Junos® OS for EX Series Ethernet Switches

Spanning-Tree Protocols for EX Series Switches

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Junos® OS for EX Series Ethernet Switches Spanning-Tree Protocols for EX Series Switches
Release 12.3

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Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at http://www.juniper.net/techpubs/.

If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

Juniper Networks Books publishes books by Juniper Networks engineers and subject matter experts. These books go beyond the technical documentation to explore the nuances of network architecture, deployment, and administration. The current list can be viewed at http://www.juniper.net/books.

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.xsl;
       }
     }
   }
   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.xsl; }
   ```

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 the CLI User Guide.

Documentation Conventions

Table 1 on page xiii 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.

Table 2 on page xiii 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**
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`

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

Convention	Description	Examples
Italic text like this	• Introduces or emphasizes important new terms. • Identifies book names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS System Basics Configuration Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	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** *domain-name*
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• 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)	Enclose 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)	Enclose a variable for which you can substitute one or more values.	**community name members [** ***community-ids*** **]**

Indention and braces ({ })	Identify a level in the configuration hierarchy.	[edit]
		routing-options {
		  static {
		  route default {
		  nexthop *address*;
		  retain;
		  }
		  }
		}

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
J-Web GUI Conventions		
Bold text like this	Represents J-Web graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.
> (bold right angle bracket)	Separates levels in a hierarchy of J-Web 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 send your comments to techpubs-comments@juniper.net, or fill out the documentation feedback form at https://www.juniper.net/cgi-bin/docbugreport/ . If you are using e-mail, be sure to include the following information with your comments:

- Document or topic name
- URL or page number
- Software release 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 JNASC 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/.
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- 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: https://www.juniper.net/alerts/

- 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

Overview

- Spanning Trees Overview on page 3

CHAPTER 1

Spanning Trees Overview

- Understanding MSTP for EX Series Switches on page 4
- Understanding RSTP for EX Series Switches on page 6
- Understanding STP for EX Series Switches on page 11
- Understanding VSTP for EX Series Switches on page 12
- Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 14
- Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 15
- Understanding Root Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 17

Understanding MSTP for EX Series Switches

Ethernet networks are susceptible to broadcast storms if loops are introduced. However, an Ethernet network should always include loops because they provide redundant paths in case of a link failure. Spanning-tree protocols address both of these issues because they provide link redundancy while simultaneously preventing undesirable loops.

Spanning-tree protocols intelligently avoid loops in a network by creating a tree topology (spanning-tree) of the entire bridged network with only one available path between the tree root and a leaf. All other paths are forced into a standby state. The tree *root* is a switch within the network elected by the STA (spanning-tree algorithm) to use when computing the best path between bridges throughout the network and the root bridge. Frames travel through the network to their destination—a *leaf* such as an end-user PC—along branches. A tree *branch* is a network segment, or link, between bridges. Switches that forward frames through an STP spanning-tree are called *designated bridges*.

Juniper Networks EX Series Ethernet 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). This topic explains MSTP.

This topic describes:

- MSTP Maps Multiple VLANs on page 4
- Configuring MSTP Regions on page 5
- Selecting a Spanning-Tree Protocol on page 5

MSTP Maps Multiple VLANs

MSTP is an extension of RSTP that maps multiple independent spanning-tree instances onto one physical topology. Each spanning-tree instance (STI) includes one or more VLANs. Unlike in STP and RSTP configurations, a port may belong to multiple VLANs and be dynamically blocked in one spanning-tree instance but forwarding in another. This behavior significantly improves network resource utilization by load-balancing across the network and maintaining switch CPU loads at moderate levels. MSTP also leverages the fast re-convergence time of RSTP when a network, switch, or port failure occurs within a spanning-tree instance.

MSTP creates a Common and Internal Spanning-Tree (CIST) to interconnect and manage all MSTP regions and even individual devices that run RSTP or STP, which are recognized as distinct spanning-tree regions by MSTP. The CIST views each MSTP region as a virtual bridge, regardless of the actual number of devices participating in the MSTP region, and enables MSTIs to link to other regions. The CIST is a single topology that connects all switches (STP, RSTP, and MSTP devices) through an active topology, ensuring connectivity between LANs and devices within a bridged network. This functionality provided by MSTP enables you to better utilize network resources while remaining backward-compatible with older network devices.

Configuring MSTP Regions

When enabling MSTP, you define one or more MSTP regions. An MSTP region defines a logical domain where MSTIs can be administered independently of MSTIs in other regions, setting the boundary for Bridge Protocol Data Units (BPDUs) sent by one MSTI. An MSTP region is a group of switches that is defined by three parameters:

- Region name—User-defined alphanumeric name for the region.
- Revision level—User-defined value that identifies the region.
- Mapping table—Numerical digest of VLAN-to-instance mappings.

An MSTP region can support up to 64 MST instances, and each MSTI can support from 1 to 4094 VLANs. When you define a region, MSTP automatically creates an internal spanning-tree instance (IST instance 0) that provides the root switch for the region and includes all currently configured VLANs that are not specifically assigned to a user-defined Multiple Spanning-Tree Instance (MSTI). An MSTI includes all static VLANs that you specifically add to it. The switch places any dynamically created VLANs in the IST instance by default, unless you explicitly map them to another MSTI. Once you assign a VLAN to a user-defined MSTI, the switch removes the VLAN from the IST instance.

Selecting a Spanning-Tree Protocol

The default factory configuration for EX Series switches is RSTP, a faster version of STP. To determine which spanning-tree protocol is best for your situation, see Table 3 on page 5 below.

Table 3: Selecting a Spanning-Tree Protocol

Protocol	Advantages	Disadvantages
RSTP	• Rapid Spanning-Tree Protocol is the default switch configuration and is recommended for most network configurations because it converges more quickly than STP after a failure. • Voice and video work better with RSTP than they do with STP. • RSTP is backward compatible with STP so switches do not all have to run RSTP. • RSTP supports more ports than MSTP or VSTP	• RSTP does not work with 802.1D 1998 bridges. • RSTP is not recommended for multiple VLAN networks because it is not VLAN-aware—as a result, all VLANs within a LAN share the same spanning-tree. This limits the number of forwarding paths for data traffic.
STP	• Spanning-Tree Protocol works with 802.1D 1998 bridges. • RSTP is backward compatible with STP so switches do not all have to run STP.	• STP is slower than RSTP. • STP is not recommended for multiple VLAN networks because it is not VLAN-aware—as a result, all VLANs within a LAN share the same spanning-tree. This limits the number of forwarding paths for data traffic.
MSTP	• Multiple Spanning-Tree Protocol works with most VLANs. • RSTP and STP are recognized as distinct spanning-tree regions by MSTP.	• Some protocols require compatibility that is not provided by MSTP. In this case, use VSTP. • MSTP supports a limited number of ports. • MSTP uses more CPU than RSTP and does not converge as fast as RSTP.

Table 3: Selecting a Spanning-Tree Protocol *(continued)*

Protocol	Advantages	Disadvantages
VSTP	• VLAN Spanning-Tree Protocol works with VLANs that require device compatibility. • VSTP and RSTP are the only spanning-tree protocols that can be configured concurrently on a switch.	• With VSTP there can be only STP instance per VLAN, whereas MSTP lets you combine multiple VLANs in one instance. • VSTP supports a limited number of ports compared to RSTP. • VSTP uses more CPU than RSTP and does not converge as fast as RSTP. • Having a large number of VSTP and RSTP instances can cause continuous changes in the topology. As a workaround, reduce the number of VSTP instances to fewer than 190.

Related Documentation

- Understanding STP for EX Series Switches on page 11
- Understanding RSTP for EX Series Switches on page 6
- Understanding VSTP for EX Series Switches on page 12
- Understanding Layer 2 Protocol Tunneling on EX Series Switches
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38

Understanding RSTP for EX Series Switches

Ethernet networks are susceptible to broadcast storms if loops are introduced. However, an Ethernet network should always include loops because they provide redundant paths in case of a link failure. Spanning tree protocols address both of these issues because they provide link redundancy while simultaneously preventing undesirable loops. Rapid Spanning-Tree Protocol (RSTP) is the default spanning-tree protocol for preventing loops on Ethernet networks.

This topic describes:

- Spanning-Tree Protocols Help Prevent Broadcast Storms on page 7
- RSTP is an Enhancement of the Original STP on page 7
- Port Roles Determine Participation in The Spanning-Tree on page 7
- Port States Determine How a Port Processes a Frame on page 8
- Edge Ports Connect to Devices That Cannot Be Part of a Spanning-Tree on page 8
- BPDUs Maintain the Spanning-Tree on page 8
- When an RSTP Root Bridge Fails on page 9
- Switches Must Relearn MAC Addresses After a Link Failure on page 9
- Selecting a Spanning-Tree Protocol on page 9

Spanning-Tree Protocols Help Prevent Broadcast Storms

Spanning tree protocols intelligently avoid loops in a network by creating a tree topology (spanning-tree) of the entire bridged network with only one available path between the tree root and a leaf. All other paths are forced into a standby state. The tree *root* is a switch within the network elected by the STA (spanning-tree algorithm) to use when computing the best path between bridges throughout the network and the root bridge. Frames travel through the network to their destination—a *leaf* such as an end-user PC—along branches. A tree *branch* is a network segment, or link, between bridges. Switches that forward frames through an STP spanning-tree are called *designated bridges*.

Juniper Networks EX Series Ethernet 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). This topic explains the spanning-tree default RSTP.

RSTP is an Enhancement of the Original STP

RSTP evolved from the original STP IEEE 802.1D protocol to provide faster spanning-tree re-convergence after a switch port, switch, or LAN failure. Where STP took up to 50 seconds to respond to topology changes, RSTP responds to changes within the timeframe of three hello BPDUs (bridge protocol data units), or 6 seconds. This is the primary reason that RSTP is the default configuration on EX Series switches. In addition, note that EX Series switches configured to use STP actually run RSTP force version 0, which is compatible with STP.

Port Roles Determine Participation in The Spanning-Tree

Each port has both a state and a role. A port's *role* determines how it participates in the spanning-tree. The five port roles used in RSTP are:

- Root port—The port closest to the root bridge (has the lowest path cost from a bridge). This is the only port that receives frames from and forwards frames to the root bridge.
- Designated port—The port that forwards traffic away from the root bridge toward a leaf. A designated bridge has one designated port for every link connection it serves. A root bridge forwards frames from all of its ports, which serve as designated ports.
- Alternate port—A port that provides an alternate path toward the root bridge if the root port fails and is placed in the discarding state. This port is not part of the active spanning-tree, but if the root port fails, the alternate port immediately takes over.
- Backup port—A port that provides a backup path toward the leaves of the spanning-tree if a designated port fails and is placed in the discarding state. A backup port can only exist where two or more bridge ports connect to the same LAN for which the bridge serves as the designated bridge. A backup port for a designated port immediately takes over if the port fails.
- Disabled port—The port is not part of the active spanning-tree.

Port States Determine How a Port Processes a Frame

Each port has both a state and a role. A port's *state* determines how it processes a frame. RSTP places each port of a designated bridge in one of three states:

- Discarding—The port discards all BPDUs. A port in this state discards all frames it receives and does not learn MAC addresses.
- Learning—The port prepares to forward traffic by examining received frames for location information in order to build its MAC address table.
- Forwarding—The port filters and forwards frames. A port in the forwarding state is part of the active spanning-tree.

Edge Ports Connect to Devices That Cannot Be Part of a Spanning-Tree

RSTP also defines the concept of an *edge port*, which is a designated port that connects to non-STP-capable devices, such as PCs, servers, routers, or hubs that are not connected to other switches. Because edge ports connect directly to end stations, they cannot create network loops and can transition to the forwarding state immediately. You can manually configure edge ports, and a switch can also detect edge ports by noting the absence of communication from the end stations.

The edge ports themselves do send BPDUs to the spanning-tree. If you have a good understanding of the implications on your network and want to modify RSTP on the edge port interface, see Configuring RSTP (CLI Procedure) .

BPDUs Maintain the Spanning-Tree

Spanning-tree protocols use frames called bridge protocol data units (BPDUs) to create and maintain the spanning-tree. A BPDU frame is a message sent from one switch to another to communicate information about itself, such as its bridge ID, root path costs, and port MAC addresses. The initial exchange of BPDUs between switches determines the root bridge. Simultaneously, BPDUs are used to communicate the cost of each link between branch devices, which is based upon port speed or user configuration. RSTP uses this path cost to determine the ideal route for data frames to travel from one leaf to another leaf and then blocks all other routes. If an edge port receives a BPDU, it automatically transitions to a regular RSTP port.

When the network is in a steady state, the spanning-tree converges when the spanning-tree algorithm (STA) identifies both the root and designated bridges and all ports are in either a forwarding or blocking state. To maintain the tree, the root bridge continues to send BPDUs at a “hello time” interval (default 2 seconds). These BPDUs continue to communicate the current tree topology. When a port receives a hello BPDU, it compares the information to that already stored for the receiving port. One of three actions takes place when a switch receives a BPDU:

- If the BPDU data matches the existing entry in the MAC address table, the port resets a timer called “max age” to zero and then forwards a new BPDU with the current active topology information to the next port in the spanning-tree.

- If the topology in the BPDU has been changed, the information is updated in the MAC address table, “max age” is again set to zero, and a new BPDU is forwarded with the current active topology information to the next port in the spanning-tree.
- When an RSTP port does not receive a BPDU for three hello times, it reacts one of two ways. If the port is the root port, a complete rework of the spanning-tree occurs—see When an RSTP Root Bridge Fails. If the bridge is any non-root bridge, RSTP detects that the connected device cannot send BPDUs and converts that port to an edge port.

When an RSTP Root Bridge Fails

When a link to the root port goes down, a flag called a topology change notification (TCN) is added to the BPDU. When this BPDU reaches the next port in the VLAN, the MAC address table is flushed and the BPDU is sent to the next bridge. Eventually, all ports in the VLAN have flushed their MAC address tables. Then, RSTP configures a new root port.

After a root port or a designated port fails, the alternate or backup port takes over after an exchange of BPDUs called the proposal-agreement handshake. RSTP propagates this handshake over *point-to-point links*, which are dedicated links between two network nodes, or switches, that connect one port to another. If a local port becomes a new root or designated port, it negotiates a rapid transition with the receiving port on the nearest neighboring switch by using the proposal-agreement handshake to ensure a loop-free topology.

Switches Must Relearn MAC Addresses After a Link Failure

Because a link failure causes all associated ports to flush their MAC address table, the network may be slower as it floods to relearn the MAC addresses. There is a way to speed up this relearning process. During TCN propagation, the Layer 2 forwarding table of switches is flushed, resulting in a flood of data packets. The ARP feature causes the switch to proactively send ARP requests for IP addresses in the ARP cache (present because of Layer 3 VLAN interface). With ARP on STP enabled, as the reply comes through, the switches builds up the Layer 2 forwarding table, thus limiting the flooding later. Enabling ARP on STP is most useful to prevent excessive flooding in large Layer 2 networks using RVIs.

Selecting a Spanning-Tree Protocol

The default factory configuration for EX Series switches is RSTP, a faster version of the original STP. To determine which spanning-tree protocol is best for your situation, see Table 4 on page 10 below.

Table 4: Selecting a Spanning-Tree Protocol

Protocol	Advantages	Disadvantages
RSTP	• Rapid Spanning-Tree Protocol is the default switch configuration and is recommended for most network configurations because it converges more quickly than STP after a failure. • Voice and video work better with RSTP than they do with STP. • RSTP is backward compatible with STP so switches do not all have to run RSTP. • RSTP supports more ports than MSTP or VSTP	• RSTP does not work with 802.1D 1998 bridges. • RSTP is not recommended for multiple VLAN networks because it is not VLAN-aware—as a result, all VLANs within a LAN share the same spanning-tree. This limits the number of forwarding paths for data traffic.
STP	• Spanning-Tree Protocol works with 802.1D 1998 bridges. • RSTP is backward compatible with STP so switches do not all have to run STP.	• STP is slower than RSTP. • STP is not recommended for multiple VLAN networks because it is not VLAN-aware—as a result, all VLANs within a LAN share the same spanning-tree. This limits the number of forwarding paths for data traffic.
MSTP	• Multiple Spanning-Tree Protocol works with most VLANs. • RSTP and STP are recognized as distinct spanning-tree regions by MSTP.	• Some protocols require compatibility that is not provided by MSTP. In this case, use VSTP. • MSTP supports a limited number of ports. • MSTP uses more CPU than RSTP and does not converge as fast as RSTP.
VSTP	• VLAN Spanning-Tree Protocol works with VLANS that require device compatibility. • VSTP and RSTP are the only spanning-tree protocols that can be configured concurrently on a switch.	• With VSTP there can be only STP instance per VLAN, whereas MSTP lets you combine multiple VLANs in one instance. • VSTP supports a limited number of ports compared to RSTP. • VSTP uses more CPU than RSTP and does not converge as fast as RSTP. • Having a large number of VSTP and RSTP instances can cause continuous changes in the topology. As a workaround, reduce the number of VSTP instances to fewer than 190.

Related Documentation

- Understanding STP for EX Series Switches on page 11
- Understanding MSTP for EX Series Switches on page 4
- Understanding VSTP for EX Series Switches on page 12
- Understanding Layer 2 Protocol Tunneling on EX Series Switches
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21

Understanding STP for EX Series Switches

Ethernet networks are susceptible to broadcast storms if loops are introduced. However, an Ethernet network should always include loops because they provide redundant paths in case of a link failure. Spanning-tree protocols address both of these issues because they provide link redundancy while simultaneously preventing undesirable loops.

Juniper Networks EX Series Ethernet 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). Configure STP when you need to support older 802.1D 1998 bridges. However, note that EX Series switches configured to use STP actually run RSTP force version 0, which is compatible with STP. For an explanation of RSTP, see "Understanding RSTP for EX Series Switches" on page 6

This topic describes:

- Selecting a Spanning-Tree Protocol on page 11

Selecting a Spanning-Tree Protocol

The default factory configuration for EX Series switches is RSTP, a faster version of STP. To determine which spanning-tree protocol is best for your situation, see Table 5 on page 11 below.

Table 5: Selecting a Spanning-Tree Protocol

Protocol	Advantages	Disadvantages
RSTP	• Rapid Spanning-Tree Protocol is the default switch configuration and is recommended for most network configurations because it converges more quickly than STP after a failure. • Voice and video work better with RSTP than they do with STP. • RSTP is backward compatible with STP so switches do not all have to run RSTP. • RSTP supports more ports than MSTP or VSTP	• RSTP does not work with 802.1D 1998 bridges. • RSTP is not recommended for multiple VLAN networks because it is not VLAN-aware—as a result, all VLANs within a LAN share the same spanning-tree. This limits the number of forwarding paths for data traffic.
STP	• Spanning-Tree Protocol works with 802.1D 1998 bridges. • RSTP is backward compatible with STP so switches do not all have to run STP.	• STP is slower than RSTP. • STP is not recommended for multiple VLAN networks because it is not VLAN-aware—as a result, all VLANs within a LAN share the same spanning-tree. This limits the number of forwarding paths for data traffic.
MSTP	• Multiple Spanning-Tree Protocol works with most VLANs. • RSTP and STP are recognized as distinct spanning-tree regions by MSTP.	• Some protocols require compatibility that is not provided by MSTP. In this case, use VSTP. • MSTP supports a limited number of ports. • MSTP uses more CPU than RSTP and does not converge as fast as RSTP.

Table 5: Selecting a Spanning-Tree Protocol *(continued)*

Protocol	Advantages	Disadvantages
VSTP	• VLAN Spanning-Tree Protocol works with VLANs that require device compatibility. • VSTP and RSTP are the only spanning-tree protocols that can be configured concurrently on a switch.	• With VSTP there can be only STP instance per VLAN, whereas MSTP lets you combine multiple VLANs in one instance. • VSTP supports a limited number of ports compared to RSTP. • VSTP uses more CPU than RSTP and does not converge as fast as RSTP. • Having a large number of VSTP and RSTP instances can cause continuous changes in the topology. As a workaround, reduce the number of VSTP instances to fewer than 190.

Related Documentation

- Configuring STP (CLI Procedure) on page 83
- Understanding RSTP for EX Series Switches on page 6
- Understanding MSTP for EX Series Switches on page 4
- Understanding VSTP for EX Series Switches on page 12
- Understanding Layer 2 Protocol Tunneling on EX Series Switches

Understanding VSTP for EX Series Switches

Juniper Networks EX Series Ethernet 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 factory configuration for EX Series switches uses RSTP. If you use VLANs, however, we recommend that you enable MSTP unless your network requires the device compatibility provided by VSTP. Switches configured to run VSTP automatically assign each VLAN to one spanning-tree instance that runs RSTP. While this approach is useful to optimize network usage in small networks with a limited number of VLANs, a VSTP configuration in a network with several hundred VLANs can overload switch CPUs. MSTP ensures that your network is not slowed down by the increased network traffic caused by hundreds of VLANs, each with its own spanning-tree instance.

When using VSTP, you can selectively configure up to 253 VLANs per switch—additional VLANs use RSTP. (VSTP and RSTP are the only spanning-tree protocols that can be configured concurrently on a switch.)

NOTE: When you configure VSTP, we recommend that you enable VSTP on all VLANs that can receive VSTP bridge protocol data units (BPDUs).

NOTE: When you configure VSTP with the **set protocol vstp vlan all** command, VLAN ID 1 is not set; it is excluded so that the configuration is compatible with Cisco PVST+. If you want VLAN ID 1 to be included in the VSTP configuration on your switch, you must set it separately with the **set protocol vstp vlan 1** command.

Selecting a Spanning-Tree Protocol

The default factory configuration for EX Series switches is RSTP, a faster version of STP. To determine which spanning-tree protocol is best for your situation, see Table 6 on page 13.

Table 6: Selecting a Spanning-Tree Protocol

Protocol	Advantages	Disadvantages
RSTP	• Rapid Spanning Tree Protocol is the default switch configuration and is recommended for most network configurations because it converges more quickly than STP after a failure. • Voice and video work better with RSTP than they do with STP. • RSTP is backward compatible with STP so switches do not all have to run RSTP. • RSTP supports more ports than MSTP or VSTP.	• RSTP does not work with 802.1D 1998 bridges. • RSTP is not recommended for multiple VLAN networks because it is not VLAN-aware—as a result, all VLANs within a LAN share the same spanning tree. This limits the number of forwarding paths for data traffic.
STP	• Spanning Tree Protocol works with 802.1D 1998 bridges. • RSTP is backward compatible with STP so switches do not all have to run STP.	• STP is slower than RSTP. • STP is not recommended for multiple VLAN networks because it is not VLAN-aware—as a result, all VLANs within a LAN share the same spanning-tree. This limits the number of forwarding paths for data traffic.
MSTP	• Multiple Spanning Tree Protocol works with most VLANs. • RSTP and STP are recognized as distinct Spanning Tree regions by MSTP.	• Some protocols require compatibility that is not provided by MSTP. In this case, use VSTP. • MSTP supports a limited number of ports. • MSTP uses more CPU than RSTP and does not converge as fast as RSTP.
VSTP	• VLAN Spanning Tree Protocol works with VLANs that require device compatibility. • VSTP and RSTP are the only spanning-tree protocols that can be configured concurrently on a switch.	• With VSTP there can be only STP instance per VLAN, whereas MSTP lets you combine multiple VLANs in one instance. • VSTP supports a limited number of ports compared to RSTP. • VSTP uses more CPU than RSTP and does not converge as fast as RSTP.

Related Documentation

- Understanding STP for EX Series Switches on page 11
- Understanding RSTP for EX Series Switches on page 6
- Understanding MSTP for EX Series Switches on page 4

- Understanding Layer 2 Protocol Tunneling on EX Series Switches
- Configuring VSTP (CLI Procedure) on page 88

Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches

Networks frequently use multiple protocols simultaneously to achieve different goals and in some cases those protocols might conflict with each other. One such case is when spanning-tree protocols are active on the network, where a special type of switching frame called a bridge protocol data unit (BPDU) can conflict with BPDUs generated on other devices such as PCs. The different kinds of BPDUs are not compatible but they can still be recognized by other devices that use BPDUs and cause network outages. You need to protect any device that recognizes BPDUs from picking up incompatible BPDUs.

- Different Kinds of BPDUs on page 14
- Protecting Switches From Incompatible BPDUs on page 14

Different Kinds of BPDUs

Spanning-tree protocols such as Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), and Multiple Spanning Tree Protocol (MSTP) generate their own BPDUs. These peer STP applications use their BPDUs to communicate, and ultimately, the exchange of BPDUs determines which interfaces block traffic and which interfaces become root ports and forward traffic.

User bridge applications running on a PC can also generate BPDUs. If these BPDUs are picked up by STP applications running on the switch, they can trigger STP miscalculations, and those miscalculations can lead to network outages. Similarly, BPDUs generated by STP protocols can cause problems if they are picked up by devices like PCs that are not using STP. Some mechanism for BPDU protection must be implemented in these cases.

Protecting Switches From Incompatible BPDUs

To protect the state of spanning-tree protocols on switches from outside BPDUs, enable BPDU protection on the interfaces of a switch on which spanning-tree protocols are configured and are connected to user devices (such as PCs)—for example, on edge ports connected to PCs. Use the same strategy when a device on which STP is not configured is connected to a switch through a trunk interface that could be forwarding BPDUs generated by spanning-tree protocols. In this case, you would protect the device from BPDUs generated by the STP on the switch.

To configure BPDU protection on a switch on which spanning-tree protocols are configured, include the **bpdu-block-on-edge** statement at the [**edit protocols** (**stp** | **mstp** | **rstp**)] hierarchy level. To prevent such a switch from forwarding BPDUs generated by spanning-tree protocols to devices, include the **bpdu-block** statement at the [**edit ethernet-switching-options**] hierarchy level.

NOTE: You can configure the drop option under the bpdu-block statement only on interfaces on which no spanning-tree protocol is configured.

When an interface configured with BPDU protection encounters an incompatible BPDU, it drops that BPDU and then, either shuts down or continues to receive packets other than spanning-tree protocol BPDUs (for STP, MSTP, and RSTP) depending on the configuration defined in the **bpdu-block** statement. If the interface continues to be open after dropping all incompatible BPDUs, all traffic except incompatible BPDUs continues to ingress and egress through the interface.

If the interface shuts down after dropping all BPDUs, there are two ways to re-enable the interface:

- Include the **disable-timeout** statement in the BPDU configuration so that the interface automatically returns to service after the timer expires.
- Issue the operational mode command **clear ethernet-switching bpdu-error** on the switch. This command will only re-enable an interface but the BPDU configuration for the interface will continue to exist unless you remove the BPDU configuration explicitly.

NOTE: You can also configure BPDU drop protection on a switch without spanning trees—typically, you do this when such a switch is connected to a switch with spanning trees through a trunk interface.

Related Documentation

- Configuring BPDU Protection on an Interface (CLI Procedure) on page 89
- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66
- Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 15
- Understanding Root Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 17
- Understanding STP for EX Series Switches on page 11

Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches

Juniper Networks EX Series Ethernet Switches provide 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 moving into a forwarding state that would result in a loop opening up in the network.

A loop-free network in spanning-tree topologies is supported through the exchange of a special type of frame called 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.

However, 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 loop protection is enabled, the spanning-tree topology detects root ports and blocked ports and makes sure 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 doesn't transition the interface to a forwarding state, but instead transitions it to a loop-inconsistent state. The interface recovers and then 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 switch 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 (**log**, **block**, or both).

Note that 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 EX Series Switches on page 72
- Understanding Root Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 17
- Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 14
- Understanding MSTP for EX Series Switches on page 4
- Understanding RSTP for EX Series Switches on page 6
- Understanding STP for EX Series Switches on page 11
- Understanding VSTP for EX Series Switches on page 12

Understanding Root Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches

Juniper Networks EX Series Ethernet Switches provide 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 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 and which interfaces become root ports and forward traffic.

However, a root port elected through this process has the possibility of being wrongly elected. A user bridge application running on a PC can generate BPDUs, too, and interfere with root port election. Root protection allows network administrators to manually enforce the root bridge placement in the network.

Enable root protection on interfaces that should not receive superior 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 superior 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 superior 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 superior 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 EX Series Switches on page 76
- Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches on page 72
- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66
- Understanding MSTP for EX Series Switches on page 4
- Understanding RSTP for EX Series Switches on page 6
- Understanding STP for EX Series Switches on page 11
- Understanding VSTP for EX Series Switches on page 12

PART 2

Configuration

- Configuration Examples on page 21
- Configuration Tasks on page 83
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CHAPTER 2

Configuration Examples

- Example: Faster Convergence and Improved Network Stability with RSTP on EX Series Switches on page 21
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66
- Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches on page 72
- Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX Series Switches on page 76

Example: Faster Convergence and Improved Network Stability with RSTP on EX Series Switches

EX Series switches use Rapid Spanning Tree Protocol (RSTP) by default to provide a loop-free topology.

When switches that support redundant Routing Engines use RSTP, it is important to keep RSTP synchronized on both Routing Engines so that no loss of service occurs after a Routing Engine switchover. Nonstop bridging protocol keeps Routing Engines synchronized.

This example describes how to configure RSTP and NSB on four EX Series switches:

- Requirements on page 22
- Overview and Topology on page 22
- Configuring RSTP and Nonstop Bridging on Switch 1 on page 24
- Configuring RSTP and Nonstop Bridging on Switch 2 on page 27
- Configuring RSTP and Nonstop Bridging on Switch 3 on page 30
- Configuring RSTP and Nonstop Bridging on Switch 4 on page 33
- Verification on page 36

Requirements

This example uses the following hardware and software components:

- Junos OS Release 11.3 or later for EX Series switches
- Four EX Series switches

Before you configure the switches for RSTP, be sure you have:

- Installed the four switches. See Connecting and Configuring an EX Series Switch (J-Web Procedure).
- Performed the initial software configuration on all switches. See Installing and Connecting an EX3200 Switch.

Overview and Topology

RSTP works by identifying certain links as point to point links and blocking other possible paths. When one of the point-to-point links fails, a designated alternate link transitions to the forwarding state and take over. Configuring nonstop bridging (NSB) on a switch with redundant Routing Engines keeps RSTP synchronized on both Routing Engines. This way, RSTP remains active immediately after a switchover because it is already synchronized to the backup Routing Engine. RSTP does not have to reconverge after a Routing Engine switchover when NSB is enabled because the neighbor devices do not detect an RSTP change on the switch. In this example, four EX Series switches are connected in the topology displayed in Figure 1 on page 23 to create a loop-free topology with NSB applied to switches with dual Routing Engines.

Figure 1: Network Topology for RSTP

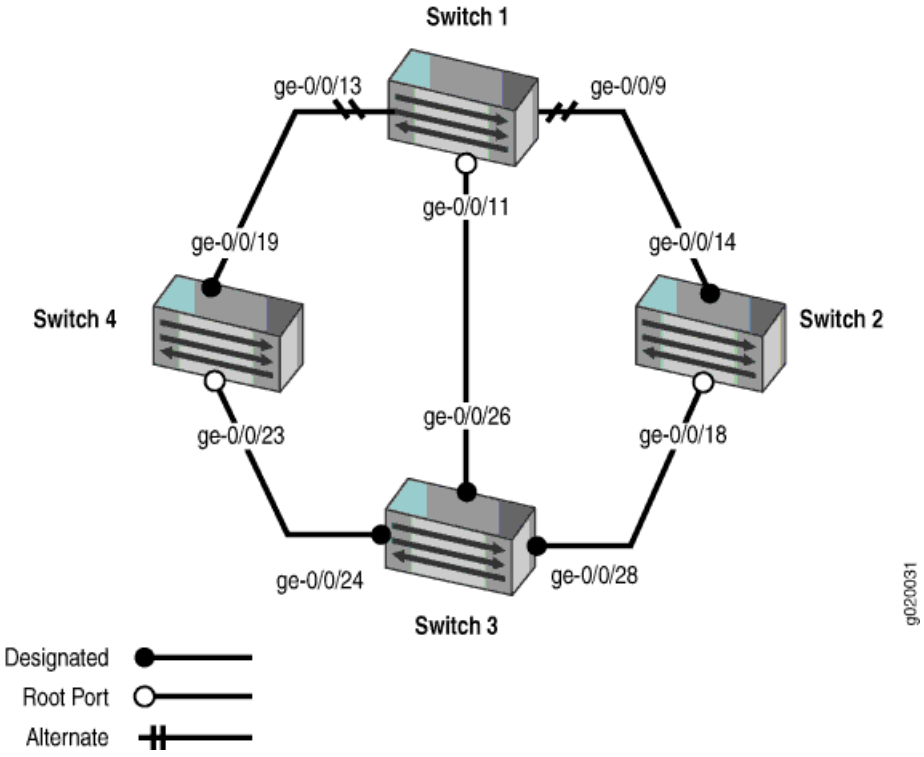


Table 7 on page 23 shows the components of the topology for this example.

NOTE: You can configure RSTP on logical or physical interfaces. This example shows RSTP configured on logical interfaces.

Table 7: Components of the Topology for Configuring RSTP

Property	Settings
Switch 1	The following interfaces on Switch 1 are connected in this way: • **ge-0/0/9** is connected to Switch 2 • **ge-0/0/13** is connected to Switch 4 • **ge-0/0/11** is connected to Switch 3
Switch 2	The following interfaces on Switch 2 are connected in this way: • **ge-0/0/14** is connected to Switch 1 • **ge-0/0/18** is connected to Switch 3
Switch 3	The following interfaces on Switch 3 are connected in this way: • **ge-0/0/26** is connected to Switch 1 • **ge-0/0/28** is connected to Switch 2 • **ge-0/0/24** is connected to Switch 4

Table 7: Components of the Topology for Configuring RSTP *(continued)*

Property	Settings
Switch 4	The following interfaces on Switch 4 are connected in this way: • **ge-0/0/19** is connected to Switch 1 • **ge-0/0/23** is connected to Switch 3
VLAN names and tag IDs	**voice-vlan**, tag **10** **employee-vlan**, tag **20** **guest-vlan**, tag **30** **camera-vlan**, tag **40**

This configuration example creates a loop-free topology between four EX Series 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.

NOTE: You also can create a loop-free topology between the aggregation layer and the distribution layer using redundant trunk links. For more information about configuring redundant trunk links, see Example: Configuring Redundant Trunk Links for Faster Recovery.

Configuring RSTP and Nonstop Bridging on Switch 1

CLI Quick Configuration

To quickly configure RSTP and nonstop bridging on Switch 1, copy the following commands and paste them into the switch terminal window:

```
[edit]
set vlans voice-vlan description “Voice VLAN”
set vlans voice-vlan vlan-id 10
set vlans employee-vlan description “Employee VLAN”
set vlans employee-vlan vlan-id 20
set vlans guest-vlan description “Guest VLAN”
set vlans guest-vlan vlan-id 30
set vlans camera-vlan description “Camera VLAN”
set vlans camera-vlan vlan-id 40
set interfaces ge-0/0/13 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge–0/0/9 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge–0/0/11 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge–0/0/13 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/9 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/11 unit 0 family ethernet-switching port-mode trunk
```

```
set protocols rstp bridge-priority 16k
set protocols rstp interface ge-0/0/13.0 cost 1000
set protocols rstp interface ge-0/0/13.0 mode point-to-point
set protocols rstp interface ge-0/0/9.0 cost 1000
set protocols rstp interface ge-0/0/9.0 mode point-to-point
set protocols rstp interface ge-0/0/11.0 cost 1000
set protocols rstp interface ge-0/0/11.0 mode point-to-point
```

If Switch 1 includes dual Routing Engines, configure NSB. To quickly configure nonstop bridging on Switch 1, copy the following commands and paste them into the switch terminal window:

```
set chassis redundancy graceful switchover
set system commit synchronize
set ethernet-switching-options nonstop-bridging
```

Step-by-Step Procedure

To configure RSTP and nonstop bridging on Switch 1:

1. Configure the VLANs **voice-vlan**, **employee-vlan**, **guest-vlan**, and **camera-vlan**:

```
[edit vlans]
user@switch1# set voice-vlan description “Voice VLAN”
user@switch1# set voice-vlan vlan-id 10
user@switch1# set employee-vlan description “Employee VLAN”
user@switch1# set employee-vlan vlan-id 20
user@switch1# set guest-vlan description “Guest VLAN”
user@switch1# set guest-vlan vlan-id 30
user@switch1# set camera-vlan description “Camera VLAN”
user@switch1# set camera-vlan vlan-id 40
```

2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:

```
[edit interfaces]
user@switch1# set ge-0/0/13 unit 0 family ethernet-switching vlan members [10 20 30
40]
user@switch1# set ge-0/0/9 unit 0 family ethernet-switching vlan members [10 20 30
40]
user@switch1# set ge-0/0/11 unit 0 family ethernet-switching vlan members [10 20 30
40]
```

3. Configure the port mode for the interfaces:

```
[edit interfaces]
user@switch1# set ge-0/0/13 unit 0 family ethernet-switching port-mode trunk
user@switch1# set ge-0/0/9 unit 0 family ethernet-switching port-mode trunk
user@switch1# set ge-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 ge-0/0/13.0 cost 1000
user@switch1# rstp interface ge-0/0/13.0 mode point-to-point
user@switch1# rstp interface ge-0/0/9.0 cost 1000
user@switch1# rstp interface ge-0/0/9.0 mode point-to-point
user@switch1# rstp interface ge-0/0/11.0 cost 1000
user@switch1# rstp interface ge-0/0/11.0 mode point-to-point
```

Step-by-Step Procedure

If Switch 1 includes dual Routing Engines, configure nonstop bridging. To configure NSB on Switch 1:

1. Enable graceful Routing Engine switchover (GRES):

```
[edit chassis redundancy]
user@switch1# set graceful-switchover
```

2. Configure the switch to always synchronize configuration changes between the Routing Engines:

```
[edit system]
user@switch1# set commit synchronize
```

If you try to commit a configuration in which nonstop bridging is configured but synchronization of configuration changes is not configured, the configuration is not committed.

3. Enable nonstop bridging:

```
[edit ethernet-switching-options]
user@switch1# set nonstop-bridging
```

NOTE: This process enables NSB for all NSB-supported Layer 2 protocols on the switch, including RSTP.

Results

Results Check the results of the configuration:

```
user@switch1> show configuration
interfaces {
    ge-0/0/13 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
        }
    }
    ge-0/0/9 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
        }
    }
    ge-0/0/11 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
```

```
    }
  }
}
protocols {
  rstp {
    bridge-priority 16k;
      interface ge-0/0/13.0 {
        cost 1000;
        mode point-to-point;
      }
      interface ge-0/0/9.0 {
        cost 1000;
        mode point-to-point;
      }
      interface ge-0/0/11.0 {
        cost 1000;
        mode point-to-point;
      }
    }
  }
}
vlans {
  voice-vlan {
    vlan-id 10;
  }
  employee-vlan {
    vlan-id 20;
  }
  guest-vlan {
    vlan-id 30;
  }
  camera-vlan {
    vlan-id 40;
  }
}
system {
  commit synchronize;
}
chassis {
  redundancy {
    graceful-switchover;
  }
ethernet-switching-options {
  nonstop-bridging;
}
```

Configuring RSTP and Nonstop Bridging on Switch 2

CLI Quick Configuration

To quickly configure RSTP and nonstop bridging on Switch 2, copy the following commands and paste them into the switch terminal window:

```
[edit]
set vlans voice-vlan description “Voice VLAN”
set vlans voice-vlan vlan-id 10
set vlans employee-vlan description “Employee VLAN”
set vlans employee-vlan vlan-id 20
```

```
set vlans guest-vlan description “Guest VLAN”
set vlans guest-vlan vlan-id 30
set vlans camera-vlan description “Camera VLAN”
set vlans camera-vlan vlan-id 40
set interfaces ge-0/0/14 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge-0/0/18 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge-0/0/14 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/18 unit 0 family ethernet-switching port-mode trunk
set protocols rstp bridge-priority 32k
set protocols rstp interface ge-0/0/14.0 cost 1000
set protocols rstp interface ge-0/0/14.0 mode point-to-point
set protocols rstp interface ge-0/0/18.0 cost 1000
set protocols rstp interface ge-0/0/18.0 mode point-to-point
```

If Switch 2 includes dual Routing Engines, configure NSB. To quickly configure nonstop bridging on Switch 2, copy the following commands and paste them into the switch terminal window:

```
set chassis redundancy graceful switchover
set system commit synchronize
set ethernet-switching-options nonstop-bridging
```

Step-by-Step Procedure

To configure RSTP and nonstop bridging on Switch 2:

1. Configure the VLANs **voice-vlan**, **employee-vlan**, **guest-vlan**, and **camera-vlan**:

   ```
   [edit vlans]
   user@switch2# set voice-vlan description “Voice VLAN”
   user@switch2# set voice-vlan vlan-id 10
   user@switch2# set employee-vlan description “Employee VLAN”
   user@switch2# set employee-vlan vlan-id 20
   user@switch2# set guest-vlan description “Guest VLAN”
   user@switch2# set guest-vlan vlan-id 30
   user@switch2# set camera-vlan vlan-description “Camera VLAN”
   user@switch2# set camera-vlan vlan-id 40
   ```

2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:

   ```
   [edit interfaces]
   user@switch2# set ge-0/0/14 unit 0 family ethernet-switching vlan members [10 20 30
   40]
   user@switch2# set ge-0/0/18 unit 0 family ethernet-switching vlan members [10 20 30
   40]
   ```

3. Configure the port mode for the interfaces:

   ```
   [edit interfaces]
   user@switch2# set ge-0/0/14 unit 0 family ethernet-switching port-mode trunk
   user@switch2# set ge-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 ge-0/0/14.0 cost 1000
   user@switch2# rstp interface ge-0/0/14.0 mode point-to-point
   user@switch2# rstp interface ge-0/0/18.0 cost 1000
   user@switch2# rstp interface ge-0/0/18.0 mode point-to-point
   ```

Step-by-Step Procedure

If Switch 2 includes dual Routing Engines, configure nonstop bridging. To configure NSB on Switch 2:

1. Enable graceful Routing Engine switchover (GRES):

```
[edit chassis redundancy]
user@switch2# set graceful-switchover
```

2. Configure the switch to always synchronize configuration changes between the Routing Engines:

```
[edit system]
user@switch2# set commit synchronize
```

If you try to commit a configuration in which nonstop bridging is configured but synchronization of configuration changes is not configured, the configuration is not committed.

3. Enable nonstop bridging:

```
[edit ethernet-switching-options]
user@switch2# set nonstop-bridging
```

NOTE: This process enables NSB for all NSB-supported Layer 2 protocols on the switch, including RSTP.

Results

Results Check the results of the configuration:

```
user@switch2> show configuration
interfaces {
    ge-0/0/14 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
        }
    }
    ge-0/0/18 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
        }
    }
}
protocols {
    rstp {
        bridge-priority 32k;
            interface ge-0/0/14.0 {
                cost 1000;
                mode point-to-point;
            }
```

```
            interface ge-0/0/18.0 {
              cost 1000;
              mode point-to-point;
            }
          }
        }
      }
      vlans {
        voice-vlan {
          vlan-id 10;
        }
        employee-vlan {
          vlan-id 20;
        }
        guest-vlan {
          vlan-id 30;
        }
        camera-vlan {
          vlan-id 40;
        }
      }
      system {
        commit synchronize;
      }
      chassis {
        redundancy {
          graceful-switchover;
        }
      ethernet-switching-options {
        nonstop-bridging;
      }
```

Configuring RSTP and Nonstop Bridging on Switch 3

CLI Quick Configuration

To quickly configure RSTP and nonstop bridging on Switch 3, copy the following commands and paste them into the switch terminal window:

```
[edit]
set vlans voice-vlan description “Voice VLAN”
set vlans voice-vlan vlan-id 10
set vlans employee-vlan description “Employee VLAN”
set vlans employee-vlan vlan-id 20
set vlans guest-vlan description “Guest VLAN”
set vlans guest-vlan vlan-id 30
set vlans camera-vlan description “Camera VLAN”
set vlans camera-vlan vlan-id 40
set interfaces ge-0/0/26 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge-0/0/28 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge-0/0/24 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge-0/0/26 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/28 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/24 unit 0 family ethernet-switching port-mode trunk
set protocols rstp bridge-priority 8k
set protocols rstp interface ge-0/0/26.0 cost 1000
set protocols rstp interface ge-0/0/26.0 mode point-to-point
set protocols rstp interface ge-0/0/28.0 cost 1000
set protocols rstp interface ge-0/0/28.0 mode point-to-point
```

```
set protocols rstp interface ge-0/0/24.0 cost 1000
set protocols rstp interface ge-0/0/24.0 mode point-to-point
```

If Switch 3 includes dual Routing Engines, configure NSB. To quickly configure nonstop bridging on Switch 3, copy the following commands and paste them into the switch terminal window:

```
set chassis redundancy graceful switchover
set system commit synchronize
set ethernet-switching-options nonstop-bridging
```

Step-by-Step Procedure

To configure RSTP and nonstop bridging on Switch 3:

1. Configure the VLANs **voice-vlan**, **employee-vlan**, **guest-vlan**, and **camera-vlan**:

```
[edit vlans]
user@switch3# set voice-vlan description “Voice VLAN”
user@switch3# set voice-vlan vlan-id 10
user@switch3# set employee-vlan description “Employee VLAN”
user@switch3# set employee-vlan vlan-id 20
user@switch3# set guest-vlan description “Guest VLAN”
user@switch3# set guest-vlan vlan-id 30
user@switch3# set camera-vlan description “Camera VLAN”
user@switch3# set camera-vlan vlan-id 40
```

2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:

```
[edit interfaces]
user@switch3# set ge-0/0/26 unit 0 family ethernet-switching vlan members [10 20 30
40]
user@switch3# set ge-0/0/28 unit 0 family ethernet-switching vlan members [10 20 30
40]
user@switch3# set ge-0/0/24 unit 0 family ethernet-switching vlan members [10 20 30
40]
```

3. Configure the port mode for the interfaces:

```
[edit interfaces]
user@switch3# set ge-0/0/26 unit 0 family ethernet-switching port-mode trunk
user@switch3# set ge-0/0/28 unit 0 family ethernet-switching port-mode trunk
user@switch3# set ge-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 ge-0/0/26.0 cost 1000
user@switch3# rstp interface ge-0/0/26.0 mode point-to-point
user@switch3# rstp interface ge-0/0/28.0 cost 1000
user@switch3# rstp interface ge-0/0/28.0 mode point-to-point
user@switch3# rstp interface ge-0/0/24.0 cost 1000
user@switch3# rstp interface ge-0/0/24.0 mode point-to-point
```

Step-by-Step Procedure

If Switch 3 includes dual Routing Engines, configure nonstop bridging. To configure NSB on Switch 3:

1. Enable graceful Routing Engine switchover (GRES):

```
[edit chassis redundancy]
user@switch3# set graceful-switchover
```

2. Configure the switch to always synchronize configuration changes between the Routing Engines:

```
[edit system]
user@switch3# set commit synchronize
```

If you try to commit a configuration in which nonstop bridging is configured but synchronization of configuration changes is not configured, the configuration is not committed.

3. Enable nonstop bridging:

```
[edit ethernet-switching-options]
user@switch3# set nonstop-bridging
```

NOTE: This process enables NSB for all NSB-supported Layer 2 protocols on the switch, including RSTP.

Results

Results Check the results of the configuration:

```
user@switch3> show configuration
  interfaces {
    ge-0/0/26 {
      unit 0 {
        family ethernet-switching {
          port-mode trunk;
          vlan {
            members [10 20 30 40];
          }
        }
      }
    }
    ge-0/0/28 {
      unit 0 {
        family ethernet-switching {
          port-mode trunk;
          vlan {
            members [10 20 30 40];
          }
        }
      }
    }
    ge-0/0/24 {
      unit 0 {
        family ethernet-switching {
          port-mode trunk;
          vlan {
            members [10 20 30 40];
          }
        }
      }
    }
  }
}
```

```
protocols {
   rstp {
      bridge-priority 8k;
         interface ge-0/0/26.0 {
            cost 1000;
            mode point-to-point;
         }
         interface ge-0/0/28.0 {
            cost 1000;
            mode point-to-point;
         }
         interface ge-0/0/24.0 {
            cost 1000;
            mode point-to-point;
         }
      }
      bridge-priority 8k;
         }
      }
   }
}
vlans {
   voice-vlan {
      vlan-id 10;
   }
   employee-vlan {
      vlan-id 20;
   }
   guest-vlan {
      vlan-id 30;
   }
   camera-vlan {
      vlan-id 40;
   }
}
system {
   commit synchronize;
}
chassis {
   redundancy {
      graceful-switchover;
   }
ethernet-switching-options {
   nonstop-bridging;
}
```

Configuring RSTP and Nonstop Bridging on Switch 4

CLI Quick Configuration

To quickly configure RSTP and nonstop bridging on Switch 4, copy the following commands and paste them into the switch terminal window:

```
[edit]
set vlans voice-vlan description “Voice VLAN”
set vlans voice-vlan vlan–id 10
set vlans employee-vlan description “Employee VLAN”
set vlans employee-vlan vlan-id 20
```

```
set vlans guest-vlan description “Guest VLAN”
set vlans guest-vlan vlan-id 30
set vlans camera-vlan description “Camera VLAN”
set vlans camera-vlan vlan-id 40
set interfaces ge-0/0/23 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge-0/0/19 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge-0/0/23 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/19 unit 0 family ethernet-switching port-mode trunk
set protocols rstp bridge-priority 16k
set protocols rstp interface ge-0/0/23.0 cost 1000
set protocols rstp interface ge-0/0/23.0 mode point-to-point
set protocols rstp interface ge-0/0/19.0 cost 1000
set protocols rstp interface ge-0/0/19.0 mode point-to-point
```

If Switch 4 includes dual Routing Engines, configure NSB. To quickly configure nonstop bridging on Switch 4, copy the following commands and paste them into the switch terminal window:

```
set chassis redundancy graceful switchover
set system commit synchronize
set ethernet-switching-options nonstop-bridging
```

Step-by-Step Procedure

To configure RSTP and nonstop bridging on Switch 4:

1. Configure the VLANs **voice-vlan**, **employee-vlan**, **guest-vlan**, and **camera-vlan**:

   ```
   [edit vlans]
   user@switch4# set voice-vlan description “Voice VLAN”
   user@switch4# set voice-vlan vlan-id 10
   user@switch4# set employee-vlan description “Employee VLAN”
   user@switch4# set employee-vlan vlan-id 20
   user@switch4# set guest-vlan description “Guest VLAN”
   user@switch4# set guest-vlan vlan-id 30
   user@switch4# set camera-vlan description “Camera VLAN”
   user@switch4# set camera-vlan vlan-id 40
   ```

2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:

   ```
   [edit interfaces]
   user@switch4# set ge-0/0/23 unit 0 family ethernet-switching vlan members [10 20 30
   40]
   user@switch4# set ge-0/0/19 unit 0 family ethernet-switching vlan members [10 20 30
   40]
   ```

3. Configure the port mode for the interfaces:

   ```
   [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 RSTP on the switch:

   ```
   [edit protocols]
   user@switch4# rstp bridge-priority 16k
   user@switch4# rstp interface all cost 1000
   user@switch4# rstp interface ge-0/0/23.0 cost 1000
   user@switch4# rstp interface ge-0/0/23.0 mode point-to-point
   user@switch4# rstp interface ge-0/0/19.0 cost 1000
   user@switch4# rstp interface ge-0/0/19.0 mode point-to-point
   ```

Step-by-Step Procedure

If Switch 4 includes dual Routing Engines, configure nonstop bridging. To configure NSB on Switch 4:

1. Enable graceful Routing Engine switchover (GRES):

```
[edit chassis redundancy]
user@switch4# set graceful-switchover
```

2. Configure the switch to always synchronize configuration changes between the Routing Engines:

```
[edit system]
user@switch4# set commit synchronize
```

If you try to commit a configuration in which nonstop bridging is configured but synchronization of configuration changes is not configured, the configuration is not committed.

3. Enable nonstop bridging:

```
[edit ethernet-switching-options]
user@switch4# set nonstop-bridging
```

NOTE: This process enables NSB for all NSB-supported Layer 2 protocols on the switch, including RSTP.

Results

Results

Check the results of the configuration:

```
user@switch4> show configuration
interfaces {
    ge-0/0/23 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
        }
    }
    ge-0/0/19 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
        }
    }
}
protocols {
    rstp {
```

```
        bridge-priority 16k;
          interface ge-0/0/23.0 {
            cost 1000;
            mode point-to-point;
          }
          interface ge-0/0/19.0 {
            cost 1000;
            mode point-to-point;
          }
        }
      }
    }
    vlans {
      voice-vlan {
        vlan-id 10;
      }
      employee-vlan {
        vlan-id 20;
      }
      guest-vlan {
        vlan-id 30;
      }
      camera-vlan {
        vlan-id 40;
      }
    }
    system {
      commit synchronize;
    }
    chassis {
      redundancy {
        graceful-switchover;
      }
    ethernet-switching-options {
      nonstop-bridging;
    }
```

Verification

To confirm that the configuration is working properly, perform these tasks on both Routing Engines:

- Verifying RSTP Configuration on Switch 1 on page 36
- Verifying RSTP Configuration on Switch 2 on page 37
- Verifying RSTP Configuration on Switch 3 on page 37
- Verifying RSTP Configuration on Switch 4 on page 38

Verifying RSTP Configuration on Switch 1

Purpose Verify the RSTP configuration on Switch 1.

Action Use the operational mode command:

```
user@switch1> show spanning-tree interface

Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/13.0    128:526      128:526  16384.0019e25040e0      1000  BLK    ALT
ge-0/0/9.0     128:522      128:522  32768.0019e2503d20      1000  BLK    ALT
ge-0/0/11.0    128:524      128:524   8192.0019e25051e0      1000  FWD    ROOT
```

Meaning Refer to the topology in Figure 1 on page 23. The operational mode command **show spanning-tree interface** shows that **ge-0/0/13.0** is in a forwarding state. The other interfaces on Switch 1 are blocking.

Verifying RSTP Configuration on Switch 2

Purpose Use this procedure to verify the RSTP configuration on both Switch 2 Routing Engines.

Action Use the operational mode command:

```
user@switch2> show spanning-tree interface


Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/14.0     128:527      128:527  32768.0019e2503d20      1000  FWD    DESG
ge-0/0/18.0     128:529      128:529   8192.0019e25051e0      1000  FWD    ROOT
```

Meaning Refer to the topology in Figure 1 on page 23. The operational mode command **show spanning-tree interface** shows that **ge-0/0/18.0** is in a forwarding state and is the root port.

Verifying RSTP Configuration on Switch 3

Purpose Use this procedure to verify the RSTP configuration on both Switch 3 Routing Engines.

Action Use the operational mode commands:

```
user@switch3> show spanning-tree interface

Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/26.0     128:539      128:539   8192.0019e25051e0      1000  FWD    DESG
ge-0/0/28.0     128:541      128:541   8192.0019e25051e0      1000  FWD    DESG
ge-0/0/24.0     128:537      128:537   8192.0019e25051e0      1000  FWD    DESG
```

Meaning Refer to the topology in Figure 1 on page 23. The operational mode command **show spanning-tree interface** shows that no interface is the root interface.

Verifying RSTP Configuration on Switch 4

Purpose Use this procedure to verify the RSTP configuration on both Switch 4 Routing Engines.

Action Use the operational mode commands:

```
user@switch4> show spanning-tree interface
Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost

ge-0/0/23.0    128:536      128:536   8192.0019e25051e0      1000  FWD    ROOT
ge-0/0/19.0    128:532      128:532   16384.0019e25040e0     1000  FWD    DESG
```

Meaning Refer to the topology in Figure 1 on page 23. The operational mode command **show spanning-tree interface** shows that interface **ge-0/0/23.0** is the root interface and forwarding.

Related Documentation

- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Understanding RSTP for EX Series Switches on page 6

Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches

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 better load sharing across redundant links.

Up to 64 MSTI instances can be created for an EX Series switch, and each MSTI can support up to 4094 VLANs.

This example describes how to configure MSTP on four EX Series switches:

- Requirements on page 39
- Overview and Topology on page 39
- Configuring MSTP on Switch 1 on page 42
- Configuring MSTP on Switch 2 on page 45
- Configuring MSTP on Switch 3 on page 47
- Configuring MSTP on Switch 4 on page 50
- Verification on page 53

Requirements

This example uses the following hardware and software components:

- Junos OS Release 9.0 or later for EX Series switches
- Four EX Series switches

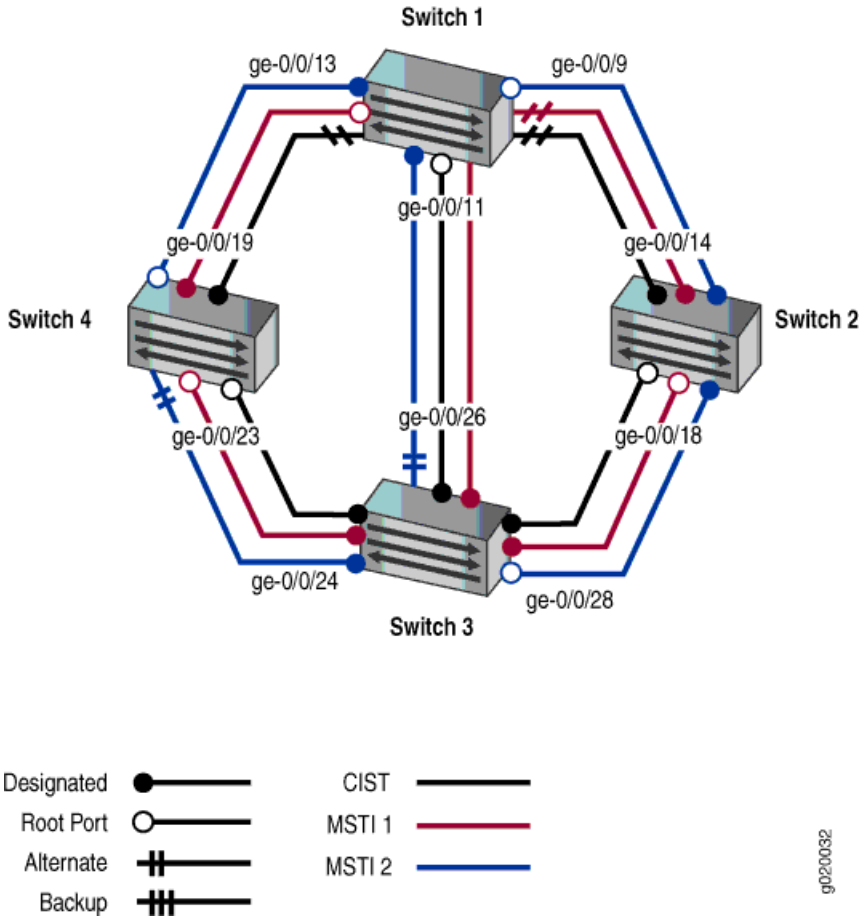
Before you configure the switches for MSTP, be sure you have:

- Installed the four switches. See Connecting and Configuring an EX Series Switch (J-Web Procedure).
- Performed the initial software configuration on all switches. See Installing and Connecting an EX3200 Switch.

Overview and Topology

When the number of VLANs grows in a network, MSTP provides a more efficient 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 2: Network Topology for MSTP



The interfaces shown in Table 8 on page 40 will be configured for MSTP.

NOTE: You can configure MSTP on logical or physical interfaces. This example shows MSTP configured on logical interfaces.

Table 8: Components of the Topology for Configuring MSTP on EX Series Switches

Property	Settings
Switch 1	The following ports on Switch 1 are connected in this way: • **ge-0/0/9** is connected to Switch 2 • **ge-0/0/13** is connected to Switch 4 • **ge-0/0/11** is connected to Switch 3
Switch 2	The following ports on Switch 2 are connected in this way: • **ge-0/0/14** is connected to Switch 1 • **ge-0/0/18** is connected to Switch 3

Table 8: Components of the Topology for Configuring MSTP on EX Series Switches *(continued)*

Property	Settings
Switch 3	The following ports on Switch 3 are connected in this way: • **ge-0/0/26** is connected to Switch 1 • **ge-0/0/28** is connected to Switch 2 • **ge-0/0/24** is connected to Switch 4
Switch 4	The following ports on Switch 4 are connected in this way: • **ge-0/0/19** is connected to Switch 1 • **ge-0/0/23** is connected to Switch 3
VLAN names and tag IDs	**voice-vlan**, tag **10** **employee-vlan**, tag **20** **guest-vlan**, tag **30** **camera-vlan**, tag **40**
MSTIs	**1** **2**

The topology in Figure 2 on page 40 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 **voice-vlan** supports voice traffic and has a VLAN tag identifier of 10.
- **employee-vlan** supports data traffic and has a VLAN tag identifier of 20.
- The **guest-vlan** supports guest VLAN traffic (for supplicants that fail 802-1X authentication) and has a VLAN tag identifier of 30.
- The **camera-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:

```
[edit]
set vlans voice-vlan description “Voice VLAN”
set vlans voice-vlan vlan-id 10
set vlans employee-vlan description “Employee VLAN”
set vlans employee-vlan vlan-id 20
set vlans guest-vlan description “Guest VLAN”
set vlans guest-vlan vlan-id 30
set vlans camera-vlan description “Camera VLAN”
set vlans camera-vlan vlan-id 40
set interfaces ge-0/0/13 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge–0/0/9 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge–0/0/11 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge–0/0/13 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/9 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-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 ge-0/0/13.0 cost 1000
set protocols mstp interface ge-0/0/13.0 mode point-to-point
set protocols mstp interface ge-0/0/9.0 cost 1000
set protocols mstp interface ge-0/0/9.0 mode point-to-point
set protocols mstp interface ge-0/0/11.0 cost 1000
set protocols mstp interface ge-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 ge-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 **voice-vlan**, **employee-vlan**, **guest-vlan**, and **camera-vlan**:

   ```
   [edit vlans]
   user@switch1# set voice-vlan description “Voice VLAN”
   user@switch1# set voice-vlan vlan-id 10
   user@switch1# set employee-vlan description “Employee VLAN”
   user@switch1# set employee-vlan vlan-id 20
   user@switch1# set guest-vlan description “Guest VLAN”
   user@switch1# set guest-vlan vlan-id 30
   user@switch1# set camera-vlan description “Camera VLAN”
   user@switch1# set guest-vlan vlan-id 40
   ```

2. Configure the VLANs on the interfaces, including support for the Ethernet Switching protocol:

   ```
   [edit interfaces]
   user@switch1# set ge–0/0/13 unit 0 family ethernet-switching vlan members [10 20 30
   40]
   user@switch1# set ge-0/0/9 unit 0 family ethernet-switching vlan members [10 20 30
   40]
   user@switch1# set ge-0/0/11 unit 0 family ethernet-switching vlan members [10 20 30
   40]
   ```

3. Configure the port mode for the interfaces:

   ```
   [edit interfaces]
   ```

```
user@switch1# set ge–0/0/13 unit 0 family ethernet-switching port-mode trunk
user@switch1# set ge-0/0/9 unit 0 family ethernet-switching port-mode trunk
user@switch1# set ge-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 ge-0/0/13.0 cost 1000
user@switch1# mstp interface ge-0/0/13.0 mode point-to-point
user@switch1# mstp interface ge-0/0/9.0 cost 1000
user@switch1# mstp interface ge-0/0/9.0 mode point-to-point
user@switch1# mstp interface ge-0/0/11.0 cost 4000
user@switch1# mstp interface ge-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 ge-0/0/11.0 cost 4000
user@switch1# mstp msti 2 bridge-priority 8k
user@switch1# mstp msti 2 vlan [30 40]
```

Results

Results Check the results of the configuration:

```
user@switch1> show configuration
interfaces {
    ge-0/0/13 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members 10;
                    members 20;
                    members 30;
                    members 40;
                }
            }
        }
    }
    ge-0/0/9 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members 10;
                    members 20;
                    members 30;
                    members 40;
                }
            }
        }
    }
    ge-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 ge-0/0/13.0 {
      cost 1000;
      mode point-to-point;
    }
    interface ge-0/0/9.0 {
      cost 1000;
      mode point-to-point;
    }
    interface ge-0/0/11.0 {
      cost 4000;
      mode point-to-point;
    }
  msti 1 {
    bridge-priority 16k;
    vlan [ 10 20 ];
    interface ge-0/0/11.0 {
      cost 4000;
    }
  }
  msti 2 {
    bridge-priority 8k;
    vlan [ 30 40 ];
  }
}
vlans {
  voice-vlan {
    vlan-id 10;
  }
  employee-vlan {
    vlan-id 20;
  }
  guest-vlan {
    vlan-id 30;
  }
  camera-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:

```
[edit]
set vlans voice-vlan description “Voice VLAN”
set vlans voice-vlan vlan—id 10
set vlans employee-vlan description “Employee VLAN”
set vlans employee-vlan vlan-id 20
set vlans guest-vlan description “Guest VLAN”
set vlans guest-vlan vlan-id 30
set vlans camera-vlan description “Camera VLAN”
set vlans camera-vlan vlan-id 40
set interfaces ge—0/0/14 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge-0/0/18 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge-0/0/14 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-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 ge-0/0/14.0 cost 1000
set protocols mstp interface ge-0/0/14.0 mode point-to-point
set protocols mstp interface ge-0/0/18.0 cost 1000
set protocols mstp interface ge-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 **voice-vlan**, **employee-vlan**, **guest-vlan**, and **camera-vlan**:

   ```
   [edit vlans]
   user@switch2# set voice-vlan description “Voice VLAN”
   user@switch2# set voice-vlan vlan-id 10
   user@switch2# set employee-vlan description “Employee VLAN”
   user@switch2# set employee-vlan vlan-id 20
   user@switch2# set guest-vlan description “Guest VLAN”
   user@switch2# set guest-vlan vlan-id 30
   user@switch2# set camera-vlan vlan-description “Camera VLAN”
   user@switch2# set guest-vlan vlan-id 40
   ```

2. Configure the VLANs on the interfaces, including support for the Ethernet Switching protocol:

   ```
   [edit interfaces]
   user@switch2# set ge-0/0/14 unit 0 family ethernet-switching vlan members [10 20 30
   40]
   user@switch2# set ge-0/0/18 unit 0 family ethernet-switching vlan members [10 20 30
   40]
   ```

3. Configure the port mode for the interfaces:

   ```
   [edit interfaces]
   user@switch2# set ge-0/0/14 unit 0 family ethernet-switching port-mode trunk
   user@switch2# set ge-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 ge-0/0/14.0 cost 1000
user@switch2# mstp interface ge-0/0/14.0 mode point-to-point
user@switch2# mstp interface ge-0/0/18.0 cost 1000
user@switch2# mstp interface ge-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

Results Check the results of the configuration:

```
user@switch2> show configuration
interfaces {
    ge-0/0/14 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members 10;
                    members 20;
                    members 30;
                    members 40;
                }
            }
        }
    }
    ge-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 ge-0/0/14.0 {
            cost 1000;
            mode point-to-point;
        }
        interface ge-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 ];
      }
    }
  }
  vlans {
    voice-vlan {
      vlan-id 10;
    }
    employee-vlan {
      vlan-id 20;
    }
    guest-vlan {
      vlan-id 30;
    }
    camera-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:

```
[edit]
set vlans voice-vlan description “Voice VLAN”
set vlans voice-vlan vlan-id 10
set vlans employee-vlan description “Employee VLAN”
set vlans employee-vlan vlan-id 20
set vlans guest-vlan description “Guest VLAN”
set vlans guest-vlan vlan-id 30
set vlans camera-vlan description “Camera VLAN”
set vlans camera-vlan vlan—id 40
set interfaces ge—0/0/26 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge—0/0/28 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge—0/0/24 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge-0/0/26 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/28 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-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 ge-0/0/26.0 cost 1000
set protocols mstp interface ge-0/0/26.0 mode point-to-point
set protocols mstp interface ge-0/0/28.0 cost 1000
set protocols mstp interface ge-0/0/28.0 mode point-to-point
set protocols mstp interface ge-0/0/24.0 cost 1000
set protocols mstp interface ge-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 **voice-vlan**, **employee-vlan**, **guest-vlan**, and **camera-vlan**:

```
[edit vlans]
user@switch3# set voice-vlan description “Voice VLAN”
user@switch3# set voice-vlan vlan-id 10
user@switch3# set employee-vlan description “Employee VLAN”
user@switch3# set employee-vlan vlan-id 20
user@switch3# set guest-vlan description “Guest VLAN”
user@switch3# set guest-vlan vlan-id 30
user@switch3# set camera-vlan description “Camera VLAN”
user@switch3# set guest-vlan vlan-id 40
```

2. Configure the VLANs on the interfaces, including support for the Ethernet Switching protocol:

```
[edit interfaces]
user@switch3# set ge-0/0/26 unit 0 family ethernet-switching vlan members [10 20 30
40]
user@switch3# set ge-0/0/28 unit 0 family ethernet-switching vlan members [10 20 30
40]
user@switch3# set ge-0/0/24 unit 0 family ethernet-switching vlan members [10 20 30
40]
```

3. Configure the port mode for the interfaces:

```
[edit interfaces]
user@switch3# set ge-0/0/26 unit 0 family ethernet-switching port-mode trunk
user@switch3# set ge-0/0/28 unit 0 family ethernet-switching port-mode trunk
user@switch3# set ge-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 ge-0/0/26.0 cost 1000
user@switch3# mstp interface ge-0/0/26.0 mode point-to-point
user@switch3# mstp interface ge-0/0/28.0 cost 1000
user@switch3# mstp interface ge-0/0/28.0 mode point-to-point
user@switch3# mstp interface ge-0/0/24.0 cost 1000
user@switch3# mstp interface ge-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

Results

Check the results of the configuration:

```
user@switch3> show configuration
  interfaces {
    ge-0/0/26 {
      unit 0 {
        family ethernet-switching {
          port-mode trunk;
          vlan {
            members 10;
            members 20;
```

```
                members 30;
                members 40;
              }
            }
          }
        }
        ge-0/0/28 {
          unit 0 {
            family ethernet-switching {
              port-mode trunk;
              vlan {
                members 10;
                members 20;
                members 30;
                members 40;
              }
            }
          }
        }
        ge-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 ge-0/0/26.0 {
          cost 1000;
          mode point-to-point;
        }
        interface ge-0/0/28.0 {
          cost 1000;
          mode point-to-point;
        }
        interface ge-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 ];
      }
    }
  }
  vlans {
    voice-vlan {
      vlan-id 10;
    }
    employee-vlan {
      vlan-id 20;
    }
    guest-vlan {
      vlan-id 30;
    }
    camera-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:

```
[edit]
set vlans voice–vlan description “Voice VLAN”
set vlans voice-vlan vlan–id 10
set vlans employee—vlan description “Employee VLAN”
set vlans employee—vlan vlan—id 20
set vlans guest—vlan description “Guest VLAN”
set vlans guest—vlan vlan—id 30
set vlans camera—vlan description “Camera VLAN”
set vlans camera—vlan vlan—id 40
set interfaces ge-0/0/23 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge-0/0/19 unit 0 family ethernet-switching vlan members [10 20 30 40]
set interfaces ge—0/0/23 unit 0 family ethernet-switching port-mode trunk
set interfaces ge—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 ge—0/0/23.0 cost 1000
set protocols mstp interface ge—0/0/23.0 mode point-to-point
set protocols mstp interface ge—0/0/19.0 cost 1000
set protocols mstp interface ge—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 **voice-vlan**, **employee-vlan**, **guest-vlan**, and **camera-vlan**:

```
[edit vlans]
user@switch4# set voice-vlan description “Voice VLAN”
user@switch4# set voice-vlan vlan—id 10
user@switch4# set employee-vlan description “Employee VLAN”
user@switch4# set employee-vlan vlan—id 20
user@switch4# set guest-vlan description “Guest VLAN”
user@switch4# set guest-vlan vlan—id 30
user@switch4# set camera-vlan description “Camera VLAN”
user@switch4# set guest-vlan vlan—id 40
```

2. Configure the VLANs on the interfaces, including support for the Ethernet Switching protocol:

```
[edit interfaces]
user@switch4# set ge-0/0/23 unit 0 family ethernet-switching vlan members [10 20 30
40]
user@switch4# set ge-0/0/19 unit 0 family ethernet-switching vlan members [10 20 30
40]
```

3. Configure the port mode for the interfaces:

```
[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 ge—0/0/23.0 cost 1000
user@switch4# mstp interface ge—0/0/23.0 mode point-to-point
user@switch4# mstp interface ge—0/0/19.0 cost 1000
user@switch4# mstp interface ge—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

Results

Check the results of the configuration:

```
user@switch4> show configuration
interfaces {
  ge-0/0/23 {
    unit 0 {
      family ethernet-switching {
        port-mode trunk;
        vlan {
          members 10;
          members 20;
          members 30;
          members 40;
        }
      }
    }
```

```
    }
    ge-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 ge-0/0/23.0 {
        cost 1000;
        mode point-to-point;
      }
      interface ge-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 ];
      }
    }
}
vlans {
    voice-vlan {
      vlan-id 10;
    }
    employee-vlan {
      vlan-id 20;
    }
    guest-vlan {
      vlan-id 30;
    }
    camera-vlan {
      vlan-id 40;
    }
}
```

Verification

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

- Verifying MSTP Configuration on Switch 1 on page 53
- Verifying MSTP Configuration on Switch 2 on page 55
- Verifying MSTP Configuration on Switch 3 on page 57
- Verifying MSTP Configuration on Switch 4 on page 59

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      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/13.0    128:527      128:525  16384.0019e25040e0      1000  FWD    ROOT
ge-0/0/9.0     128:529      128:513  32768.0019e2503d20      1000  BLK    ALT
ge-0/0/11.0    128:531      128:513   8192.0019e25051e0      4000  BLK    ALT

Spanning tree interface parameters for instance 1

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/13.0    128:527      128:525  16385.0019e25040e0      1000  FWD    ROOT
ge-0/0/9.0     128:529      128:513  32769.0019e2503d20      1000  BLK    ALT
ge-0/0/11.0    128:531      128:513   4097.0019e25051e0      4000  BLK    ALT

Spanning tree interface parameters for instance 2

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/13.0    128:527      128:527   8194.0019e25044e0      1000  FWD    DESG
ge-0/0/9.0     128:529      128:513   4098.0019e2503d20      1000  FWD    ROOT
ge-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                         : ge-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                         : ge-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                         : ge-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 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      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/14.0     128:513      128:513  32768.0019e2503d20      1000  FWD    DESG
ge-0/0/18.0     128:519      128:515   8192.0019e25051e0      1000  FWD    ROOT

Spanning tree interface parameters for instance 1

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/14.0     128:513      128:513  32769.0019e2503d20      1000  FWD    DESG
ge-0/0/18.0     128:519      128:515   4097.0019e25051e0      1000  FWD    ROOT

Spanning tree interface parameters for instance 2

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/14.0     128:513      128:513   4098.0019e2503d20      1000  FWD    DESG

ge-0/0/18.0     128:519      128:519   4098.0019e2503d20      1000  FWD    DESG


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                         : ge-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                         : ge-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 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      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/26.0     128:513      128:513   8192.0019e25051e0      1000  FWD    DESG
ge-0/0/28.0     128:515      128:515   8192.0019e25051e0      1000  FWD    DESG
ge-0/0/24.0     128:517      128:517   8192.0019e25051e0      1000  FWD    DESG

Spanning tree interface parameters for instance 1

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/26.0     128:513      128:513   4097.0019e25051e0      1000  FWD    DESG
ge-0/0/28.0     128:515      128:515   4097.0019e25051e0      1000  FWD    DESG
ge-0/0/24.0     128:517      128:517   4097.0019e25051e0      1000  FWD    DESG


Spanning tree interface parameters for instance 2

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/26.0     128:513      128:531   8194.0019e25044e0      1000  BLK    ALT
ge-0/0/28.0     128:515      128:519   4098.0019e2503d20      1000  FWD    ROOT
ge-0/0/24.0     128:517      128:517  16386.0019e25051e0      1000  FWD    DESG


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                       : ge-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 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      Designated         Port    State  Role
                         port ID        bridge ID          Cost

ge-0/0/23.0    128:523      128:517   8192.0019e25051e0      1000  FWD    ROOT
ge-0/0/19.0    128:525      128:525  16384.0019e25040e0      1000  FWD    DESG

Spanning tree interface parameters for instance 1

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/23.0    128:523      128:517   4097.0019e25051e0      1000  FWD    ROOT
ge-0/0/19.0    128:525      128:525  16385.0019e25040e0      1000  FWD    DESG


Spanning tree interface parameters for instance 2

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/23.0    128:523      128:517  16386.0019e25051e0      1000  BLK    ALT
ge-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                         : ge-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                         : ge-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                         : ge-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 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 EX Series Switches on page 21
- Understanding MSTP for EX Series Switches on page 4

Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches

EX Series switches provide Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree protocol (RSTP), and Multiple Spanning Tree Protocol (MSTP). All spanning-tree protocols use a special type of frame called a bridge protocol data unit (BPDU) to communicate. Other devices—PC bridging applications, for example, also use BPDUs and generate their own BPDUs. These different BPDUs are not compatible. When BPDUs generated by spanning-tree protocols are transmitted to a device that uses another type of BPDU, they can cause problems on the device. Similarly, if switches within a spanning-tree topology receive BPDUs from other devices, network outages can occur because of STP miscalculations.

This example configures BPDU protection on an EX Series switch that uses RSTP. The upstream configuration is done on the edge interfaces, where outside BPDUs are often received from other devices:

- Requirements on page 62
- Overview and Topology on page 62
- Configuration on page 63
- Verification on page 64

Requirements

This example uses the following hardware and software components:

- Two EX Series switches in an RSTP topology
- Junos OS Release 9.1 or later for EX Series switches

Before you configure the interfaces on Switch 2 for BPDU protection, be sure you have:

- RSTP enabled on the switches.

NOTE: **By default, RSTP is enabled on all EX Series switches.**

Overview and Topology

The switches, being in an RSTP topology, support a loop-free network through the exchange of BPDUs. Receipt of outside BPDUs in an STP, RSTP, or MSTP topology, however, can lead to network outages by triggering an STP misconfiguration. To prevent such outages, enable BPDU protection on STP interfaces that could receive outside BPDUs. If an outside BPDU is received on a BPDU-protected interface, the interface shuts down to prevent the outside BPDU from accessing the STP interface.

Figure 3 on page 63 shows the topology for this example. In this example, Switch 1 and Switch 2 are configured for RSTP and create a loop-free topology. The interfaces on Switch 2 are edge access ports—edge access ports frequently receive outside BPDUs generated by PC applications.

This example configures interface **ge-0/0/5.0** and interface **ge-0/0/6.0** as edge ports on Switch 2, and then configures BPDU protection on those ports. With BPDU protection enabled, these interfaces shut down when they encounter an outside BPDU sent by the PCs connected to Switch 2.

Figure 3: BPDU Protection Topology

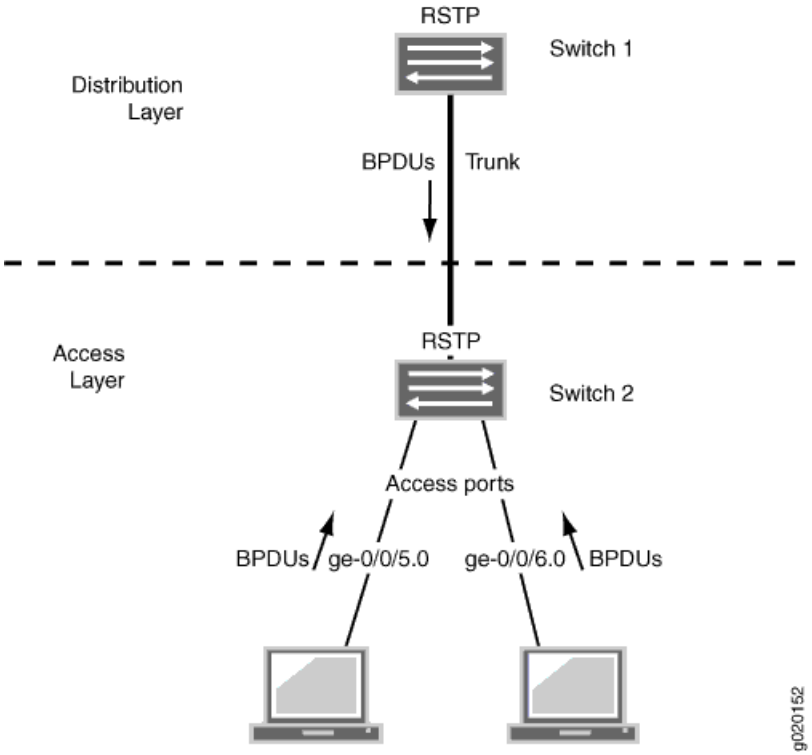


Table 9 on page 63 shows the components that will be configured for BPDU protection.

Table 9: Components of the Topology for Configuring BPDU Protection on EX Series Switches

Property	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: • **ge-0/0/5.0** • **ge-0/0/6.0**

This configuration example uses RSTP topology. You also can configure BPDU protection for STP or MSTP topologies at the [**edit protocols** (**mstp** | **stp**)] hierarchy level.

Configuration

To configure BPDU protection on two access interfaces:

CLI Quick Configuration

Quickly configure RSTP on the two Switch 2 interfaces, and then configure BPDU protection on all edge ports on Switch 2 by copying the following commands and pasting them into the switch terminal window:

```
[edit]
set protocols rstp interface ge-0/0/5.0 edge
set protocols rstp interface ge-0/0/6.0 edge
set protocols rstp bpdu-block-on-edge
```

Step-by-Step Procedure

To configure RSTP on the two Switch 2 interfaces, and then configure BPDU protection:

1. Configure RSTP on interface **ge-0/0/5.0** and interface **ge-0/0/6.0**, and configure them as edge ports:

```
[edit protocols rstp]
user@switch# set interface ge-0/0/5.0 edge
user@switch# set interface ge-0/0/6.0 edge
```

2. Configure BPDU protection on all edge ports on this switch:

```
[edit protocols rstp]
user@switch# set bpdu-block-on-edge
```

Results

Results

Check the results of the configuration:

```
user@switch> show configuration protocols rstp
interface ge-0/0/5.0 {
   edge;
}
interface ge-0/0/6.0 {
   edge;
}
bpdu-block-on-edge;
```

Verification

To confirm that the configuration is working properly:

- Displaying the Interface State Before BPDU Protection Is Triggered on page 64
- Verifying That BPDU Protection Is Working Correctly on page 65

Displaying the Interface State Before BPDU Protection Is Triggered

Purpose

Before BPDUs can be received from PCs connected to interface **ge-0/0/5.0** and interface **ge-0/0/6.0**, confirm the interface state.

Action Use the operational mode command:

```
user@switch> show spanning-tree interface

Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/0.0     128:513      128:513  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/1.0     128:514      128:514  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/2.0     128:515      128:515  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/3.0     128:516      128:516  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/4.0     128:517      128:517  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/5.0     128:518      128:518  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/6.0     128:519      128:519  32768.0019e2503f00     20000  FWD    DESG
[output truncated]
```

Meaning The output from the operational mode command **show spanning-tree interface** shows that **ge-0/0/5.0** and interface **ge-0/0/6.0** are ports in a forwarding state.

Verifying That BPDU Protection Is Working Correctly

Purpose In this example, the PCs connected to Switch 2 start sending BPDUs to interface **ge-0/0/5.0** and interface **ge-0/0/6.0** . Verify that BPDU protection is working on the interfaces.

Action Use the operational mode command:

```
user@switch> show spanning-tree interface

Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/0.0     128:513      128:513  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/1.0     128:514      128:514  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/2.0     128:515      128:515  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/3.0     128:516      128:516  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/4.0     128:517      128:517  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/5.0     128:518      128:518  32768.0019e2503f00     20000  BLK    DIS
(Bpdu-Incon)
ge-0/0/6.0     128:519      128:519  32768.0019e2503f00     20000  BLK    DIS
(Bpdu-Incon)
ge-0/0/7.0     128:520        128:1  16384.00aabbcc0348     20000  FWD    ROOT
ge-0/0/8.0     128:521      128:521  32768.0019e2503f00     20000  FWD    DESG
[output truncated]
```

Meaning When BPDUs are sent from the PCs to interface **ge-0/0/5.0** and interface **ge-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 causes the interfaces to shut down.

Disabling the BPDU protection configuration on an interface does not automatically re-enable the interface. However, if the disable-timeout (Spanning Trees) statement has been included in the BPDU configuration, the interface does return to service after

the timer expires. Otherwise, you must use the operational mode command clear ethernet-switching bpdu-error to unblock and re-enable the interface.

If the PCs 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, causing them to shut down. In such cases, you need to find and repair the misconfiguration on the PCs that is sending BPDUs to Switch 2.

Related Documentation

- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66
- Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches on page 72
- Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX Series Switches on page 76
- Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 14

Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches

Spanning-tree protocols support loop-free network communication through the exchange of a special type of frame called a bridge protocol data unit (BPDU). However, when BPDUs generated by spanning-tree protocols are communicated to devices on which spanning-tree protocols are not configured, these devices recognize the BPDUs, which can lead to network outages. You can, however, enable BPDU protection on switch interfaces to prevent BPDUs generated by spanning-tree protocols from passing through those interfaces. When BPDU protection is enabled, an interface shuts down or drops BPDU packets when any incompatible BPDU is encountered, thereby preventing the BPDUs generated by spanning-tree protocols from reaching the switch. When an interface is configured to drop BPDU packets, all traffic except the incompatible BPDUs can pass through the interface.

NOTE: **The BPDU drop feature can be specified only on interfaces on which no spanning-tree protocol is configured.**

This example configures BPDU protection on STP switch downstream interfaces that connect to two PCs:

- Requirements on page 67
- Overview and Topology on page 67
- Configuration on page 69
- Verification on page 71

Requirements

This example uses the following hardware and software components:

- One EX Series switch in an RSTP topology
- One EX Series switch that is not in any spanning-tree topology
- Junos OS Release 9.1 or later for EX Series switches

Before you configure the interfaces on Switch 2 for BPDU protection, be sure you have:

- Ensured that RSTP is operating on Switch 1.
- Disabled or enabled RSTP on Switch 2 (depending on the configuration that you plan to implement.)

  If you want to enable the BPDU shutdown feature, then it is optional to disable spanning-tree protocols on the interface.

NOTE: **By default, RSTP is enabled on all EX Series switches.**

Overview and Topology

EX Series switches provide Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree protocol (RSTP), and Multiple Spanning Tree Protocol (MSTP). All spanning-tree protocols use a special type of frame called a BPDU to communicate. Other devices also use BPDUs—PC bridging applications, for example, generate their own BPDUs. These different BPDUs are not compatible. When BPDUs generated by spanning-tree protocols are transmitted to a device that uses another type of BPDU, they can cause problems on the device. Similarly, if switches within a spanning-tree topology receive BPDUs from other devices, network outages can occur because of the miscalculations caused by the outside BPDUs. Therefore, you must configure BPDU protection on interfaces in a spanning-tree topology to avoid network outages.

This example explains how to block outside BPDUs from reaching a switch interface connected to devices that are not part of the STP topology. This example addresses two scenarios. In the first scenario, an interface is shutdown when it encounters an outside BPDU. In the second scenario, an interface drops only BPDU packets while retaining the status of the interface as up and allowing all other traffic to pass through the interface.

Figure 3 on page 63 shows the topology for this example. Switch 1 and Switch 2 are connected through a trunk interface. Switch 1 is configured for RSTP while Switch 2 has a spanning-tree protocol configured on it for the first scenario, and does not have a spanning-tree protocol configured on it for the second scenario.

In the first scenario, this example configures downstream BPDU protection on Switch 2 interfaces **ge-0/0/5.0** and **ge-0/0/6.0** when the default spanning-tree protocol (RSTP) is not disabled on these interfaces. When BPDU protection is enabled with the **shutdown**

statement, the switch interfaces will shut down if BPDUs generated by the laptops attempt to access Switch 2.

In the second scenario, this example configures downstream BPDU protection on Switch 2 interfaces **ge-0/0/5.0** and **ge-0/0/6.0** when the default spanning-tree protocol (RSTP) is disabled on these interfaces. When BPDU protection is enabled with the **drop** statement, the switch interfaces drop only the BPDUs while allowing remaining traffic to pass through and retaining their status as up if BPDUs generated by the laptops attempt to access Switch 2.

CAUTION: When configuring BPDU protection on an interface without spanning trees connected to a switch with spanning trees, be careful that you do not configure BPDU protection on all interfaces. Doing so could prevent BPDUs being received on switch interfaces (such as a trunk interface) that you intended to have receive BPDUs from a switch with spanning trees.

Figure 4: BPDU Protection Topology

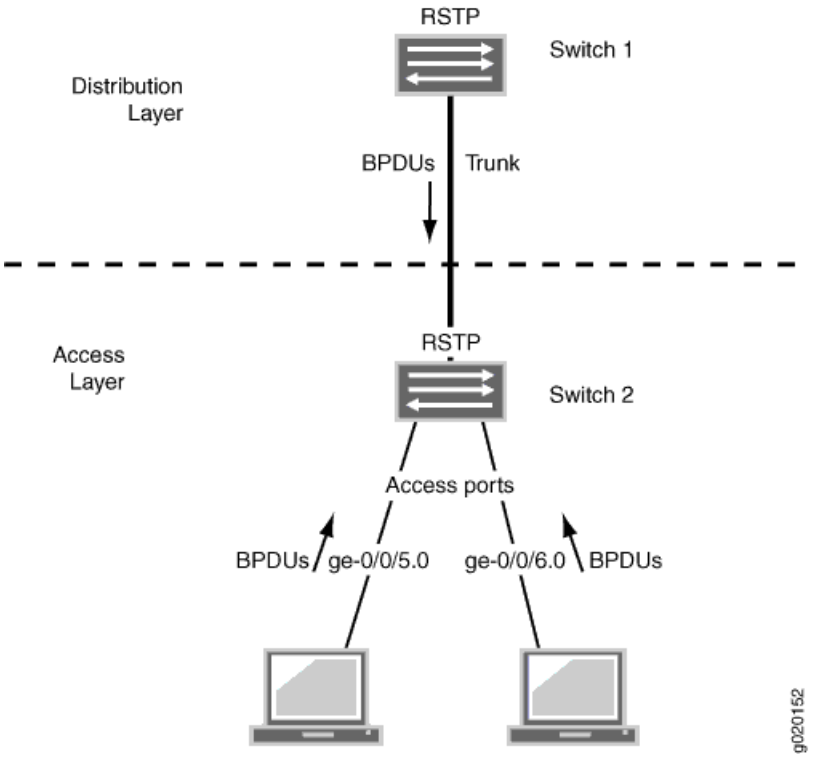


Table 10 on page 68 shows the components that will be configured for BPDU protection.

Table 10: Components of the Topology for Configuring BPDU Protection on EX Series Switches

Property	Settings
Switch 1 (Distribution Layer)	Switch 1 is connected to Switch 2 through a trunk interface. Switch 1 is configured for RSTP.

Table 10: Components of the Topology for Configuring BPDU Protection on EX Series Switches *(continued)*

Property	Settings
Switch 2 (Access Layer)	Switch 2 has two downstream access ports connected to laptops: • ge-0/0/5.0 • ge-0/0/6.0

Configuration

To configure BPDU protection on the interfaces:

CLI Quick Configuration

This is the first scenario that explains configuration for the **shutdown** statement. To quickly configure BPDU protection on Switch 2 for the **shutdown** statement, copy the following commands and paste them into the switch terminal window:

```
[edit]
user@switch# set ethernet-switching-options bpdu-block interface ge-0/0/5.0 shutdown
[edit]
user@switch# set ethernet-switching-options bpdu-block interface ge-0/0/6.0 shutdown
```

Step-by-Step Procedure

To configure BPDU protection for the **shutdown** statement:

1. Configure the BPDU **shutdown** statement on the downstream interface **ge-0/0/5.0** on Switch 2:

   ```
   [edit ethernet-switching-options]
   user@switch# set bpdu-block interface ge-0/0/5.0 shutdown
   ```

2. Configure the BPDU **shutdown** statement on the downstream interface **ge-0/0/6.0** on Switch 2:

   ```
   [edit ethernet-switching-options]
   user@switch# set bpdu-block interface ge-0/0/6.0 shutdown
   ```

Results

Results

Check the results of the configuration:

```
user@switch> show ethernet-switching-options
bpdu-block {
  interface ge-0/0/5.0 {
    shutdown;
    }
  interface ge-0/0/6.0 {
    shutdown;
    }
}
```

CLI Quick Configuration

This is the second scenario that explains configuration for the **drop** statement. To quickly configure BPDU protection on Switch 2 for the **drop** statement, copy the following commands and paste them into the switch terminal window:

```
[edit]
user@switch# set protocols rstp interface ge-0/0/5.0 disable
user@switch# set protocols rstp interface ge-0/0/6.0 disable
```

```
user@switch#  set ethernet-switching-options bpdu-block interface ge-0/0/5.0 drop
user@switch#  set ethernet-switching-options bpdu-block interface ge-0/0/6.0 drop
```

NOTE: You can also disable RSTP globally using the **delete protocols rstp**, the **set protocols rstp disable**, or the **set protocols rstp interface all disable** command.

Step-by-Step Procedure

To configure BPDU protection for the **drop** statement:

1. Disable RSTP on both the interfaces **ge-0/0/5.0** and **ge-0/0/6.0** interfaces:

   ```
   [edit]
   user@switch#  set protocols rstp interface ge-0/0/5.0 disable
   user@switch#  set protocols rstp interface ge-0/0/6.0 disable
   ```

2. Configure the BPDU **drop** statement on the downstream interface **ge-0/0/5.0** on Switch 2:

   ```
   [edit ethernet-switching-options]
   user@switch#  set bpdu-block interface ge-0/0/5.0 drop
   ```

3. Configure the BPDU **drop** statement on the downstream interface **ge-0/0/6.0** on Switch 2:

   ```
   [edit ethernet-switching-options]
   user@switch#  set bpdu-block interface ge-0/0/6.0 drop
   ```

Results

Results

Check the results of the configuration:

```
user@switch> show protocols rstp
interface ge-0/0/5.0 {
   disable;
}
interface ge-0/0/6.0 {
   disable;
}
user@switch> show ethernet-switching-options
bpdu-block {
   interface ge-0/0/5.0 {
      drop;
      }
   interface ge-0/0/6.0 {
      drop;
      }
}
```

Verification

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

- Displaying the Interface State Before BPDU Protection Is Triggered on page 71
- Verifying That BPDU Shutdown Protection Is Working Correctly on page 71
- Verifying That BPDU Drop Protection Is Working Correctly on page 72

Displaying the Interface State Before BPDU Protection Is Triggered

Purpose Before any BPDUs can be received on Switch 2 on either interface **ge-0/0/5.0** or interface **ge-0/0/6.0**, confirm the state of those interfaces.

Action Use the operational mode command **show ethernet-switching interfaces**:

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

Interface    State  VLAN members     Tag   Tagging    Blocking
ge-0/0/5.0   up     default               untagged   unblocked
ge-0/0/6.0   up     default               untagged   unblocked
```

Meaning The output from the operational mode command **show ethernet-switching interfaces** shows that **ge-0/0/5.0** and interface **ge-0/0/6.0** are **up** and unblocked.

Verifying That BPDU Shutdown Protection Is Working Correctly

Purpose Verify that BPDU protection is working correctly in the network by checking to see whether BPDUs have been blocked appropriately.

Action Issue **show ethernet-switching interfaces** to see what happened when the BPDUs reached the two interfaces configured for BPDU protection on Switch 2:

```
user@switch>  show ethernet-switching interfaces
Interface    State  VLAN members     Tag   Tagging     Blocking
ge-0/0/5.0   down   default               untagged    Disabled by bpdu-control
ge-0/0/6.0   down   default               untagged    Disabled by bpdu-control
```

Meaning When the BPDUs sent from laptops reached interfaces **ge-0/0/5.0** and **ge-0/0/6.0** on Switch 2, the interfaces transitioned to a BPDU inconsistent state, shutting down the two interfaces to prevent BPDUs from reaching the laptops.

You need to re-enable the blocked interfaces. There are two ways to do this. If you included the statement disable-timeout (Spanning Trees) in the BPDU configuration, the interface returns to service after the timer expires. Otherwise, use the operational mode command clear ethernet-switching bpdu-error to unblock and re-enable **ge-0/0/5.0** and **ge-0/0/5.0**. This command will only re-enable an interface but the BPDU configuration for the interface will continue to exist unless you remove the BPDU configuration explicitly.

If BPDUs reach the downstream interfaces on Switch 2 again, BPDU protection is triggered again and the interfaces shut down. In such cases, you must find and repair the misconfiguration that is sending BPDUs to interfaces **ge-0/0/5.0** and **ge-0/0/6.0**.

Verifying That BPDU Drop Protection Is Working Correctly

Purpose Verify that BPDU drop protection is working correctly in the network by checking to see whether BPDUs have been blocked appropriately.

Action Issue **show ethernet-switching interfaces** to see what happened when the BPDUs reached the two interfaces configured for BPDU protection on Switch 2:

```
user@switch>  show ethernet-switching interfaces
Interface    State  VLAN members     Tag   Tagging  Blocking
ge-0/0/5.0   up     default               untagged unblocked-xSTP bpdu
                                                  filter enabled
ge-0/0/6.0   up     default               untagged unblocked-xSTP bpdu
                                                  filter enabled
```

Meaning When the BPDUs sent from laptops reached interfaces **ge-0/0/5.0** and **ge-0/0/6.0** on Switch 2, the interfaces dropped those BPDUs to prevent them from reaching Switch 2, and the state of both the interfaces is **up**.

Related Documentation

- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches on page 72
- Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX Series Switches on page 76
- Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 14

Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches

EX Series switches 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 result in a loop opening up in the network.

This example describes how to configure loop protection for an interface on an EX Series switch in an RSTP topology:

- Requirements on page 73
- Overview and Topology on page 73
- Configuration on page 74
- Verification on page 75

Requirements

This example uses the following hardware and software components:

- Junos OS Release 9.1 or later for EX Series switches
- Three EX Series switches in an RSTP topology

Before you configure the interface for loop protection, be sure you have:

- RSTP operating on the switches.

NOTE: **By default, RSTP is enabled on all EX Series switches.**

Overview and Topology

A loop-free network in spanning-tree topologies is supported through the exchange of a special type of frame called 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 opens up 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.

CAUTION: **An interface can be configured for either loop protection or root protection, but not for both.**

Three EX Series switches are displayed in Figure 5 on page 74. In this example, they are configured for RSTP and create a loop-free topology. Interface **ge-0/0/6** is blocking traffic between Switch 3 and Switch 1; thus, traffic is forwarded through interface **ge-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 **ge-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 5: Network Topology for Loop Protection

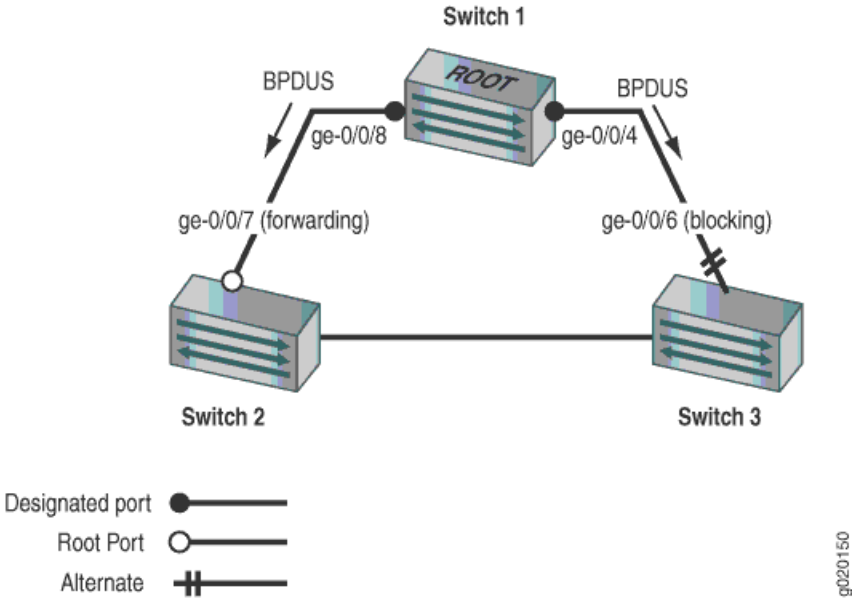


Table 11 on page 74 shows the components that will be configured for loop protection.

Table 11: Components of the Topology for Configuring Loop Protection on EX Series Switches

Property	Settings
Switch 1	Switch 1 is the root bridge.
Switch 2	Switch 2 has the root port **ge-0/0/7**.
Switch 3	Switch 3 is connected to Switch 1 through interface **ge-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 also can configure loop protection for STP or MSTP topologies at the [**edit protocols** (**mstp** | **stp**)] hierarchy level.

Configuration

To configure loop protection on an interface:

CLI Quick Configuration

To quickly configure loop protection on interface **ge-0/0/6**:

```
[edit]
set protocols rstp interface ge-0/0/6 bpdu-timeout-action block
```

Step-by-Step Procedure

To configure loop protection:

1. Configure interface **ge-0/0/6** on Switch 3:

```
[edit protocols rstp]
user@switch# set interface ge-0/0/6 bpdu-timeout-action (Spanning Trees) block
```

Results

Results

Check the results of the configuration:

```
user@switch> show configuration protocols rstp
interface ge-0/0/6.0 {
  bpdu-timeout-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 75
- Verifying That Loop Protection Is Working on an Interface on page 76

Displaying the Interface State Before Loop Protection Is Triggered

Purpose

Before loop protection is triggered on interface **ge-0/0/6**, confirm that the interface is blocking.

Action

Use the operational mode command:

```
user@switch>  show spanning-tree interface

Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/0.0     128:513      128:513  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/1.0     128:514      128:514  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/2.0     128:515      128:515  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/3.0     128:516      128:516  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/4.0     128:517      128:517  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/5.0     128:518      128:518  32768.0019e2503f00     20000  FWD    DESG
ge-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 **ge-0/0/6.0** is the alternate port and in a blocking state.

Verifying That Loop Protection Is Working on an Interface

Purpose Verify the loop protection configuration on interface **ge-0/0/6**. RSTP has been disabled on interface **ge-0/0/4** on Switch 1. This will stop BPDUs from being sent to interface **ge-0/0/6** and trigger loop protection on the interface.

Action Use the operational mode command:

```
user@switch> show spanning-tree interface

Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/0.0     128:513      128:513  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/1.0     128:514      128:514  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/2.0     128:515      128:515  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/3.0     128:516      128:516  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/4.0     128:517      128:517  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/5.0     128:518      128:518  32768.0019e2503f00     20000  FWD    DESG
ge-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 **ge-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 EX Series Switches on page 21
- Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX Series Switches on page 76
- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66
- Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 15

Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX Series Switches

EX Series switches 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 manually enforce the root bridge placement in the network.

This example describes how to configure root protection on an interface on an EX Series switch:

- Requirements on page 77
- Overview and Topology on page 77
- Configuration on page 79
- Verification on page 79

Requirements

This example uses the following hardware and software components:

- Junos OS Release 9.1 or later for EX Series switches
- Four EX Series 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 all EX Series switches.**

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.

However, a root port elected through this process has the possibility of being wrongly elected. A user bridge application running on a PC can generate BPDUs, too, and interfere with root port election.

To prevent this from happening, enable root protection on interfaces that should not receive superior 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 superior BPDUs. Otherwise, it participates in the spanning-tree topology.

CAUTION: **An interface can be configured for either root protection or loop protection, but not for both.**

Four EX Series switches are displayed in Figure 6 on page 78. In this example, they are configured for RSTP and create a loop-free topology. Interface **ge-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 **ge-0/0/6** on Switch 1 is the root port.

This example shows how to configure root protection on interface **ge-0/0/7** to prevent it from transitioning to become the root port.

Figure 6: Network Topology for Root Protection

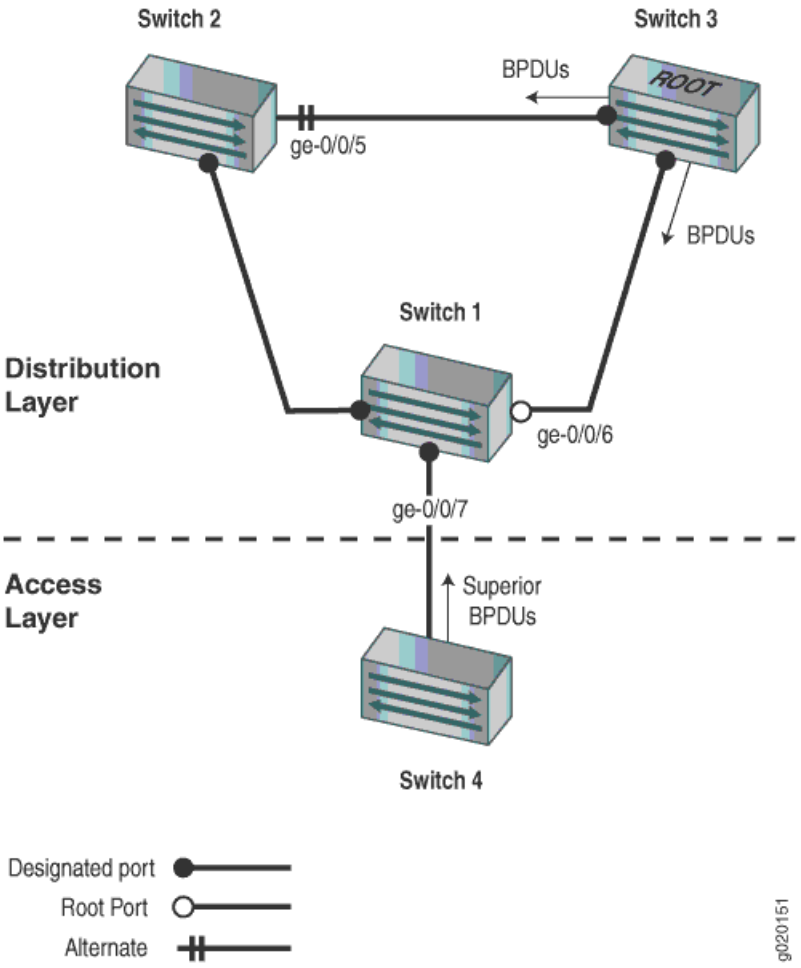


Table 12 on page 78 shows the components that will be configured for root protection.

Table 12: Components of the Topology for Configuring Root Protection on EX Series Switches

Property	Settings
Switch 1	Switch 1 is connected to Switch 4 through interface **ge-0/0/7**.
Switch 2	Switch 2 is connected to Switch 1 and Switch 3. Interface **ge-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.

Table 12: Components of the Topology for Configuring Root Protection on EX Series Switches *(continued)*

Property	Settings
Switch 4	Switch 4 is connected to Switch 1. After loop protection is configured on interface **ge-0/0/7**, Switch 4 will send superior BPDUs that will trigger loop protection on interface **ge-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 also can configure root protection for STP or MSTP topologies at the [**edit protocols** (**mstp** | **stp**)] hierarchy level.

Configuration

To configure root protection on an interface:

CLI Quick Configuration

To quickly configure root protection on interface **ge-0/0/7**, copy the following command and paste it into the switch terminal window:

```
[edit]
set protocols rstp interface ge-0/0/7 no-root-port
```

Step-by-Step Procedure

To configure root protection:

1. Configure interface **ge-0/0/7**:

   ```
   [edit protocols rstp]
   user@switch#
   set interface ge-0/0/7 no-root-port (Spanning Trees)
   ```

Results

Results

Check the results of the configuration:

```
user@switch> show configuration protocols rstp
interface ge-0/0/7.0 {
    no-root-port;
}
```

Verification

To confirm that the configuration is working properly:

- Displaying the Interface State Before Root Protection Is Triggered on page 80
- Verifying That Root Protection Is Working on the Interface on page 80

Displaying the Interface State Before Root Protection Is Triggered

Purpose Before root protection is triggered on interface **ge-0/0/7**, confirm the interface state.

Action Use the operational mode command:

```
user@switch>  show spanning-tree interface

Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/0.0     128:513      128:513  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/1.0     128:514      128:514  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/2.0     128:515      128:515  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/3.0     128:516      128:516  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/4.0     128:517      128:517  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/5.0     128:518        128:2  16384.00aabbcc0348     20000  BLK    ALT
ge-0/0/6.0     128:519        128:1  16384.00aabbcc0348     20000  FWD    ROOT
ge-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 **ge-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 smaller bridge priority on the Switch 4 causes it to send superior BPDUs to interface **ge-0/0/7**. Receipt of superior BPDUs on interface **ge-0/0/7** will trigger root protection. Verify that root protection is operating on interface **ge-0/0/7**.

Action Use the operational mode command:

```
user@switch> show spanning-tree interface

Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/0.0     128:513      128:513  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/1.0     128:514      128:514  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/2.0     128:515      128:515  32768.0019e2503f00     20000  BLK    DIS
ge-0/0/3.0     128:516      128:516  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/4.0     128:517      128:517  32768.0019e2503f00     20000  FWD    DESG
ge-0/0/5.0     128:518        128:2  16384.00aabbcc0348     20000  BLK    ALT
ge-0/0/6.0     128:519        128:1  16384.00aabbcc0348     20000  FWD    ROOT
ge-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 **ge-0/0/7.0** has transitioned to a loop inconsistent state. The loop inconsistent state makes the interface block and prevents the interface from becoming a candidate for the root port. When the root bridge no longer receives superior STP BPDUs from the interface, the interface will recover and transition back to a forwarding state. Recovery is automatic.

Related Documentation

- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches on page 72
- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66
- Understanding Root Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 17

CHAPTER 3

Configuration Tasks

- Configuring STP (CLI Procedure) on page 83
- Configuring Spanning-Tree Protocols (J-Web Procedure) on page 84
- Configuring VSTP (CLI Procedure) on page 88
- Configuring BPDU Protection on an Interface (CLI Procedure) on page 89
- Unblocking an Interface That Receives BPDUs in Error (CLI Procedure) on page 95

Configuring STP (CLI Procedure)

The default spanning-tree protocol for EX Series switches is Rapid Spanning Tree Protocol (RSTP). RSTP provides faster convergence times than the original Spanning Tree Protocol (STP). However, some legacy networks require the slower convergence times of basic STP that work with 802.1D 1998 bridges.

If your network includes 802.1D 1998 bridges, you can remove RSTP and explicitly configure STP. When you explicitly configure STP, the switches 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.

To configure STP:

1. Either delete RSTP on the entire switch or disable RSTP on specific interfaces:
   - To delete RSTP on the entire switch:

     ```
     [edit protocols]
     user@switch# delete rstp
     ```
   - To disable RSTP on a specific interface:

     ```
     [edit protocols]
     user@switch# set rstp interface interface-name disable
     ```
2. Enable STP either on all interfaces or on a specific interface:
   - To enable STP on all interfaces:

     ```
     [edit protocols]
     user@switch# set stp interface all
     ```
   - To enable STP on a specific interface:

     ```
     [edit protocols]
     user@switch# set stp interface interface-name
     ```

3. (Optional) Only if a routed VLAN interface (RVI) is configured, enable the Address Resolution Protocol (ARP) for faster MAC address recovery:

   - To enable ARP on STP on all interfaces:

     ```
     [edit protocols]
     user@switch#  set stp interface all arp-on-stp
     ```

   - To enable ARP on STP on a specific interface:

     ```
     [edit protocols]
     user@switch#  set stp interface interface-name  arp-on-stp
     ```

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Understanding STP for EX Series Switches on page 11

Configuring Spanning-Tree Protocols (J-Web Procedure)

EX 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). You can configure STP, RSTP, and MSTP using the J-Web interface. You can configure bridge protocol data unit (BPDU) protection on interfaces to prevent them from receiving BPDUs that could result in STP misconfigurations, which could lead to network outages.

To configure STP, MSTP, or RSTP for an EX Series switch using the J-Web interface:

1. Select **Configure** > **Switching** > **Spanning Tree**.

   The Spanning Tree Configuration page displays the spanning-tree protocol configuration parameters and a list of interfaces configured for each spanning-tree protocol configuration.

   NOTE: After you make changes to the configuration in this page, you must commit the changes for them to take effect. To commit all changes to the active configuration, select **Commit Options** > **Commit**. See Using the Commit Options to Commit Configuration Changes for details about all commit options.

2. Click one:

   - **Add**—Creates a spanning-tree protocol configuration.

     a. Select a protocol name.

     b. Enter information as described in Table 13 on page 85.

     c. Click **OK** to apply changes to the configuration or click **Cancel** to cancel without saving changes.

   - **Edit**—Modifies a selected spanning-tree protocol configuration.

a. Enter information as described in Table 13 on page 85.

b. Click **OK** to apply changes to the configuration or click **Cancel** to cancel without saving changes.

- **Delete**—Deletes a selected spanning-tree protocol configuration.

Table 13: Spanning-Tree Protocol Configuration Parameters

Field	Function	Your Action
General		
Protocol Name	Specifies the spanning-tree protocol type: STP, MSTP, or RSTP.	None.
Disable	Disables spanning-tree protocol on the interface.	To enable this option, select the check box.
BPDU Protect	Specifies BPDU protection on all edge interfaces on the switch.	To enable this option, select the check box.
Bridge Priority	Specifies 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.	Select a value from the list.
Forward Delay	Specifies the number of seconds an interface waits before changing from spanning-tree learning and listening states to the forwarding state.	Type a value.
Hello Time	Specifies the time interval in seconds at which the root bridge transmits configuration BPDUs.	Type a value.
Max Age	Specifies the maximum-aging time in seconds for all MST instances. The maximum aging time is the number of seconds a switch waits without receiving spanning-tree configuration messages before attempting a reconfiguration.	Type a value.
Max Hops	(MSTP only) Specifies the number of hops in a region before the BPDU is discarded.	Type a value.
Configuration Name	(MSTP only) Specifies the MSTP region name carried in the MSTP BPDUs.	Type a name.
Revision Level	(MSTP only) Specifies the revision number of the MSTP configuration.	Type a value.
Ports		

Table 13: Spanning-Tree Protocol Configuration Parameters *(continued)*

Field	Function	Your Action
Interface Name	Specifies an interface for the spanning-tree protocol.	1. Click the **Ports** tab. 2. Choose one: • Click **Add** and select an interface from the list. For an EX8200 Virtual Chassis configuration, select the member, FPC, and the interface from the list. • Select an interface in the **Port/State** table and click **Edit**. • To delete an interface from the configuration, select it in the **Port/State** table and click **Remove**.
Cost	Specifies the link cost to determine which bridge is the designated bridge and which interface is the designated interface.	Type a value.
Priority	Specifies the interface priority to determine which interface is elected as the root port.	Select a value from the list.
Disable Port	Disables the spanning-tree protocol on the interface.	To enable the option, select the check box.
Edge	Configures the interface as an edge interface. Edge interfaces immediately transition to a forwarding state.	To enable the option, select the check box.
No Root Port	Specifies an interface as a spanning-tree designated port. If the bridge receives superior STP 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 superior STP BPDUs on the root-protected interface, interface traffic is no longer blocked.	To enable the option, select the check box.
Interface Mode	Specifies the link mode.	1. To enable the option, select the check box. 2. Select one: • **Point to Point**—For a full-duplex link, the default link mode is point-to-point. • **Shared**—For a half-duplex link, the default link mode is shared.
BPDU Timeout Action	Specifies the BPDU timeout action for the interface.	Select one: • **Log** • **Block**
MSTI (MSTP only)		

Table 13: Spanning-Tree Protocol Configuration Parameters *(continued)*

Field	Function	Your Action
MSTI Name	Specifies a name (an MSTI ID) for the MST instance.	1. Click the **MSTI** tab. 2. Choose one: • Click **Add**. • Select an MSTI ID and click **Edit**. • To delete an MSTI from the configuration, select the MSTI ID and slick **Remove**.
Bridge Priority	Specifies 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.	Select a value from the list.
VLAN ID	Specifies the VLAN for the MST instance.	In the VLAN box, choose one: • Click **Add**, select a VLAN from the list and click **OK**. • To remove a VLAN association, select the VLAN ID, click **Remove**, and click **OK**.
Interfaces	Specifies an interface for the MST instance.	1. In the Interfaces box, click **Add** and select an interface from the list, or select an interface from the list and click **Edit**. 2. Specify the link cost to determine which bridge is the designated bridge and which interface is the designated interface. 3. Specify the interface priority to determine which interface is elected as the root port. 4. If you want to disable the interface, select the check box. 5. Click OK. To delete an interface configuration, select the interface, click **Remove**, and click **OK**.

Related Documentation

- Configuring STP (CLI Procedure) on page 83
- Monitoring Spanning-Tree Protocols on page 145
- Unblocking an Interface That Receives BPDUs in Error (CLI Procedure) on page 95
- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21

Configuring VSTP (CLI Procedure)

The default spanning-tree protocol for EX Series switches is Rapid Spanning Tree Protocol (RSTP). VLAN Spanning Tree Protocol (VSTP) is an alternate protocol that allows EX Series switches to run one or more Spanning Tree Protocol (STP) or 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.

NOTE: EX Series switches can have a maximum of 253 VLANs on VSTP. Therefore, to have as many spanning-tree protocol VLANs as possible, use both VSTP and RSTP. RSTP will then be applied to VLANs that exceed the limit for VSTP. Because RSTP is enabled by default, you just need to additionally enable VSTP.

You can configure VSTP for an interface at the global level (for all configured VLANs) or for a specific VLAN.

NOTE:

- If you configure VSTP on an interface at both the global and the specific VLAN level, the interface configuration that is defined at the specific VLAN level overrides the interface configuration that is defined at the global level.
- If you specify VSTP to be configured on an interface that is not configured to belong to the VLAN (or VLANs), an error message is displayed.

To configure VSTP:

1. Configure VSTP on a group of VLANs, on all VLANs, or on a specific VLAN, or a specific interface within a VLAN, or on a specific interface that belongs to all VLANs:
   - To enable VSTP on multiple VLANs using a VLAN group:

     ```
     [edit protocols]
     user@switch# set vstp vlan-group group group-name vlan vlan-id-range
     ```

     NOTE: EX Series switches can have a maximum of 253 VLANs on VSTP.

   - To enable VSTP on all VLANs:

     NOTE: When you configure VSTP with the set protocol vstp vlan all command, VLAN ID 1 is not set; it is excluded so that the configuration is compatible with Cisco PVST+. If you want VLAN ID 1 to be included in the VSTP configuration on your switch, you must set it separately with the set protocol vstp vlan 1 command.

```
[edit protocols]
user@switch# set vstp vlan all
```

NOTE: EX Series switches can have a maximum of 253 VLANs on VSTP. RSTP will then be applied to VLANs that exceed the limit for VSTP. Be sure that RSTP is also enabled (the default setting) when you use the command set vstp vlan all. In addition to this being a recommended practice, your configuration will not commit if VSTP is enabled on a switch with more than 253 VLANs.

- To enable VSTP on a VLAN using a single VLAN ID:

  ```
  [edit protocols]
  user@switch# set vstp vlan vlan-id
  ```

- To enable VSTP on a VLAN using a single VLAN name:

  ```
  [edit protocols]
  user@switch# set vstp vlan vlan-name
  ```

- To enable VSTP on an interface at the global level:

  ```
  [edit protocols]
  user@switch# set vstp vlan all interface interface-name
  ```

- To enable VSTP on an interface for a specific VLAN:

  ```
  [edit protocols]
  user@switch# set vstp vlan (vlan-id | vlan-name)interface interface-name
  ```

2. (Optional) Enable the Address Resolution Protocol (ARP) for faster MAC address recovery only If a routed VLAN interface (RVI) is configured:

   - To enable ARP on VSTP for all VLANs:

     ```
     [edit protocols]
     user@switch# set vstp vlan all arp-on-stp
     ```

   - To enable ARP on VSTP on a VLAN using a single VLAN ID:

     ```
     [edit protocols]
     user@switch# set vstp vlan vlan-id arp-on-stp
     ```

   - To enable ARP on VSTP on a VLAN using a single VLAN name:

     ```
     [edit protocols]
     user@switch# set vstp vlan vlan-name arp-on-stp
     ```

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Understanding VSTP for EX Series Switches on page 12

Configuring BPDU Protection on an Interface (CLI Procedure)

EX Series switches support spanning-tree protocols that prevent loops in a network by creating a tree topology (spanning-tree) of the entire bridged network. All spanning-tree protocols use a special type of frame called bridge protocol data units (BPDUs) to communicate with each other. Other devices in the network, such as PCs, generate their

own BPDUs that are not compatible with the spanning-tree BPDUs. When BPDUs generated by other devices are transmitted to switches on which spanning-tree protocols are configured, a misconfiguration can occur in the spanning tree and a network outage can occur. Therefore, it is necessary to protect an interface in a spanning-tree topology from BPDUs generated from other devices.

You can enable BPDU protection on interfaces that are configured as edge ports by using the **bpdu-block-on-edge** command. If you have not configured a port as an edge port, you can still configure BPDU protection on the interface by using the **bpdu-block** command under the **set ethernet-switching-options** hierarchy. You can also use the **bpdu-block** command to configure BPDU protection on interfaces configured for a spanning-tree.

This topic describes:

- Configuring BPDU protection For Edge Interfaces on page 90
- Configuring BPDU Protection for Interfaces (Port Shutdown Mode) on page 91
- Configuring BPDU Protection for Interfaces (BPDU Drop Mode) on page 93

Configuring BPDU protection For Edge Interfaces

In a spanning-tree topology, if a switch is an access switch then interfaces on that switch will be connected to end devices such as PCs, servers, routers, or hubs, that are not connected to other switches. You configure these interfaces as edge interfaces because they directly connect to end devices. Interfaces that are configured as edge interfaces can transition to a forwarding state immediately because they cannot create network loops. A switch detects edge ports by noting the absence of communication from the end stations. As edge ports are connected to end devices, it is imperative that you configure BPDU protection on edge ports to protect the switch from outside BPDUs. If BPDU protection is enabled on an edge interface, the interface shuts down on encountering an outside BPDU thereby preventing any traffic from passing through the interface. You can re-enable the interface either by using the **disable-timeout** command while configuring BPDU protection, or by issuing the **clear ethernet-switching bpdu-error** operational mode command. The **clear ethernet-switching bpdu-error** command will only re-enable an interface but the BPDU configuration for the interface will continue to exist unless you explicitly remove the BPDU configuration.

To configure BPDU protection on an edge interface of a switch:

NOTE: Ensure that the switch is connected to an end device.

1. Configure any spanning-tree protocol on the switch if not configured already. RSTP is configured in this procedure.

   NOTE: The Rapid Spanning Tree Protocol (RSTP) is configured by default on a switch.

   ```
   [edit protocols]
   user@switch# set rstp
   ```

2. Enable RSTP on a specific interface and set a priority for the interface—for example, **ge-0/0/0.0**:

   ```
   [edit protocols]
   user@switch# set rstp interface ge-0/0/0.0 priority 16
   ```

3. Configure the **ge-0/0/0.0** interface as an edge interface and enable BPDU protection on that interface:

   ```
   [edit protocols]
   user@switch# set rstp bpdu-block-on-edge interface ge-0/0/0.0 edge
   ```

4. Commit the configuration:

   ```
   [edit]
   user@switch# commit
   ```

5. Verify that BPDU protection is configured properly on the edge interface (**ge-0/0/0.0**):

   - Run the **show ethernet-switching interfaces** operational mode command to ensure that BPDU protection is configured on the edge interface:

     ```
     user@switch> show ethernet-switching interfaces
     Interface    State  VLAN members     Tag   Tagging     Blocking
     ge-0/0/0.0   down   default             untagged   Disabled by bpdu-control
     me0.0        up     mgmt                  untagged   unblocked
     ```

     In this output, you note that the **ge-0/0/0.0** interface is down because it has received BPDUs from the end device. Also, note that the state of the **Blocking** field is **Disabled by bpdu-control**, which indicates that the port is disabled because of BPDU protection.

   - Run the **show spanning-tree interfaces** operational mode command to ensure that the **ge-0/0/0.0** interface is not displayed in the output.

Configuring BPDU Protection for Interfaces (Port Shutdown Mode)

In a spanning-tree network, you might need to configure BPDU protection on interfaces that are not explicitly configured as edge interfaces. In such cases, use the **set ethernet-switching-options bpdu-block** configuration command for BPDU protection. When you use this command, you can configure for the interface to either shutdown, or to only drop the BPDU packets and retain its state as up, on receiving incompatible BPDU packets. For the procedure to configure an interface to drop BPDU packets and to retain its status as up, see "Configuring BPDU Protection for Interfaces (BPDU Drop Mode)" on page 93. For configuring an interface to only drop incompatible BPDU packets and to retain the interface state as up, no spanning-tree protocol must be configured on the interface and also on the switch.

This section discusses the procedure to shutdown an interface when it receives incompatible BPDU packets. To configure an interface to shutdown upon receipt of incompatible BPDUs, a spanning-tree protocol may or may not be configured on the interface or switch.

To configure BPDU shutdown protection on interfaces:

NOTE: Ensure that the switch on which you are configuring BPDU protection is connected to a peer device.

1. Ensure that the interface on which you want to enable BPDU protection, is up and unblocked. For example, if you want to configure BPDU protection on the **ge-0/0/0.0** interface, following is the output of the **show ethernet-switching interfaces** command if the interface is up and unblocked:

```
user@switch> show ethernet-switching interfaces
Interface    State  VLAN members        Tag   Tagging  Blocking
ge-0/0/0.0   up     default                   untagged unblocked
```

   In this output, note that the state of the **ge-0/0/0.0** interface is **up** and the value for the **Blocking** field is **unblocked**.

2. (Optional) Configure any spanning-tree protocol on the switch if not configured already. The Rapid Spanning Tree Protocol (RSTP) is configured in this procedure.

```
[edit protocols]
user@switch# set rstp
```

NOTE: The Rapid Spanning Tree Protocol (RSTP) is configured by default on a switch.

3. Enable RSTP on a specific interface—for example, **ge-0/0/0.0**:

```
[edit protocols]
user@switch# set rstp interface ge-0/0/0.0
```

4. (Optional) Ensure that the spanning-tree protocol is configured on the **ge-0/0/0.0** interface:

```
user@switch> show spanning-tree interface
Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role

                          port ID        bridge ID          Cost
ge-0/0/0.0     128:513       16:513   8192.841888af0681     20000  FWD    ROOT
```

   In this output, the **ge-0/0/0.0** interface is displayed because a spanning-tree protocol is configured on this interface.

5. Enable the BPDU protection on the interface (**ge-0/0/0.0**) so that the interface shuts down on receiving incompatible BPDU packets:

```
[edit]
user@switch# set ethernet-switching-options bpdu-block interface ge-0/0/0.0 shutdown
```

6. Commit the configuration change:

```
[edit]
user@switch# commit
```

7. Verify that the BPDU protection is configured on the interface:

   - Run the **show ethernet-switching interfaces** operational mode command to ensure that the BPDU protection is configured on the interface:

```
user@switch> show ethernet-switching interfaces
Interface     State  VLAN members      Tag   Tagging     Blocking
ge-0/0/0.0    down   default                 untagged    Disabled by
                                                         bpdu-control
```

     In this output, note that the state of the **ge-0/0/0.0** interface is down because it has received incompatible BPDUs from another device. Also, note that the value of the **Blocking** field is **Disabled by bpdu-control**, which indicates that the port is disabled because of BPDU protection.

   - Run the **show spanning-tree interfaces** operational mode command to ensure that the **ge-0/0/0.0** interface is not displayed in the output.

Configuring BPDU Protection for Interfaces (BPDU Drop Mode)

For certain access switches, you might want interfaces on the switch not to shutdown on encountering incompatible BPDU packets; instead, only drop incompatible BPDU packets while allowing the remaining traffic to pass through. Such an interface must not have a spanning-tree protocol configured on it, so that packets that pass through the interface will not cause STP misconfiguration and consequent network outages.

To configure BPDU protection for an interface to only drop incompatible BPDU packets and to allow the remaining traffic to pass through, while retaining the interface status as up:

NOTE: Ensure that the switch on which you are configuring BPDU protection is connected to a peer device.

1. Delete or disable any spanning-tree protocol (for instance, RSTP as in this procedure) configured on the switch or on any interface.

   - To delete a spanning-tree protocol on the entire switch:

     ```
     [edit]
     user@switch# delete protocols rstp
     ```

     Or,

     ```
     [edit]
     user@switch# set protocols rstp disable
     ```

   - To delete a spanning-tree protocol on a specific interface (for example, **ge-0/0/0.0**) on the switch:

     ```
     [edit]
     user@switch# set protocols rstp interface ge-0/0/0.0 disable
     ```

   NOTE: As RSTP is configured on a switch by default, ensure that you delete or disable RSTP even though you had not configured it explicitly.

2. Ensure that the interface on which you want to enable the BPDU protection, is up and unblocked. For example, if you want to configure the BPDU protection on the **ge-0/0/0.0** interface, following is the output of the **show ethernet-switching interfaces** command if the interface is up and unblocked:

   ```
   user@switch> show ethernet-switching interfaces
   Interface    State  VLAN members        Tag   Tagging  Blocking
   ge-0/0/0.0   up     default                   untagged unblocked
   ```

   In this output, note that the state of the **ge-0/0/0.0** interface is **up** and the value for the **Blocking** field is **unblocked**.

3. Enable the BPDU protection on the interface (**ge-0/0/0.0** in this procedure) to drop BPDU packets:

   ```
   [edit]
   user@switch set ethernet-switching-options bpdu-block interface ge-0/0/0.0 drop
   ```

4. Commit the configuration:

   ```
   [edit]
   user@switch# commit
   ```

5. Verify that the BPDU protection is configured on the interface:

   - Run the **show ethernet-switching interfaces** operational mode command to ensure that the BPDU protection is configured on the interface:

     ```
     user@switch> show ethernet-switching interfaces
     Interface    State  VLAN members     Tag   Tagging  Blocking
     ge-0/0/0.0   up     default               untagged unblocked-xSTP bpdu
                                                      filter enabled
     ```

     In this output, note that the **ge-0/0/0.0** interface is up even though it has received incompatible BPDU packets because the **drop** feature is configured for this interface. Also, note that the state of the **Blocking** field is **unblocked-xSTP bpdu filter enabled**, which indicates that the BPDU **drop** feature is enabled on this interface.

- Run the **show spanning-tree interfaces** operational mode command to ensure that the **ge-0/0/0.0** interface is displayed in the output and that the **State** of the interface is **DIS**, which indicates that the interface discards all incompatible BPDUs:

```
user@switch> show spanning-tree interface
Spanning tree interface parameters for instance 0

Interface  Port ID  Designated   Designated      Port   State   Role
                      port ID      bridge ID       Cost
ge-0/0/0.0 128:513   16:513    8192.841888af0681  20000   DIS    DIS
```

Related Documentation

- Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 14
- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66

Unblocking an Interface That Receives BPDUs in Error (CLI Procedure)

EX Series switches 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 either shuts down or transitions to a blocking state and stops forwarding frames. In the latter scenario, after the misconfiguration that triggered the BPDUs being sent to an interface is fixed in the topology, the interface can be unblocked and returned to service.

To unblock an interface and return it to service using the CLI:

- Automatically unblock an interface by configuring a timer that expires:

```
[edit ethernet-switching-options]
user@switch# set bpdu-block disable-timeout 30
```

  All interfaces on the switch will be re-enabled (unblocked) after the timer expires. However, once an interface on the switch receives a new spanning-tree protocol BPDU, the interface returns to the blocked state.

- Manually unblock an interface using the operational mode command:

```
user@switch> clear ethernet-switching bpdu-error interface ge-0/0/6.0
```

  This command will only re-enable an interface but the BPDU configuration for the interface will continue to exist unless you remove the BPDU configuration explicitly.

Related Documentation

- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66
- Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 14

CHAPTER 4

Configuration Statements

- [edit protocols] Configuration Statement Hierarchy on EX Series Switches on page 97
- [edit protocols mstp] Configuration Statement Hierarchy on EX Series Switches on page 98
- [edit protocols rstp] Configuration Statement Hierarchy on EX Series Switches on page 100
- [edit protocols stp] Configuration Statement Hierarchy on EX Series Switches on page 101
- [edit protocols vstp] Configuration Statement Hierarchy on EX Series Switches on page 103

[edit protocols] Configuration Statement Hierarchy on EX Series Switches

Each of the following topics lists the statements at a subhierarchy of the **[edit protocols]** hierarchy:

- [edit protocols bfd] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols bgp] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols connections] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols dcbx] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols dot1x] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols igmp] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols igmp-snooping] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols isis] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols lacp] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols link-management] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols lldp] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols lldp-med] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols mld] Configuration Statement Hierarchy on EX Series Switches

- [edit protocols mld-snooping] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols mpls] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols msdp] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols mstp] Configuration Statement Hierarchy on EX Series Switches on page 98
- [edit protocols mvrp] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols neighbor-discovery] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols oam] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols ospf] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols ospf3] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols pim] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols rip] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols ripng] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols router-advertisement] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols router-discovery] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols rstp] Configuration Statement Hierarchy on EX Series Switches on page 100
- [edit protocols rsvp] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols sflow] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols stp] Configuration Statement Hierarchy on EX Series Switches on page 101
- [edit protocols uplink-failure-detection] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols vrrp] Configuration Statement Hierarchy on EX Series Switches
- [edit protocols vstp] Configuration Statement Hierarchy on EX Series Switches on page 103

Related Documentation

- EX Series Switch Software Features Overview
- Junos® OS for EX Series Switches, Release 12.2

[edit protocols mstp] Configuration Statement Hierarchy on EX Series Switches

This topic lists supported and unsupported configuration statements in the **[edit protocols mstp]** hierarchy level on EX Series switches.

- *Supported* statements are those that you can use to configure some aspect of a software feature on the switch.
- *Unsupported* statements are those that appear in the command-line interface (CLI) on the switch, but that have no effect on switch operation if you configure them.
- Not all features are supported on all switch platforms. For detailed information about feature support on specific EX Series switch platforms, see EX Series Switch Software Features Overview.

This topic lists:

- Supported Statements in the [edit protocols mstp] Hierarchy Level on page 99
- Unsupported Statements in the [edit protocols mstp] Hierarchy Level on page 100

Supported Statements in the [edit protocols mstp] Hierarchy Level

The following hierarchy shows the **[edit protocols mstp]** configuration statements supported on EX Series switches:

```
protocols {
  mstp {
    bpdu-block-on-edge;
    bridge-priority priority;
    configuration-name configuration-name;
    disable;
    forward-delay seconds;
    hello-time seconds;
    interface interface-name {
      arp-on-stp;
      bpdu-timeout-action {
        block;
        log;
      }
      cost cost;
      disable;
      edge;
      mode (point-to-point | shared);
      no-root-port;
      priority interface-priority;
    }
    max-age seconds;
    max-hops hops;
    msti identifier {
      bridge-priority priority;
      interface interface-name {
        arp-on-stp;
        cost cost;
        disable;
        priority interface-priority;
      }
      vlan [ vlan-ids ];
    }
    revision-level revision-level;
    traceoptions {
```

```
        file filename <files number> <size maximum-file-size> <world-readable |
          no-world-readable>;
        flag flag <disable>;
      }
    }
  }
```

Unsupported Statements in the [edit protocols mstp] Hierarchy Level

All statements in the **[edit protocols mstp]** hierarchy level that are displayed in the command-line interface (CLI) on the switch are supported on the switch and operate as documented.

Related Documentation

- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- [edit protocols] Configuration Statement Hierarchy on EX Series Switches

[edit protocols rstp] Configuration Statement Hierarchy on EX Series Switches

This topic lists supported and unsupported configuration statements in the **[edit protocols rstp]** hierarchy level on EX Series switches.

- *Supported* statements are those that you can use to configure some aspect of a software feature on the switch.
- *Unsupported* statements are those that appear in the command-line interface (CLI) on the switch, but that have no effect on switch operation if you configure them.
- Not all features are supported on all switch platforms. For detailed information about feature support on specific EX Series switch platforms, see EX Series Switch Software Features Overview.

This topic lists:

- Supported Statements in the [edit protocols rstp] Hierarchy Level on page 100
- Unsupported Statements in the [edit protocols rstp] Hierarchy Level on page 101

Supported Statements in the [edit protocols rstp] Hierarchy Level

The following hierarchy shows the **[edit protocols rstp]** configuration statements supported on EX Series switches:

```
protocols {
  rstp {
    bpdu-block-on-edge;
    bridge-priority priority;
    disable;
    forward-delay seconds;
    hello-time seconds;
    interface (all | interface-name) {
      arp-on-stp;
      bpdu-timeout-action {
        block;
```

```
            log;
          }
          cost cost;
          disable;
          edge;
          mode mode;
          no-root-port;
          priority priority;
        }
        max-age seconds;
        traceoptions {
          file filename <files number > <size size> <no-stamp | no-world-readable |
            world-readable>;
          flag flag;
        }
      }
    }
```

Unsupported Statements in the [edit protocols rstp] Hierarchy Level

All statements in the **[edit protocols rstp]** hierarchy level that are displayed in the command-line interface (CLI) on the switch are supported on the switch and operate as documented.

Related Documentation

- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding RSTP for EX Series Switches on page 6
- **show spanning-tree bridge on page 153**
- **show spanning-tree interface on page 163**
- [edit protocols] Configuration Statement Hierarchy on EX Series Switches

[edit protocols stp] Configuration Statement Hierarchy on EX Series Switches

This topic lists supported and unsupported configuration statements in the **[edit protocols stp]** hierarchy level on EX Series switches.

- *Supported* statements are those that you can use to configure some aspect of a software feature on the switch.
- *Unsupported* statements are those that appear in the command-line interface (CLI) on the switch, but that have no effect on switch operation if you configure them.
- Not all features are supported on all switch platforms. For detailed information about feature support on specific EX Series switch platforms, see EX Series Switch Software Features Overview.

This topic lists:

- Supported Statements in the [edit protocols stp] Hierarchy Level on page 102
- Unsupported Statements in the [edit protocols stp] Hierarchy Level on page 102

Supported Statements in the [edit protocols stp] Hierarchy Level

The following hierarchy shows the **[edit protocols stp]** configuration statements supported on EX Series switches:

```
protocols {
  stp {
  bpdu-block-on-edge;
  bridge-priority priority;
  disable;
  forward-delay seconds;
  hello-time seconds;
  interface (all | interface-name) {
    arp-on-stp;
    bpdu-timeout-action {
      block;
      log;
    }
    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;
  }
}
```

Unsupported Statements in the [edit protocols stp] Hierarchy Level

All statements in the **[edit protocols stp]** hierarchy level that are displayed in the command-line interface (CLI) on the switch are supported on the switch and operate as documented.

Related Documentation

- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Configuring STP (CLI Procedure) on page 83
- Understanding STP for EX Series Switches on page 11
- **show spanning-tree bridge on page 153**
- **show spanning-tree interface on page 163**
- [edit protocols] Configuration Statement Hierarchy on EX Series Switches

[edit protocols vstp] Configuration Statement Hierarchy on EX Series Switches

This topic lists supported and unsupported configuration statements in the **[edit protocols vstp]** hierarchy level on EX Series switches.

- *Supported* statements are those that you can use to configure some aspect of a software feature on the switch.
- *Unsupported* statements are those that appear in the command-line interface (CLI) on the switch, but that have no effect on switch operation if you configure them.
- Not all features are supported on all switch platforms. For detailed information about feature support on specific EX Series switch platforms, see EX Series Switch Software Features Overview.

This topic lists:

- Supported Statements in the [edit protocols vstp] Hierarchy Level on page 103
- Unsupported Statements in the [edit protocols vstp] Hierarchy Level on page 104

Supported Statements in the [edit protocols vstp] Hierarchy Level

The following hierarchy shows the **[edit protocols vstp]** configuration statements supported on EX Series switches:

```
protocols {
  vstp {
    bpdu-block-on-edge;
    disable;
    force-version stp;
    vlan (vlan-id | vlan-name) {
      bridge-priority priority;
      forward-delay seconds;
      hello-time seconds;
      interface (all | interface-name) {
        arp-on-stp;
        bpdu-timeout-action {
          block;
          log;
        }
        cost  cost;
        disable;
        edge;
        mode mode;
        no-root-port;
        priority priority;
      }
      max-age seconds;
      traceoptions {
        file filename <files number > <size size> <no-stamp | no-world-readable |
          world-readable>;
        flag flag;
      }
    }
```

```
    }
}
```

Unsupported Statements in the [edit protocols vstp] Hierarchy Level

All statements in the **[edit protocols vstp]** hierarchy level that are displayed in the command-line interface (CLI) on the switch are supported on the switch and operate as documented.

Related Documentation

- Configuring VSTP (CLI Procedure)
- Understanding VSTP for EX Series Switches on page 12
- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- [edit protocols] Configuration Statement Hierarchy on EX Series Switches

block (Spanning Trees)

Syntax block;

Hierarchy Level

[edit protocols mstp interface (all | *interface-name*) bpdu-timeout-action],
[edit protocols rstp interface (all | *interface-name*) bpdu-timeout-action],
[edit protocols stp interface (all | *interface-name*) bpdu-timeout-action],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*) bpdu-timeout-action]

Release Information

Statement introduced in Junos OS Release 9.1 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description Configure loop protection on a specific interface.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches on page 72
- Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 15
- Understanding VSTP for EX Series Switches on page 12

bpdu-block

Syntax

```
bpdu-block {
  interface (all | [interface-name]);
  disable-timeout seconds;
}
```

Hierarchy Level [edit ethernet-switching-options]

Release Information Statement introduced in Junos OS Release 9.1 for EX Series switches.

Description Configure BPDU protection on all interfaces or on a specified interface. If the interface receives incompatible BPDUs, it is disabled, or it is disabled for a specified timeout period (during which the BPDU packets are dropped).

The remaining statements are explained separately.

Required Privilege Level system—To view this statement in the configuration.
system-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- clear ethernet-switching bpdu-error on page 150
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66
- Unblocking an Interface That Receives BPDUs in Error (CLI Procedure) on page 95

bpdu-block-on-edge

Syntax bpdu-block-on-edge;

Hierarchy Level [edit protocols mstp],
[edit protocols rstp],
[edit protocols vstp]

Release Information Statement introduced in Junos OS Release 9.1 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.
Statement updated in Junos OS Release 11.1 for EX Series switches to change blocking behavior to port shutdown.

Description Configure bridge protocol data unit (BPDU) protection on all edge ports of a switch.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- clear ethernet-switching bpdu-error on page 150
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Understanding VSTP for EX Series Switches on page 12

bpdu-timeout-action (Spanning Trees)

Syntax

```
bpdu-timeout-action {
  block;
  log;
}
```

Hierarchy Level

[edit protocols mstp interface (all | *interface-name*)],
[edit protocols mstp interface (all | *interface-name*) arp-on-stp],
[edit protocols rstp interface (all | *interface-name*)],
[edit protocols rstp interface (all | *interface-name*) arp-on-stp],
[edit protocols stp interface (all | *interface-name*)],
[edit protocols stp interface (all | *interface-name*) arp-on-stp],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*)]
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*) arp-on-stp]

Release Information

Statement introduced in Junos OS Release 9.1 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description

Configure the BPDU timeout action on a specific interface. You must configure at least one action (**log**, **block**, or both).

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

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches on page 72
- Understanding VSTP for EX Series Switches on page 12

bridge-priority (Spanning Trees)

Syntax bridge-priority *priority*;

Hierarchy Level
[edit protocols mstp],
[edit protocols mstp msti *msti-id*],
[edit protocols rstp],
[edit protocols stp],
[edit protocols vstp vlan *vlan-id*]

Release Information
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description 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.

Default 32,768

Options
priority—Bridge priority. It can be set only in increments of 4096.
Range: 0 through 61,440
Default: 32,768

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Understanding MSTP for EX Series Switches on page 4
- Understanding VSTP for EX Series Switches on page 12

configuration-name (Spanning Trees)

Syntax configuration-name *configuration-name*;

Hierarchy Level [edit protocols mstp]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description Specify the configuration name. The configuration name is the MSTP region name carried in the MSTP BPDUs.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding MSTP for EX Series Switches on page 4

cost (Spanning Trees)

Syntax cost *cost*;

Hierarchy Level
[edit protocols mstp interface (all | *interface-name*)],
[edit protocols mstp interface (all | *interface-name*) arp-on-stp],
[edit protocols mstp msti *msti-id* interface *interface-name* arp-on-stp],
[edit protocols mstp msti *msti-id* interface *interface-name*],
[edit protocols rstp interface (all | *interface-name*)],
[edit protocols rstp interface (all | *interface-name*) arp-on-stp],
[edit protocols stp interface (all | *interface-name*)],
[edit protocols stp interface (all | *interface-name*) arp-on-stp],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*)],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*) arp-on-stp]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description 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.

Default The link cost is determined by the link speed.

Options ***cost***—Link cost associated with the port.

Range: 1 through 200,000,000

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Understanding RSTP for EX Series Switches on page 6
- Understanding STP for EX Series Switches on page 11
- Understanding MSTP for EX Series Switches on page 4
- Understanding VSTP for EX Series Switches on page 12

disable (BPDU Block)

Syntax disable;

Hierarchy Level [edit ethernet-switching-options bpdu-block interface]

Release Information Statement introduced in Junos OS Release 12.2 for EX Series switches.

Description Disable BPDU protection on all interfaces or on specific interfaces.

Default Not enabled

Required Privilege Level system—To view this statement in the configuration.
system-control—To add this statement to the configuration.

Related Documentation

- interface on page 119
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66
- show spanning-tree interface on page 163

disable (Spanning Trees)

Syntax

disable;

Hierarchy Level

[edit protocols mpls],
[edit protocols mpls interface (all | *interface-name*)],
[edit protocols mstp],
[edit protocols mstp interface (all | *interface-name*)],
[edit protocols mstp interface (all | *interface-name*) arp-on-stp],
[edit protocols mstp msti *msti-id* vlan (*vlan-id* | *vlan-name*) interface (all | *interface-name*)],
[edit protocols mstp msti *msti-id* vlan (*vlan-id* | *vlan-name*) interface *interface-name* arp-on-stp],
[edit protocols rstp],
[edit protocols rstp interface (all | *interface-name*)],
[edit protocols rstp interface (all | *interface-name*) arp-on-stp],
[edit protocols stp],
[edit protocols stp interface (all | *interface-name*)],
[edit protocols stp interface (all | *interface-name*) arp-on-stp],
[edit protocols vstp],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*)]
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*) arp-on-stp]

Release Information

Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description

Disable STP, MPLS, MSTP, RSTP, or VSTP on the switch or on a specific interface.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding STP for EX Series Switches on page 11
- Understanding VSTP for EX Series Switches on page 12

disable-timeout (Spanning Trees)

Syntax disable-timeout *timeout*;

Hierarchy Level [edit ethernet-switching-options bpdu-block]

Release Information Statement introduced in Junos OS Release 9.1 for EX Series switches.

Description For interfaces configured for BPDU protection, specify the amount of time an interface receiving BPDUs is disabled.

Default The disable timeout is not enabled.

Options ***timeout*** —Amount of time, in seconds, the interface receiving BPDUs is disabled. Once the timeout expires, the interface is brought back into service.

Range: 10 through 3600 seconds

Required Privilege Level system—To view this statement in the configuration.
system-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66
- Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 14

drop (BPDU Block)

Syntax drop;

Hierarchy Level [edit ethernet-switching-options bpdu-block interface (all | [*interface-name*])]

Release Information Statement introduced in Junos OS Release 12.2 for EX Series switches.

Description Drop spanning-tree protocol BPDUs (for STP, MSTP, and RSTP) entering any or a specified interface. You can configure the **drop** statement only on interfaces on which no spanning-tree protocol is configured.

Default Not enabled

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 14
- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66

edge (Spanning Trees)

Syntax

edge;

Hierarchy Level

[edit protocols mstp interface (all | *interface-name*)],
[edit protocols mstp interface (all | *interface-name*) arp-on-stp],
[edit protocols mstp msti *msti-id* interface *interface-name*],
[edit protocols mstp msti *msti-id* interface (all | *interface-name*) arp-on-stp],
[edit protocols rstp interface (all | *interface-name*)],
[edit protocols rstp interface (all | *interface-name*) arp-on-stp],
[edit protocols stp interface (all | *interface-name*)],
[edit protocols stp interface (all | *interface-name*) arp-on-stp],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*)],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*) arp-on-stp]

Release Information

Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description

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.

Default

Edge interfaces are not enabled.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding STP for EX Series Switches on page 11
- Understanding VSTP for EX Series Switches on page 12

force-version (Spanning Trees)

Syntax force-version stp;

Hierarchy Level [edit protocols vstp]

Release Information Statement introduced in Junos OS Release 9.4 for EX Series switches.

Description Force VLAN Spanning Tree Protocol (VSTP) to use the STP protocol instead of the default protocol, RSTP.

Options **stp**—Spanning Tree Protocol

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Understanding VSTP for EX Series Switches on page 12
- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163

forward-delay (Spanning Trees)

Syntax forward-delay *seconds*;

Hierarchy Level [edit protocols mstp],
[edit protocols rstp],
[edit protocols stp],
[edit protocols vstp vlan *vlan-id*]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description 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.

Default 15 seconds

Options ***seconds***—Number of seconds the bridge interface remains in the listening and learning states.

Range: 4 through 30 seconds

Default: 15 seconds

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding MSTP for EX Series Switches on page 4
- Understanding STP for EX Series Switches on page 11
- Understanding VSTP for EX Series Switches on page 12

hello-time (Spanning Trees)

Syntax hello-time *seconds*;

Hierarchy Level [edit protocols mstp],
[edit protocols rstp],
[edit protocols stp],
[edit protocols vstp vlan *vlan-id*]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description 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.

Default 2 seconds

Options ***seconds***—Number of seconds between transmissions of configuration BPDUs.

Range: 1 through 10 seconds

Default: 2 seconds

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding MSTP for EX Series Switches on page 4
- Understanding STP for EX Series Switches on page 11
- Understanding VSTP for EX Series Switches on page 12

interface (BPDU Block)

Syntax

```
interface (all | [interface-name]) {
(disable | drop | shutdown);
}
```

Hierarchy Level [edit ethernet-switching-options bpdu-block]

Release Information Statement introduced in Junos OS Release 9.1 for EX Series switches.

Description Apply BPDU protection on all interfaces or on one or more specified interfaces.

Options

all—All interfaces.

[***interface-name***]—One or more Ethernet interface names.

The remaining statements are explained separately.

Required Privilege Level

system—To view this statement in the configuration.
system-control—To add this statement to the configuration.

Related Documentation

- **show spanning-tree bridge on page 153**
- **show spanning-tree interface on page 163**
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 66

interface (Spanning Trees)

Syntax

```
interface interface-name {
  arp-on-stp;
  bpdu-timeout-action
    block;
    log;
  cost cost;
  disable;
  edge;
  mode mode;
  no-root-port;
  priority priority;
}
```

Hierarchy Level

[edit protocols mstp],
[edit protocols mstp msti *msti-id*],
[edit protocols rstp],
[edit protocols stp],
[edit protocols vstp vlan (all | *vlan-id* | *vlan-name*)]

Release Information

Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.
Statement introduced in Junos OS Release 11.1 for the QFX Series.

Description

For Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), VLAN Spanning Tree Protocol (VSTP), or Multiple Spanning Tree Protocol (MSTP), configure an interface.

The **edge**, **mode**, and **no-root-port** options are not available at the [**edit protocols mstp msti *msti-id***] hierarchy level.

Options

interface-name—Name of an interface.

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

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Example: Configuring Network Regions for VLANs with MSTP
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP
- Configuring VSTP (CLI Procedure) on page 88

- show spanning-tree bridge on page 158

log (Spanning Trees)

Syntax log;

Hierarchy Level [edit protocols mstp interface (all | *interface-name*) bpdu-timeout-action],
[edit protocols rstp interface (all | *interface-name*) bpdu-timeout-action],
[edit protocols stp interface (all | *interface-name*) bpdu-timeout-action],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*) bpdu-timeout-action]

Release Information Statement introduced in Junos OS Release 9.1 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description For interfaces configured for loop protection, configure the software to generate a message to be sent to the system log file **/var/log/messages** to record the loop-protection event.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches on page 72
- Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 15
- Understanding VSTP for EX Series Switches on page 12

max-age (Spanning Trees)

Syntax max-age *seconds*;

Hierarchy Level [edit protocols mstp],
[edit protocols rstp],
[edit protocols stp],
[edit protocols vstp vlan *vlan-id*]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description 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.

Default 20 seconds

Options ***seconds***—The maximum age of received protocol BPDUs.

Range: 6 through 40 seconds

Default: 20 seconds

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding MSTP for EX Series Switches on page 4
- Understanding STP for EX Series Switches on page 11
- Understanding VSTP for EX Series Switches on page 12

max-hops (Spanning Trees)

Syntax max-hops *hops*;

Hierarchy Level [edit protocols mstp]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description For Multiple Spanning Tree Protocol (MSTP), configure the maximum number of hops a BPDU can be forwarded in the MSTP region.

Default 20 hops

Options ***hops*** — Number of hops the BPDU can be forwarded.

Range: 1 through 255 hops

Default: 20 hops

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Understanding MSTP for EX Series Switches on page 4

mode (Spanning Trees)

Syntax mode *mode*;

Hierarchy Level
[edit protocols mstp interface (all | *interface-name*)],
[edit protocols mstp interface (all | *interface-name*) arp-on-stp],
[edit protocols mstp msti *msti-id* interface *interface-name*],
[edit protocols mstp msti *msti-id* interface *interface-name*) arp-on-stp],
[edit protocols rstp interface (all | *interface-name*)],
[edit protocols rstp interface (all | *interface-name*) arp-on-stp],
[edit protocols stp interface (all | (all | *interface-name*)],
[edit protocols stp interface (all | *interface-name*) arp-on-stp],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*)],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*) arp-on-stp]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description 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.

Default For a full-duplex link, the default link mode is **point-to-point**. For a half-duplex link, the default link mode is **shared**.

Options *mode*—Link mode:

- **point-to-point**—Link is point to point.
- **shared**—Link is shared media.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding STP for EX Series Switches on page 11
- Understanding VSTP for EX Series Switches on page 12

msti (Spanning Trees)

Syntax

```
msti msti-id {
  vlan (vlan-id | vlan-name);
  interface interface-name {
    disable;
    cost cost;
    priority priority;
  }
}
```

Hierarchy Level [edit protocols mstp]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description 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.

Default MSTI is disabled.

Options *msti-id* —MSTI identifier.

Range: 1 through 4094. The Common Instance Spanning Tree (CIST) is always MSTI 0.

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

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Understanding MSTP for EX Series Switches on page 4

mstp (Spanning Trees)

Syntax

```
mstp {
  bpdu-block-on-edge;
  bridge-priority priority;
  configuration-name name;
  disable;
  forward-delay seconds;
  hello-time seconds;
  interface ( all | interface-name ){
    arp-on-stp;
    bpdu-timeout-action {
      block;
      log;
    }
    cost cost;
    disable;
    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;
      priority priority;
    }
  }
  revision-level revision-level;
  traceoptions {
    file filename <files number > <size size> <no-stamp | world-readable |
      no-world-readable>;
    flag flag;
  }
}
```

Hierarchy Level [edit protocols]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.

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.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Understanding MSTP for EX Series Switches on page 4

no-root-port (Spanning Trees)

Syntax
no-root-port;

Hierarchy Level
[edit protocols mstp interface (all | *interface-name*)],
[edit protocols mstp interface (all | *interface-name*) arp-on-stp],
[edit protocols rstp interface (all | *interface-name*)],
[edit protocols rstp interface (all | *interface-name*) arp-on-stp],
[edit protocols stp interface (all | *interface-name*)],
[edit protocols stp interface (all | *interface-name*) arp-on-stp],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*)],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*) arp-on-stp]

Release Information
Statement introduced in Junos OS Release 9.1 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description
Configure an interface to be a spanning-tree designated port. If the bridge receives superior 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 from being elected the root bridge. When the bridge stops receiving superior STP BPDUs on the root-protected interface, interface traffic is no longer blocked.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX Series Switches on page 76
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding VSTP for EX Series Switches on page 12

priority (Spanning Trees)

Syntax priority *priority*;

Hierarchy Level
[edit protocols mstp interface (all | *interface-name*)],
[edit protocols mstp ;interface (all | *interface-name*) arp-on-stp],
[edit protocols mstp msti *msti-id* interface *interface-name*],
[edit protocols mstp msti *msti-id* interface *interface-name* arp-on-stp],
[edit protocols rstp interface (all | *interface-name*)],
[edit protocols rstp interface (all | *interface-name*) arp-on-stp],
[edit protocols stp interface (all | *interface-name*)],
[edit protocols stp interface (all | *interface-name*) arp-on-stp],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*)],
[edit protocols vstp vlan *vlan-id* interface (all | *interface-name*) arp-on-stp]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description 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.

Default The default value is 128.

Options *priority*—Interface priority. The interface priority must be set in increments of 16.
Range: 0 through 240

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding STP for EX Series Switches on page 11
- Understanding VSTP for EX Series Switches on page 12

revision-level (Spanning Trees)

Syntax revision-level *revision-level*;

Hierarchy Level [edit protocols mstp]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description For Multiple Spanning Tree Protocol (MSTP), set the revision number of the MSTP configuration.

Default The revision level is disabled.

Options ***revision-level*** —Revision number of the MSTP region configuration.

Range: 0 through 65535

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Understanding MSTP for EX Series Switches on page 4

rstp (Spanning Trees)

Syntax

```
rstp {
  bpdu-block-on-edge;
  bridge-priority priority;
  disable;
  forward-delay seconds;
  hello-time seconds;
  interface (all | interface-name) {
    arp-on-stp;
    bpdu-timeout-action {
      block;
      log;
    }
    cost cost;
    disable;
    edge;
    mode mode;
    no-root-port;
    priority priority;
  }
  max-age seconds;
  traceoptions {
    file filename <files number > <size size> <no-stamp | no-world-readable |
      world-readable>;
    flag flag;
  }
}
```

Hierarchy Level [edit protocols]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description 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, which results in shorter convergence times than those provided by basic Spanning Tree Protocol (STP).

VSTP and RSTP can be configured concurrently. You can selectively configure up to 253 VLANs using VSTP; the remaining VLANs will be configured using RSTP. VSTP and RSTP are the only spanning-tree protocols that can be configured concurrently on the switch. See "Configuring VSTP (CLI Procedure)" on page 88 for more information on configuring VSTP and RSTP concurrently.

BEST PRACTICE: Configure RSTP when you configure VSTP. RSTP overhead is minimal and this configuration ensures that a spanning-tree protocol is running on all VLANs on your switch, even when your switch is supporting more than 253 VLANs.

The remaining statements are explained separately.

Default RSTP is enabled on all Ethernet switching interfaces.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding RSTP for EX Series Switches on page 6

shutdown (BPDU Block)

Syntax shutdown;

Hierarchy Level [edit ethernet-switching-options bpdu-block interface (all | [*interface-name*])]

Release Information Statement introduced in Junos OS Release 12.2 for EX Series switches.

Description Shut down all or specified interfaces to prevent spanning-tree protocol BPDUs (for STP, MSTP, RSTP, and VSTP) from entering the interfaces on which BPDU protection is configured.

Default Not enabled

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 14
- Unblocking an Interface That Receives BPDUs in Error (CLI Procedure) on page 95

stp (Spanning Trees)

Syntax

```
stp {
  bpdu-block-on-edge ;
  bridge-priority priority;
  disable;
  forward-delay seconds;
  hello-time seconds;
  interface (all | interface-name) {
    arp-on-stp;
    bpdu-timeout-action {
      block;
      log;
    }
    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]

Release Information Statement introduced in Junos OS Release 9.0 for EX Series switches.

Description Configure Spanning Tree Protocol (STP). When you explicitly configure STP, the switches 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 (defined in the IEEE 802.1D 1998 specification).

The remaining statements are explained separately.

Default STP is disabled. By default, RSTP is enabled on all Ethernet switching ports.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches on page 61
- Configuring STP (CLI Procedure) on page 83

- Understanding STP for EX Series Switches on page 11

traceoptions (Spanning Trees)

Syntax

```
traceoptions {
  file name <replace> <size size> <files number> <no-stamp>
    <(world-readable | no-world-readable)>;
  flag flag <flag-modifier> <disable>;
}
```

Hierarchy Level

[edit protocols mpls],
[edit protocols mstp],
[edit protocols rstp],
[edit protocols stp],
[edit protocols vstp vlan *vlan-id*]

Release Information

Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement updated in Junos OS Release 9.4 for EX Series switches to add VSTP support.

Description

Set protocol-level tracing options for MPLS, STP, RSTP, MSTP, and VSTP.

Default

Traceoptions is disabled.

Options

disable—(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 **all**.

file ***name*** —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 **/var/log/stp-log**.

files ***number*** —(Optional) Maximum number of trace files. When a trace file named ***trace-file*** reaches its maximum size, it is renamed ***trace-file*** **.0**, then ***trace-file*** **.1**, and so on, until the maximum number of trace files is reached. Then, the oldest trace file is overwritten.

If you specify a maximum number of files, you must also specify a maximum file size with the size option.

Range: 2 through 1000 files

Default: 1 trace file only

flag—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements:

- **all** —Trace all operations.
- **all-failures**—Trace all failure conditions.
- **bpdu** —Trace BPDU reception and transmission. Note that you must also use **port-transmit-state-machine** in order to log transmit operations.
- **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-state-transit-state-machine** —Trace the port state transit state machine.
- **port-transmit-state-machine** —Trace the port transmit state machine
- **ppmd** —Trace the state and events for the ppmd 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.

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 aney 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*** **.0.** When the ***trace-file*** again reaches its maximum size, ***trace-file*** **.0** is renamed ***trace-file*** **.1** and ***trace-file*** is renamed ***trace-file*** **.0**. 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: ***x*k** to specify KB, ***x*m** to specify MB, or ***x*g** 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.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- **show spanning-tree bridge on page 153**
- **show spanning-tree interface on page 163**
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21
- Understanding MSTP for EX Series Switches on page 4
- Understanding RSTP for EX Series Switches on page 6
- Understanding STP for EX Series Switches on page 11
- Understanding VSTP for EX Series Switches on page 12

vlan (Spanning Trees)

Syntax

```
vlan (vlan-id | vlan-name) {
  bridge-priority priority;
  forward-delay seconds;
  hello-time seconds;
  interface interface-name {
    bpdu-timeout-action {
      block;
      log;
    }
    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 9.0 for EX Series switches.
Statement updated with enhanced **?** (CLI completion feature) functionality in Junos OS Release 9.5 for EX Series switches.

Description

Configure the VLANs for a Multiple Spanning Tree Instance (MSTI) or VSTP instance.

NOTE: When you configure VSTP with the **set prototocol vstp vlan all** command, vlan-id 1 is excluded to be compatible with Cisco PVST+. If you want vlan-id 1 to be included in VSTP, you must set it separately with the **set protocol vstp vlan 1** command.

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.

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

- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Understanding MSTP for EX Series Switches on page 4

vlan (VSTP)

Syntax

```
vlan (all | vlan-id | vlan-name) {
  bridge-priority priority;
  forward-delay seconds;
  hello-time seconds;
  interface (all | interface-name) {
    bpdu-timeout-action {
      block;
      log;
    }
    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 vstp]

Release Information Statement introduced in Junos OS Release 9.4 for EX Series switches.
Statement updated with enhanced **?** (CLI completion feature) functionality in Junos OS Release 9.5 for EX Series switches.
Option **all** introduced in Junos OS Release 10.0 for EX Series switches.

Description Configure VSTP VLAN parameters.

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.

Options **all**—All VLANs.

vlan-id—Numeric VLAN identifier.

vlan-name—Name of the VLAN.

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 for EX Series Switches on page 12

vstp

Syntax

```
vstp {
  bpdu-block-on-edge;
  disable;
  force-version stp;
  vlan (vlan-id | vlan-name) {
    bridge-priority priority;
    forward-delay seconds;
    hello-time seconds;
    interface (all | interface-name) {
      arp-on-stp;
      bpdu-timeout-action {
        block;
        log;
      }
      cost  cost;
      disable;
      edge;
      mode mode;
      no-root-port;
      priority priority;
    }
    max-age seconds;
    traceoptions {
      file filename <files number > <size size> <no-stamp | no-world-readable |
        world-readable>;
      flag flag;
    }
  }
}
```

Hierarchy Level [edit protocols]

Release Information Statement introduced in Junos OS Release 9.4 for EX Series switches.

Description Configure VLAN Spanning Tree Protocol (VSTP). VSTP is used to prevent loops in Layer 2 networks on a per-VLAN basis.

You can have a maximum of 253 VSTP VLANs per switch.

If the number of VLANs on your switch exceeds the VSTP VLAN limit, you must use the vlan (Spanning Trees) statement to specify which VLANs or VLAN groups use VSTP. You also cannot use the **vlan all** option to configure VSTP when your switch has more than the maximum allowed VSTP VLANs. To ensure all VLANs are running a spanning-tree protocol, run RSTP for networks with large numbers of VLANs .

NOTE: When you configure VSTP with the **set protocol vstp vlan all** command, VLAN ID 1 is not set; it is excluded so that the configuration is compatible with Cisco PVST+. If you want VLAN ID 1 to be included in the VSTP configuration

on your switch, you must set it separately with the **set protocol vstp vlan 1** command.

BEST PRACTICE: Configure RSTP when you configure VSTP. RSTP overhead is minimal and this configuration ensures that some spanning tree protocol is running on all VLANs on your switch, even when your switch has more than the maximum number of allowed VSTP VLANs.

The remaining statements are explained separately.

Default VSTP is not enabled by default.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- **show spanning-tree bridge on page 153**
- **show spanning-tree interface on page 163**
- Configuring VSTP (CLI Procedure) on page 88
- Understanding VSTP for EX Series Switches on page 12

PART 3

Administration

- Routine Monitoring on page 145
- Operational Commands on page 149

CHAPTER 5

Routine Monitoring

- Monitoring Spanning-Tree Protocols on page 145

Monitoring Spanning-Tree Protocols

Purpose Use the monitoring feature to view status and information about the spanning-tree protocol parameters on your EX Series switch.

Action To display spanning-tree protocol parameter details in the J-Web interface, select **Monitor** > **Switching** > **STP**.

To display spanning-tree protocol parameter details in the CLI, enter the following commands:

- **show spanning-tree interface**
- **show spanning-tree bridge**

Meaning Table 14 on page 145 summarizes the spanning-tree protocol parameters.

Table 14: Summary of Spanning-Tree Protocols Output Fields

Field	Values
Bridge Parameters	
Context ID	An internally generated identifier.
Enabled Protocol	Spanning-tree protocol type enabled.
Root ID	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.
Bridge ID	Locally configured bridge ID.
Hello Time	The time for which the bridge interface remains in the listening or learning state.
Forward Delay	The time for which the bridge interface remains in the listening or learning state before transitioning to the forwarding state.

Table 14: Summary of Spanning-Tree Protocols Output Fields *(continued)*

Field	Values
Extended System ID	The system ID.
Inter Instance ID	An internally generated instance identifier.
Maximum Age	Maximum age of received bridge protocol data units (BPDUs).
Number of topology changes	Total number of STP topology changes detected since the switch last booted.
Spanning Tree Interface Details	
Interface Name	Interface configured to participate in the STP instance.
Port ID	Logical interface identifier configured to participate in the STP instance.
Designated Port ID	Port ID of the designated port for the LAN segment to which the interface is attached.
Designated Bridge ID	ID of the designated bridge to which the interface is attached.
Port Cost	Configured cost for the interface.
Port State	STP port state: • Forwarding (FWD) • Blocking (BLK) • Listening • Learning • Disabled
Role	MSTP or RSTP port role, Designated (DESG), backup (BKUP), alternate (ALT), or root.
Spanning Tree Statistics of Interface	
Interface	Interface for which statistics is being displayed.
BPDUs Sent	Total number of BPDUs sent.
BPDUs Received	Total number of BPDUs received.
Next BPDU Transmission	Number of seconds until the next BPDU is scheduled to be sent.

Related Documentation

- show spanning-tree interface on page 163
- show spanning-tree bridge on page 153
- Configuring Spanning-Tree Protocols (J-Web Procedure) on page 84
- Configuring STP (CLI Procedure) on page 83

- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX Series Switches on page 21

CHAPTER 6

Operational Commands

clear ethernet-switching bpdu-error

Syntax clear ethernet-switching bpdu-error interface *interface-name*

Release Information 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 BPDU error shuts down the interface and this command brings the interface back up.
Command introduced in Junos OS Release 11.1 for the QFX Series.

Description Clear bridge protocol data unit (BPDU) errors from an interface and bring up the interface.

Options ***interface-name***—Clear BPDU errors on the specified interface.

Required Privilege Level clear

Related Documentation

- show spanning-tree interface on page 167
- Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 14
- Understanding BPDU Protection for STP, RSTP, and MSTP

List of Sample Output clear ethernet-switching bpdu-error interface on page 150

Sample Output

clear ethernet-switching bpdu-error interface

```
user@switch> clear ethernet-switching bpdu-error interface xe-0/0/1.0
```

clear spanning-tree statistics

Syntax clear spanning-tree statistics
<interface *interface-name* unit *logical-unit-number*>;

Release Information Command introduced in Junos OS Release 9.0 for EX Series switches.

Description Reset STP statistics for the all interfaces or a specified interface.

Options **none**—Reset STP counters for all interfaces.

interface-name —(Optional) The name of the interface for which statistics should be reset.

logical-unit-number —(Optional) The logical unit number of the interface.

Required Privilege Level clear

Related Documentation
- show spanning-tree bridge on page 153
- show spanning-tree interface on page 163
- Understanding STP for EX Series Switches on page 11

List of Sample Output clear spanning-tree statistics on page 151

Output Fields This command produces no output.

Sample Output

clear spanning-tree statistics

```
user@switch> clear spanning—tree statistics
```

clear spanning-tree statistics

Syntax

clear spanning-tree statistics
<interface *interface-name*>
<logical-system *logical-system-name*>

Syntax (EX Series Switches and the QFX Series)

clear spanning-tree statistics
<interface *interface-name*>

Release Information

Command introduced in Junos OS Release 8.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 11.1 for the QFX Series.

Description

Clear Spanning Tree Protocol statistics.

Options

none—Reset STP counters for all interfaces for all routing instances.

interface *interface-name*—(Optional) Clear STP statistics for the specified interface only.

logical-system *logical-system-name*—(Optional) Clear STP statistics on a particular logical system.

NOTE: The logical-system option is not available on QFabric systems.

Required Privilege Level

clear

Related Documentation

- show spanning-tree statistics on page 179

List of Sample Output

clear stp statistics on page 152

Sample Output

clear stp statistics

```
user@host> clear stp statistics
```

show spanning-tree bridge

Syntax

show spanning-tree bridge
<brief | detail>
<msti *msti-id*>
<vlan *vlan-id*>

Release Information

Command introduced in Junos OS Release 9.0 for EX Series switches.

Description

Display the configured or calculated spanning-tree protocol (can be either STP, RSTP, MSTP, or VSTP) parameters.

Options

none—(Optional) Display brief spanning-tree protocol bridge information for all Multiple Spanning Tree Instances (MSTIs).

brief | detail—(Optional) Display the specified level of output.

msti *msti-id*—(Optional) Display spanning-tree protocol bridge information for the specified MSTI or Common and Internal Spanning Tree (CIST). Specify **0** for CIST. Specify a value from **1** through **4094** for an MSTI.

vlan *vlan-id*—(Optional) Display spanning-tree protocol bridge information for the specified VLAN. Specify a VLAN tag identifier from **1** through **4094**.

Required Privilege Level

view

Related Documentation

- show spanning-tree interface on page 163
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Understanding STP for EX Series Switches on page 11
- Understanding RSTP for EX Series Switches on page 6
- Understanding VSTP for EX Series Switches on page 12

List of Sample Output

show spanning-tree bridge on page 156
show spanning-tree bridge brief on page 156
show spanning-tree bridge detail on page 157

Output Fields

Table 15 on page 153 lists the output fields for the **show spanning-tree bridge** command. Output fields are listed in the approximate order in which they appear.

Table 15: show spanning-tree bridge Output Fields

Field Name	Field Description	Level of Output
Context ID	An internally generated identifier.	VSTP all, RSTP all, MSTP all, STP all

Table 15: show spanning-tree bridge Output Fields *(continued)*

Field Name	Field Description	Level of Output
Enabled protocol	Spanning-tree protocol type enabled.	VSTP all, RSTP all, MSTP all, STP all
Root ID	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.	VSTP all, RSTP all, MSTP all, STP all
Root cost	Calculated cost to reach the root bridge from the bridge where the command is entered.	VSTP all
Root port	Interface that is the current elected root port for this bridge.	VSTP all
CIST regional root	Bridge ID of the elected MSTP regional root bridge.	MSTP all
CIST internal root cost	Calculated cost to reach the regional root bridge from the bridge where the command is entered.	MSTP all
Hello time	Configured number of seconds between transmissions of configuration BPDUs.	VSTP all, RSTP all, MSTP all, STP all
Maximum age	Maximum age of received protocol BPDUs.	VSTP all, RSTP all, MSTP all, STP all
Forward delay	Configured time an STP bridge port remains in the listening and learning states before transitioning to the forwarding state.	VSTP all, RSTP all, MSTP all, STP all
Message age	Number of seconds elapsed since the most recent BPDU was received.	VSTP all, RSTP all, STP all
Number of topology changes	Total number of STP topology changes detected since the switch last booted.	VSTP all, RSTP all, MSTP all, STP all
Time since last topology change	Number of seconds elapsed since the most recent topology change.	RSTP detail
Topology change initiator	Interface name of the interface that received the topology change request.	RSTP detail

Table 15: show spanning-tree bridge Output Fields *(continued)*

Field Name	Field Description	Level of Output
Topology change last recvd. from	Bridge ID of the bridge that requested the last topology change.	RSTP detail
Bridge ID (local)	Locally configured bridge ID. The bridge ID consists of a configurable bridge priority and the MAC address of the bridge.	VSTP all, RSTP all, MSTP all, STP all
Extended system ID (local)	Internally generated system identifier.	VSTP all, RSTP all, MSTP all, STP all
MSTI regional root	Bridge ID of the elected MSTP regional root bridge.	MSTP detail
Internal instance ID (local)	An internally generated identifier.	VSTP all, RSTP all, MSTP all, STP all
Hello time (local)	Configured number of seconds between transmissions of configuration BPDUs.	RSTP detail, MSTP detail, STP detail
Maximum age (local)	Maximum age of received protocol BPDUs.	VSTP detail, RSTP detail, MSTP detail, STP detail
Forward delay (local)	Configured time an STP bridge port remains in the listening and learning states before transitioning to the forwarding state.	RSTP detail, MSTP detail, STP detail
Path Cost Method (local)	Bridges supporting 802.1D (legacy) implement only 16-bit values for path cost. Newer versions of this standard support 32-bit values.	VSTP detail, RSTP detail, MSTP detail, STP detail
Maximum Hop count (local)	Configured maximum number of hops a BPDU can be forwarded in the MSTP region.	MSTP detail

Sample Output

show spanning-tree bridge

```
user@switch> show spanning-tree bridge
 STP bridge parameters
 Context ID                          : 0
 Enabled protocol                    : MSTP

 STP bridge parameters for CIST
   Root ID                           : 32768.00:11:f2:56:df:40
   Root cost                         : 0
   Root port                         : ge-0/0/1.0
   CIST regional root                : 32768.00:11:f2:56:df:40
   CIST internal root cost           : 20000
   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   : 108 seconds
   Topology change initiator         : ge-0/0/1.0
   Topology change last recvd. from  : 00:11:f2:56:df:4c
   Local parameters
     Bridge ID                       : 32768.00:11:f2:57:1c:00
     Extended system ID              : 0
     Internal instance ID            : 0

 STP bridge parameters for MSTI 10
   MSTI regional root                : 32778.00:11:f2:56:df:40
   Root cost                         : 20000
   Root port                         : ge-0/0/1.0
   Hello time                        : 2 seconds
   Maximum age                       : 20 seconds
   Forward delay                     : 15 seconds
   Hop count                         : 19
   Number of topology changes        : 1
   Time since last topology change   : 108 seconds
   Topology change initiator         : ge-0/0/1.0
   Topology change last recvd. from  : 00:11:f2:56:df:41
   Local parameters
     Bridge ID                       : 32778.00:11:f2:57:1c:00
     Extended system ID              : 0
     Internal instance ID            : 1
```

show spanning-tree bridge brief

```
user@switch> show spanning-tree bridge brief
STP bridge parameters
Context ID      : 0
Enabled protocol    : RSTP
  Root ID       : 32768.00:19:e2:50:95:a0
  Hello time        : 2 seconds
  Maximum age       : 20 seconds
  Forward delay     : 15 seconds
  Message age       : 0
  Number of topology changes    : 0
  Local parameters
    Bridge ID       : 32768.00:19:e2:50:95:a0
```

```
    Extended system ID      : 0
    Internal instance ID    : 0
```

show spanning-tree bridge detail

```
user@switch> show spanning-tree bridge detail

STP bridge parameters
Context ID      : 0
Enabled protocol    : RSTP
  Root ID       : 32768.00:19:e2:50:95:a0
  Hello time        : 2 seconds
  Maximum age       : 20 seconds
  Forward delay     : 15 seconds
  Message age       : 0
  Number of topology changes    : 0
  Local parameters
    Bridge ID       : 32768.00:19:e2:50:95:a0
    Extended system ID      : 0
    Internal instance ID    : 0
    Hello time      : 2 seconds
    Maximum age     : 20 seconds
    Forward delay       : 15 seconds
    Path cost method    : 32 bit
```

show spanning-tree bridge

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 159
show spanning-tree bridge msti on page 160
show spanning-tree bridge vlan-id (MSTP) on page 161
show spanning-tree bridge (RSTP) on page 161
show spanning-tree bridge vlan-id (RSTP) on page 162

Output Fields

Table 16 on page 158 lists the output fields for the **show spanning-tree bridge** command. Output fields are listed in the approximate order in which they appear.

Table 16: 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.
Root ID	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.

Table 16: show spanning-tree bridge Output Fields *(continued)*

Field Name	Field Description
Root cost	Calculated cost to reach the root bridge from the bridge where the command is entered.
Root port	Interface that is the current elected root port for this bridge.
CIST regional root	Bridge ID of the elected MSTP regional root bridge.
CIST internal root cost	Calculated cost to reach the regional root bridge from the bridge where the command is entered.
Hello time	Configured number of seconds between transmissions of configuration bridge protocol data units (BPDUs).
Maximum age	Configured maximum expected arrival time of hello bridge protocol data units (BPDUs).
Forward delay	How long an STP bridge port remains in the listening and learning states before transitioning to the forwarding state.
Hop count	Configured maximum number of hops a BPDU can be forwarded in the MSTP region.
Message age	Number of elapsed seconds since the most recent BPDU was received.
Number of topology changes	Total number of STP topology changes detected since the routing device last booted.
Time since last topology change	Number of elapsed seconds since the most recent topology change.
Bridge ID (Local)	Locally configured bridge ID. The bridge ID consists of a configurable bridge priority and the MAC address of the bridge.
Extended system ID	System identifier.
MSTI regional root	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 1 101 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

Syntax

show spanning-tree interface
<brief | detail>
<interface-name *interface-name*>
<msti *msti-id*>
<vlan-id *vlan-id*>

Release Information

Command introduced in Junos OS Release 9.0 for EX Series switches.

Description

Display the configured or calculated interface-level spanning-tree protocol (can be either STP, RSTP, or MSTP) parameters. In **brief** mode, will not display interfaces that are administratively disabled or do not have a physical link.

Options

none—(Optional) Display brief STP interface information.

brief | detail—(Optional) Display the specified level of output.

interface-name *interface-name*—(Optional) Name of an interface.

msti *msti-id*—(Optional) Display STP bridge information for the specified MSTP instance ID or Common and Internal Spanning Tree (CIST). Specify **0** for CIST. Specify a value from **1** through **4094** for an MSTI.

vlan-id *vlan-id*—(Optional) For MSTP interfaces, display interface information for the specified VLAN. Specify a value from **0** through **4094**.

Required Privilege Level

view

Related Documentation

- show spanning-tree bridge on page 153
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Understanding STP for EX Series Switches on page 11
- Understanding RSTP for EX Series Switches on page 6
- Understanding MSTP for EX Series Switches on page 4
- Understanding VSTP for EX Series Switches on page 12

List of Sample Output

show spanning-tree interface on page 164
show spanning-tree interface brief on page 165
show spanning-tree interface detail on page 165
show spanning-tree interface ge-1/0/0 on page 166

Output Fields

Table 17 on page 164 lists the output fields for the **show spanning-tree Interface** command. Output fields are listed in the approximate order in which they appear.

Table 17: show spanning-tree interface Output Fields

Field Name	Field Description
Interface name	Interface configured to participate in the STP, RSTP, or MSTP instance.
Port ID	Logical interface identifier configured to participate in the MSTP instance.
Designated port ID	Port ID of the designated port for the LAN segment this interface is attached to.
Designated bridge ID	Bridge ID of the designated bridge for the LAN segment this interface is attached to.
Port Cost	Configured cost for the interface.
Port State	STP port state. Forwarding (FWD), blocking (BLK), listening, learning, or disabled.
Port Role	MSTP or RSTP port role. Designated (DESG), backup (BKUP), alternate (ALT), (ROOT), or Root Prevented (Root-Prev).
Link type	MSTP or RSTP link type. Shared or point-to-point (pt-pt) and edge or non edge.
Alternate	Identifies the interface as an MSTP or RSTP alternate root port (yes) or non-alternate root port (no).
Boundary Port	Identifies the interface as an MSTP regional boundary port (yes) or non-boundary port (no).
Edge delay while expiry count	Number of times the edge delay timer expired on that interface.
Rcvd info while expiry count	Number of times the rcvd info timer expired on that interface.

Sample Output

show spanning-tree interface

```
user@switch> show spanning-tree interface

Spanning tree interface parameters for instance 0

Interface    Port ID    Designated  Designated     Port    State  Role
                          port ID    bridge ID      Cost
ge-0/0/0.0  128:513  128:513   8192.0019e2500340    1000   FWD    DESG
ge-0/0/2.0  128:515  128:515   8192.0019e2500340    1000   BLK    DIS
ge-0/0/4.0  128:517  128:517   8192.0019e2500340    1000   FWD    DESG
ge-0/0/23.0 128:536  128:536   8192.0019e2500340    1000   FWD    DESG


Spanning tree interface parameters for instance 1

Interface    Port ID    Designated  Designated     Port    State  Role
                          port ID    bridge ID      Cost
ge-0/0/0.0  128:513  128:513   8193.0019e2500340    1000   FWD    DESG
ge-0/0/2.0  128:515  128:515   8193.0019e2500340    1000   BLK    DIS
ge-0/0/4.0  128:517  128:517   8193.0019e2500340    1000   FWD    DESG
```

```
ge-0/0/23.0 128:536  128:536   8193.0019e2500340    1000   FWD    DESG

Spanning tree interface parameters for instance 2

Interface    Port ID    Designated  Designated     Port    State  Role
                         port ID    bridge ID      Cost
ge-0/0/0.0  128:513  128:1   8194.001b549fd000  1000  FWD    ROOT
ge-0/0/2.0  128:515  128:515  32770.0019e2500340  4000  BLK    DIS
ge-0/0/4.0  128:517  128:1    16386.001b54013080  1000  BLK    ALT
ge-0/0/23.0 128:536  128:536  32770.0019e2500340  1000  FWD    DESG
```

show spanning-tree interface brief

```
user@switch> show spanning-tree interface brief
Spanning tree interface parameters for instance 0

Interface    Port ID    Designated  Designated     Port    State  Role
     port ID    bridge ID  Cost
ge-1/0/0.0  128:625  128:625  32768.0019e25095a0 20000  BLK    DIS
ge-1/0/1.0  128:626  128:626  32768.0019e25095a0 20000  BLK    DIS
ge-1/0/2.0  128:627  128:627  32768.0019e25095a0 20000  BLK    DIS
ge-1/0/10.0 128:635  128:635  32768.0019e25095a0 20000  BLK    DIS
ge-1/0/20.0 128:645  128:645  32768.0019e25095a0 20000  BLK    DIS
ge-1/0/30.0 128:655  128:655  32768.0019e25095a0 20000  BLK    DIS
```

show spanning-tree interface detail

```
user@switch> show spanning-tree interface detail
Spanning tree interface parameters for instance 0

Interface name     : ge-1/0/0.0
Port identifier    : 128.625
Designated port ID     : 128.625
Port cost      : 20000
Port state     : Blocking
Designated bridge ID   : 32768.00:19:e2:50:95:a0
Port role      : Disabled
Link type      : Pt-Pt/EDGE
Boundary port       : NA
Edge delay while expiry count  : 0
Rcvd info while expiry count   : 0

Interface name     : ge-1/0/1.0
Port identifier    : 128.626
Designated port ID     : 128.626
Port cost      : 20000
Port state     : Blocking
Designated bridge ID   : 32768.00:19:e2:50:95:a0
Port role      : Disabled
Link type      : Pt-Pt/NONEDGE
Boundary port       : NA
Edge delay while expiry count  : 0
Rvcd info while expiry count   : 0

Interface name     : ge-1/0/2.0
Port identifier    : 128.627
Designated port ID     : 128.627
Port cost      : 20000
Port state     : Blocking
Designated bridge ID   : 32768.00:19:e2:50:95:a0
```

```
Port role      : Disabled
Link type      : Pt-Pt/NONEDGE
Boundary port       : NA
Edge delay while expiry count  : 0
Rvcd info while expiry count   : 0

Interface name     : ge-1/0/10.0
Port identifier    : 128.635
Designated port ID     : 128.635
Port cost      : 20000
Port state     : Blocking
Designated bridge ID   : 32768.00:19:e2:50:95:a0
Port role      : Disabled
Link type      : Pt-Pt/NONEDGE
Boundary port       : NA
Edge delay while expiry count  : 0
Rvcd info while expiry count   : 0

Interface name     : ge-1/0/20.0
Port identifier    : 128.645
Designated port ID     : 128.645
Port cost      : 20000
Port state     : Blocking
Designated bridge ID   : 32768.00:19:e2:50:95:a0
Port role      : Disabled
Link type      : Pt-Pt/NONEDGE
Boundary port       : NA
Edge delay while expiry count  : 0
Rvcd info while expiry count   : 0
[output truncated]
```

show spanning-tree interface ge-1/0/0

```
user@switch> show spanning-tree interface ge-1/0/0

Interface    Port ID    Designated  Designated     Port    State  Role
     port ID    bridge ID  Cost
ge-1/0/0.0 128:625  128:625  32768.0019e25095a0 20000  BLK    DIS
```

show spanning-tree interface

Syntax

show spanning-tree interface
<brief | detail>
<msti *msti-id*>
<routing-instance *routing-instance-name*>
<vlan-id *vlan-id*>

Syntax (EX Series Switches and the QFX Series)

show spanning-tree interface
<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 9.0 for EX Series switches.
Command introduced in Junos OS Release 11.1 for the QFX Series.

Description

Display the configured or calculated interface-level STP parameters.

Options

none—Display brief STP interface information.

brief | detail—(Optional) Display the specified level of output.

msti *msti-id*—(Optional) Display STP interface information for the specified MST instance.

routing-instance *routing-instance-name*—(Optional) Display STP interface information for the specified routing instance.

vlan-id *vlan-id*—(Optional) Display STP interface information for the specified VLAN.

Required Privilege Level

view

List of Sample Output

show spanning-tree interface on page 168
show spanning-tree interface (QFX Series) on page 169
show spanning-tree interface detail on page 169
show spanning-tree interface msti on page 171
show spanning-tree interface vlan-id on page 171
show spanning-tree interface (VSTP) on page 172
show spanning-tree interface vlan-id (VSTP) on page 172

Output Fields

Table 18 on page 167 lists the output fields for the **show spanning-tree Interface** command. Output fields are listed in the approximate order in which they appear.

Table 18: show spanning-tree Interface Output Fields

Field Name	Field Description
Interface name	Interface configured to participate in the STP, RSTP, VSTP, or MSTP instance.

Table 18: show spanning-tree Interface Output Fields *(continued)*

Field Name	Field Description
Port ID	Logical interface identifier configured to participate in the MSTP or VSTP instance.
Designated port ID	Port ID of the designated port for the LAN segment to which this interface is attached.
Designated bridge ID	Bridge ID of the designated bridge for the LAN segment to which this interface is attached.
Port Cost	Configured cost for the interface.
Port State	STP port state: forwarding (**FWD**), blocking (**BLK**), listening, learning, or disabled.
Port Role	MSTP, VSTP, or RSTP port role: designated (**DESG**), backup (**BKUP**), alternate (**ALT**), (**ROOT**), or Root Prevented (**Root-Prev**).
Link type	MSTP, VSTP, or RSTP link type. Shared or point-to-point (pt-pt) and edge or nonedge.
Alternate	Identifies the interface as an MSTP, VSTP, or RSTP alternate root port (**Yes**) or nonalternate root port (**No**).
Boundary Port	Identifies the interface as an MSTP regional boundary port (**Yes**) or nonboundary port (**No**).

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      Designated         Port    State  Role
                         port ID       bridge ID          Cost
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      Designated         Port    State  Role
                         port ID       bridge ID          Cost
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      Designated         Port    State  Role
                         port ID        bridge ID          Cost
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@lf0> show spanning-tree interface routing-instance vs1 detail
Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
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      Designated         Port    State  Role
                         port ID        bridge ID          Cost
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      Designated         Port    State  Role
                         port ID        bridge ID          Cost
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      Designated         Port    State  Role
                         port ID        bridge ID          Cost
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      Designated         Port    State  Role
                         port ID        bridge ID          Cost
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      Designated         Cost    State  Role
                         port ID        bridge ID
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      Designated         Cost    State  Role
                         port ID        bridge ID
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      Designated         Cost    State  Role
                         port ID        bridge ID
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      Designated         Cost    State  Role
                         port ID        bridge ID
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

Syntax show spanning-tree mstp configuration
<brief | detail>

Release Information Command introduced in Junos OS Release 9.0 for EX Series switches.

Description Display the MSTP configuration.

Options **none**—Display MSTP configuration information.

brief | detail—(Optional) Display the specified level of output.

Required Privilege Level view

List of Sample Output show spanning-tree mstp configuration on page 173

Output Fields Table 19 on page 173 lists the output fields for the **show spanning-tree mstp configuration** command. Output fields are listed in the approximate order in which they appear.

Table 19: show spanning-tree mstp configuration Output Fields

Field Name	Field Description
Context identifier	Internally generated identifier.
Region name	MSTP region name carried in the MSTP BPDUs.
Revision	Revision number of the MSTP configuration.
Configuration digest	Numerical value derived from the VLAN-to-instance mapping table.
MSTI	MSTI instance identifier.
Member VLANs	Identifiers for VLANs associated with the MSTI.

Sample Output

show spanning-tree mstp configuration

```
user@host> show spanning-tree mstp configuration
MSTP configuration information
Context identifier     : 0
Region name            : region1
Revision               : 0
Configuration digest   : 0xc92e7af9febb44d8df928b87f16b


MSTI     Member VLANs
   0 0-100,105-4094
   1 101-102
   2 103-104
```

show spanning-tree mstp configuration

Syntax

show spanning-tree mstp configuration
<brief | detail>
<routing-instance *routing-instance-name*>

Syntax (EX Series Switch and the QFX Series)

show spanning-tree mstp configuration
<brief | detail>

Release Information

Command introduced in Junos OS Release 8.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 11.1 for the QFX Series.

Description

Display the MSTP configuration.

Options

none—Display MSTP configuration information.

brief | detail—(Optional) Display the specified level of output.

routing-instance *routing-instance-name*—(Optional) Display MSTP configuration information for the specified routing instance.

Required Privilege Level

view

List of Sample Output

show spanning-tree mstp configuration detail on page 176
show spanning-tree mstp configuration detail (QFX Series) on page 176

Output Fields

Table 20 on page 175 lists the output fields for the **show spanning-tree mstp configuration** command. Output fields are listed in the approximate order in which they appear.

Table 20: show spanning-tree mstp configuration Output Fields

Field Name	Field Description
Context id	Internally generated identifier.
Region name	MSTP region name carried in the MSTP BPDUs.
Revision	Revision number of the MSTP configuration.
Configuration digest	Numerical value derived from the VLAN-to-instance mapping table.
MSTI	MST instance identifier.
Member VLANs	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@lf0> 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

Syntax
show spanning-tree statistics
interface *interface-name*
vlan *vlan-id*
<brief | detail>

Release Information
Command introduced in Junos OS Release 9.0 for EX Series switches.
Option **vlan** *vlan-id* introduced in Junos OS Release 10.1 for EX Series switches.

Description
Display STP statistics on an interface, or for a VLAN when VSTP is enabled.

Options
none—Display brief STP statistics.

brief | detail—(Optional) Display the specified level of output.

interface *interface-name*—(Optional) The name of the interface.

vlan *vlan-id*—(Optional) The name of a VLAN.

Required Privilege Level
view

Related Documentation
- show spanning-tree bridge on page 153
- Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches on page 38
- Understanding STP for EX Series Switches on page 11
- Understanding RSTP for EX Series Switches on page 6
- Understanding MSTP for EX Series Switches on page 4
- Understanding VSTP for EX Series Switches on page 12

List of Sample Output
show spanning-tree statistics interface on page 178

Output Fields
Table 21 on page 177 lists the output fields for the **show spanning-tree statistics** command. Output fields are listed in the approximate order in which they appear.

Table 21: show spanning-tree statistics Output Fields

Field Name	Field Description
BPDUs sent	Total number of BPDUs sent.
BPDUs received	Total number of BPDUs received.
Interface	Interface for which the statistics are being displayed.
Next BPDU transmission	Number of seconds until the next BPDU is scheduled to be sent.

Sample Output

show spanning-tree statistics interface

```
user@switch> show spanning-tree statistics interface ge-0/0/4
Interface   BPDUs sent   BPDUs received  Next BPDU
                transmission
ge-0/0/4      7   190    0
```

show spanning-tree statistics

Syntax

show spanning-tree statistics
<brief | detail>
<interface *interface-name*>
<routing-instance *routing-instance-name*>

Syntax (EX Series Switch and the QFX Series)

show spanning-tree statistics
<brief | detail>
<interface *interface-name* | vlan *vlan-id*>

Release Information

Command introduced in Junos OS Release 8.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 11.1 for QFX Series switches.

Description

Display STP statistics.

Options

none—Display brief STP statistics.

brief | detail—(Optional) Display the specified level of output.

interface *interface-name*—(Optional) Display STP statistics for the specified interface.

routing-instance *routing-instance-name*—(Optional) Display STP statistics for the specified routing instance.

Required Privilege Level

view

List of Sample Output

show spanning-tree statistics routing-instance on page 180
show spanning-tree statistics interface routing-instance detail on page 180

Output Fields

Table 22 on page 179 lists the output fields for the **show spanning-tree statistics** command. Output fields are listed in the approximate order in which they appear.

Table 22: 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 5 secs	Number of BPDUs sent in the most recent 5-second period.
BPDUs received in last 5 secs	Number of BPDUs received in the most recent 5-second period.
Interface	Interface for which the statistics are being displayed.

Table 22: show spanning-tree statistics Output Fields *(continued)*

Field Name	Field Description
Next BPDU transmission	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                      : 121
BPDUs received                  : 537
BPDUs sent in last 5 secs       : 5
BPDUs received in last 5 secs   : 27
```

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
```