</a> <i>interface-name</i> ],<br>[edit protocols <a href="#">rstp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">stp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">vstp vlan</a> <i>vlan-id</i> <a href="#">interface</a> (all   <i>interface-name</i> )]                                                                                         |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Description</b>              | For Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), or Multiple Spanning Tree Protocol (MSTP), configure interfaces as edge interfaces. Edge interfaces immediately transition to a forwarding state.                                                                                                                                                                                                                                                                                                                      |
| <b>Default</b>                  | Edge interfaces are not enabled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li><li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li><li>• <a href="#">Understanding MSTP on page 104</a></li><li>• <a href="#">Overview of Spanning-Tree Protocols on page 103</a></li><li>• <a href="#">Understanding VSTP on page 106</a></li><li>• <a href="#">show spanning-tree bridge on page 322</a></li><li>• <a href="#">show spanning-tree interface</a></li></ul> |



## forward-delay

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>forward-delay <i>seconds</i>;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp</a> ],<br>[edit protocols <a href="#">rstp</a> ],<br>[edit protocols <a href="#">stp</a> ],<br>[edit protocols <a href="#">vstp</a> <a href="#">vlan</a> <i>vlan-id</i> ]                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b>              | For Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), or Multiple Spanning Tree Protocol (MSTP), specify how long a bridge interface remains in the listening and learning states before transitioning to the forwarding state.                                                                                                                                                                                                                                                                                                      |
| <b>Options</b>                  | <p><b><i>seconds</i></b>—Number of seconds the bridge interface remains in the listening and learning states.</p> <p><b>Range:</b> 4 through 30 seconds</p> <p><b>Default:</b> 15 seconds</p>                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li> <li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li> <li>• <a href="#">Understanding MSTP on page 104</a></li> <li>• <a href="#">Overview of Spanning-Tree Protocols on page 103</a></li> <li>• <a href="#">Understanding VSTP on page 106</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface</a></li> </ul> |

## force-version

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|                                 |                                                                                                                                                                                                                |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | force-version stp;                                                                                                                                                                                             |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">vstp</a> ]                                                                                                                                                                         |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                              |
| <b>Description</b>              | Force VLAN Spanning Tree Protocol (VSTP) to use the STP protocol instead of the default protocol, RSTP.                                                                                                        |
| <b>Options</b>                  | <b>stp</b> —Spanning Tree Protocol                                                                                                                                                                             |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                            |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">show spanning-tree bridge on page 322</a></li><li>• <i>show spanning-tree interface</i></li><li>• <a href="#">Understanding VSTP on page 106</a></li></ul> |

## hello-time

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>hello-time <i>seconds</i>;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp</a> ],<br>[edit protocols <a href="#">rstp</a> ],<br>[edit protocols <a href="#">rstp</a> ],<br>[edit protocols <a href="#">vstp</a> <a href="#">vlan</a> <i>vlan-id</i> ]                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b>              | For Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), or Multiple Spanning Tree Protocol (MSTP), specify the time interval at which the root bridge transmits configuration BPDUs.                                                                                                                                                                                                                                                                                                                                                   |
| <b>Options</b>                  | <b><i>seconds</i></b> —Number of seconds between transmissions of configuration BPDUs.<br><b>Range:</b> 1 through 10 seconds<br><b>Default:</b> 2 seconds                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Required Privilege Level</b> | <b>routing</b> —To view this statement in the configuration.<br><b>routing-control</b> —To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li> <li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li> <li>• <a href="#">Understanding MSTP on page 104</a></li> <li>• <a href="#">Overview of Spanning-Tree Protocols on page 103</a></li> <li>• <a href="#">Understanding VSTP on page 106</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface</a></li> </ul> |

## interface (Spanning Trees)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>interface <i>interface-name</i> {<br/>    arp-on-stp;<br/>    bpdu-timeout-action<br/>        block;<br/>        log;<br/>    cost <i>cost</i>;<br/>    disable;<br/>    edge;<br/>    mode <i>mode</i>;<br/>    no-root-port;<br/>    priority <i>priority</i>;<br/>}</pre>                                                                                                                                                                                                                           |
| <b>Hierarchy Level</b>          | <pre>[edit protocols mstp],<br/>[edit protocols mstp msti <i>msti-id</i>],<br/>[edit protocols rstp],<br/>[edit protocols stp],<br/>[edit protocols vstp vlan (all   <i>vlan-id</i>   <i>vlan-name</i>)]</pre>                                                                                                                                                                                                                                                                                              |
| <b>Release Information</b>      | <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.</p> <p>Statement introduced in Junos OS Release 11.1 for the QFX Series.</p>                                                                                                                                                                                                                                                           |
| <b>Description</b>              | <p>For Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), or Multiple Spanning Tree Protocol (MSTP), configure an interface.</p> <p>The <b>edge</b>, <b>mode</b>, and <b>no-root-port</b> options are not available at the <code>[edit protocols mstp msti <i>msti-id</i>]</code> hierarchy level.</p>                                                                                                                                                  |
| <b>Options</b>                  | <p><b><i>interface-name</i></b>—Name of an interface.</p> <p>The remaining statements are explained separately.</p>                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">show spanning-tree bridge</a></li><li>• <a href="#">show spanning-tree interface</a></li><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches</a></li><li>• <a href="#">Example: Faster Convergence and Improved Network Stability with RSTP on EX Series Switches</a></li><li>• <a href="#">Configuring VSTP (CLI Procedure)</a></li><li>• <a href="#">show spanning-tree bridge on page 322</a></li></ul> |

## interface (BPDU)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>interface</code> (all   [ <i>interface-name</i> ]) {<br>drop;<br>}                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Hierarchy Level</b>          | <ul style="list-style-type: none"> <li>For platforms with ELS CLI:<br/>    [edit protocols layer2-control]</li> <li>For platforms with Original CLI:<br/>    [edit ethernet-switching-options]</li> </ul>                                                                                                                                                                                                                                                                                 |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Description</b>              | Apply BPDU protection to all interfaces or one or more interfaces.                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Options</b>                  | <p><b>all</b>—All interfaces.</p> <p><b><i>interface-name</i></b>—Name of the interface.</p> <p><b>drop</b>—Drops xSTP BPDUs.</p>                                                                                                                                                                                                                                                                                                                                                         |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                            |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li><a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li> <li><a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li> <li><a href="#">Understanding BPDU Protection for STP, RSTP, and MSTP on page 107</a></li> <li><a href="#">show spanning-tree bridge on page 322</a></li> <li><a href="#">show spanning-tree interface on page 327</a></li> </ul> |

## interface (STP)

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>interface <i>interface-name</i> {<br/>    disable;<br/>    cost <i>cost</i>;<br/>    edge;<br/>    mode <i>mode</i>;<br/>    no-root-port;<br/>    priority <i>priority</i>;<br/>}</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp</a> ],<br>[edit protocols <a href="#">mstp msti</a> ],<br>[edit protocols <a href="#">rstp</a> ],<br>[edit protocols <a href="#">stp</a> ],<br>[edit protocols <a href="#">vstp vlan</a> <i>vlan-id</i> ]                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b>              | For Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), or Multiple Spanning Tree Protocol (MSTP), configure an interface.                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Options</b>                  | <p><i>interface-name</i>—Name of a Gigabit Ethernet interface.</p> <p>The remaining statements are explained separately.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li><li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li><li>• <a href="#">Understanding RSTP on page 105</a></li><li>• <a href="#">Understanding MSTP on page 104</a></li><li>• <a href="#">Overview of Spanning-Tree Protocols on page 103</a></li><li>• <a href="#">Understanding VSTP on page 106</a></li><li>• <a href="#">show spanning-tree bridge on page 322</a></li><li>• <a href="#">show spanning-tree interface</a></li></ul> |

## max-age

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>max-age <i>seconds</i>;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp</a> ],<br>[edit protocols <a href="#">rstp</a> ],<br>[edit protocols <a href="#">stp</a> ],<br>[edit protocols <a href="#">vstp</a> <a href="#">vlan</a> <i>vlan-id</i> ]                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>              | For Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), or Multiple Spanning Tree Protocol (MSTP), specify the maximum age of received protocol BPDUs.                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Options</b>                  | <b><i>seconds</i></b> —Maximum age of received protocol BPDUs.<br><b>Range:</b> 6 through 40 seconds<br><b>Default:</b> 20 seconds                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Required Privilege Level</b> | <b>routing</b> —To view this statement in the configuration.<br><b>routing-control</b> —To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li> <li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li> <li>• <a href="#">Understanding MSTP on page 104</a></li> <li>• <a href="#">Overview of Spanning-Tree Protocols on page 103</a></li> <li>• <a href="#">Understanding VSTP on page 106</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface on page 327</a></li> </ul> |

## max-hops

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|                                 |                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>max-hops hops;</code>                                                                                                                                                                                                                                                                                                        |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp</a> ]                                                                                                                                                                                                                                                                                             |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                  |
| <b>Description</b>              | For Multiple Spanning Tree Protocol (MSTP), configure the maximum number of hops that a BPDU can be forwarded in the MSTP region.                                                                                                                                                                                                  |
| <b>Options</b>                  | <p><i>hops</i> — Number of hops the BPDU can be forwarded.</p> <p><b>Range:</b> 1 through 255 hops</p> <p><b>Default:</b> 20 hops</p>                                                                                                                                                                                              |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                     |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li><li>• <a href="#">Understanding MSTP on page 104</a></li><li>• <a href="#">show spanning-tree bridge on page 322</a></li><li>• <a href="#">show spanning-tree interface on page 327</a></li></ul> |



## mode (STP)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>mode mode;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">mstp msti msti-id interface interface-name</a> ],<br>[edit protocols <a href="#">rstp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">stp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">vstp vlan vlan-id interface</a> (all   <i>interface-name</i> )]                                                                                                                                                                  |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>              | For Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), or Multiple Spanning Tree Protocol (MSTP), configure the link mode to identify point-to-point links.                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Default</b>                  | For a full-duplex link, the default link mode is <b>point-to-point</b> . For a half-duplex link, the default link mode is <b>shared</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Options</b>                  | <i>mode</i> —Link mode: <ul style="list-style-type: none"> <li>• <b>point-to-point</b>—Link is point to point.</li> <li>• <b>shared</b>—Link is shared media.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li> <li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li> <li>• <a href="#">Understanding MSTP on page 104</a></li> <li>• <a href="#">Overview of Spanning-Tree Protocols on page 103</a></li> <li>• <a href="#">Understanding VSTP on page 106</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface on page 327</a></li> </ul> |

## msti

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|                                 |                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre>msti <i>msti-id</i> {<br/>    vlan (<i>vlan-id</i>   <i>vlan-name</i>);<br/>    interface <i>interface-name</i> {<br/>        disable;<br/>        cost <i>cost</i>;<br/>        edge;<br/>        mode <i>mode</i>;<br/>        priority <i>priority</i>;<br/>    }<br/>}</pre>                                              |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp</a> ]                                                                                                                                                                                                                                                                                             |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                  |
| <b>Description</b>              | Configure the Multiple Spanning Tree Instance (MSTI) identifier for Multiple Spanning Tree Protocol (MSTP). MSTI IDs are local to each region, so you can reuse the same MSTI ID in different regions.                                                                                                                             |
| <b>Default</b>                  | MSTI is disabled.                                                                                                                                                                                                                                                                                                                  |
| <b>Options</b>                  | <p><i>msti-id</i> —MSTI identifier.</p> <p><b>Range:</b> 1 through 4094. The Common Instance Spanning Tree (CIST) is always MSTI 0.</p> <p>The remaining statements are explained separately.</p>                                                                                                                                  |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                     |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">show spanning-tree bridge on page 322</a></li><li>• <a href="#">show spanning-tree interface on page 327</a></li><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li><li>• <a href="#">Understanding MSTP on page 104</a></li></ul> |

## mstp

```

Syntax mstp {
 disable;
 bpdu-timeout-action;
 bridge-priority priority;
 configuration-name (MSTP) name;
 forward-delay seconds;
 hello-time seconds;
 interface (all | interface-name) {
 bpdu-timeout-action {
 block;
 alarm;
 }
 disable;
 cost cost;
 edge;
 mode mode;
 no-root-port;
 priority priority;
 }
 max-age seconds;
 max-hops hops;
 msti msti-id {
 vlan (vlan-id | vlan-name);
 interface interface-name {
 disable;
 cost cost;
 edge;
 mode mode;
 priority priority;
 }
 }
 traceoptions {
 file name <replace> <size size> <files number> <no-stamp>
 <(world-readable | no-world-readable)>;
 flag flag <flag-modifier> <disable>;
 }
 revision-level revision-level;
 }

```

**Hierarchy Level** [edit protocols]

**Release Information** Statement introduced in Junos OS Release 11.1 for the QFX Series.

**Description** Configure Multiple Spanning Tree Protocol (MSTP). MSTP is defined in the IEEE 802.1Q-2003 specification and is used to create a loop-free topology in networks with multiple spanning-tree regions.

The statements are explained separately.

**Default** MSTP is disabled.

|                                 |                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li><li>• <a href="#">Understanding MSTP on page 104</a></li><li>• <a href="#">show spanning-tree bridge on page 322</a></li><li>• <a href="#">show spanning-tree interface on page 327</a></li></ul> |

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## no-root-port

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|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | no-root-port;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">rstp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">stp interface</a> (all   <i>interface-name</i> )],<br>[edit protocols <a href="#">vstp vlan</a> <i>vlan-id</i> <a href="#">interface</a> (all   <i>interface-name</i> )]                                                                                                                                                                                                               |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Description</b>              | Configure an interface to be a spanning tree designated port. If the bridge receives more STP bridge protocol data units (BPDUs) on a root-protected interface, that interface transitions to a root-prevented STP state (inconsistency state) and the interface is blocked. This blocking prevents a bridge that should not be the root bridge from being elected the root bridge. When the bridge stops receiving more STP BPDUs on the root-protected interface, interface traffic is no longer blocked.                                                                              |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on page 121</a></li><li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li><li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li><li>• <a href="#">Understanding VSTP on page 106</a></li><li>• <a href="#">show spanning-tree bridge on page 322</a></li><li>• <a href="#">show spanning-tree interface on page 327</a></li></ul> |

## priority (STP)

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>priority <i>priority</i>;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Hierarchy Level</b>          | [edit protocols <code>mstp interface</code> (all   <i>interface-name</i> )],<br>[edit protocols <code>mstp msti msti-id interface interface-name</code> ],<br>[edit protocols <code>rstp interface</code> (all   <i>interface-name</i> )],<br>[edit protocols <code>stp interface</code> (all   <i>interface-name</i> )],<br>[edit protocols <code>vstp vlan vlan-id interface</code> (all   <i>interface-name</i> )]                                                                                                                                                                                 |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Description</b>              | For Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), or Multiple Spanning Tree Protocol (MSTP), specify the interface priority to control which interface is elected as the root port.                                                                                                                                                                                                                                                                                                                                                          |
| <b>Options</b>                  | <b>priority</b> —Interface priority. The interface priority must be set in increments of 16.<br><b>Range:</b> 0 through 240<br><b>Default:</b> 128                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li> <li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li> <li>• <a href="#">Understanding MSTP on page 104</a></li> <li>• <a href="#">Overview of Spanning-Tree Protocols on page 103</a></li> <li>• <a href="#">Understanding VSTP on page 106</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface on page 327</a></li> </ul> |

## protocols

```
Syntax protocols {
 bgp {
 disable;
 accept-remote-nexthop;
 advertise-external <conditional>;
 advertise-inactive;
 (advertise-peer-as | no-advertise-peer-as);
 authentication-algorithm (aes-128-cmac-96 | hmac-sha-1-96 | md5);
 authentication-key key;
 authentication-key-chain key-chain;
 bfd-liveness-detection {
 authentication {
 algorithm (keyed-md5 | keyed-sha-1 | meticulous-keyed-md5 |
 meticulous-keyed-sha-1 | simple-password);
 key-chain key-chain-name;
 loose-check;
 }
 detection-time {
 threshold milliseconds;
 }
 hold-down-interval milliseconds;
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 session-mode (automatic | multihop | single-hop);
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 version (1 | automatic);
 }
 cluster cluster-identifier;
 damping;
 description text-description;
 export [policy-names];
 family family-name {
 ... the family subhierarchies appear after the main [edit protocols bgp] hierarchy ...
 }
 graceful-restart {
 disable;
 restart-time seconds;
 stale-routes-time seconds;
 }
 group group-name {
 ... the group subhierarchy appears after the main [edit protocols bgp] hierarchy ...
 }
 hold-time seconds;
 import [policy-names];
 include-mp-next-hop;
 keep (all | none);
 local-address address;
 }
}
```

```

local-as autonomous-system <loops number> < alias> <private>;
local-preference local-preference;
log-updown;
metric-out (metric | igp (delay-med-update | offset) | minimum-igp offset);
mtu-discovery;
multihop {
 no-nexthop-change;
 ttl tll-value;
}
no-aggregator-id;
no-client-reflect;
out-delay seconds;
outbound-route-filter {
 bgp-orf-cisco-mode;
 prefix-based {
 accept {
 inet;
 inet6;
 }
 }
}
passive;
path-selection {
 always-compare-med;
 as-path-ignore;
 cisco-non-deterministic;
 external-router-id;
 med-plus-igp {
 igp-multiplier number;
 med-multiplier number;
 }
}
peer-as autonomous-system;
preference preference;
remove-private;
tcp-mss segment-size;
traceoptions {
 file filename <files number> <size maximum-file-size> <world-readable |
 no-world-readable>;
 flag flag <flag-modifier> <disable>;
}
}
dcbx {
 disable;
 interface (interface-name | all) {
 disable;
 application-map application-map-name;
 applications {
 no-auto-negotiation;
 }
 enhanced-transmission-selection {
 no-auto-negotiation;
 no-recommendation-tlv;
 recommendation-tlv {
 no-auto-negotiation;
 }
 }
 }
}

```

```

 }
 dcbx-version (auto-negotiate | ieee-dcbx | dcbx-version-1.01);
 priority-flow-control {
 no-auto-negotiation;
 }
}
}
iccp {
 authentication-key string;
 local-ip-addr local-ip-addr;
 peer ip-address {
 authentication-key string;
 backup-liveness-detection {
 backup-peer-ip ip-address;
 }
 liveness-detection {
 detection-time {
 threshold milliseconds;
 }
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 version (Liveness Detection) (1 | automatic);
 }
 local-ip-addr ipv4-address;
 session-establishment-hold-time seconds;
 }
 session-establishment-hold-time seconds;
 traceoptions {
 file <filename> <files number> <match regular-expression> <microsecond-stamp>
 <size size> <world-readable | no-world-readable>;
 flag flag;
 no-remote-trace;
 }
}
igmp-snooping {
 traceoptions {
 file filename <files number> <size size> <world-readable | no-world-readable> <match
 regex>;
 flag flag (detail | disable | receive | send);
 }
}
vlan vlan-name {
 disable;
}
interface interface-name {
 group-limit limit;
 multicast-router-interface;
 static {
 group ip-address;
 }
}
}

```



```

 robust-count number;
 }
}
isis {
 disable;
 export [policy-names];
 ignore-attached-bit;
 interface interface-name {
 bfd-liveness-detection {
 authentication {
 algorithm (keyed-md5 | keyed-sha-1 | meticulous-keyed-md5 |
 meticulous-keyed-sha-1 | simple-password);
 key-chain key-chain-name;
 loose-check;
 }
 detection-time {
 threshold milliseconds;
 }
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 }
 version (1 | automatic);
 }
 checksum;
 csnp-interval (seconds | disable);
 disable;
 hello-padding (adaptive | loose | strict);
 level (1 | 2) {
 disable;
 hello-authentication-key key;
 hello-authentication-type authentication;
 hello-interval seconds;
 hold-time seconds;
 ipv4-multicast-metric number;
 metric metric;
 passive;
 priority number;
 }
 lsp-interval milliseconds;
 mesh-group (value | blocked);
 no-ipv4-multicast;
 no-unicast-topology;
 passive;
 point-to-point;
}
level (1 | 2) {
 disable;
 authentication-key key;
 authentication-type authentication;
 external-preference preference;
 no-csnp-authentication;
}

```

```

 no-hello-authentication;
 no-psnp-authentication;
 preference preference;
 prefix-export-limit number;
 wide-metrics-only;
}
loose-authentication-check;
lsp-lifetime seconds;
max-areas number;
no-adjacency-holddown;
no-authentication-check;
no-ipv4-routing;
overload {
 advertise-high-metrics;
 timeout seconds;
}
reference-bandwidth reference-bandwidth;
rib-group {
 inet group-name;
}
topologies {
 ipv4-multicast;
}
traceoptions {
 file filename <files number> <size maximum-file-size> <world-readable |
 no-world-readable>;
 flag flag <flag-modifier> <disable>;
}
traffic-engineering {
 disable;
 family inet {
 shortcuts {
 multicast-rpf-routes;
 }
 }
}
}
lldp {
 disable;
 advertisement-interval seconds;
 hold-multiplier number;
 interface (LLDP) (all | interface-name) {
 disable;
 }
 traceoptions {
 file filename <files number> <size size> <world-readable | no-world-readable> <match
 regex>;
 flag flag (detail | disable | receive | send);
 }
}
mstp {
 disable;
 bpdu-timeout-action;
 bridge-priority priority;
 configuration-name name;
 forward-delay seconds;

```

```

hello-time seconds;
interface (all | interface-name) {
 disable;
 bpdu-timeout-action {
 block;
 alarm;
 }
 cost cost;
 edge;
 mode mode;
 no-root-port;
 priority priority;
}
max-age seconds;
max-hops hops;
msti msti-id {
 vlan (vlan-id | vlan-name);
 interface interface-name {
 disable;
 cost cost;
 edge;
 mode mode;
 priority priority;
 }
}
revision-level revision-level;
traceoptions {
 file filename <files number > <size size > <no-stamp | world-readable |
 no-world-readable>;
 flag flag;
}
}
ospf {
 disable;
 area area-id {
 area-range ip-prefix </prefix-length> <exact> <override-metric metric> <restrict>;
 context-identifier identifier
 interface interface-name {
 disable;
 authentication {
 md5 key-id key key-string <start-time YYYY-MM-DD.hh:mm>;
 simple-password key-string;
 }
 bandwidth-based-metrics {
 bandwidth value metric number;
 }
 bfd-liveness-detection {
 authentication {
 algorithm (keyed-md5 | keyed-sha-1 | meticulous-keyed-md5 |
 meticulous-keyed-sha-1 | simple-password);
 key-chain key-chain-name;
 loose-check;
 }
 detection-time {
 threshold milliseconds;
 }
 }
 }
 }
}

```

```

 full-neighbors-only;
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 version (1 | automatic);
}
dead-interval seconds;
dynamic-neighbors;
flood-reduction;
hello-interval seconds;
interface-type (nbma | p2mp | p2p);
metric metric;
neighbor address <eligible>;
no-eligible-backup;
no-interface-state-traps;
no-neighbor-down-notification;
passive {
 traffic-engineering {
 remote-node-id address;
 }
}
poll-interval seconds;
priority number;
retransmit-interval seconds;
secondary;
te-metric metric;
topology (name | default | ipv4-multicast) {
 disable;
 bandwidth-based-metrics {
 bandwidth value;
 metric number;
 }
 metric metric;
}
transit-delay seconds;
}
network-summary-export [policy-names];
network-summary-import [policy-names];
nssa {
 area-range ip-prefix </prefix-length> <exact> <override-metric metric> <restrict>;
 default-lsa {
 default-metric metric;
 metric-type type;
 type-7;
 }
}
(summaries | no-summaries);
}
stub <default-metric metric> <summaries | no-summaries>;
virtual-link neighbor-id router-id transit-area area-id {
 disable;
 authentication {

```

```

 md5 key-id key key-string <start-time YYYY-MM-DD.hh:mm>;
 simple-password key-string;
 }
 dead-interval seconds;
 demand-circuit;
 flood-reduction;
 hello-interval seconds;
 ipsec-sa sa-name;
 no-neighbor-down-notification;
 retransmit-interval seconds;
 topology (name | default | ipv4-multicast) {
 disable;
 metric metric;
 }
 transit-delay seconds;
}
}
database-protection {
 ignore-count number;
 ignore-time seconds;
 maximum-lsa number;
 reset-time seconds;
 warning-only;
 warning-threshold percent;
}
export [policy-names];
external-preference preference;
graceful-restart {
 disable;
 helper-disable <both | restart-signaling | standard>;
 no-strict-lsa-checking;
 notify-duration seconds;
 restart-duration seconds;
}
import [policy-names];
no-nssa-abr;
no-rfc-1583;
overload <timeout seconds>;
preference preference;
prefix-export-limit number;
reference-bandwidth reference-bandwidth;
rib-group group-name;
topology (default | ipv4-multicast | name) {
 overload;
 prefix-export-limit number;
 topology-id number;
}
}
traceoptions {
 file filename <files number> <size maximum-file-size> <world-readable |
 no-world-readable>;
 flag flag <flag-modifier> <disable>;
}
}
traffic-engineering {
 advertise-unnumbered-interfaces;
 credibility-protocol-preference;
 ignore-lsp-metrics;
}

```

```
 multicast-rpf-routes;
 no-topology;
 shortcuts <lsp-metric-into-summary>;
 }
}
pim {
 disable;
 assert-timeout seconds;
 dense-groups {
 addresses;
 }
 dr-election-on-p2p;
 export ;
 family (inet | inet6) {
 disable;
 }
 graceful-restart {
 disable;
 restart-duration seconds;
 }
 import [policy-names];
 interface interface-name {
 accept-remote-source;
 disable;
 family (inet | inet6) {
 disable;
 }
 hello-interval seconds;
 mode (dense | sparse | sparse-dense);
 neighbor-policy [policy-names];
 override-interval milliseconds;
 priority number;
 propagation-delay milliseconds;
 reset-tracking-bit;
 version version;
 }
 join-load-balance;
 join-prune-timeout;
 nonstop-routing;
 override-interval milliseconds;
 propagation-delay milliseconds;
 reset-tracking-bit;
 rib-group group-name;
 rp {
 auto-rp {
 (announce | discovery | mapping);
 (mapping-agent-election | no-mapping-agent-election);
 }
 bootstrap {
 family (inet | inet6) {
 export [policy-names];
 import [policy-names];
 priority number;
 }
 }
 }
 bootstrap-import [policy-names];
```

```

bootstrap-export [policy-names];
bootstrap-priority number;
dr-register-policy [policy-names];
embedded-rp {
 group-ranges {
 destination-ip-prefix</prefix-length>;
 }
 maximum-rps limit;
}
local {
 family (inet | inet6) {
 address address;
 anycast-pim {
 disable;
 rp-set {
 address address <forward-msdp-sa>;
 }
 local-address address;
 }
 group-ranges {
 destination-ip-prefix</prefix-length>;
 }
 hold-time seconds;
 priority number;
 }
}
rp-register-policy [policy-names];
spt-threshold {
 infinity [policy-names];
}
static {
 address address {
 group-ranges {
 version version;
 destination-ip-prefix</prefix-length>;
 }
 }
}
}
rpf-selection {
 group group-address{
 source source-address{
 next-hop next-hop-address;
 }
 wildcard-source {
 next-hop next-hop-address;
 }
 }
 prefix-list prefix-list-addresses {
 source source-address {
 next-hop next-hop-address;
 }
 wildcard-source {
 next-hop next-hop-address;
 }
 }
}

```

```
traceoptions {
 file filename <files number> <size size> <world-readable | no-world-readable>;
 flag flag <flag-modifier> <disable>;
}
tunnel-devices [mt-fpc/pic/port];
}
rip {
 authentication-key password;
 authentication-type type;
 (check-zero | no-check-zero);
 group group-name {
 bfd-liveness-detection {
 authentication {
 algorithm (keyed-md5 | keyed-sha-1 | meticulous-keyed-md5 |
 meticulous-keyed-sha-1 | simple-password);
 key-chain key-chain-name;
 loose-check;
 }
 detection-time {
 threshold milliseconds;
 }
 minimum-interval milliseconds;
 minimum-receive-interval milliseconds;
 multiplier number;
 no-adaptation;
 transmit-interval {
 minimum-interval milliseconds;
 threshold milliseconds;
 }
 version (1 | automatic);
 }
 }
 export [policy-names];
 import [policy-names];
 metric-out metric;
 neighbor neighbor-name {
 any-sender;
 authentication-key password;
 authentication-type type;
 bfd-liveness-detection {
 ... same statements as at the [edit protocols rip group group-name
 bfd-liveness-detection] hierarchy level ...
 }
 (check-zero | no-check-zero);
 import [policy-names];
 message-size number;
 metric-in metric;
 receive (both | none | version-1 | version-2);
 route-timeout seconds;
 send (broadcast | multicast | none | version-1);
 update-interval seconds;
 }
 preference preference;
 route-timeout seconds;
 update-interval seconds;
}
holddown seconds;
```



```

import [policy-names];
message-size number;
metric-in metric;
receive (both | none | version-1 | version-2);
rib-group group-name;
route-timeout seconds;
send (broadcast | multicast | none | version-1);
traceoptions {
 file filename <files number> <size maximum-file-size> <world-readable |
 no-world-readable>;
 flag flag <flag-modifier> <disable>;
}
update-interval seconds;
}
rstp {
 disable;
 bpdu-block-on-edge;
 bridge-priority priority;
 forward-delay seconds;
 hello-time seconds;
 interface (all | interface-name) {
 disable;
 bpdu-timeout-action {
 alarm;
 block;
 }
 cost cost;
 edge;
 mode mode;
 no-root-port;
 priority priority;
 }
 max-age seconds;
}
traceoptions {
 file filename <files number> <size size> <no-stamp> <world-readable |
 no-world-readable>;
 flag flag;
}
}
stp {
 disable;
 bridge-priority priority;
 forward-delay seconds;
 hello-time seconds;
 interface (all | interface-name) {
 disable;
 bpdu-timeout-action {
 alarm;
 block;
 }
 cost cost;
 edge;
 mode mode;
 no-root-port;
 priority priority;
 }
}

```

```

 }
 max-age seconds;
 }
 traceoptions {
 file filename <files number > <size size > <no-stamp | world-readable |
 no-world-readable>;
 flag flag;
 }
 uplink-failure-detection {
 group group-name {
 link-to-monitor interface-name;
 link-to-disable interface-name;
 }
 }
}
vstp {
 bpdu-block-on-edge;
 disable (Spanning Trees);
 force-version (Spanning Trees) stp;
 vlan (Spanning Trees) vlan-id {
 bridge-priority (Spanning Trees) priority;
 forward-delay (Spanning Trees) seconds;
 hello-time (Spanning Trees) seconds;
 interface (Spanning Trees) (all | interface-name) {
 bpdu-timeout-action (Spanning Trees) {
 block (Spanning Trees);
 log (Spanning Trees);
 }
 cost (Spanning Trees) cost;
 disable (Spanning Trees);
 edge (Spanning Trees);
 mode (Spanning Trees) mode;
 no-root-port (Spanning Trees);
 priority (Spanning Trees) priority;
 }
 max-age (Spanning Trees) seconds;
 traceoptions (Spanning Trees) {
 file filename <files number > <size size > <no-stamp | world-readable |
 no-world-readable>;
 flag flag;
 }
 }
}
}
}

```

|                          |                                                                                                                                                    |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Hierarchy Level          | [edit]                                                                                                                                             |
| Release Information      | Statement introduced in Junos OS Release 14.1X53-D20 for OCX Series switches.<br>Statement introduced in Junos OS Release 11.1 for the QFX Series. |
| Description              | Configure protocols.<br><br>The remaining statements are explained separately.                                                                     |
| Required Privilege Level | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                |

**Related Documentation**

- [Junos OS Routing Protocols Configuration Guide](#)

## revision-level

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|                                 |                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | revision-level <i>revision-level</i> ;                                                                                                                                                                                                                                                                                                  |
| <b>Hierarchy Level</b>          | [edit protocols <a href="#">mstp</a> ]                                                                                                                                                                                                                                                                                                  |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                       |
| <b>Description</b>              | For Multiple Spanning Tree Protocol (MSTP), set the revision number of the MSTP configuration.                                                                                                                                                                                                                                          |
| <b>Default</b>                  | The revision number is disabled.                                                                                                                                                                                                                                                                                                        |
| <b>Options</b>                  | <i>revision-level</i> —Revision number of the MSTP region configuration.<br><b>Range:</b> 0 through 65535                                                                                                                                                                                                                               |
| <b>Required Privilege Level</b> | routing—To view this statement in the configuration.<br>routing-control—To add this statement to the configuration.                                                                                                                                                                                                                     |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Network Regions for VLANs with MSTP on page 126</a></li> <li>• <a href="#">Understanding MSTP on page 104</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface on page 327</a></li> </ul> |

## rstp

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre> rstp {   disable;   bpdu-block-on-edge;   bridge-priority <i>priority</i>;   forward-delay <i>seconds</i>;   hello-time <i>seconds</i>;   interface (all   <i>interface-name</i>) {     bpdu-timeout-action {       block;       alarm;     }     disable;     cost <i>cost</i>;     edge;     mode <i>mode</i>;     no-root-port;     priority <i>priority</i>;   }   max-age <i>seconds</i>;   traceoptions {     file <i>name</i> &lt;replace&gt; &lt;size <i>size</i>&gt; &lt;files <i>number</i>&gt; &lt;no-stamp&gt;       &lt;(world-readable   no-world-readable)&gt;;     flag <i>flag</i> &lt;<i>flag-modifier</i>&gt; &lt;disable&gt;;   } } </pre> |
| <b>Hierarchy Level</b>          | [edit protocols]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b>              | <p>Configure Rapid Spanning Tree Protocol (RSTP). RSTP is defined in the IEEE 802.1D-2004 specification and is used to prevent loops in Layer 2 networks, providing shorter convergence times than those provided with basic STP.</p> <p>The statements are explained separately.</p>                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Default</b>                  | RSTP is enabled on all Ethernet switching interfaces.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149</a></li> <li>• <a href="#">Understanding RSTP on page 105</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface on page 327</a></li> </ul>                                                                                                                                                                                                                                                                                                     |

## stp

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <pre> stp {   disable;   bridge-priority <i>priority</i>;   forward-delay <i>seconds</i>;   hello-time <i>seconds</i>;   interface (all   <i>interface-name</i>) {     disable;     bpdu-timeout-action {       block;       alarm;     }     cost <i>cost</i>;     edge;     mode <i>mode</i>;     no-root-port;     priority <i>priority</i>;   }   max-age <i>seconds</i>;   traceoptions {     file <i>name</i> &lt;replace&gt; &lt;size <i>size</i>&gt; &lt;files <i>number</i>&gt; &lt;no-stamp&gt;       &lt;(world-readable   no-world-readable)&gt;;     flag <i>flag</i> &lt;<i>flag-modifier</i>&gt; &lt;disable&gt;;   } } </pre> |
| <b>Hierarchy Level</b>          | [edit protocols]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Release Information</b>      | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b>              | <p>When you explicitly configure STP, a switch uses the IEEE 802.1D 2004 specification, force version 0. This configuration runs a version of RSTP that is compatible with the classic, basic STP (defined in the IEEE 802.1D 1998 specification).</p> <p>The remaining statements are explained separately.</p>                                                                                                                                                                                                                                                                                                                              |
| <b>Default</b>                  | STP is disabled; by default, RSTP is enabled on all Ethernet switching ports.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Required Privilege Level</b> | <p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Example: Configuring BPDU Protection on STP Interfaces to Prevent STP Miscalculations on page 113</a></li> <li>• <a href="#">Configuring STP on page 111</a></li> <li>• <a href="#">Overview of Spanning-Tree Protocols on page 103</a></li> <li>• <a href="#">show spanning-tree bridge on page 322</a></li> <li>• <a href="#">show spanning-tree interface on page 327</a></li> </ul>                                                                                                                                                                                                  |

## traceoptions (STP)

|                            |                                                                                                                                                                                                                                                          |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | <pre> traceoptions {     file <i>name</i> &lt;replace&gt; &lt;size <i>size</i>&gt; &lt;files <i>number</i>&gt; &lt;no-stamp&gt;       &lt;(world-readable   no-world-readable)&gt;;     flag <i>flag</i> &lt;flag-modifier&gt; &lt;disable&gt;; } </pre> |
| <b>Hierarchy Level</b>     | <pre> [edit protocols <i>mstp</i>], [edit protocols <i>rstp</i>], [edit protocols <i>stp</i>], [edit protocols <i>vstp</i> vlan <i>vlan-id</i>] [edit protocols layer2-control] </pre>                                                                   |
| <b>Release Information</b> | Statement introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                        |



**NOTE:** traceoptions is not supported on QFabric systems.

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | Set STP protocol-level tracing options.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Default</b>     | Traceoptions is disabled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Options</b>     | <p><b>disable</b>—(Optional) Disable the tracing operation. One use of this option is to disable a single operation when you have defined a broad group of tracing operations, such as <b>all</b>.</p> <p><b>file <i>name</i></b>—Name of the file to receive the output of the tracing operation. Enclose the name in quotation marks. We recommend that you place STP tracing output in the file <code>/var/log/stp-log</code>.</p> <p><b>files <i>number</i></b>—(Optional) Maximum number of trace files. When a trace file named <b>trace-file</b> reaches its maximum size, it is renamed <b>trace-file.0</b>, then <b>trace-file.1</b>, and so on, until the maximum number of trace files is reached. Then, the oldest trace file is overwritten.</p> <p>If you specify a maximum number of files, you must also specify a maximum file size with the <b>size</b> option.</p> <p><b>Range:</b> 2 through 1000 files</p> <p><b>Default:</b> 1 trace file only</p> <p><b>flag</b>—Tracing operation to perform. To specify more than one tracing operation, include multiple <b>flag</b> statements. These are the STP-specific tracing options:</p> <ul style="list-style-type: none"> <li><b>all</b>—Trace all operations.</li> <li><b>all-failures</b>—Trace all failure conditions.</li> <li><b>bpdu</b>—Trace BPDU reception and transmission.</li> </ul> |

- **bridge-detection-state-machine**—Trace the bridge detection state machine.
- **events**—Trace events of the protocol state machine.
- **port-information-state-machine**—Trace the port information state machine.
- **port-migration-state-machine**—Trace the port migration state machine.
- **port-receive-state-machine**—Trace the port receive state machine.
- **port-role-select-state-machine**—Trace the port role selection state machine.
- **port-role-transit-state-machine**—Trace the port role transit state machine.
- **port-transmit-state-machine**—Trace the port transmit state machine.
- **port-state-transit-state-machine**—Trace the port state transit state machine.
- **ppmd**—Trace the state and events for the ppm process.
- **state-machine-variables**—Trace when the state machine variables change.
- **timers**—Trace protocol timers.
- **topology-change-state-machine**—Trace the topology change state machine.

The following are the global tracing options:

- **all**—All tracing operations.
- **config-internal**—Trace configuration internals.
- **general**—Trace general events.
- **normal**—All normal events.

**Default:** If you do not specify this option, only unusual or abnormal operations are traced.

- **parse**—Trace configuration parsing.
- **policy**—Trace policy operations and actions.
- **regex-parse**—Trace regular-expression parsing.
- **route**—Trace routing table changes.
- **state**—Trace state transitions.
- **task**—Trace protocol task processing.
- **timer**—Trace protocol task timer processing.

**no-stamp**—(Optional) Do not place timestamp information at the beginning of each line in the trace file.

**Default:** If you omit this option, timestamp information is placed at the beginning of each line of the tracing output.

**no-world-readable**—(Optional) Prevent any user from reading the log file.

**replace**—(Optional) Replace an existing trace file if there is one.

**Default:** If you do not include this option, tracing output is appended to an existing trace file.

**size** *size*—(Optional) Maximum size of each trace file, in kilobytes (KB) or megabytes (MB). When a trace file named **trace-file** reaches this size, it is renamed **trace-file.O**. When the **trace-file** again reaches its maximum size, **trace-file.O** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.O**. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also specify a maximum number of trace files with the **files** option.

**Syntax:** **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

**Range:** 10 KB through the maximum file size supported on your system

**Default:** 1 MB

**world-readable**—(Optional) Allow any user to read the log file.

|                           |                                                             |
|---------------------------|-------------------------------------------------------------|
| <b>Required Privilege</b> | routing—To view this statement in the configuration.        |
| <b>Level</b>              | routing-control—To add this statement to the configuration. |



- Related Documentation**
- [Example: Configuring Network Regions for VLANs with MSTP on page 126](#)
  - [Example: Configuring Faster Convergence and Improving Network Stability with RSTP on page 149](#)
  - [Understanding RSTP on page 105](#)
  - [Understanding MSTP on page 104](#)
  - [Overview of Spanning-Tree Protocols on page 103](#)
  - [Understanding VSTP on page 106](#)
  - [show spanning-tree bridge on page 322](#)
  - [show spanning-tree interface on page 327](#)

## vlan (STP)

```
Syntax vlan (vlan-id | vlan-name) {
 bridge-priority priority;
 forward-delay seconds;
 hello-time seconds;
 interface (all | interface-name) {
 bpdu-timeout-action {
 block;
 alarm;
 }
 cost cost;
 disable;
 edge;
 mode mode;
 no-root-port;
 priority priority;
 }
 max-age seconds;
 traceoptions {
 file filename <files number > <size size> <no-stamp | world-readable |
 no-world-readable>;
 flag flag;
 }
 }
```

**Hierarchy Level** [edit protocols **mstp** **msti** *msti-id*],  
[edit protocols **vstp**]

**Release Information** Statement introduced in Junos OS Release 11.1 for the QFX Series.

**Description** Configure the VLANs for a Multiple Spanning Tree Instance (MSTI).

The remaining statements are explained separately.



**TIP:** To display a list of all configured VLANs on the system, including VLANs that are configured but not committed, type ? after vlan or vlans in your configuration mode command line. Note that only one VLAN is displayed for a VLAN range.

**Default** Not enabled.

**Options** *vlan-id*—Numeric VLAN identifier.

*vlan-name*—Name of the VLAN.

**Required Privilege Level** routing—To view this statement in the configuration.  
routing-control—To add this statement to the configuration.

- Related Documentation**
- [Example: Configuring Network Regions for VLANs with MSTP on page 126](#)
  - [Understanding MSTP on page 104](#)
  - [Understanding VSTP on page 106](#)

## vstp

**Syntax**

```
vstp {
 disable;
 bpdu-block-on-edge;
 force-version stp;
 vlan (vlan-id | vlan-name) {
 bridge-priority priority;
 forward-delay seconds;
 hello-time seconds;
 interface (all | interface-name) {
 disable;
 bpdu-timeout-action {
 alarm;
 block;
 }
 cost cost;
 edge;
 mode mode;
 no-root-port;
 priority priority;
 }
 max-age seconds;
 traceoptions {
 file name <replace> <size size> <files number> <no-stamp>
 <world-readable | no-world-readable>;
 flag flag <flag-modifier> <disable>;
 }
 }
}
```

**Hierarchy Level** [edit protocols]

**Release Information** Statement introduced in Junos OS Release 11.1 for the QFX Series.

**Description** Configure VLAN Spanning Tree Protocol (VSTP). VSTP is used to prevent loops in Layer 2 networks on a per-VLAN basis.

The remaining statements are explained separately.

**Required Privilege Level** routing—To view this statement in the configuration.  
routing-control—To add this statement to the configuration.

- Related Documentation**
- [Understanding VSTP on page 106](#)
  - [show spanning-tree bridge on page 322](#)
  - [show spanning-tree interface on page 327](#)




## CHAPTER 19

# Operational Commands (Bridging and VLANs)

- `clear ethernet-switching table`
- `show ethernet-switching interfaces`
- `show ethernet-switching mac-learning-log`
- `show ethernet-switching mac-notification`
- `show ethernet-switching statistics aging`
- `show ethernet-switching statistics mac-learning`
- `show ethernet-switching table`
- `show vlans`

## clear ethernet-switching table

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>              | clear ethernet-switching table<br><interface <i>interface-name</i> ><br><mac <i>mac-address</i> ><br><management-vlan><br><persistent-mac < <i>interface</i>   <i>mac-address</i> >><br><vlan <i>vlan-name</i> >                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Syntax (QFX Series)</b> | clear ethernet-switching table<br><interface <i>interface-name</i> ><br><mac <i>mac-address</i> ><br><persistent-mac < <i>interface</i>   <i>mac-address</i> >><br><vlan <i>vlan-name</i> >                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Release Information</b> | Command introduced in Junos OS Release 9.3 for EX Series switches.<br>Command introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Description</b>         | <div>  <p><b>NOTE:</b> On a QFabric system, using this command on an FCoE-enabled VLAN when FCoE sessions are active can cause traffic flooding and FCoE traffic drop. The FCoE sessions are not terminated and the traffic reconverges after a short period of time.</p> </div> <p>Clear learned entries, which are media access control (MAC) addresses, in the Ethernet switching table (also called the forwarding database table).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Options</b>             | <p><b>none</b>—Clear learned entries in the Ethernet switching table, except for persistent MAC addresses.</p> <p><b>interface <i>interface-name</i></b>—(Optional) Clear all learned MAC addresses for the specified interface from the Ethernet switching table.</p> <p><b>mac <i>mac-address</i></b>—(Optional) Clear the specified learned MAC address from the Ethernet switching table.</p> <p><b>management-vlan</b>—(Optional) Clear all MAC addresses learned for the management VLAN from the Ethernet switching table. Note that you do not specify a VLAN name because only one management VLAN exists.</p> <p><b>persistent-mac &lt;<i>interface</i>   <i>mac-address</i>&gt;</b>—(Optional) Clear all MAC addresses, including persistent MAC addresses. Use the <b>interface</b> option to clear all MAC addresses on an interface, or use the <b>mac-address</b> option to clear all entries for a specific MAC address.</p> <p>Use this command whenever you move a device in your network that has a persistent MAC address on the switch. If you move the device to another port on the switch and do not clear the persistent MAC address from the original port it was learned on, then the new port will not learn the MAC address and the device will not be able to connect. If the original port is down when you move the device, then the new port</p> |

will learn the MAC address and the device can connect—however, unless you cleared the MAC address on the original port, when the port comes back up, the system reinstalls the persistent MAC address in the forwarding table for that port. If this occurs, the address is removed from the new port and the device loses connectivity.

**vlan *vlan-name***—(Optional) Clear all MAC addresses learned for the specified VLAN from the Ethernet switching table.

**Required Privilege Level**

view

**Related Documentation**

- *show ethernet-switching table*
- [show ethernet-switching table on page 300](#)
- *Verifying That Persistent MAC Learning Is Working Correctly*

**List of Sample Output**    [clear ethernet-switching table on page 285](#)

**Output Fields**    This command produces no output.

## Sample Output

[clear ethernet-switching table](#)

```
user@switch> clear ethernet-switching table
```

## show ethernet-switching interfaces

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show ethernet-switching interfaces<br><brief   detail   summary><br><interface <i>interface-name</i> >                                                                                                                                                                                                                                                                                                      |
| <b>Release Information</b>      | Command introduced in Junos OS Release 14.1X53-D20 for OCX Series switches.<br>Command introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                              |
| <b>Description</b>              | Display information about switched Ethernet interfaces.                                                                                                                                                                                                                                                                                                                                                     |
| <b>Options</b>                  | <p><b>none</b>—(Optional) Display brief information for Ethernet-switching interfaces.</p> <p><b>brief   detail   summary</b>—(Optional) Display the specified level of output.</p> <p><b>interface <i>interface-name</i></b>—(Optional) Display Ethernet-switching information for a specific interface.</p>                                                                                               |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">Troubleshooting Ethernet Switching on page 51</a><a href="#">Understanding Bridging and VLANs on page 4</a></li> <li>• <i>Example: Setting Up Basic Bridging and a VLAN on the QFX Series</i></li> <li>• <i>Example: Setting Up Bridging with Multiple VLANs</i></li> <li>• <i>Understanding FCoE</i></li> <li>• <i>Interfaces Overview</i></li> </ul> |
| <b>List of Sample Output</b>    | <a href="#">show ethernet-switching interfaces on page 287</a><br><a href="#">show ethernet-switching interfaces summary on page 288</a><br><a href="#">show ethernet-switching interfaces brief on page 288</a><br><a href="#">show ethernet-switching interfaces detail on page 288</a><br><a href="#">show ethernet-switching interfaces interface-name on page 289</a>                                  |
| <b>Output Fields</b>            | <a href="#">Table 20 on page 286</a> lists the output fields for the <b>show ethernet-switching interfaces</b> command. Output fields are listed in the approximate order in which they appear.                                                                                                                                                                                                             |

**Table 20: show ethernet-switching interfaces Output Fields**

| Field Name          | Field Description                                      | Level of Output              |
|---------------------|--------------------------------------------------------|------------------------------|
| <b>Interface</b>    | Name of a switching interface.                         | All levels                   |
| <b>State</b>        | Interface state. Values are <b>up</b> or <b>down</b> . | none, brief, detail, summary |
| <b>VLAN members</b> | Name of a VLAN.                                        | none, brief, detail, summary |



Table 20: show ethernet-switching interfaces Output Fields (*continued*)

| Field Name               | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Level of Output                                     |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <b>Blocking</b>          | Forwarding state of the interface: <ul style="list-style-type: none"> <li>• <b>blocked</b>—Traffic is not being forwarded on the interface.</li> <li>• <b>unblocked</b>—Traffic is forwarded on the interface.</li> <li>• <b>MAC limit exceeded</b>—The interface is temporarily disabled because of a MAC limiting error. The disabled interface is automatically restored to service when the disable timeout expires.</li> <li>• <b>MAC move limit exceeded</b>—The interface is temporarily disabled because of a MAC move limiting error. The disabled interface is automatically restored to service when the disable timeout expires.</li> <li>• <b>Storm control in effect</b> —The interface is temporarily disabled because of a storm control error. The disabled interface is automatically restored to service when the disable timeout expires.</li> <li>• <b>Storm control shutdown in effect</b> —The interface is temporarily disabled because of a storm control shutdown error. The disabled interface is automatically restored to service when the disable timeout expires.</li> </ul> | none, <b>brief</b> , <b>detail</b> , <b>summary</b> |
| <b>Index</b>             | VLAN index internal to Junos OS software.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>detail</b>                                       |
| <b>untagged   tagged</b> | Specifies whether the interface forwards IEEE802.1Q-tagged or untagged traffic.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>detail</b>                                       |

## Sample Output

### show ethernet-switching interfaces

```
user@switch> show ethernet-switching interfaces
```

```

Interface State VLAN members Blocking
xe-0/0/0.0 up T1122 unblocked
xe-0/0/1.0 down default - MAC limit exceeded
xe-0/0/2.0 down default - MAC move limit exceeded
xe-0/0/3.0 down default - Storm control in effect
xe-0/0/4.0 down default unblocked
xe-0/0/5.0 down default unblocked
xe-0/0/6.0 down default unblocked
xe-0/0/7.0 down default unblocked
xe-0/0/8.0 down default unblocked
xe-0/0/9.0 up T111 unblocked
xe-0/0/10.0 down default unblocked
xe-0/0/11.0 down default unblocked
xe-0/0/12.0 down default unblocked
xe-0/0/13.0 down default unblocked
xe-0/0/14.0 down default unblocked
xe-0/0/15.0 down default unblocked
xe-0/0/16.0 down default unblocked
xe-0/0/17.0 down default unblocked
xe-0/0/18.0 down default unblocked
xe-0/0/19.0 up T111 unblocked
xe-0/1/0.0 down default unblocked
xe-0/1/1.0 down default unblocked
xe-0/1/2.0 down default unblocked
xe-0/1/3.0 down default unblocked

```

### show ethernet-switching interfaces summary

```
user@switch> show ethernet-switching interfaces summary
xe-0/0/0.0
xe-0/0/1.0
xe-0/0/2.0
xe-0/0/3.0
xe-0/0/8.0
xe-0/0/10.0
xe-0/0/11.0
```

### show ethernet-switching interfaces brief

```
user@switch> show ethernet-switching interfaces brief
Interface State VLAN members Blocking
xe-0/0/0.0 down default unblocked
xe-0/0/1.0 down employee-vlan unblocked
xe-0/0/2.0 down employee-vlan unblocked
xe-0/0/3.0 down employee-vlan unblocked
xe-0/0/8.0 down employee-vlan unblocked
xe-0/0/10.0 down default unblocked
xe-0/0/11.0 down employee-vlan unblocked
```

### show ethernet-switching interfaces detail

```
user@switch> show ethernet-switching interfaces detail
Interface: xe-0/0/0.0 Index: 65
State: down
VLANs:
 default untagged unblocked

Interface: xe-0/0/1.0 Index: 66
State: down
VLANs:
 employee-vlan untagged unblocked

Interface: xe-0/0/2.0 Index: 67
State: down
VLANs:
 employee-vlan untagged unblocked

Interface: xe-0/0/3.0 Index: 68
State: down
VLANs:
 employee-vlan untagged unblocked

Interface: xe-0/0/8.0 Index: 69
State: down
VLANs:
 employee-vlan untagged unblocked

Interface: xe-0/0/10.0 Index: 70
State: down
VLANs:
 default untagged unblocked

Interface: xe-0/0/11.0 Index: 71
State: down
VLANs:
 employee-vlan tagged unblocked
```

**show ethernet-switching interfaces interface-name**

```
user@switch> show ethernet-switching interfaces xe-0/0/0.0
 Interface State VLAN members Blocking
xe-0/0/0.0 down default unblocked
```

## show ethernet-switching mac-learning-log

|                                 |                                                                                                                                                                                         |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show ethernet-switching mac-learning-log                                                                                                                                                |
| <b>Release Information</b>      | Command introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                         |
| <b>Description</b>              | Displays the event log of learned MAC addresses.                                                                                                                                        |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                    |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">show ethernet-switching table on page 300</a></li> <li>• <a href="#">show ethernet-switching interfaces on page 286</a></li> </ul> |
| <b>List of Sample Output</b>    | <a href="#">show ethernet-switching mac-learning-log on page 290</a>                                                                                                                    |
| <b>Output Fields</b>            | Table 21 on page 290 lists the output fields for the <b>show ethernet-switching mac-learning-log</b> command. Output fields are listed in the approximate order in which they appear.   |

Table 21: show ethernet-switching mac-learning-log Output Fields

| Field Name            | Field Description                                                                                                                                                                                                                                                                             |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Date and Time</b>  | Timestamp in UTC when the MAC operation occurred.                                                                                                                                                                                                                                             |
| <b>vlan_name</b>      | VLAN name. A value defined by the user for all user-configured VLANs. The name of the VLAN on which the MAC is learned.                                                                                                                                                                       |
| <b>MAC</b>            | Learned MAC address.                                                                                                                                                                                                                                                                          |
| <b>Event op</b>       | MAC address that are added, learned, deleted, changed or moved from one interface to another interface.                                                                                                                                                                                       |
| <b>Interface Name</b> | The name of the interface on which the MAC address is learned. When a MAC address is moved, there is another field with the name of the interface. The log displays the name of the interface from where the MAC address moved, and the name of the interface to where the MAC address moved. |
| <b>Flags</b>          | Displays the MAC address flags in which the MAC event occurred. This option is for debugging purposes.                                                                                                                                                                                        |

## Sample Output

### show ethernet-switching mac-learning-log

```

user@switch> show ethernet-switching mac-learning-log
Mon Jun 30 13:49:49 2014 vlan_name v11+11 mac 00:10:94:00:00:02 was learned on
ge-1/0/22.0 with flags: 0x2001f << MAC address that as dynamically learned
Mon Jun 30 13:50:29 2014 vlan_name v11+11 mac 00:10:94:00:00:02 was deleted from
ge-1/0/22.0 with flags: 0x1080 << MAC address that was deleted
Mon Jun 30 13:51:28 2014 vlan_name v11+11 mac 00:00:00:01:01:01 was added to
ge-1/0/22.0 with flags: 0x2013f << Static MAC address that was added
Mon Jun 30 13:51:46 2014 vlan_name v11+11 mac 00:00:00:01:01:01 was deleted from
ge-1/0/22.0 with flags: 0x1120 << delete of Static MAC address that was deleted

```

```
Mon Jun 30 13:52:03 2014 vlan_name v11+11 mac 00:10:94:00:00:02 was learned on
ge-1/0/22.0 with flags: 0x2001f << MAC address that was dynamically learned
Mon Jun 30 13:52:11 2014 vlan_name v11+11 mac 00:10:94:00:00:02 was moved from
ge-1/0/22.0 to ge-1/0/21.0 with flags: 0x2101f << MAC address that was moved
Mon Jun 30 13:54:24 2014 vlan_name v11+11 mac 00:10:94:00:00:02 was changed on
ge-1/0/21.0 with flags: 0x2113f << MAC address that changed from a dynamic
address to a static address
```

## show ethernet-switching mac-notification

|                                 |                                                                                                                                                                                                     |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show ethernet-switching mac-notification                                                                                                                                                            |
| <b>Release Information</b>      | Command introduced in Junos OS Release 9.6 for EX Series switches.<br>Command introduced in Junos OS Release 11.1 for the QFX Series.                                                               |
| <b>Description</b>              | Display information about MAC notification.                                                                                                                                                         |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <i>Verifying That MAC Notification Is Working Properly</i></li> </ul>                                                                                      |
| <b>List of Sample Output</b>    | <a href="#">show ethernet-switching mac-notification (MAC Notification Enabled) on page 292</a><br><a href="#">show ethernet-switching mac-notification (MAC Notification Disabled) on page 292</a> |
| <b>Output Fields</b>            | Table 22 on page 292 lists the output fields for the <b>show ethernet-switching mac-notification</b> command. Output fields are listed in the order in which they appear.                           |

Table 22: show ethernet-switching mac-notification Output Fields

| Field Name                         | Field Description                                                                                                                                                                 |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Notification Status</b>         | MAC notification status: <ul style="list-style-type: none"> <li>• <b>Enabled</b>—MAC notification is enabled.</li> <li>• <b>Disabled</b>—MAC notification is disabled.</li> </ul> |
| <b>Notification Interval</b>       | MAC notification interval in seconds.                                                                                                                                             |
| <b>Notifications Sent</b>          | Number of notifications sent to SNMP when MACs are learned or when MACs age out.                                                                                                  |
| <b>Notifications Table Maxsize</b> | Maximum size of the notification table, which is populated when notifications are sent to the SNMP server.                                                                        |

### Sample Output

#### show ethernet-switching mac-notification (MAC Notification Enabled)

```

user@switch> show ethernet-switching mac-notification
Notification Status : Enabled
Notification Interval : 30
Notifications Sent : 0
Notifications Table Maxsize : 256

```

### Sample Output

#### show ethernet-switching mac-notification (MAC Notification Disabled)

```

user@switch> show ethernet-switching mac-notification
Notification Status : Disabled
Notification Interval : 0

```

Notifications Sent : 0  
Notifications Table Maxsize : 256

## show ethernet-switching statistics aging

|                                 |                                                                                                                                                                                                   |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show ethernet-switching statistics aging<br><brief   detail>                                                                                                                                      |
| <b>Release Information</b>      | Command introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                   |
| <b>Description</b>              | Display media access control (MAC) aging statistics.                                                                                                                                              |
| <b>Options</b>                  | <b>none</b> —(Optional) Display MAC aging statistics.<br><b>brief   detail</b> —(Optional) Display the specified level of output.                                                                 |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                              |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <a href="#">show ethernet-switching statistics mac-learning on page 296</a></li> <li>• <a href="#">Configuring MAC Table Aging on page 40</a></li> </ul> |
| <b>List of Sample Output</b>    | <a href="#">show ethernet-switching statistics aging on page 295</a>                                                                                                                              |
| <b>Output Fields</b>            | Table 23 on page 294 lists the output fields for the <b>show ethernet-switching statistics aging</b> command. Output fields are listed in the approximate order in which they appear.             |

Table 23: show ethernet-switching statistics aging Output Fields

| Field Name                         | Field Description                                                                                                                                                                                                                                                                                                                                                                   | Level of Output |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Total age messages received</b> | Total number of aging messages received from the hardware.                                                                                                                                                                                                                                                                                                                          | All levels      |
| <b>Immediate aging</b>             | Aging message indicating that the entry should be removed immediately.                                                                                                                                                                                                                                                                                                              | All levels      |
| <b>MAC address seen</b>            | Aging message indicating that the MAC address has been detected by hardware and that the aging timer should be stopped.                                                                                                                                                                                                                                                             | All levels      |
| <b>MAC address not seen</b>        | Aging message indicating that the MAC address has not been detected by the hardware and that the aging timer should be started.                                                                                                                                                                                                                                                     | All levels      |
| <b>Error age messages</b>          | The received aging message contains the following errors: <ul style="list-style-type: none"> <li>• <b>Invalid VLAN</b>—The VLAN of the packet does not exist.</li> <li>• <b>No such entry</b>—The MAC address and VLAN pair provided by the aging message does not exist.</li> <li>• <b>Static entry</b>—An unsuccessful attempt was made to age out a static MAC entry.</li> </ul> | All levels      |



## Sample Output

### show ethernet-switching statistics aging

```
user@switch> show ethernet-switching statistics aging
```

```
Total age messages received: 0
```

```
Immediate aging: 0, MAC address seen: 0, MAC address not seen: 0
```

```
Error age messages: 0
```

```
Invalid VLAN: 0, No such entry: 0, Static entry: 0
```

## show ethernet-switching statistics mac-learning

---

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>show ethernet-switching statistics mac-learning</code><br><code>&lt;brief   detail&gt;</code><br><code>&lt;interface <i>interface-name</i>&gt;</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Release Information</b>      | Command introduced in Junos OS Release 9.4 for EX Series switches.<br>Command introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Description</b>              | Display media access control (MAC) learning statistics.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Options</b>                  | <b>none</b> —(Optional) Display MAC learning statistics for all interfaces.<br><br><b>brief   detail</b> —(Optional) Display the specified level of output. The default is <b>brief</b> .<br><br><b>interface <i>interface-name</i></b> —(Optional) Display MAC learning statistics for the specified interface.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">show ethernet-switching statistics aging</a></li><li>• <a href="#">show ethernet-switching mac-learning-log</a></li><li>• <a href="#">show ethernet-switching table</a></li><li>• <a href="#">show ethernet-switching interfaces</a></li><li>• <a href="#">Example: Setting Up Basic Bridging and a VLAN for an EX Series Switch</a></li><li>• <a href="#">Example: Setting Up Bridging with Multiple VLANs for EX Series Switches</a></li><li>• <a href="#">show ethernet-switching statistics aging on page 294</a></li><li>• <a href="#">show ethernet-switching mac-learning-log on page 290</a></li><li>• <a href="#">show ethernet-switching table on page 300</a></li><li>• <a href="#">show ethernet-switching interfaces on page 286</a></li><li>• <a href="#">Example: Setting Up Basic Bridging and a VLAN on the QFX Series</a></li><li>• <a href="#">Example: Setting Up Bridging with Multiple VLANs</a></li></ul> |
| <b>List of Sample Output</b>    | <a href="#">show ethernet-switching statistics mac-learning on page 297</a><br><a href="#">show ethernet-switching statistics mac-learning detail on page 298</a><br><a href="#">show ethernet-switching statistics mac-learning interface ge-0/0/28 detail on page 298</a><br><a href="#">show ethernet-switching statistics mac-learning interface on page 298</a><br><a href="#">show ethernet-switching statistics mac-learning detail (QFX Series) on page 298</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Output Fields</b>            | <a href="#">Table 24 on page 297</a> lists the output fields for the <b>show ethernet-switching statistics mac-learning</b> command. Output fields are listed in the approximate order in which they appear.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

Table 24: show ethernet-switching statistics mac-learning Output Fields

| Field Name                                   | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Level of Output |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Interface</b>                             | Name of the interface for which statistics are being reported. (Displayed in the output under the heading <b>Interface</b> .)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | All levels      |
| <b>Learning message from local packets</b>   | MAC learning message generated due to packets coming in on the management interface. (Displayed in the output under the heading <b>Local pkts</b> .)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | All levels      |
| <b>Learning message from transit packets</b> | MAC learning message generated due to packets coming in on network interfaces. (Displayed in the output under the heading <b>Transit pkts</b> .)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | All levels      |
| <b>Learning message with error</b>           | <p>MAC learning messages received with errors (Displayed under the heading <b>Error</b>):</p> <ul style="list-style-type: none"> <li>• <b>Invalid VLAN</b>—The VLAN of the packet does not exist.</li> <li>• <b>Invalid MAC</b>—The MAC address is either NULL or a multicast MAC address.</li> <li>• <b>Security violation</b>—The MAC address is not an allowed MAC address.</li> <li>• <b>Interface down</b>—The MAC address is learned on an interface that is down.</li> <li>• <b>Incorrect membership</b>—The MAC address is learned on an interface that is not a member of the VLAN.</li> <li>• <b>Interface limit</b>—The number of MAC addresses learned on the interface has exceeded the limit.</li> <li>• <b>MAC move limit</b>—This MAC address has moved among multiple interfaces too many times in a given interval.</li> <li>• <b>VLAN limit</b>—The number of MAC addresses learned on the VLAN has exceeded the limit.</li> <li>• <b>VLAN membership limit</b>—The number of MAC addresses learned on the interface as a member of the specified VLAN (VLAN membership MAC limit) has exceeded the limit.</li> <li>• <b>Invalid VLAN index</b>—The VLAN of the packet, although configured, does not yet exist in the kernel.</li> <li>• <b>Interface not learning</b>—The MAC address is learned on an interface that does not yet allow learning—for example, the interface is blocked.</li> <li>• <b>No nexthop</b>—The MAC address is learned on an interface that does not have a unicast next hop.</li> <li>• <b>MAC learning disabled</b>—The MAC address is learned on an interface on which MAC learning has been disabled.</li> <li>• <b>Others</b>—The message contains some other error.</li> </ul> | All levels      |

## Sample Output

### show ethernet-switching statistics mac-learning

```
user@switch> show ethernet-switching statistics mac-learning
```

```
Learning stats: 0 learn msg rcvd, 0 error
Interface Local pkts Transit pkts Error
ge-0/0/0.0 0 0 0
ge-0/0/1.0 0 0 0
ge-0/0/2.0 0 0 0
ge-0/0/3.0 0 0 0
```

**show ethernet-switching statistics mac-learning detail**

```
user@switch> show ethernet-switching statistics mac-learning detail
```

```
Learning stats: 0 learn msg rcvd, 0 error
```

```
Interface: ge-0/0/0.0
```

```
Learning message from local packets: 0
```

```
Learning message from transit packets: 1
```

```
Learning message with error: 0
```

```
Invalid VLAN: 0 Invalid MAC: 0
```

```
Security violation: 0 Interface down: 0
```

```
Incorrect membership: 0 Interface limit: 0
```

```
MAC move limit: 0 VLAN limit: 0
```

```
Invalid VLAN index: 0 Interface not learning: 0
```

```
No nexthop: 0 MAC learning disabled: 0
```

```
Others: 0
```

```
Interface: ge-0/0/1.0
```

```
Learning message from local packets: 0
```

```
Learning message from transit packets: 2
```

```
Learning message with error: 0
```

```
Invalid VLAN: 0 Invalid MAC: 0
```

```
Security violation: 0 Interface down: 0
```

```
Incorrect membership: 0 Interface limit: 0
```

```
MAC move limit: 0 VLAN limit: 0
```

```
Invalid VLAN index: 0 Interface not learning: 0
```

```
No nexthop: 0 MAC learning disabled: 0
```

```
Others: 0
```

**show ethernet-switching statistics mac-learning interface ge-0/0/28 detail**

```
user@switch> show ethernet-switching statistics mac-learning interface ge-0/0/28 detail
```

```
Interface: ge-0/0/28.0
```

```
Learning message from local packets: 0
```

```
Learning message from transit packets: 5
```

```
Learning message with error: 0
```

```
Invalid VLAN: 0 Invalid MAC: 0
```

```
Security violation: 0 Interface down: 0
```

```
Incorrect membership: 0 Interface limit: 0
```

```
MAC move limit: 0 VLAN limit: 0
```

```
VLAN membership limit: 20
```

```
Invalid VLAN index: 0 Interface not learning: 0
```

```
No nexthop: 0 MAC learning disabled: 0
```

```
Others: 0
```

**show ethernet-switching statistics mac-learning interface**

```
user@switch> show ethernet-switching statistics mac-learning interface ge-0/0/1
```

```
Interface Local pkts Transit pkts Error
```

```
ge-0/0/1.0 0 1 1
```

**show ethernet-switching statistics mac-learning detail (QFX Series)**

```
user@switch> show ethernet-switching statistics mac-learning detail
```

```
Learning stats: 0 learn msg rcvd, 0 error
```

```
Interface: xe-0/0/0.0
```

```
Learning message from local packets: 0
```

```
Learning message from transit packets: 1
```

```
Learning message with error: 0
```

|                       |   |                         |   |
|-----------------------|---|-------------------------|---|
| Invalid VLAN:         | 0 | Invalid MAC:            | 0 |
| Security violation:   | 0 | Interface down:         | 0 |
| Incorrect membership: | 0 | Interface limit:        | 0 |
| MAC move limit:       | 0 | VLAN limit:             | 0 |
| Invalid VLAN index:   | 0 | Interface not learning: | 0 |
| No nexthop:           | 0 | MAC learning disabled:  | 0 |
| Others:               | 0 |                         |   |

Interface: xe-0/0/1.0

Learning message from local packets: 0

Learning message from transit packets: 2

Learning message with error: 0

|                       |   |                         |   |
|-----------------------|---|-------------------------|---|
| Invalid VLAN:         | 0 | Invalid MAC:            | 0 |
| Security violation:   | 0 | Interface down:         | 0 |
| Incorrect membership: | 0 | Interface limit:        | 0 |
| MAC move limit:       | 0 | VLAN limit:             | 0 |
| Invalid VLAN index:   | 0 | Interface not learning: | 0 |
| No nexthop:           | 0 | MAC learning disabled:  | 0 |
| Others:               | 0 |                         |   |

## show ethernet-switching table

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show ethernet-switching table<br><brief   detail   extensive   summary><br><interface <i>interface-name</i> ><br><management-vlan><br><sort-by ( <i>name</i>   <i>tag</i> )><br><vlan <i>vlan-name</i> >                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Release Information</b>      | Command introduced in Junos OS Release 11.1 for the QFX Series.<br>Output for private VLANs introduced in Junos OS Release 12.1 for the QFX Series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Description</b>              | Displays the Ethernet switching table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Options</b>                  | <p><b>none</b>—(Optional) Display brief information about the Ethernet switching table.</p> <p><b>brief   detail   extensive   summary</b>—(Optional) Display the specified level of output.</p> <p><b>interface <i>interface-name</i></b>—(Optional) Display the Ethernet switching table for a specific interface.</p> <p><b>management-vlan</b>—(Optional) Display the Ethernet switching table for a management VLAN.</p> <p><b>sort-by (<i>name</i>   <i>tag</i>)</b>—(Optional) Display VLANs in ascending order of VLAN IDs or VLAN names.</p> <p><b>vlan <i>vlan-name</i></b>—(Optional) Display the Ethernet switching table for a specific VLAN.</p> |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"> <li>• <i>Example: Setting Up Basic Bridging and a VLAN on the QFX Series</i></li> <li>• <i>Example: Setting Up Bridging with Multiple VLANs</i></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>List of Sample Output</b>    | <a href="#">show ethernet-switching table (Enhanced Layer 2 Software) on page 301</a><br><a href="#">show ethernet-switching table on page 302</a><br><a href="#">show ethernet-switching table (Private VLANs) on page 303</a><br><a href="#">show ethernet-switching table brief on page 303</a><br><a href="#">show ethernet-switching table detail on page 304</a><br><a href="#">show ethernet-switching table extensive on page 305</a><br><a href="#">show ethernet-switching table interface on page 307</a>                                                                                                                                           |
| <b>Output Fields</b>            | Table 25 on page 300 lists the output fields for the <b>show ethernet-switching table</b> command. Output fields are listed in the approximate order in which they appear.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

Table 25: show ethernet-switching table Output Fields

| Field Name | Field Description | Level of Output |
|------------|-------------------|-----------------|
| VLAN       | Name of a VLAN.   | All levels      |

Table 25: show ethernet-switching table Output Fields (*continued*)

| Field Name         | Field Description                                                                                                                                                                                                                                                                                             | Level of Output          |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <b>MAC address</b> | MAC address associated with the VLAN.                                                                                                                                                                                                                                                                         | All levels               |
| <b>Type</b>        | Type of MAC address: <ul style="list-style-type: none"> <li>• <b>static</b>—The MAC address is manually created.</li> <li>• <b>learn</b>—The MAC address is learned dynamically from a packet's source MAC address.</li> <li>• <b>flood</b>—The MAC address is unknown and flooded to all members.</li> </ul> | All levels               |
| <b>Age</b>         | Time remaining before the entry ages out and is removed from the Ethernet switching table.                                                                                                                                                                                                                    | All levels               |
| <b>Interfaces</b>  | Interface associated with learned MAC addresses or with the <b>All-members</b> option (flood entry).                                                                                                                                                                                                          | All levels               |
| <b>Learned</b>     | For learned entries, the time at which the entry was added to the Ethernet switching table.                                                                                                                                                                                                                   | <b>detail, extensive</b> |

## Sample Output

### show ethernet-switching table (Enhanced Layer 2 Software)

```
user@switch> show ethernet-switching table
MAC flags (S - static MAC, D - dynamic MAC, L - locally learned, P - Persistent
static
 SE - statistics enabled, NM - non configured MAC, R - remote PE MAC,
0 - ovsdb MAC)
```

```
Ethernet switching table : 2 entries, 2 learned
```

```
Routing instance : default-switch
```

| Vlan<br>name | MAC<br>address    | MAC<br>flags | Age | Logical<br>interface |
|--------------|-------------------|--------------|-----|----------------------|
| vlan1        | b0:c6:9a:ca:3c:01 | D            | -   | ae1.0                |
| vlan1        | b0:c6:9a:ca:3c:03 | D            | -   | ae1.0                |

```
MAC flags (S - static MAC, D - dynamic MAC, L - locally learned, P - Persistent
static
```

```
 SE - statistics enabled, NM - non configured MAC, R - remote PE MAC,
0 - ovsdb MAC)
```

```
Ethernet switching table : 2 entries, 2 learned
```

```
Routing instance : default-switch
```

| Vlan<br>name | MAC<br>address    | MAC<br>flags | Age | Logical<br>interface |
|--------------|-------------------|--------------|-----|----------------------|
| vlan10       | b0:c6:9a:ca:3c:01 | D            | -   | ae1.0                |
| vlan10       | b0:c6:9a:ca:3c:03 | D            | -   | ae1.0                |

MAC flags (S - static MAC, D - dynamic MAC, L - locally learned, P - Persistent static

SE - statistics enabled, NM - non configured MAC, R - remote PE MAC, O - ovsdb MAC)

Ethernet switching table : 2 entries, 2 learned

Routing instance : default-switch

| Vlan name | MAC address       | MAC flags | Age | Logical interface |
|-----------|-------------------|-----------|-----|-------------------|
| vlan2     | b0:c6:9a:ca:3c:01 | D         | -   | ae1.0             |
| vlan2     | b0:c6:9a:ca:3c:03 | D         | -   | ae1.0             |

MAC flags (S - static MAC, D - dynamic MAC, L - locally learned, P - Persistent static

SE - statistics enabled, NM - non configured MAC, R - remote PE MAC, O - ovsdb MAC)

Ethernet switching table : 2 entries, 2 learned

Routing instance : default-switch

| Vlan name | MAC address       | MAC flags | Age | Logical interface |
|-----------|-------------------|-----------|-----|-------------------|
| vlan3     | b0:c6:9a:ca:3c:01 | D         | -   | ae1.0             |
| vlan3     | b0:c6:9a:ca:3c:03 | D         | -   | ae1.0             |

MAC flags (S - static MAC, D - dynamic MAC, L - locally learned, P - Persistent static

SE - statistics enabled, NM - non configured MAC, R - remote PE MAC, O - ovsdb MAC)

Ethernet switching table : 2 entries, 2 learned

Routing instance : default-switch

| Vlan name | MAC address       | MAC flags | Age | Logical interface |
|-----------|-------------------|-----------|-----|-------------------|
| vlan4     | b0:c6:9a:ca:3c:01 | D         | -   | ae1.0             |
| vlan4     | b0:c6:9a:ca:3c:03 | D         | -   | ae1.0             |

### show ethernet-switching table

user@switch> show ethernet-switching table

Ethernet-switching table: 57 entries, 17 learned

| VLAN  | MAC address       | Type   | Age | Interfaces  |
|-------|-------------------|--------|-----|-------------|
| F2    | *                 | Flood  | -   | All-members |
| F2    | 00:00:05:00:00:03 | Learn  | 0   | xe-0/0/44.0 |
| F2    | 00:19:e2:50:7d:e0 | Static | -   | Router      |
| Linux | *                 | Flood  | -   | All-members |
| Linux | 00:19:e2:50:7d:e0 | Static | -   | Router      |
| Linux | 00:30:48:90:54:89 | Learn  | 0   | xe-0/0/47.0 |
| T1    | *                 | Flood  | -   | All-members |
| T1    | 00:00:05:00:00:01 | Learn  | 0   | xe-0/0/46.0 |
| T1    | 00:00:5e:00:01:00 | Static | -   | Router      |
| T1    | 00:19:e2:50:63:e0 | Learn  | 0   | xe-0/0/46.0 |
| T1    | 00:19:e2:50:7d:e0 | Static | -   | Router      |
| T10   | *                 | Flood  | -   | All-members |



```

T10 00:00:5e:00:01:09 Static - Router
T10 00:19:e2:50:63:e0 Learn 0 xe-0/0/46.0
T10 00:19:e2:50:7d:e0 Static - Router
T111 * Flood - All-members
T111 00:19:e2:50:63:e0 Learn 0 xe-0/0/15.0
T111 00:19:e2:50:7d:e0 Static - Router
T111 00:19:e2:50:ac:00 Learn 0 xe-0/0/15.0
T2 * Flood - All-members
T2 00:00:5e:00:01:01 Static - Router
T2 00:19:e2:50:63:e0 Learn 0 xe-0/0/46.0
T2 00:19:e2:50:7d:e0 Static - Router
T3 * Flood - All-members
T3 00:00:5e:00:01:02 Static - Router
T3 00:19:e2:50:63:e0 Learn 0 xe-0/0/46.0
T3 00:19:e2:50:7d:e0 Static - Router
T4 * Flood - All-members
T4 00:00:5e:00:01:03 Static - Router
T4 00:19:e2:50:63:e0 Learn 0 xe-0/0/46.0
[output truncated]

```

### show ethernet-switching table (Private VLANs)

```

user@switch> show ethernet-switching table
Ethernet-switching table: 10 entries, 3 learned
VLAN MAC address Type Age Interfaces
pvlan * Flood - All-members
pvlan 00:10:94:00:00:02 Replicated - xe-0/0/28.0
pvlan 00:10:94:00:00:35 Replicated - xe-0/0/46.0
pvlan 00:10:94:00:00:46 Replicated - xe-0/0/4.0
c2 * Flood - All-members
c2 00:10:94:00:00:02 Learn 0 xe-0/0/28.0
c1 * Flood - All-members
c1 00:10:94:00:00:46 Learn 0 xe-0/0/4.0
__pvlan_pvlan_xe-0/0/46.0__ * Flood - All-members
__pvlan_pvlan_xe-0/0/46.0__ 00:10:94:00:00:35 Learn 0 xe-0/0/46.0

```

### show ethernet-switching table brief

```

user@switch> show ethernet-switching table brief
Ethernet-switching table: 57 entries, 17 learned
VLAN MAC address Type Age Interfaces
F2 * Flood - All-members
F2 00:00:05:00:00:03 Learn 0 xe-0/0/44.0
F2 00:19:e2:50:7d:e0 Static - Router
Linux * Flood - All-members
Linux 00:19:e2:50:7d:e0 Static - Router
Linux 00:30:48:90:54:89 Learn 0 xe-0/0/47.0
T1 * Flood - All-members
T1 00:00:05:00:00:01 Learn 0 xe-0/0/46.0
T1 00:00:5e:00:01:00 Static - Router
T1 00:19:e2:50:63:e0 Learn 0 xe-0/0/46.0
T1 00:19:e2:50:7d:e0 Static - Router
T10 * Flood - All-members
T10 00:00:5e:00:01:09 Static - Router
T10 00:19:e2:50:63:e0 Learn 0 xe-0/0/46.0
T10 00:19:e2:50:7d:e0 Static - Router
T111 * Flood - All-members
T111 00:19:e2:50:63:e0 Learn 0 xe-0/0/15.0
T111 00:19:e2:50:7d:e0 Static - Router
T111 00:19:e2:50:ac:00 Learn 0 xe-0/0/15.0
T2 * Flood - All-members

```

```

T2 00:00:5e:00:01:01 Static - Router
T2 00:19:e2:50:63:e0 Learn 0 xe-0/0/46.0
T2 00:19:e2:50:7d:e0 Static - Router
T3 * Flood - All-members
T3 00:00:5e:00:01:02 Static - Router
T3 00:19:e2:50:63:e0 Learn 0 xe-0/0/46.0
T3 00:19:e2:50:7d:e0 Static - Router
T4 * Flood - All-members
T4 00:00:5e:00:01:03 Static - Router
T4 00:19:e2:50:63:e0 Learn 0 xe-0/0/46.0
[output truncated]

```

### show ethernet-switching table detail

```

user@switch> show ethernet-switching table detail
Ethernet-switching table: 57 entries, 17 learned
F2, *
 Interface(s): xe-0/0/44.0
 Type: Flood
 Nexthop index: 0

F2, 00:00:05:00:00:03
 Interface(s): xe-0/0/44.0
 Type: Learn, Age: 0, Learned: 2:03:09
 Nexthop index: 0

F2, 00:19:e2:50:7d:e0
 Interface(s): Router
 Type: Static
 Nexthop index: 0

Linux, *
 Interface(s): xe-0/0/47.0
 Type: Flood
 Nexthop index: 0

Linux, 00:19:e2:50:7d:e0
 Interface(s): Router
 Type: Static
 Nexthop index: 0

Linux, 00:30:48:90:54:89
 Interface(s): xe-0/0/47.0
 Type: Learn, Age: 0, Learned: 2:03:08
 Nexthop index: 0

T1, *
 Interface(s): xe-0/0/46.0
 Type: Flood
 Nexthop index: 0

T1, 00:00:05:00:00:01
 Interface(s): xe-0/0/46.0
 Type: Learn, Age: 0, Learned: 2:03:07
 Nexthop index: 0

T1, 00:00:5e:00:01:00
 Interface(s): Router
 Type: Static
 Nexthop index: 0

```

```

T1, 00:19:e2:50:63:e0
 Interface(s): xe-0/0/46.0
 Type: Learn, Age: 0, Learned: 2:03:07
 Nexthop index: 0

T1, 00:19:e2:50:7d:e0
 Interface(s): Router
 Type: Static
 Nexthop index: 0

T10, *
 Interface(s): xe-0/0/46.0
 Type: Flood
 Nexthop index: 0

T10, 00:00:5e:00:01:09
 Interface(s): Router
 Type: Static
 Nexthop index: 0

T10, 00:19:e2:50:63:e0
 Interface(s): xe-0/0/46.0
 Type: Learn, Age: 0, Learned: 2:03:08
 Nexthop index: 0

T10, 00:19:e2:50:7d:e0
 Interface(s): Router
 Type: Static
 Nexthop index: 0

T111, *
 Interface(s): xe-0/0/15.0
 Type: Flood
 Nexthop index: 0
[output truncated]

```

### show ethernet-switching table extensive

```

user@switch> show ethernet-switching table extensive
Ethernet-switching table: 57 entries, 17 learned
F2, *
 Interface(s): xe-0/0/44.0
 Type: Flood
 Nexthop index: 0

F2, 00:00:05:00:00:03
 Interface(s): xe-0/0/44.0
 Type: Learn, Age: 0, Learned: 2:03:09
 Nexthop index: 0

F2, 00:19:e2:50:7d:e0
 Interface(s): Router
 Type: Static
 Nexthop index: 0

Linux, *
 Interface(s): xe-0/0/47.0
 Type: Flood
 Nexthop index: 0

Linux, 00:19:e2:50:7d:e0

```

```
Interface(s): Router
Type: Static
Nexthop index: 0

Linux, 00:30:48:90:54:89
Interface(s): xe-0/0/47.0
Type: Learn, Age: 0, Learned: 2:03:08
Nexthop index: 0

T1, *
Interface(s): xe-0/0/46.0
Type: Flood
Nexthop index: 0

T1, 00:00:05:00:00:01
Interface(s): xe-0/0/46.0
Type: Learn, Age: 0, Learned: 2:03:07
Nexthop index: 0

T1, 00:00:5e:00:01:00
Interface(s): Router
Type: Static
Nexthop index: 0

T1, 00:19:e2:50:63:e0
Interface(s): xe-0/0/46.0
Type: Learn, Age: 0, Learned: 2:03:07
Nexthop index: 0

T1, 00:19:e2:50:7d:e0
Interface(s): Router
Type: Static
Nexthop index: 0

T10, *
Interface(s): xe-0/0/46.0
Type: Flood
Nexthop index: 0

T10, 00:00:5e:00:01:09
Interface(s): Router
Type: Static
Nexthop index: 0

T10, 00:19:e2:50:63:e0
Interface(s): xe-0/0/46.0
Type: Learn, Age: 0, Learned: 2:03:08
Nexthop index: 0

T10, 00:19:e2:50:7d:e0
Interface(s): Router
Type: Static
Nexthop index: 0

T111, *
Interface(s): xe-0/0/15.0
Type: Flood
Nexthop index: 0
[output truncated]
```

**show ethernet-switching table interface**

```
user@switch> show ethernet-switching table interface xe-0/0/1
Ethernet-switching table: 1 unicast entries
VLAN MAC address Type Age Interfaces
V1 * Flood - All-members
V1 00:00:05:00:00:05 Learn 0 xe-0/0/1.0
```

## show vlans

**Syntax** `show vlans`  
`<brief | detail | extensive>`  
`<dot1q-tunneling>`  
`<sort-by (tag | name)>`  
`<vlan-range-name>`

**Release Information** Command introduced in Junos OS Release 11.1 for the QFX Series.  
Option **dot1q-tunneling** added in Junos OS Release 12.1 for the QFX Series.

**Description** Display information about VLANs configured on bridged Ethernet interfaces. For interfaces configured to support a VoIP VLAN and a data VLAN, the **show vlans** command displays both tagged and untagged membership for those VLANs.



**NOTE:** When a series of VLANs is created using the `vlan-range` statement, such VLAN names are preceded and followed by a double underscore. For example, a series of VLANs using the VLAN range 1 through 3 and the base VLAN name `marketing` would be displayed as `__marketing_1__`, `__marketing_2__`, and `__marketing_3__`.



**NOTE:** To display an 802.1X supplicant successfully authenticated in multiple-supplicant mode with dynamic VLAN movement, use the `show vlans vlan-name extensive` operational mode command, where *vlan-name* is the dynamic VLAN.

**Options** **none**—Display information for all VLANs. VLAN information is displayed by VLAN name in ascending order.

**brief | detail | extensive**—(Optional) Display the specified level of output.

**sort-by (tag | name)**—(Optional) Display VLANs in ascending order of VLAN IDs or VLAN names.

**vlan-range-name**—(Optional) Display VLANs in ascending order of VLAN range names.

**Required Privilege Level** `view`

**Related Documentation**

- [Example: Setting Up Basic Bridging and a VLAN on the QFX Series](#)
- [Example: Setting Up Bridging with Multiple VLANs](#)
- [Understanding Bridging and VLANs](#)
- [show ethernet-switching interfaces on page 286](#)

**List of Sample Output**

- [show vlans on page 311](#)
- [show vlans \(Private VLANs\) on page 311](#)
- [show vlans brief on page 312](#)
- [show vlans detail on page 312](#)
- [show vlans extensive \(Port-Based\) on page 313](#)
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- [show vlans extensive \(Q-in-Q Tunneling\) on page 314](#)
- [show vlans extensive \(Q-in-Q Tunneling and L2TP\) on page 314](#)
- [show vlans sort-by tag on page 314](#)
- [show vlans sort-by name on page 315](#)
- [show vlans tag on page 316](#)

**Output Fields** Table 26 on page 309 lists the output fields for the **show vlans** command. Output fields are listed in the approximate order in which they appear.

**Table 26: show vlans Output Fields**

| Field Name                  | Field Description                                                                                                                                                            | Level of Output          |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <b>Name</b>                 | Name of a VLAN.                                                                                                                                                              | none, <b>brief</b>       |
| <b>Tag</b>                  | 802.1Q tag applied to this VLAN. If <b>none</b> is displayed, no tag is applied.                                                                                             | All levels               |
| <b>Interfaces</b>           | Interface associated with learned MAC addresses or <b>All-members</b> option (flood entry). An asterisk (*) beside the interface indicates that the interface is <b>UP</b> . | All levels               |
| <b>Address</b>              | IP address.                                                                                                                                                                  | none, <b>brief</b>       |
| <b>Ports Active /Total</b>  | Number of interfaces associated with a VLAN: <b>Active</b> indicates interfaces that are <b>UP</b> , and <b>Total</b> indicates interfaces that are active and inactive.     | <b>brief</b>             |
| <b>VLAN</b>                 | Name of a VLAN.                                                                                                                                                              | <b>detail, extensive</b> |
| <b>Admin state</b>          | State of the interface. Values are:<br><br><b>enabled</b> —The interface is turned on, and the physical link is operational and can pass packets.                            | <b>detail,extensive</b>  |
| <b>MAC learning Status</b>  | Indicates if MAC learning is disabled.                                                                                                                                       | <b>detail, extensive</b> |
| <b>Description</b>          | Description for the VLAN.                                                                                                                                                    | <b>detail,extensive</b>  |
| <b>Primary IP</b>           | Primary IP address associated with a VLAN.                                                                                                                                   | <b>detail</b>            |
| <b>Number of interfaces</b> | Number of interfaces associated with a VLAN. Both the total number of interfaces and the number of active interfaces associated with a VLAN are displayed.                   | <b>detail, extensive</b> |
| <b>STP</b>                  | Spanning tree associated with a VLAN.                                                                                                                                        | <b>detail,extensive</b>  |
| <b>Tagged interfaces</b>    | Tagged interfaces with which a VLAN is associated.                                                                                                                           | <b>detail,extensive</b>  |

Table 26: show vlans Output Fields (*continued*)

| Field Name              | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Level of Output   |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Untagged interfaces     | Untagged interfaces with which a VLAN is associated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | detail. extensive |
| Dot1q Tunneling Status  | Indicates if Q-in-Q tunneling is enabled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | extensive         |
| Customer VLAN ranges    | List of customer VLAN (C-VLAN) ranges associated with this service VLAN (S-VLAN).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | extensive         |
| Private VLAN Mode       | The private VLAN mode for this VLAN. Values include <b>Primary</b> , <b>Isolated</b> , and <b>Community</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | extensive         |
| Primary VLAN            | Primary VLAN tag for this secondary VLAN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | extensive         |
| Internal Index          | VLAN index internal to Junos OS software.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | extensive         |
| Origin                  | Manner in which the VLAN was created: <b>static</b> or <b>learn</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | extensive         |
| Protocol                | Port-based VLAN or MAC-based VLAN. MAC-based protocol is displayed when VLAN assignment is done either statically or dynamically through 802.1X,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | extensive         |
| IP addresses            | IP address associated with a VLAN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | extensive         |
| Number of MAC entries   | For MAC-based VLANs created either statically or dynamically, the MAC addresses associated with an interface.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | extensive         |
| Number of mapping rules | Number of mapping rules for Q-in-Q tunneling ( <b>Push</b> ) and VLAN translation ( <b>Swap</b> ).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |
| Secondary VLANs         | Secondary VLANs associated with a primary VLAN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | extensive         |
| Isolated VLANs          | Isolated VLANs associated with a primary VLAN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | extensive         |
| Community VLANs         | Community VLANs associated with a primary VLAN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | extensive         |
| VLANs summary           | VLAN counts: <ul style="list-style-type: none"> <li>• <b>Total</b>—Total number of VLANs on the switch.</li> <li>• <b>Configured VLANs</b>—Number of VLANs that are based on user-configured settings.</li> <li>• <b>Internal VLANs</b>—Number of VLANs created by the system with no explicit configuration or protocol—for example, the <b>default</b> VLAN and the VLAN created when a trunk interface is not configured with native VLAN membership.</li> <li>• <b>Temporary VLANs</b>—Number of VLANs from the previous configuration that the system retains for a limited time after restart. Temporary VLANs are converted into one of the other types of VLAN, or are removed from the system if the current configuration does not require them.</li> </ul> | All levels        |



Table 26: show vlans Output Fields (*continued*)

| Field Name                          | Field Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Level of Output |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Dot1q VLANs summary</b>          | 802.1Q VLAN counts: <ul style="list-style-type: none"> <li>• <b>Total</b>—Total number of 802.1Q-tagged and untagged VLANs on the switch.</li> <li>• <b>Tagged VLANs</b>—Number of 802.1Q-tagged VLANs.</li> <li>• <b>Untagged VLANs</b>—Number of untagged 802.1Q VLANs.</li> <li>• <b>Private VLAN</b>—Counts of the following kinds of 802.1Q private VLANs (PVLANS):           <ul style="list-style-type: none"> <li>• <b>Primary VLANs</b>—Number of primary forwarding private VLANs.</li> <li>• <b>Community VLANs</b>—Number of community transporting and forwarding private VLANs.</li> <li>• <b>Isolated VLANs</b>—Number of isolated receiving and forwarding private VLANs.</li> <li>• <b>Inter-switch-isolated VLANs</b>—Number of inter-switch isolated receiving and forwarding private VLANs.</li> </ul> </li> </ul> | All levels      |
| <b>Dot1q Tunneled VLANs summary</b> | Q-in-Q-tunneled VLAN counts: <ul style="list-style-type: none"> <li>• <b>Total</b>—Total number of Q-in-Q-tunneled VLANs on the switch.</li> <li>• <b>Private VLAN</b>—Counts of primary, community, and isolated Q-in-Q-tunneled private VLANs (PVLANS).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | All levels      |

## Sample Output

### show vlans

```
user@switch> show vlans
```

| Name    | Tag  | Interfaces                                                                                                                                                                                                                                                                                           |
|---------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| default | None | xe-0/0/34.0, xe-0/0/33.0, xe-0/0/32.0, xe-0/0/31.0, xe-0/0/30.0, xe-0/0/29.0, xe-0/0/28.0, xe-0/0/27.0, xe-0/0/26.0, xe-0/0/25.0, xe-0/0/19.0, xe-0/0/18.0, xe-0/0/17.0, xe-0/0/16.0, xe-0/0/15.0, xe-0/0/14.0, xe-0/0/13.0, xe-0/0/11.0, xe-0/0/9.0, xe-0/0/8.0, xe-0/0/3.0, xe-0/0/2.0, xe-0/0/1.0 |
| v0001   | 1    | xe-0/0/24.0, xe-0/0/23.0, xe-0/0/22.0, xe-0/0/21.0                                                                                                                                                                                                                                                   |
| v0002   | 2    | None                                                                                                                                                                                                                                                                                                 |
| v0003   | 3    | None                                                                                                                                                                                                                                                                                                 |
| v0004   | 4    | None                                                                                                                                                                                                                                                                                                 |
| v0005   | 5    | None                                                                                                                                                                                                                                                                                                 |

### show vlans (Private VLANs)

```
user@switch> show vlans
```

| Name                        | Tag | Interfaces |
|-----------------------------|-----|------------|
| __pvlan_pvlan_xe-0/0/46.0__ |     |            |

```

c1 xe-0/0/44.0*, xe-0/0/46.0*
c2 xe-0/0/4.0*, xe-0/0/44.0*
default xe-0/0/28.0*, xe-0/0/44.0*
pvlan 500
 None
 xe-0/0/4.0*, xe-0/0/28.0*, xe-0/0/44.0*, xe-0/0/46.0*

```

### show vlans brief

```
user@switch> show vlans brief
```

| Name    | Tag  | Address | Ports<br>Active/Total |
|---------|------|---------|-----------------------|
| default | None |         | 0/23                  |
| v0001   | 1    |         | 0/4                   |
| v0002   | 2    |         | 0/0                   |
| v0003   | 3    |         | 0/0                   |
| v0004   | 4    |         | 0/0                   |
| v0005   | 5    |         | 0/0                   |
| v0006   | 6    |         | 0/0                   |
| v0007   | 7    |         | 0/0                   |
| v0008   | 8    |         | 0/0                   |
| v0009   | 9    |         | 0/0                   |
| v0010   | 10   |         | 0/2                   |
| v0011   | 11   |         | 0/0                   |
| v0012   | 12   |         | 0/0                   |
| v0013   | 13   |         | 0/0                   |
| v0014   | 14   |         | 0/0                   |
| v0015   | 15   |         | 0/0                   |
| v0016   | 16   |         | 0/0                   |

### show vlans detail

```
user@switch> show vlans detail
```

```
VLAN: default, Tag: Untagged, Admin state: Enabled
```

```
Description: None
```

```
Primary IP: None, Number of interfaces: 23 (Active = 0)
```

```
STP: None, RTG: None
```

```
Untagged interfaces: xe-0/0/34.0, xe-0/0/33.0, xe-0/0/32.0, xe-0/0/31.0,
xe-0/0/30.0, xe-0/0/29.0, xe-0/0/28.0, xe-0/0/27.0, xe-0/0/26.0,
xe-0/0/25.0, xe-0/0/19.0, xe-0/0/18.0, xe-0/0/17.0, xe-0/0/16.0,
xe-0/0/15.0, xe-0/0/14.0, xe-0/0/13.0, xe-0/0/11.0, xe-0/0/9.0, xe-0/0/8.0,
xe-0/0/3.0, xe-0/0/2.0, xe-0/0/1.0,
```

```
Tagged interfaces: None
```

```
VLAN: v0001, Tag: 802.1Q Tag 1, Admin state: Enabled
```

```
Description: None
```

```
Primary IP: None, Number of interfaces: 4 (Active = 0)
```

```
Dot1q Tunneling Status: Enabled
```

```
STP: None, RTG: None
```

```
Untagged interfaces: None
```

```
Tagged interfaces: xe-0/0/24.0, xe-0/0/23.0, xe-0/0/22.0, xe-0/0/21.0,
```

```
VLAN: v0002, Tag: 802.1Q Tag 2, Admin state: Enabled
```

```
Description: None
```

```
Primary IP: None, Number of interfaces: 0 (Active = 0)
```

```
STP: None, RTG: None
```

```
Untagged interfaces: None
```

```
Tagged interfaces: None
```

```

VLAN: v0003, Tag: 802.1Q Tag 3, Admin state: Enabled
Description: None
Primary IP: None, Number of interfaces: 0 (Active = 0)
STP: None, RTG: None
Untagged interfaces: None
Tagged interfaces: None

VLAN: vlan4000, 802.1Q Tag: Untagged, Admin State: Enabled
MAC learning Status: Disabled
Number of interfaces: 0 (Active = 0)

```

### show vlans extensive (Port-Based)

```

user@switch> show vlans extensive
VLAN: default, created at Mon Feb 4 12:13:47 2008
Tag: None, Internal index: 0, Admin state: Enabled, Origin: static
Description: None
Customer VLAN ranges:
 1-4100
Protocol: Port based
IP addresses: None
STP: None, RTG: None.
Number of interfaces: Tagged 0 (Active = 0), Untagged 23 (Active = 0)
 xe-0/0/34.0 (untagged, access)
 xe-0/0/33.0 (untagged, access)
 xe-0/0/32.0 (untagged, access)
 xe-0/0/31.0 (untagged, access)
 xe-0/0/30.0 (untagged, access)
 xe-0/0/29.0 (untagged, access)
 xe-0/0/28.0 (untagged, access)
 xe-0/0/27.0 (untagged, access)
 xe-0/0/26.0 (untagged, access)
 xe-0/0/25.0 (untagged, access)
 xe-0/0/19.0 (untagged, access)
 xe-0/0/18.0 (untagged, access)
 xe-0/0/17.0 (untagged, access)
 xe-0/0/16.0 (untagged, access)
 xe-0/0/15.0 (untagged, access)
 xe-0/0/14.0 (untagged, access)
 xe-0/0/13.0 (untagged, access)
 xe-0/0/11.0 (untagged, access)
 xe-0/0/9.0 (untagged, access)
 xe-0/0/8.0 (untagged, access)
 xe-0/0/3.0 (untagged, access)
 xe-0/0/2.0 (untagged, access)
 xe-0/0/1.0 (untagged, access)

Secondary VLANs: Isolated 1, Community 1
Isolated VLANs :
 __pvlan_pvlan_xe-0/0/3.0__
Community VLANs :
 comm1

VLAN: v0001, created at Mon Feb 4 12:13:47 2008
Tag: 1, Internal index: 1, Admin state: Enabled, Origin: static
Description: None
Protocol: Port based, Layer 3 interface: None
IP addresses: None
STP: None, RTG: None.
Number of interfaces: Tagged 4 (Active = 0), Untagged 0 (Active = 0)

```

```

xe-0/0/24.0 (tagged, trunk)
xe-0/0/23.0 (tagged, trunk)
xe-0/0/22.0 (tagged, trunk)
xe-0/0/21.0 (tagged, trunk)

```

```

VLAN: v0002, created at Mon Feb 4 12:13:47 2008
Tag: 2, Internal index: 2, Admin state: Enabled, Origin: static
Description: None
Protocol: Port based, Layer 3 interface: None
IP addresses: None
STP: None, RTG: None.
Number of interfaces: Tagged 0 (Active = 0), Untagged 0 (Active = 0)
None

VLAN: v0003, created at Mon Feb 4 12:13:47 2008
Tag: 3, Internal index: 3, Admin state: Enabled, Origin: static
Description: None
Protocol: Port based, Layer 3 interface: None
IP addresses: None
STP: None, RTG: None.
Number of interfaces: Tagged 0 (Active = 0), Untagged 0 (Active = 0)
None

```

#### show vlans (Q-in-Q Tunneling)

```

user@switch> show vlans dot1q-tunneling
Name Tag Interfaces
sv100 100 xe-0/0/4.0*, xe-0/0/15.0*

```

#### show vlans extensive (Q-in-Q Tunneling)

```

user@switch> show vlans sv100 extensive
VLAN: sv100, Created at: Sat Sep 10 12:53:52 2011
802.1Q Tag: 100, Internal index: 2, Admin State: Enabled, Origin: Static
Dot1q Tunneling Status: Enabled
Customer VLAN ranges:
 10-20
 40-50
Protocol: Port Mode
Number of interfaces: Tagged 1 (Active = 1), Untagged 0 (Active = 0)
 ge-0/0/0.0, tagged, trunk

Number of mapping rules:
 Push 1 (Active = 0), Policy 0 (Active = 0), Swap 0 (Active = 0)

 xe-0/0/3.0*, 300, push

```

#### show vlans extensive (Q-in-Q Tunneling and L2TP)

```

user@switch> show vlans v1 extensive
VLAN: v1, Created at: Fri Mar 2 05:07:38 2012
802.1Q Tag: 100, Internal index: 4, Admin State: Enabled, Origin: Static
Dot1q Tunneling status: Enabled
Layer2 Protocol Tunneling status: Enabled

```

#### show vlans sort-by tag

```

user@switch> show vlans sort-by tag
Name Tag Interfaces
default None
__vlan-x_1__ 1

```

|               |    |      |
|---------------|----|------|
| __vlan-x_2__  | 2  | None |
| __vlan-x_3__  | 3  | None |
| __vlan-x_4__  | 4  | None |
| __vlan-x_5__  | 5  | None |
| __vlan-x_6__  | 6  | None |
| __vlan-x_7__  | 7  | None |
| __vlan-x_8__  | 8  | None |
| __vlan-x_9__  | 9  | None |
| __vlan-x_10__ | 10 | None |
| __vlan-x_11__ | 11 | None |
| __vlan-x_12__ | 12 | None |
| __vlan-x_13__ | 13 | None |
| __vlan-x_14__ | 14 | None |
| __vlan-x_15__ | 15 | None |
| __vlan-x_16__ | 16 | None |
| __vlan-x_17__ | 17 | None |
| __vlan-x_18__ | 18 | None |
| __vlan-x_19__ | 19 | None |
| __vlan-x_20__ | 20 | None |

### show vlans sort-by name

```
user@switch> show vlans sort-by employee
```

| Name             | Tag | Interfaces   |
|------------------|-----|--------------|
| __employee_120__ | 120 | xe-0/0/22.0* |
| __employee_121__ | 121 | xe-0/0/22.0* |
| __employee_122__ | 122 | xe-0/0/22.0* |
| __employee_123__ | 123 | xe-0/0/22.0* |
| __employee_124__ | 124 | xe-0/0/22.0* |
| __employee_125__ | 125 | xe-0/0/22.0* |
| __employee_126__ | 126 | xe-0/0/22.0* |
| __employee_127__ | 127 | xe-0/0/22.0* |

```
__employee_128__ 128 xe-0/0/22.0*
__employee_129__ 129 xe-0/0/22.0*
__employee_130__ 130 xe-0/0/22.0*
 xe-0/0/22.0*
```

### show vlans tag

```
user@switch> show vlans employee
```

| Name             | Tag | Interfaces   |
|------------------|-----|--------------|
| __employee_120__ | 120 | xe-0/0/22.0* |
| __employee_121__ | 121 | xe-0/0/22.0* |
| __employee_122__ | 122 | xe-0/0/22.0* |
| __employee_123__ | 123 | xe-0/0/22.0* |
| __employee_124__ | 124 | xe-0/0/22.0* |
| __employee_125__ | 125 | xe-0/0/22.0* |
| __employee_126__ | 126 | xe-0/0/22.0* |
| __employee_127__ | 127 | xe-0/0/22.0* |
| __employee_128__ | 128 | xe-0/0/22.0* |
| __employee_129__ | 129 | xe-0/0/22.0* |
| __employee_130__ | 130 | xe-0/0/22.0* |

## CHAPTER 20

# Operational Commands (Proxy ARP)

- `show system statistics arp`

## show system statistics arp

---

|                                 |                                                                                                                                                                                                    |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | show system statistics arp                                                                                                                                                                         |
| <b>Release Information</b>      | Command introduced in Junos OS Release 9.6 for EX Series switches.                                                                                                                                 |
| <b>Description</b>              | Display system-wide Address Resolution Protocol (ARP) statistics.                                                                                                                                  |
| <b>Required Privilege Level</b> | view                                                                                                                                                                                               |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <i>Example: Configuring Proxy ARP on an EX Series Switch</i></li><li>• <a href="#">Verifying That Proxy ARP Is Working Correctly on page 100</a></li></ul> |

## show system statistics arp

```
user@switch> show system statistics arp
arp:
 90060 datagrams received
 34 ARP requests received
 610 ARP replies received
 0 resolution request received
 0 unrestricted proxy requests
 0 restricted proxy requests
 0 received proxy requests
 0 unrestricted proxy requests not proxied
 0 restricted proxy requests not proxied
 0 datagrams with bogus interface
 0 datagrams with incorrect length
 0 datagrams for non-IP protocol
 0 datagrams with unsupported op code
 0 datagrams with bad protocol address length
 0 datagrams with bad hardware address length
 0 datagrams with multicast source address
 0 datagrams with multicast target address
 0 datagrams with my own hardware address
 0 datagrams for an address not on the interface
 0 datagrams with a broadcast source address
 294 datagrams with source address duplicate to mine
 89113 datagrams which were not for me
 0 packets discarded waiting for resolution
 0 packets sent after waiting for resolution
 309 ARP requests sent
 35 ARP replies sent
 0 requests for memory denied
 0 requests dropped on entry
 0 requests dropped during retry
 0 requests dropped due to interface deletion
 0 requests on unnumbered interfaces
 0 new requests on unnumbered interfaces
 0 replies for from unnumbered interfaces
 0 requests on unnumbered interface with non-subnetted donor
 0 replies from unnumbered interface with non-subnetted donor
```



## CHAPTER 21

# Operational Commands (Spanning-Tree Protocols)

- `clear bpdu-error`
- `clear spanning-tree statistics`
- `show spanning-tree bridge`
- `show spanning-tree interface`
- `show spanning-tree mstp configuration`
- `show spanning-tree statistics`

## clear bpdv-error

---


|                                 |                                                                                                                                                                                                                                                                                                              |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Syntax</b>                   | <code>clear bpdv-error interface <i>interface-name</i></code>                                                                                                                                                                                                                                                |
| <b>Release Information</b>      | Command introduced in Junos OS Release 9.1 for EX Series switches. Command updated in Junos OS Release 11.1 for EX Series switches—a BPDv error shuts down the interface and this command brings the interface back up.<br>Command introduced in Junos OS Release 11.1 for the QFX Series.                   |
| <b>Description</b>              | Clear bridge protocol data unit (BPDv) errors from an interface and bring up the interface.                                                                                                                                                                                                                  |
| <b>Options</b>                  | <i>interface-name</i> —Clear BPDv errors on the specified interface.                                                                                                                                                                                                                                         |
| <b>Required Privilege Level</b> | clear                                                                                                                                                                                                                                                                                                        |
| <b>Related Documentation</b>    | <ul style="list-style-type: none"><li>• <a href="#">show spanning-tree interface on page 327</a></li><li>• <a href="#">Understanding BPDv Protection for STP, RSTP, and MSTP on EX Series Switches</a></li><li>• <a href="#">Understanding BPDv Protection for STP, RSTP, and MSTP on page 107</a></li></ul> |
| <b>List of Sample Output</b>    | <a href="#">clear bpdv-error interface on page 320</a>                                                                                                                                                                                                                                                       |

### Sample Output

#### clear bpdv-error interface

```
user@switch> clear bpdv-error interface xe-0/0/1.0
```

## clear spanning-tree statistics

|                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>List of Syntax</b>                                                                                                                                                                                   | <a href="#">Syntax on page 321</a><br><a href="#">Syntax (EX Series Switches and the QFX Series) on page 321</a>                                                                                                                                                                                                        |
| <b>Syntax</b>                                                                                                                                                                                           | clear spanning-tree statistics<br><interface <i>interface-name</i> ><br><logical-system <i>logical-system-name</i> >                                                                                                                                                                                                    |
| <b>Syntax (EX Series Switches and the QFX Series)</b>                                                                                                                                                   | clear spanning-tree statistics<br><interface <i>interface-name</i> >                                                                                                                                                                                                                                                    |
| <b>Release Information</b>                                                                                                                                                                              | Command introduced in Junos OS Release 8.4.<br>Command introduced in Junos OS Release 9.0 for EX Series switches.<br>Command introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                                                    |
| <b>Description</b>                                                                                                                                                                                      | Clear Spanning Tree Protocol statistics.                                                                                                                                                                                                                                                                                |
| <b>Options</b>                                                                                                                                                                                          | <b>none</b> —Reset STP counters for all interfaces for all routing instances.<br><br><b>interface <i>interface-name</i></b> —(Optional) Clear STP statistics for the specified interface only.<br><br><b>logical-system <i>logical-system-name</i></b> —(Optional) Clear STP statistics on a particular logical system. |
| <div>  <div> <p><b>NOTE:</b> The <b>logical-system</b> option is not available on QFabric systems.</p> </div> </div> |                                                                                                                                                                                                                                                                                                                         |
| <b>Required Privilege Level</b>                                                                                                                                                                         | clear                                                                                                                                                                                                                                                                                                                   |
| <b>Related Documentation</b>                                                                                                                                                                            | <ul style="list-style-type: none"> <li><a href="#">show spanning-tree statistics on page 335</a></li> </ul>                                                                                                                                                                                                             |
| <b>List of Sample Output</b>                                                                                                                                                                            | <a href="#">clear stp statistics on page 321</a>                                                                                                                                                                                                                                                                        |

### Sample Output

#### clear stp statistics

```
user@host> clear stp statistics
```

## show spanning-tree bridge

**List of Syntax** [Syntax on page 322](#)  
[Syntax \(QFX Series\) on page 322](#)

**Syntax** show spanning-tree bridge  
 <brief | detail>  
 <msti *msti-id*>  
 <routing-instance *routing-instance-name*>  
 <vlan-id *vlan-id*>

**Syntax (QFX Series)** show spanning-tree bridge  
 <brief | detail>  
 <msti *msti-id*>  
 <vlan-id *vlan-id*>

**Release Information** Command introduced in Junos OS Release 8.4.  
 Command introduced in Junos OS Release 11.1 for the QFX Series.

**Description** Display the configured or calculated Spanning Tree Protocol (STP) parameters.

**Options** **none**—(Optional) Display brief STP bridge information for all multiple spanning-tree instances (MSTIs).

**brief | detail**—(Optional) Display the specified level of output.

**msti *msti-id***—(Optional) Display STP bridge information for the specified MSTI.

**routing-instance *routing-instance-name***—(Optional) Display STP bridge information for the specified routing instance.

**vlan-id *vlan-id***—(Optional) Display STP bridge information for the specified VLAN.

**Required Privilege Level** view

**List of Sample Output** [show spanning-tree bridge routing-instance on page 323](#)  
[show spanning-tree bridge msti on page 324](#)  
[show spanning-tree bridge vlan-id \(MSTP\) on page 325](#)  
[show spanning-tree bridge \(RSTP\) on page 325](#)  
[show spanning-tree bridge vlan-id \(RSTP\) on page 326](#)

**Output Fields** [Table 27 on page 322](#) lists the output fields for the **show spanning-tree bridge** command. Output fields are listed in the approximate order in which they appear.

**Table 27: show spanning-tree bridge Output Fields**

| Field Name            | Field Description                                                  |
|-----------------------|--------------------------------------------------------------------|
| Routing instance name | Name of the routing instance under which the bridge is configured. |
| Enabled protocol      | Spanning Tree Protocol type enabled.                               |

Table 27: show spanning-tree bridge Output Fields (*continued*)

| Field Name                             | Field Description                                                                                                                               |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Root ID</b>                         | Bridge ID of the elected spanning-tree root bridge. The bridge ID consists of a configurable bridge priority and the MAC address of the bridge. |
| <b>Root cost</b>                       | Calculated cost to reach the root bridge from the bridge where the command is entered.                                                          |
| <b>Root port</b>                       | Interface that is the current elected root port for this bridge.                                                                                |
| <b>CIST regional root</b>              | Bridge ID of the elected MSTP regional root bridge.                                                                                             |
| <b>CIST internal root cost</b>         | Calculated cost to reach the regional root bridge from the bridge where the command is entered.                                                 |
| <b>Hello time</b>                      | Configured number of seconds between transmissions of configuration BPDUs.                                                                      |
| <b>Maximum age</b>                     | Configured maximum expected arrival time of hello bridge protocol data units (BPDUs).                                                           |
| <b>Forward delay</b>                   | How long an STP bridge port remains in the listening and learning states before transitioning to the forwarding state.                          |
| <b>Hop count</b>                       | Configured maximum number of hops a BPDU can be forwarded in the MSTP region.                                                                   |
| <b>Message age</b>                     | Number of elapsed seconds since the most recent BPDU was received.                                                                              |
| <b>Number of topology changes</b>      | Total number of STP topology changes detected since the routing device last booted.                                                             |
| <b>Time since last topology change</b> | Number of elapsed seconds since the most recent topology change.                                                                                |
| <b>Bridge ID (Local)</b>               | Locally configured bridge ID. The bridge ID consists of a configurable bridge priority and the MAC address of the bridge.                       |
| <b>Extended system ID</b>              | System identifier.                                                                                                                              |
| <b>MSTI regional root</b>              | Bridge ID of the elected MSTP regional root bridge.                                                                                             |

## Sample Output

### show spanning-tree bridge routing-instance

```

user@host> show spanning-tree bridge routing-instance vs1 detail
STP bridge parameters
Routing instance name : vs1
Enabled protocol : MSTP

```

```

STP bridge parameters for CIST
 Root ID : 32768.00:13:c3:9e:c8:80
 Root cost : 0
 Root port : ge-10/2/0
 CIST regional root : 32768.00:13:c3:9e:c8:80
 CIST internal root cost : 22000
 Hello time : 2 seconds
 Maximum age : 20 seconds
 Forward delay : 15 seconds
 Hop count : 18
 Message age : 0
 Number of topology changes : 1
 Time since last topology change : 1191 seconds
 Local parameters
 Bridge ID : 32768.00:90:69:0b:7f:d1
 Extended system ID : 1

STP bridge parameters for MSTI 1
 MSTI regional root : 32769.00:13:c3:9e:c8:80
 Root cost : 22000
 Root port : ge-10/2/0
 Hello time : 2 seconds
 Maximum age : 20 seconds
 Forward delay : 15 seconds
 Hop count : 18
 Number of topology changes : 1
 Time since last topology change : 1191 seconds
 Local parameters
 Bridge ID : 32769.00:90:69:0b:7f:d1
 Extended system ID : 1

STP bridge parameters for MSTI 2
 MSTI regional root : 32770.00:13:c3:9e:c8:80
 Root cost : 22000
 Root port : ge-10/2/0
 Hello time : 2 seconds
 Maximum age : 20 seconds
 Forward delay : 15 seconds
 Hop count : 18
 Number of topology changes : 1
 Time since last topology change : 1191 seconds
 Local parameters
 Bridge ID : 32770.00:90:69:0b:7f:d1
 Extended system ID : 1

```

### show spanning-tree bridge msti

```

user@host> show spanning-tree bridge msti 1 routing-instance vs1 detail
STP bridge parameters
Routing instance name : vs1
Enabled protocol : MSTP

STP bridge parameters for MSTI 1
 MSTI regional root : 32769.00:13:c3:9e:c8:80
 Root cost : 22000
 Root port : xe-10/2/0
 Hello time : 2 seconds
 Maximum age : 20 seconds
 Forward delay : 15 seconds
 Hop count : 18

```

```

Number of topology changes : 1
Time since last topology change : 1191 seconds
Local parameters
 Bridge ID : 32769.00:90:69:0b:7f:d1
 Extended system ID : 1

```

### show spanning-tree bridge vlan-id (MSTP)

```
user@host> show spanning-tree bridge vlan-id 1101 routing-instance vs1 detail
```

```

STP bridge parameters
Routing instance name : vs1
Enabled protocol : MSTP

STP bridge parameters for CIST
Root ID : 32768.00:13:c3:9e:c8:80
Root cost : 0
Root port : xe-10/2/0
CIST regional root : 32768.00:13:c3:9e:c8:80
CIST internal root cost : 22000
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Hop count : 18
Message age : 0
Number of topology changes : 0
Local parameters
 Bridge ID : 32768.00:90:69:0b:7f:d1
 Extended system ID : 1
 Hello time : 2 seconds
 Maximum age : 20 seconds
 Forward delay : 15 seconds
 Path cost method : 32 bit
 Maximum hop count : 20

```

### show spanning-tree bridge (RSTP)

```
user@host> show spanning-tree bridge
```

```

STP bridge parameters
Routing instance name : GLOBAL
Enabled protocol : RSTP
Root ID : 28672.00:90:69:0b:3f:d0
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Message age : 0
Number of topology changes : 58
Time since last topology change : 14127 seconds
Local parameters
 Bridge ID : 28672.00:90:69:0b:3f:d0
 Extended system ID : 0

STP bridge parameters for bridge VLAN 10
Root ID : 28672.00:90:69:0b:3f:d0
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Message age : 0
Number of topology changes : 58
Time since last topology change : 14127 seconds
Local parameters
 Bridge ID : 28672.00:90:69:0b:3f:d0

```

```
Extended system ID : 0

STP bridge parameters for bridge VLAN 20
Root ID : 28672.00:90:69:0b:3f:d0
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Message age : 0
Number of topology changes : 58
Time since last topology change : 14127 seconds
Local parameters
 Bridge ID : 28672.00:90:69:0b:3f:d0
 Extended system ID : 0
```

#### show spanning-tree bridge vlan-id (RSTP)

```
user@host> show spanning-tree bridge vlan-id 10
STP bridge parameters
Routing instance name : GLOBAL
Enabled protocol : RSTP

STP bridge parameters for VLAN 10
Root ID : 28672.00:90:69:0b:3f:d0
Hello time : 2 seconds
Maximum age : 20 seconds
Forward delay : 15 seconds
Message age : 0
Number of topology changes : 58
Time since last topology change : 14127 seconds
Local parameters
 Bridge ID : 28672.00:90:69:0b:3f:d0
 Extended system ID : 0
```



## show spanning-tree interface

|                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>List of Syntax</b>                                 | <a href="#">Syntax on page 327</a><br><a href="#">Syntax (EX Series Switches and the QFX Series) on page 327</a>                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Syntax</b>                                         | <pre>show spanning-tree interface &lt;brief   detail&gt; &lt;msti <i>msti-id</i>&gt; &lt;routing-instance <i>routing-instance-name</i>&gt; &lt;vlan-id <i>vlan-id</i>&gt;</pre>                                                                                                                                                                                                                                                                                                                                  |
| <b>Syntax (EX Series Switches and the QFX Series)</b> | <pre>show spanning-tree interface &lt;brief   detail&gt; &lt;msti <i>msti-id</i>&gt; &lt;vlan-id <i>vlan-id</i>&gt;</pre>                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Release Information</b>                            | <p>Command introduced in Junos OS Release 8.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.1 for the QFX Series.</p>                                                                                                                                                                                                                                                                                                              |
| <b>Description</b>                                    | Display the configured or calculated interface-level STP parameters.                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Options</b>                                        | <p><b>none</b>—Display brief STP interface information.</p> <p><b>brief   detail</b>—(Optional) Display the specified level of output.</p> <p><b>msti <i>msti-id</i></b>—(Optional) Display STP interface information for the specified MST instance.</p> <p><b>routing-instance <i>routing-instance-name</i></b>—(Optional) Display STP interface information for the specified routing instance.</p> <p><b>vlan-id <i>vlan-id</i></b>—(Optional) Display STP interface information for the specified VLAN.</p> |
| <b>Required Privilege Level</b>                       | view                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>List of Sample Output</b>                          | <a href="#">show spanning-tree interface on page 328</a><br><a href="#">show spanning-tree interface (QFX Series) on page 329</a><br><a href="#">show spanning-tree interface detail on page 329</a><br><a href="#">show spanning-tree interface msti on page 331</a><br><a href="#">show spanning-tree interface vlan-id on page 331</a><br><a href="#">show spanning-tree interface (VSTP) on page 332</a><br><a href="#">show spanning-tree interface vlan-id (VSTP) on page 332</a>                          |
| <b>Output Fields</b>                                  | <p><a href="#">Table 28 on page 327</a> lists the output fields for the <b>show spanning-tree interface</b> command. Output fields are listed in the approximate order in which they appear.</p>                                                                                                                                                                                                                                                                                                                 |

**Table 28: show spanning-tree Interface Output Fields**

| Field Name            | Field Description                                                             |
|-----------------------|-------------------------------------------------------------------------------|
| <b>Interface name</b> | Interface configured to participate in the STP, RSTP, VSTP, or MSTP instance. |

Table 28: show spanning-tree Interface Output Fields (*continued*)

| Field Name                  | Field Description                                                                                                                                                     |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Port ID</b>              | Logical interface identifier configured to participate in the MSTP or VSTP instance.                                                                                  |
| <b>Designated port ID</b>   | Port ID of the designated port for the LAN segment to which this interface is attached.                                                                               |
| <b>Designated bridge ID</b> | Bridge ID of the designated bridge for the LAN segment to which this interface is attached.                                                                           |
| <b>Port Cost</b>            | Configured cost for the interface.                                                                                                                                    |
| <b>Port State</b>           | STP port state: forwarding ( <b>FWD</b> ), blocking ( <b>BLK</b> ), listening, learning, or disabled.                                                                 |
| <b>Port Role</b>            | MSTP, VSTP, or RSTP port role: designated ( <b>DESG</b> ), backup ( <b>BKUP</b> ), alternate ( <b>ALT</b> ), ( <b>ROOT</b> ), or Root Prevented ( <b>Root-Prev</b> ). |
| <b>Link type</b>            | MSTP, VSTP, or RSTP link type. Shared or point-to-point (pt-pt) and edge or nonedge.                                                                                  |
| <b>Alternate</b>            | Identifies the interface as an MSTP, VSTP, or RSTP alternate root port ( <b>Yes</b> ) or nonalternate root port ( <b>No</b> ).                                        |
| <b>Boundary Port</b>        | Identifies the interface as an MSTP regional boundary port ( <b>Yes</b> ) or nonboundary port ( <b>No</b> ).                                                          |

## Sample Output

### show spanning-tree interface

```
user@host> show spanning-tree interface routing-instance vs1 detail
Spanning tree interface parameters for instance 0
```

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-----------|---------|-----------------------|-------------------------|--------------|-------|------|
| ae1       | 128:1   | 128:1                 | 32768.0090690b47d1      | 1000         | FWD   | DESG |
| ge-2/1/2  | 128:2   | 128:2                 | 32768.0090690b47d1      | 20000        | FWD   | DESG |
| ge-2/1/5  | 128:3   | 128:3                 | 32768.0090690b47d1      | 29999        | FWD   | DESG |
| ge-2/2/1  | 128:4   | 128:26                | 32768.0013c39ec880      | 20000        | FWD   | ROOT |
| xe-9/2/0  | 128:5   | 128:5                 | 32768.0090690b47d1      | 2000         | FWD   | DESG |
| xe-9/3/0  | 128:6   | 128:6                 | 32768.0090690b47d1      | 2000         | FWD   | DESG |

```
Spanning tree interface parameters for instance 1
```

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-----------|---------|-----------------------|-------------------------|--------------|-------|------|
| ae1       | 128:1   | 128:1                 | 32769.0090690b47d1      | 1000         | FWD   | DESG |
| ge-2/1/2  | 128:2   | 128:2                 | 32769.0090690b47d1      | 20000        | FWD   | DESG |
| ge-2/1/5  | 128:3   | 128:3                 | 32769.0090690b47d1      | 29999        | FWD   | DESG |
| ge-2/2/1  | 128:4   | 128:26                | 32769.0013c39ec880      | 20000        | FWD   | ROOT |
| xe-9/2/0  | 128:5   | 128:5                 | 32769.0090690b47d1      | 2000         | FWD   | DESG |
| xe-9/3/0  | 128:6   | 128:6                 | 32769.0090690b47d1      | 2000         | FWD   | DESG |

Spanning tree interface parameters for instance 2

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-----------|---------|-----------------------|-------------------------|--------------|-------|------|
| ae1       | 128:1   | 128:1                 | 32770.0090690b47d1      | 1000         | FWD   | DESG |
| ge-2/1/2  | 128:2   | 128:2                 | 32770.0090690b47d1      | 20000        | FWD   | DESG |
| ge-2/1/5  | 128:3   | 128:3                 | 32770.0090690b47d1      | 29999        | FWD   | DESG |
| ge-2/2/1  | 128:4   | 128:26                | 32770.0013c39ec880      | 20000        | FWD   | ROOT |
| xe-9/2/0  | 128:5   | 128:5                 | 32770.0090690b47d1      | 2000         | FWD   | DESG |
| xe-9/3/0  | 128:6   | 128:6                 | 32770.0090690b47d1      | 2000         | FWD   | DESG |

### show spanning-tree interface (QFX Series)

```
user@1f0> show spanning-tree interface routing-instance vs1 detail
Spanning tree interface parameters for instance 0
```

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-----------|---------|-----------------------|-------------------------|--------------|-------|------|
| ae1       | 128:1   | 128:1                 | 32768.0090690b47d1      | 1000         | FWD   | DESG |
| ge-2/1/2  | 128:2   | 128:2                 | 32768.0090690b47d1      | 20000        | FWD   | DESG |
| ge-2/1/5  | 128:3   | 128:3                 | 32768.0090690b47d1      | 29999        | FWD   | DESG |
| ge-2/2/1  | 128:4   | 128:26                | 32768.0013c39ec880      | 20000        | FWD   | ROOT |
| xe-9/2/0  | 128:5   | 128:5                 | 32768.0090690b47d1      | 2000         | FWD   | DESG |
| xe-9/3/0  | 128:6   | 128:6                 | 32768.0090690b47d1      | 2000         | FWD   | DESG |

Spanning tree interface parameters for instance 1

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-----------|---------|-----------------------|-------------------------|--------------|-------|------|
| ae1       | 128:1   | 128:1                 | 32769.0090690b47d1      | 1000         | FWD   | DESG |
| ge-2/1/2  | 128:2   | 128:2                 | 32769.0090690b47d1      | 20000        | FWD   | DESG |
| ge-2/1/5  | 128:3   | 128:3                 | 32769.0090690b47d1      | 29999        | FWD   | DESG |
| ge-2/2/1  | 128:4   | 128:26                | 32769.0013c39ec880      | 20000        | FWD   | ROOT |
| xe-9/2/0  | 128:5   | 128:5                 | 32769.0090690b47d1      | 2000         | FWD   | DESG |
| xe-9/3/0  | 128:6   | 128:6                 | 32769.0090690b47d1      | 2000         | FWD   | DESG |

Spanning tree interface parameters for instance 2

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-----------|---------|-----------------------|-------------------------|--------------|-------|------|
| ae1       | 128:1   | 128:1                 | 32770.0090690b47d1      | 1000         | FWD   | DESG |
| ge-2/1/2  | 128:2   | 128:2                 | 32770.0090690b47d1      | 20000        | FWD   | DESG |
| ge-2/1/5  | 128:3   | 128:3                 | 32770.0090690b47d1      | 29999        | FWD   | DESG |
| ge-2/2/1  | 128:4   | 128:26                | 32770.0013c39ec880      | 20000        | FWD   | ROOT |
| xe-9/2/0  | 128:5   | 128:5                 | 32770.0090690b47d1      | 2000         | FWD   | DESG |
| xe-9/3/0  | 128:6   | 128:6                 | 32770.0090690b47d1      | 2000         | FWD   | DESG |

### show spanning-tree interface detail

```
user@host> show spanning-tree interface routing-instance vs1 detail
Spanning tree interface parameters for instance 0
```

```
Interface name : ae1
Port identifier : 128.1
Designated port ID : 128.1
Port cost : 1000
Port state : Forwarding
Designated bridge ID : 32768.00:90:69:0b:47:d1
Port role : Designated
Link type : Pt-Pt/NONEDGE
```

```
Boundary port : No

Interface name : ge-2/1/2
Port identifier : 128.2
Designated port ID : 128.2
Port cost : 20000
Port state : Forwarding
Designated bridge ID : 32768.00:90:69:0b:47:d1
Port role : Designated
Link type : Pt-Pt/NONEDGE
Boundary port : No

Interface name : ge-2/1/5
Port identifier : 128.3
Designated port ID : 128.3
Port cost : 29999
Port state : Forwarding
Designated bridge ID : 32768.00:90:69:0b:47:d1
Port role : Designated
Link type : Pt-Pt/NONEDGE
Boundary port : No

Interface name : ge-2/2/1
Port identifier : 128.4
Designated port ID : 128.26
Port cost : 20000
Port state : Forwarding
Designated bridge ID : 32768.00:13:c3:9e:c8:80
Port role : Root
Link type : Pt-Pt/NONEDGE
Boundary port : No

Interface name : xe-9/2/0
Port identifier : 128.5
Designated port ID : 128.5
Port cost : 2000
Port state : Forwarding
Designated bridge ID : 32768.00:90:69:0b:47:d1
Port role : Designated
Link type : Pt-Pt/NONEDGE
Boundary port : No

Interface name : xe-9/3/0
Port identifier : 128.6
Designated port ID : 128.6
Port cost : 2000
Port state : Forwarding
Designated bridge ID : 32768.00:90:69:0b:47:d1
Port role : Designated
Link type : Pt-Pt/NONEDGE
Boundary port : No
```

#### Spanning tree interface parameters for instance 1

```
Interface name : ae1
Port identifier : 128.1
Designated port ID : 128.1
Port cost : 1000
Port state : Forwarding
Designated bridge ID : 32768.00:90:69:0b:47:d1
```

```

Port role : Designated
Link type : Pt-Pt/NONEDGE
Boundary port : No

Interface name : ge-2/1/2
Port identifier : 128.2
Designated port ID : 128.2
Port cost : 20000
Port state : Forwarding
Designated bridge ID : 32768.00:90:69:0b:47:d1
Port role : Designated
Link type : Pt-Pt/NONEDGE
Boundary port : No

Interface name : ge-2/1/5
Port identifier : 128.3
Designated port ID : 128.3
Port cost : 29999
Port state : Forwarding
Designated bridge ID : 32768.00:90:69:0b:47:d1
Port role : Designated
Link type : Pt-Pt/NONEDGE
Boundary port : No

Interface name : ge-2/2/1
Port identifier : 128.4
Designated port ID : 128.26
Port cost : 20000
Port state : Forwarding
Designated bridge ID : 32768.00:13:c3:9e:c8:80
Port role : Root
Link type : Pt-Pt/NONEDGE
Boundary port : No

...

```

### show spanning-tree interface msti

```

user@host> show spanning-tree interface msti 1 routing-instance vs1 detail
Spanning tree interface parameters for instance 1

```

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-----------|---------|-----------------------|-------------------------|--------------|-------|------|
| xe-7/0/0  | 128:1   | 128:1                 | 32769.0090690b4fd1      | 2000         | FWD   | DESG |
| ge-5/1/0  | 128:2   | 128:2                 | 32769.0090690b4fd1      | 20000        | FWD   | DESG |
| ge-5/1/1  | 128:3   | 128:3                 | 32769.0090690b4fd1      | 20000        | FWD   | DESG |
| ae1       | 128:4   | 128:1                 | 32769.0090690b47d1      | 10000        | BLK   | ALT  |
| ge-5/1/4  | 128:5   | 128:3                 | 32769.0090690b47d1      | 20000        | BLK   | ALT  |
| xe-7/2/0  | 128:6   | 128:6                 | 32769.0090690b47d1      | 2000         | FWD   | ROOT |

### show spanning-tree interface vlan-id

```

user@host> show spanning-tree interface vlan-id 101 routing-instance vs1 detail
Spanning tree interface parameters for instance 0

```

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Port<br>Cost | State | Role |
|-----------|---------|-----------------------|-------------------------|--------------|-------|------|
| ge-11/0/5 | 128:1   | 128:1                 | 32768.0090690b7fd1      | 20000        | FWD   | DESG |
| ge-11/0/6 | 128:2   | 128:1                 | 32768.0090690b7fd1      | 20000        | BLK   | BKUP |
| ge-11/1/0 | 128:3   | 128:2                 | 32768.0090690b4fd1      | 20000        | BLK   | ALT  |
| ge-11/1/1 | 128:4   | 128:3                 | 32768.0090690b4fd1      | 20000        | BLK   | ALT  |

|           |       |       |                    |       |     |      |
|-----------|-------|-------|--------------------|-------|-----|------|
| ge-11/1/4 | 128:5 | 128:1 | 32768.0090690b47d1 | 20000 | BLK | ALT  |
| xe-10/0/0 | 128:6 | 128:5 | 32768.0090690b4fd1 | 2000  | BLK | ALT  |
| xe-10/2/0 | 128:7 | 128:4 | 32768.0090690b47d1 | 2000  | FWD | ROOT |

**show spanning-tree interface (VSTP)**

```
user@host> show spanning-tree interface
```

```
Spanning tree interface parameters for instance 0
```

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Cost  | State | Role |
|-----------|---------|-----------------------|-------------------------|-------|-------|------|
| ge-1/0/1  | 128:1   | 128:1                 | 28672.0090690b3fe0      | 20000 | FWD   | DESG |
| ge-1/0/2  | 128:2   | 128:2                 | 28672.0090690b3fe0      | 20000 | FWD   | DESG |

```
Spanning tree interface parameters for VLAN 10
```

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Cost  | State | Role |
|-----------|---------|-----------------------|-------------------------|-------|-------|------|
| ge-1/0/1  | 128:1   | 128:1                 | 28672.0090690b3fe0      | 20000 | FWD   | DESG |
| ge-1/0/2  | 128:2   | 128:2                 | 28672.0090690b3fe0      | 20000 | FWD   | DESG |

```
Spanning tree interface parameters for VLAN 20
```

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Cost  | State | Role |
|-----------|---------|-----------------------|-------------------------|-------|-------|------|
| ge-1/0/1  | 128:1   | 128:1                 | 28672.0090690b3fe0      | 20000 | FWD   | DESG |
| ge-1/0/2  | 128:2   | 128:2                 | 28672.0090690b3fe0      | 20000 | FWD   | DESG |

**show spanning-tree interface vlan-id (VSTP)**

```
user@host> show spanning-tree interface vlan-id 10
```

```
Spanning tree interface parameters for VLAN 10
```

| Interface | Port ID | Designated<br>port ID | Designated<br>bridge ID | Cost  | State | Role |
|-----------|---------|-----------------------|-------------------------|-------|-------|------|
| ge-1/0/1  | 128:1   | 128:1                 | 28672.0090690b3fe0      | 20000 | FWD   | DESG |
| ge-1/0/2  | 128:2   | 128:2                 | 28672.0090690b3fe0      | 20000 | FWD   | DESG |

## show spanning-tree mstp configuration

|                                                     |                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>List of Syntax</b>                               | <a href="#">Syntax on page 333</a><br><a href="#">Syntax (EX Series Switch and the QFX Series) on page 333</a>                                                                                                                                                                          |
| <b>Syntax</b>                                       | show spanning-tree mstp configuration<br><brief   detail><br><routing-instance <i>routing-instance-name</i> >                                                                                                                                                                           |
| <b>Syntax (EX Series Switch and the QFX Series)</b> | show spanning-tree mstp configuration<br><brief   detail>                                                                                                                                                                                                                               |
| <b>Release Information</b>                          | Command introduced in Junos OS Release 8.4.<br>Command introduced in Junos OS Release 9.0 for EX Series switches.<br>Command introduced in Junos OS Release 11.1 for the QFX Series.                                                                                                    |
| <b>Description</b>                                  | Display the MSTP configuration.                                                                                                                                                                                                                                                         |
| <b>Options</b>                                      | <b>none</b> —Display MSTP configuration information.<br><br><b>brief   detail</b> —(Optional) Display the specified level of output.<br><br><b>routing-instance <i>routing-instance-name</i></b> —(Optional) Display MSTP configuration information for the specified routing instance. |
| <b>Required Privilege Level</b>                     | view                                                                                                                                                                                                                                                                                    |
| <b>List of Sample Output</b>                        | <a href="#">show spanning-tree mstp configuration detail on page 334</a><br><a href="#">show spanning-tree mstp configuration detail (QFX Series) on page 334</a>                                                                                                                       |
| <b>Output Fields</b>                                | <a href="#">Table 29 on page 333</a> lists the output fields for the <b>show spanning-tree mstp configuration</b> command. Output fields are listed in the approximate order in which they appear.                                                                                      |

**Table 29: show spanning-tree mstp configuration Output Fields**

| Field Name                  | Field Description                                                |
|-----------------------------|------------------------------------------------------------------|
| <b>Context id</b>           | Internally generated identifier.                                 |
| <b>Region name</b>          | MSTP region name carried in the MSTP BPDUs.                      |
| <b>Revision</b>             | Revision number of the MSTP configuration.                       |
| <b>Configuration digest</b> | Numerical value derived from the VLAN-to-instance mapping table. |
| <b>MSTI</b>                 | MST instance identifier.                                         |
| <b>Member VLANs</b>         | VLAN identifiers associated with the MSTI.                       |

## Sample Output

### show spanning-tree mstp configuration detail

```
user@host> show spanning-tree mstp configuration routing-instance vs1 detail
MSTP configuration information
Context identifier : 1
Region name : henry
Revision : 3
Configuration digest : 0x6da4b5c4fd587757eef35675365e1

MSTI Member VLANs
 0 0-99,101-199,201-4094
 1 100
 2 200
```

### show spanning-tree mstp configuration detail (QFX Series)

```
user@1f0> show spanning-tree mstp configuration routing-instance vs1 detail
MSTP configuration information
Context identifier : 1
Region name : henry
Revision : 3
Configuration digest : 0x6da4b5c4fd587757eef35675365e1

MSTI Member VLANs
 0 0-99,101-199,201-4094
 1 100
 2 200
```



## show spanning-tree statistics

|                                                     |                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>List of Syntax</b>                               | <a href="#">Syntax on page 335</a><br><a href="#">Syntax (EX Series Switch and the QFX Series) on page 335</a>                                                                                                                                                                                                                                                                 |
| <b>Syntax</b>                                       | <pre>show spanning-tree statistics &lt;brief   detail&gt; &lt;interface <i>interface-name</i>&gt; &lt;routing-instance <i>routing-instance-name</i>&gt;</pre>                                                                                                                                                                                                                  |
| <b>Syntax (EX Series Switch and the QFX Series)</b> | <pre>show spanning-tree statistics &lt;brief   detail&gt; &lt;interface <i>interface-name</i>   vlan <i>vlan-id</i>&gt;</pre>                                                                                                                                                                                                                                                  |
| <b>Release Information</b>                          | <p>Command introduced in Junos OS Release 8.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.1 for QFX Series switches.</p>                                                                                                                                                                       |
| <b>Description</b>                                  | Display STP statistics.                                                                                                                                                                                                                                                                                                                                                        |
| <b>Options</b>                                      | <p><b>none</b>—Display brief STP statistics.</p> <p><b>brief   detail</b>—(Optional) Display the specified level of output.</p> <p><b>interface <i>interface-name</i></b>—(Optional) Display STP statistics for the specified interface.</p> <p><b>routing-instance <i>routing-instance-name</i></b>—(Optional) Display STP statistics for the specified routing instance.</p> |
| <b>Required Privilege Level</b>                     | view                                                                                                                                                                                                                                                                                                                                                                           |
| <b>List of Sample Output</b>                        | <a href="#">show spanning-tree statistics routing-instance on page 336</a><br><a href="#">show spanning-tree statistics interface routing-instance detail on page 336</a>                                                                                                                                                                                                      |
| <b>Output Fields</b>                                | <p><a href="#">Table 30 on page 335</a> lists the output fields for the <b>show spanning-tree statistics</b> command. Output fields are listed in the approximate order in which they appear.</p>                                                                                                                                                                              |

**Table 30: show spanning-tree statistics Output Fields**

| Field Name                      | Field Description                                     |
|---------------------------------|-------------------------------------------------------|
| Message type                    | Type of message being counted.                        |
| BPDUs sent                      | Total number of BPDUs sent.                           |
| BPDUs received                  | Total number of BPDUs received.                       |
| BPDUs sent in last interval     | Number of BPDUs sent within a specified interval.     |
| BPDUs received in last interval | Number of BPDUs received within a specified interval. |

Table 30: show spanning-tree statistics Output Fields (*continued*)

| Field Name                    | Field Description                                              |
|-------------------------------|----------------------------------------------------------------|
| <b>Interface</b>              | Interface for which the statistics are being displayed.        |
| <b>Next BPDU transmission</b> | Number of seconds until the next BPDU is scheduled to be sent. |

## Sample Output

### show spanning-tree statistics routing-instance

```

user@host> show spanning-tree statistics routing-instance vs1 detail
Routing instance level STP statistics
Message type : bpdus
BPDUs sent : 1396
BPDUs received : 1027
BPDUs sent in last interval : 5 (duration: 4 sec)
BPDUs received in last interval: 4 (duration: 4 sec)

```

### show spanning-tree statistics interface routing-instance detail

```

user@host> show spanning-tree statistics interface ge-11/1/4 routing-instance vs1 detail
Interface BPDUs sent BPDUs received Next BPDU
 transmission
ge-11/1/4 7 190 0

```