

Spanning-Tree Protocols Feature Guide for EX2300, EX3400, and EX4300 Switches

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Spanning-Tree Protocols Feature Guide for EX2300, EX3400, and EX4300 Switches
Release 15.1
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- Supported Platforms on page xi
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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.

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Supported Platforms

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

- EX Series

Using the Examples in This Manual

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

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

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

Merging a Full Example

To merge a full example, follow these steps:

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

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

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

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

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

Merging a Snippet

To merge a snippet, follow these steps:

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

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

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

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

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

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

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

For more information about the **load** command, see 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.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

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

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

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

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

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

Documentation Feedback

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

- Online feedback rating system—On any page of the Juniper Networks TechLibrary site at <http://www.juniper.net/techpubs/index.html>, simply click the stars to rate the content, and use the pop-up form to provide us with information about your experience. Alternately, you can use the online feedback form at <http://www.juniper.net/techpubs/feedback/>.
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Requesting Technical Support

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

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at <http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf>.
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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:
<http://kb.juniper.net/InfoCenter/>
- Join and participate in the Juniper Networks Community Forum:
<http://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <http://www.juniper.net/cm/>

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

Opening a Case with JTAC

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

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

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

PART 1

RSTP

- [Configuring RSTP on page 3](#)

CHAPTER 1

Configuring RSTP

- [Understanding RSTP for EX Series and QFX Series Switches on page 3](#)
- [Example: Configuring Faster Convergence and Improved Network Stability with RSTP on page 8](#)
- [Configuring RSTP \(CLI Procedure\) on page 24](#)

Understanding RSTP for EX Series and QFX Series Switches

Ethernet networks are susceptible to broadcast storms if loops are introduced. However, an Ethernet network needs to 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 3](#)
- [RSTP is an Enhancement of the Original STP on page 4](#)
- [Port Roles Determine Participation in the Spanning Tree on page 4](#)
- [Port States Determine How a Port Processes a Frame on page 4](#)
- [Edge Ports Connect to Devices That Cannot Be Part of a Spanning Tree on page 5](#)
- [BPDUs Maintain the Spanning-Tree on page 5](#)
- [When an RSTP Root Bridge Fails on page 6](#)
- [Switches Must Relearn MAC Addresses After a Link Failure on page 6](#)
- [Selecting a Spanning Tree Protocol on page 6](#)

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 and QFX Series switches provide Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP), and VLAN Spanning Tree Protocol (VSTP). This topic explains the spanning-tree default RSTP.



NOTE: If you are using Junos OS for EX Series and QFX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style, you can force the original IEEE 802.1D Spanning Tree Protocol (STP) version to run in place of RSTP or VSTP by setting [force-version](#).

RSTP is an Enhancement of the Original STP

RSTP evolved from the original STP IEEE 802.1D protocol to provide faster spanning-tree reconvergence 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 role and a state. 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 exist only 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 devices that are not STP-capable, 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.

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 might 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 Address Resolution Protocol (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 build 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.



NOTE: The ARP feature is not available on Junos OS for EX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style.

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 3 on page 7](#) below.

Table 3: Selecting a Spanning Tree Protocol

Protocol	Advantages	Disadvantages
RSTP	<ul style="list-style-type: none"> 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; therefore, switches do not all have to run RSTP. RSTP supports more ports than MSTP or VSTP 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Spanning Tree Protocol works with 802.1D 1998 bridges. RSTP is backward compatible with STP; therefore, switches do not all have to run STP. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Multiple Spanning Tree Protocol works with most VLANs. RSTP and STP are recognized as distinct spanning-tree regions by MSTP. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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](#)
 - [Understanding MSTP for EX Series and QFX Series Switches on page 29](#)
 - [Understanding VSTP for EX Series Switches and QFX Series Switches on page 57](#)
 - [Understanding Layer 2 Protocol Tunneling on EX Series Switches](#)
 - [Example: Faster Convergence and Improved Network Stability with RSTP on EX Series Switches](#)
 - [Example: Configuring Faster Convergence and Improved Network Stability with RSTP on page 8](#)
 - [Configuring RSTP \(CLI Procedure\) on page 24](#)

Example: Configuring Faster Convergence and Improved Network Stability with RSTP



NOTE: This example uses Junos OS for EX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Example: Faster Convergence and Improved Network Stability with RSTP on EX Series Switches*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

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 8](#)
- [Overview and Topology on page 8](#)
- [Configuring RSTP and Nonstop Bridging on Switch 1 on page 10](#)
- [Configuring RSTP and Nonstop Bridging on Switch 2 on page 13](#)
- [Configuring RSTP and Nonstop Bridging on Switch 3 on page 16](#)
- [Configuring RSTP and Nonstop Bridging on Switch 4 on page 20](#)
- [Verification on page 22](#)

Requirements

This example uses the following software and hardware components:

- Junos OS Release 15.1 or later or later for EX Series switches
- Four EX Series switches

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

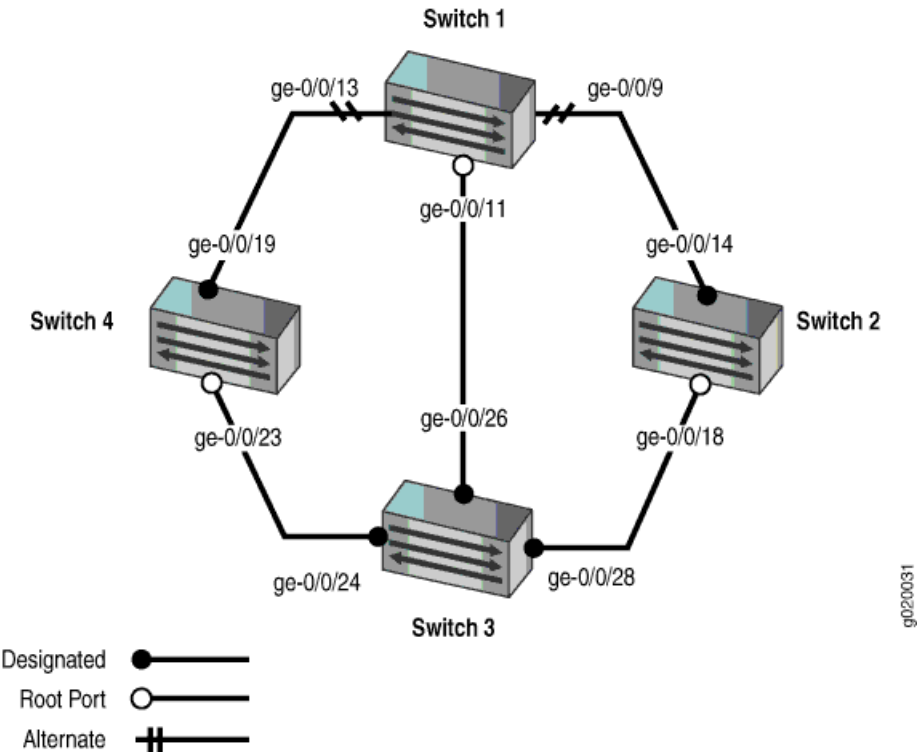
- Installed and connected the four switches. See the hardware documentation for your switch.
- Performed the initial software configuration on all switches. See *Connecting and Configuring an EX Series Switch (CLI Procedure)* or *Connecting and Configuring an EX Series Switch (J-Web Procedure)*.

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 9](#) to create a loop-free topology with NSB applied to switches with dual Routing Engines.

Figure 1: Network Topology for RSTP



[Table 4 on page 9](#) shows the components of the topology for this example.



NOTE: You can configure RSTP only on physical interfaces, not on logical interfaces.

Table 4: Components of the Topology for Configuring RSTP

Property	Settings
Switch 1	The following interfaces on Switch 1 are connected in this way: <ul style="list-style-type: none">• 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

Table 4: Components of the Topology for Configuring RSTP (*continued*)

Property	Settings
Switch 2	<p>The following interfaces on Switch 2 are connected in this way:</p> <ul style="list-style-type: none"> • ge-0/0/14 is connected to Switch 1 • ge-0/0/18 is connected to Switch 3
Switch 3	<p>The following interfaces on Switch 3 are connected in this way:</p> <ul style="list-style-type: none"> • 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	<p>The following interfaces on Switch 4 are connected in this way:</p> <ul style="list-style-type: none"> • ge-0/0/19 is connected to Switch 1 • ge-0/0/23 is connected to Switch 3
VLAN names and tag IDs	<p>voice-vlan, tag 10 employee-vlan, tag 20 guest-vlan, tag 30 camera-vlan, tag 40</p>

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 interface-mode trunk
set interfaces ge-0/0/9 unit 0 family ethernet-switching interface-mode trunk
set interfaces ge-0/0/11 unit 0 family ethernet-switching interface-mode trunk
set protocols rstp bridge-priority 16k
set protocols rstp interface all cost 1000
set protocols rstp interface all 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 protocols layer2-control 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 interface-mode trunk
user@switch1# set ge-0/0/9 unit 0 family ethernet-switching interface-mode trunk
user@switch1# set ge-0/0/11 unit 0 family ethernet-switching interface-mode trunk

```

4. Configure RSTP on the switch:

```

[edit protocols]
user@switch1# rstp bridge-priority 16k
user@switch1# rstp interface all cost 1000
user@switch1# rstp interface all 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 protocols layer2-control]
user@switch1# set nonstop-bridging
```



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

Results Check the results of the configuration:

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

```

        members [10 20 30 40];
    }
}
}
}
protocols {
    layer2-control {
        nonstop-bridging;
    }
    rstp {
        bridge-priority 16k;
        interface ge-0/0/13 {
            cost 1000;
            mode point-to-point;
        }
        interface ge-0/0/9 {
            cost 1000;
            mode point-to-point;
        }
        interface ge-0/0/11 {
            cost 1000;
            mode point-to-point;
        }
    }
}
}
vpls {
    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;
    }
}

```

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 interface-mode trunk
set interfaces ge-0/0/18 unit 0 family ethernet-switching interface-mode trunk
set protocols rstp bridge-priority 32k
set protocols rstp interface ge-0/0/14 cost 1000
set protocols rstp interface ge-0/0/14 mode point-to-point
set protocols rstp interface ge-0/0/18 cost 1000
set protocols rstp interface ge-0/0/18 mode point-to-point

```



NOTE: Starting with Junos OS Release 15.1 for EX Series and QFX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style, you can configure spanning tree parameters globally on all spanning tree interfaces. See ["Configuring RSTP \(CLI Procedure\)"](#) on page 24 for additional information.

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 protocols layer2-control 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 interface-mode trunk

```

- user@switch2# set ge-0/0/18 unit 0 family ethernet-switching interface-mode trunk
4. Configure RSTP on the switch:

```
[edit protocols]
user@switch2# rstp bridge-priority 32k
user@switch2# rstp interface ge-0/0/14 cost 1000
user@switch2# rstp interface ge-0/0/14 mode point-to-point
user@switch2# rstp interface ge-0/0/18 cost 1000
user@switch2# rstp interface ge-0/0/18 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 protocols layer2-control]
user@switch2# set nonstop-bridging
```



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

Results Check the results of the configuration:

```
user@switch2> show configuration
interfaces {
  ge-0/0/14 {
    unit 0 {
      family ethernet-switching {
        interface-mode trunk;
        vlan {
          members [10 20 30 40];
        }
      }
    }
  }
  ge-0/0/18 {
    unit 0 {
      family ethernet-switching {
        interface-mode trunk;
        vlan {
          members [10 20 30 40];
        }
      }
    }
  }
}
```

```
    }
  }
}
}
protocols {
  layer2-control {
    nonstop-bridging;
  }
  rstp {
    bridge-priority 32k;
    interface ge-0/0/14 {
      cost 1000;
      mode point-to-point;
    }
    interface ge-0/0/18 {
      cost 1000;
      mode point-to-point;
    }
  }
}
}
vpls {
  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;
  }
}
```

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 vpls voice-vlan description "Voice VLAN"
set vpls voice-vlan vlan-id 10
set vpls employee-vlan description "Employee VLAN"
set vpls employee-vlan vlan-id 20
set vpls guest-vlan description "Guest VLAN"
set vpls 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 interface-mode trunk
set interfaces ge-0/0/28 unit 0 family ethernet-switching interface-mode trunk
set interfaces ge-0/0/24 unit 0 family ethernet-switching interface-mode trunk
set protocols rstp bridge-priority 8k
set protocols rstp interface ge-0/0/26 cost 1000
set protocols rstp interface ge-0/0/26 mode point-to-point
set protocols rstp interface ge-0/0/28 cost 1000
set protocols rstp interface ge-0/0/28 mode point-to-point
set protocols rstp interface ge-0/0/24 cost 1000
set protocols rstp interface ge-0/0/24 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 protocols layer2-control 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 interface-mode trunk
user@switch3# set ge-0/0/28 unit 0 family ethernet-switching interface-mode trunk
user@switch3# set ge-0/0/24 unit 0 family ethernet-switching interface-mode trunk

```

4. Configure RSTP on the switch:

```

[edit protocols]
user@switch3# rstp bridge-priority 8k
user@switch3# rstp interface ge-0/0/26 cost 1000
user@switch3# rstp interface ge-0/0/26 mode point-to-point
user@switch3# rstp interface ge-0/0/28 cost 1000
user@switch3# rstp interface ge-0/0/28 mode point-to-point

```

```

user@switch3# rstp interface ge-0/0/24 cost 1000
user@switch3# rstp interface ge-0/0/24 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 protocols layer2-control]
user@switch3# set nonstop-bridging

```



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

Results Check the results of the configuration:

```

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

```

```
        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members [10 20 30 40];
            }
        }
    }
}
protocols {
    layer2-control {
        nonstop-bridging;
    }
    rstp {
        bridge-priority 8k;
        interface ge-0/0/26 {
            cost 1000;
            mode point-to-point;
        }
        interface ge-0/0/28 {
            cost 1000;
            mode point-to-point;
        }
        interface ge-0/0/24 {
            cost 1000;
            mode point-to-point;
        }
    }
    bridge-priority 8k;
}
}
vllans {
    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;
    }
}
```

Configuring RSTP and Nonstop Bridging on Switch 4

CLI Quick Configuration	<p>To quickly configure RSTP and nonstop bridging on Switch 4, copy the following commands and paste them into the switch terminal window:</p> <pre>[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 interface-mode trunk set interfaces ge-0/0/19 unit 0 family ethernet-switching interface-mode trunk set protocols rstp bridge-priority 16k set protocols rstp interface ge-0/0/23 cost 1000 set protocols rstp interface ge-0/0/23 mode point-to-point set protocols rstp interface ge-0/0/19 cost 1000 set protocols rstp interface ge-0/0/19 mode point-to-point</pre> <p>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:</p> <pre>set chassis redundancy graceful switchover set system commit synchronize set protocols layer2-control nonstop-bridging</pre>
Step-by-Step Procedure	<p>To configure RSTP and nonstop bridging on Switch 4:</p> <ol style="list-style-type: none">1. Configure the VLANs voice-vlan, employee-vlan, guest-vlan, and camera-vlan:<pre>[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</pre>2. Configure the VLANs on the interfaces, including support for the Ethernet switching protocol:<pre>[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]</pre>3. Configure the port mode for the interfaces:<pre>[edit interfaces] user@switch4# set ge-0/0/23 unit 0 family ethernet-switching interface-mode trunk user@switch4# set ge-0/0/19 unit 0 family ethernet-switching interface-mode trunk</pre>4. Configure RSTP on the switch:

```
[edit protocols]
user@switch4# rstp bridge-priority 16k
user@switch4# rstp interface ge-0/0/23 cost 1000
user@switch4# rstp interface ge-0/0/23 mode point-to-point
user@switch4# rstp interface ge-0/0/19 cost 1000
user@switch4# rstp interface ge-0/0/19 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 protocols layer2-control]
user@switch4# set nonstop-bridging
```



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

Results Check the results of the configuration:

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

```
    }  
  }  
  protocols {  
    layer2-control {  
      nonstop-bridging;  
    }  
    rstp {  
      bridge-priority 16k;  
      interface ge-0/0/23 {  
        cost 1000;  
        mode point-to-point;  
      }  
      interface ge-0/0/19 {  
        cost 1000;  
        mode point-to-point;  
      }  
    }  
  }  
}  
vpls {  
  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;  
  }  
}
```

Verification

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

- [Verifying RSTP Configuration on Switch 1 on page 22](#)
- [Verifying RSTP Configuration on Switch 2 on page 23](#)
- [Verifying RSTP Configuration on Switch 3 on page 23](#)
- [Verifying RSTP Configuration on Switch 4 on page 24](#)

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 port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/13	128:526	128:526	16384.0019e25040e0	1000	BLK	ALT
ge-0/0/9	128:522	128:522	32768.0019e2503d20	1000	BLK	ALT
ge-0/0/11	128:524	128:524	8192.0019e25051e0	1000	FWD	ROOT

Meaning Refer to the topology in [Figure 1 on page 9](#). The operational mode command **show spanning-tree interface** shows that **ge-0/0/13** 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 port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/14	128:527	128:527	32768.0019e2503d20	1000	FWD	DESG
ge-0/0/18	128:529	128:529	8192.0019e25051e0	1000	FWD	ROOT

Meaning Refer to the topology in [Figure 1 on page 9](#). The operational mode command **show spanning-tree interface** shows that **ge-0/0/18** 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 port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/26	128:539	128:539	8192.0019e25051e0	1000	FWD	DESG
ge-0/0/28	128:541	128:541	8192.0019e25051e0	1000	FWD	DESG
ge-0/0/24	128:537	128:537	8192.0019e25051e0	1000	FWD	DESG

Meaning Refer to the topology in [Figure 1 on page 9](#). 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 port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/23	128:536	128:536	8192.0019e25051e0	1000	FWD	ROOT
ge-0/0/19	128:532	128:532	16384.0019e25040e0	1000	FWD	DESG

Meaning Refer to the topology in [Figure 1 on page 9](#). The operational mode command **show spanning-tree interface** shows that interface **ge-0/0/23** is the root interface and forwarding.

- Related Documentation**
- [95775Configuring RSTP \(CLI Procedure\) on page 24](#)
 - [Understanding RSTP for EX Series and QFX Series Switches on page 3](#)

Configuring RSTP (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). Because RSTP is configured by default, you only need to use this procedure if another spanning-tree protocol has been configured. In that case, you can reconfigure RSTP.

To enable RSTP:

1. Disable the other configured spanning-tree protocol (MSTP):

- To disable MSTP:

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

2. Configure RSTP

- To enable RSTP on a specific interface:

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

- To disable RSTP on a specific interface:

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

- To enable RSTP on a range of interfaces:

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

- To enable RSTP on all interfaces:

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

Related Documentation

- *show spanning-tree bridge*
- *show spanning-tree interface*
- [Understanding RSTP for EX Series and QFX Series Switches on page 3](#)

PART 2

MSTP

- [Configuring MSTP on page 29](#)

CHAPTER 2

Configuring MSTP

- [Understanding MSTP for EX Series and QFX Series Switches on page 29](#)
- [Example: Configuring Network Regions for VLANs with MSTP on page 32](#)
- [Configuring MSTP on page 53](#)

Understanding MSTP for EX Series and QFX Series Switches

Ethernet networks are susceptible to broadcast storms if loops are introduced. However, an Ethernet network needs to 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*. 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 and QFX Series switches provide Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP), and VLAN Spanning Tree Protocol (VSTP). This topic explains MSTP.



NOTE: If you are using Junos OS for EX Series and QFX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style, you can force the original IEEE 802.1D Spanning Tree Protocol (STP) version to run in place of RSTP or VSTP by setting **force-version**.

This topic describes:

- [MSTP Maps Multiple VLANs on page 30](#)
- [Configuring MSTP Regions on page 30](#)
- [Selecting a Spanning Tree Protocol on page 30](#)

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 might 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 reconvergence 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 multiple spanning-tree instances (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 multiple spanning-tree instances (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 MSTIs,, 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 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 5 on page 31](#) below.

Table 5: Selecting a Spanning Tree Protocol

Protocol	Advantages	Disadvantages
RSTP	<ul style="list-style-type: none"> 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; therefore, switches do not all have to run RSTP. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Spanning Tree Protocol works with 802.1D 1998 bridges. RSTP is backward compatible with STP; therefore, switches do not all have to run STP. 	<ul style="list-style-type: none"> 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. If you are using Junos OS for EX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style, you can force the original IEEE 802.1D Spanning Tree Protocol (STP) version to run in place of RSTP or VSTP by setting force-version. However, the CLI does not include <code>[edit protocols stp]</code>.
MSTP	<ul style="list-style-type: none"> Multiple Spanning Tree Protocol works with most VLANs. RSTP and STP are recognized as distinct spanning-tree regions by MSTP. 	<ul style="list-style-type: none"> Some protocols require compatibility that is not provided by MSTP. In this case, use VSTP. MSTP uses more CPU than RSTP and does not converge as fast as RSTP.
VSTP	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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. Ensure to check the scale limits before configuring large number of VSTP instances.

- Related Documentation**
- [Understanding STP for EX Series Switches](#)
 - [Understanding RSTP for EX Series and QFX Series Switches on page 3](#)
 - [Understanding VSTP for EX Series Switches and QFX Series Switches on page 57](#)
 - [Understanding Layer 2 Protocol Tunneling on EX Series Switches](#)
 - [Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches](#)
 - [Example: Configuring Network Regions for VLANs with MSTP on page 32](#)
 - [Configuring MSTP on page 53](#)

Example: Configuring Network Regions for VLANs with MSTP



NOTE: This example uses Junos OS for EX Series and QFX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Example: Configuring Network Regions for VLANs with MSTP on EX Series Switches*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

Multiple Spanning Tree Protocol (MSTP) is used to create a loop-free topology in networks using multiple spanning-tree regions in which each region contains multiple spanning-tree instances (MSTIs). MSTIs provide different paths for different VLANs. This functionality facilitates better load sharing across redundant links.

Up to 64 MSTIs 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 32](#)
- [Overview and Topology on page 32](#)
- [Configuring MSTP on Switch 1 on page 35](#)
- [Configuring MSTP on Switch 2 on page 38](#)
- [Configuring MSTP on Switch 3 on page 40](#)
- [Configuring MSTP on Switch 4 on page 43](#)
- [Verification on page 46](#)

Requirements

This example uses the following software and hardware components:

- Junos OS Release 13.2X50-D10 or later for EX Series switches
- Four EX Series switches

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

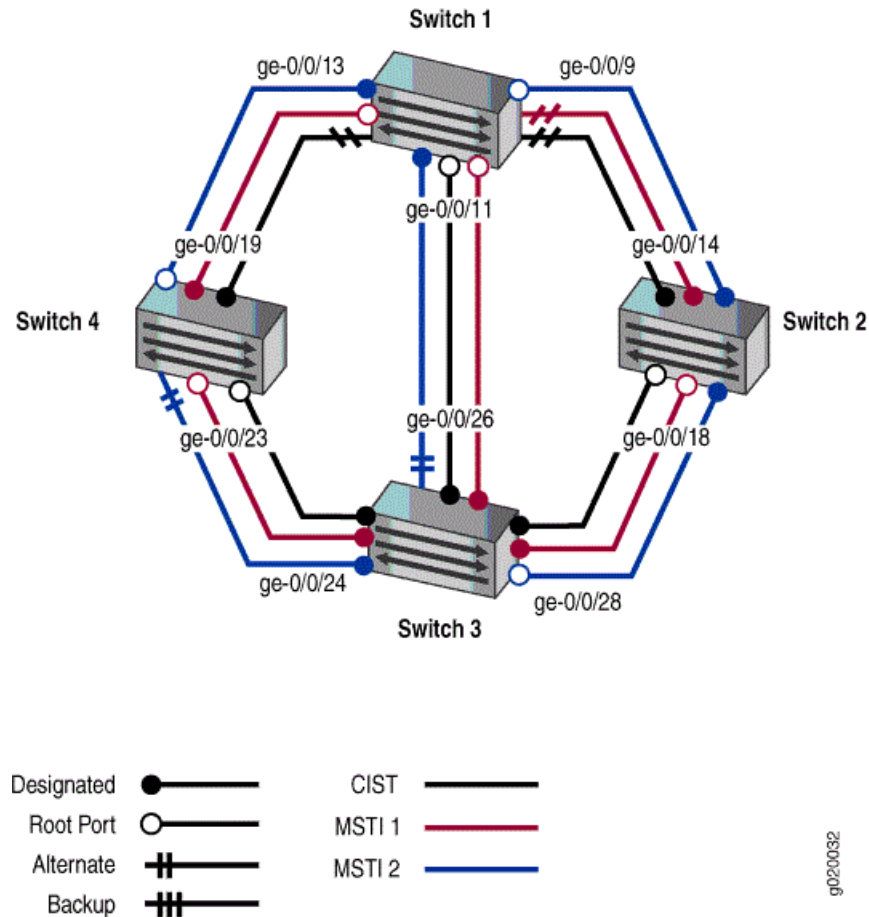
- Installed and connected the four switches. See the hardware documentation for your switch.
- Performed the initial software configuration on all switches. See *Connecting and Configuring an EX Series Switch (CLI Procedure)* or *Connecting and Configuring an EX Series Switch (J-Web Procedure)*.

Overview and Topology

When the number of VLANs grows in a network, MSTP provides an efficient way of creating a loop-free topology by 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 the demand on system resources.

Figure 2: Network Topology for MSTP



The interfaces shown in [Figure 2 on page 33](#) will be configured for MSTP.



NOTE: You can configure MSTP only on physical interfaces, not on logical interfaces.

Table 6: Components of the Topology for Configuring MSTP on EX Series Switches

Property	Settings
Switch 1	<p>The following interfaces on Switch 1 are connected in this way:</p> <ul style="list-style-type: none"> • 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

Table 6: Components of the Topology for Configuring MSTP on EX Series Switches (*continued*)

Property	Settings
Switch 2	<p>The following interfaces on Switch 2 are connected in this way:</p> <ul style="list-style-type: none"> • ge-0/0/14 is connected to Switch 1 • ge-0/0/18 is connected to Switch 3
Switch 3	<p>The following interfaces on Switch 3 are connected in this way:</p> <ul style="list-style-type: none"> • 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	<p>The following interfaces on Switch 4 are connected in this way:</p> <ul style="list-style-type: none"> • ge-0/0/19 is connected to Switch 1 • ge-0/0/23 is connected to Switch 3
VLAN names and tag IDs	<p>voice-vlan, tag 10 employee-vlan, tag 20 guest-vlan, tag 30 camera-vlan, tag 40</p>
MSTIs	<p>1 2</p>
MSTI region	region1

The topology in [Figure 2 on page 33](#) shows a common and internal spanning tree (CIST). The CIST is a single spanning tree connecting all devices in the network. The switch with the lowest bridge priority is elected as the root bridge of the CIST. You can control the election of the root bridge by configuring the bridge priority. Switch 3 is the root bridge of the CIST.

The ports in an MSTP topology 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* becomes the active designated port and starts forwarding data when the designated port goes down.

In this example, one MSTP region contains Switch 1, Switch 2, Switch 3, and Switch 4. Within the region, four VLANs are created:

- **voice-vlan** supports voice traffic and has the VLAN tag identifier of 10.
- **employee-vlan** supports data traffic and has the VLAN tag identifier of 20.

- **guest-vlan** supports guest VLAN traffic (for supplicants that fail authentication) and has the VLAN tag identifier of **30**.
- **camera-vlan** supports video traffic and has the 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 interface-mode trunk
set interfaces ge-0/0/9 unit 0 family ethernet-switching interface-mode trunk
set interfaces ge-0/0/11 unit 0 family ethernet-switching interface-mode trunk
set protocols mstp configuration-name region1
set protocols mstp bridge-priority 16k
set protocols mstp interface ge-0/0/13 cost 1000
set protocols mstp interface ge-0/0/13 mode point-to-point
set protocols mstp interface ge-0/0/9 cost 1000
set protocols mstp interface ge-0/0/9 mode point-to-point
set protocols mstp interface ge-0/0/11 cost 1000
set protocols mstp interface ge-0/0/11 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 cost 1000
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:



NOTE: Starting with Junos OS Release 15.1 for EX Series and QFX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style, you can configure spanning tree parameters globally on all spanning tree interfaces. See [“Configuring MSTP” on page 53](#) for additional information.

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 interface-mode trunk
user@switch1# set ge-0/0/9 unit 0 family ethernet-switching interface-mode trunk
user@switch1# set ge-0/0/11 unit 0 family ethernet-switching interface-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 cost 1000
user@switch1# mstp interface ge-0/0/13 mode point-to-point
user@switch1# mstp interface ge-0/0/9 cost 1000
user@switch1# mstp interface ge-0/0/9 mode point-to-point
user@switch1# mstp interface ge-0/0/11 cost 1000
user@switch1# mstp interface ge-0/0/11 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 cost 1000
user@switch1# mstp msti 2 bridge-priority 8k
user@switch1# mstp msti 2 vlan [30 40]
```

Results

Check the results of the configuration:

```
user@switch1> show configuration
interfaces {
  ge-0/0/13 {
```

```

    unit 0 {
        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members 10;
                members 20;
                members 30;
                members 40;
            }
        }
    }
}
ge-0/0/9 {
    unit 0 {
        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members 10;
                members 20;
                members 30;
                members 40;
            }
        }
    }
}
ge-0/0/11 {
    unit 0 {
        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members 10;
                members 20;
                members 30;
                members 40;
            }
        }
    }
}
}
protocols {
    mstp {
        configuration-name region1;
        bridge-priority 16k;
        interface ge-0/0/13 {
            cost 1000;
            mode point-to-point;
        }
        interface ge-0/0/9 {
            cost 1000;
            mode point-to-point;
        }
        interface ge-0/0/11 {
            cost 1000;
            mode point-to-point;
        }
    }
    msti 1 {

```

```
        bridge-priority 16k;
        vlan [ 10 20];
        interface ge-0/0/11 {
            cost 1000;
        }
    }
    msti 2 {
        bridge-priority 8k;
        vlan [ 30 40 ];
    }
}
vlangs {
    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 interface-mode trunk
set interfaces ge-0/0/18 unit 0 family ethernet-switching interface-mode trunk
set protocols mstp configuration-name region1
set protocols mstp bridge-priority 32k
set protocols mstp interface ge-0/0/14 cost 1000
set protocols mstp interface ge-0/0/14 mode point-to-point
set protocols mstp interface ge-0/0/18 cost 1000
set protocols mstp interface ge-0/0/18 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 30
```

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 interface-mode trunk
user@switch2# set ge-0/0/18 unit 0 family ethernet-switching interface-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 cost 1000
user@switch2# mstp interface ge-0/0/14 mode point-to-point
user@switch2# mstp interface ge-0/0/18 cost 1000
user@switch2# mstp interface ge-0/0/18 mode point-to-point
user@switch2# mstp msti 1 bridge-priority 32k
user@switch2# mstp msti 1 vlan [10 20]
user@switch2# mstp msti 2 bridge-priority 4k
user@switch2# mstp msti 2 vlan [30 40]
```

Results Check the results of the configuration:

```
user@switch2> show configuration
interfaces {
  ge-0/0/14 {
    unit 0 {
      family ethernet-switching {
        interface-mode trunk;
        vlan {
          members 10;
          members 20;
          members 30;
          members 40;
        }
      }
    }
  }
  ge-0/0/18 {
    unit 0 {
```

```
        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members 10;
                members 20;
                members 30;
                members 40;
            }
        }
    }
}
protocols {
    mstp {
        configuration-name region1;
        bridge-priority 32k;
        interface ge-0/0/14 {
            cost 1000;
            mode point-to-point;
        }
        interface ge-0/0/18 {
            cost 1000;
            mode point-to-point;
        }
        msti 1 {
            bridge-priority 32k;
            vlan [10 20];
        }
        msti 2 {
            bridge-priority 4k;
            vlan [30 40];
        }
    }
}
vlands {
    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 vlands 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 interface-mode trunk
set interfaces ge-0/0/28 unit 0 family ethernet-switching interface-mode trunk
set interfaces ge-0/0/24 unit 0 family ethernet-switching interface-mode trunk
set protocols mstp configuration-name region1
set protocols mstp bridge-priority 8k
set protocols mstp interface ge-0/0/26 cost 1000
set protocols mstp interface ge-0/0/26 mode point-to-point
set protocols mstp interface ge-0/0/28 cost 1000
set protocols mstp interface ge-0/0/28 mode point-to-point
set protocols mstp interface ge-0/0/24 cost 1000
set protocols mstp interface ge-0/0/24 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 interface-mode trunk
user@switch3# set ge-0/0/28 unit 0 family ethernet-switching interface-mode trunk
user@switch3# set ge-0/0/24 unit 0 family ethernet-switching interface-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 cost 1000

```

```
user@switch3# mstp interface ge-0/0/26 mode point-to-point
user@switch3# mstp interface ge-0/0/28 cost 1000
user@switch3# mstp interface ge-0/0/28 mode point-to-point
user@switch3# mstp interface ge-0/0/24 cost 1000
user@switch3# mstp interface ge-0/0/24 mode point-to-point
user@switch3# mstp msti 1 bridge-priority 4k
user@switch3# mstp msti 1 vlan [10 20]
user@switch3# mstp msti 2 bridge-priority 16k
user@switch3# mstp msti 2 vlan [30 40]
```

Results Check the results of the configuration:

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

```

mstp {
  configuration-name region1;
  bridge-priority 8k;
  interface ge-0/0/26 {
    cost 1000;
    mode point-to-point;
  }
  interface ge-0/0/28 {
    cost 1000;
    mode point-to-point;
  }
  interface ge-0/0/24 {
    cost 1000;
    mode point-to-point;
  }
  msti 1 {
    bridge-priority 4k;
    vlan [10 20];
  }
  msti 2 {
    bridge-priority 16k;
    vlan [30 40];
  }
}
}
vlangs {
  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 interface-mode trunk
set interfaces ge-0/0/19 unit 0 family ethernet-switching interface-mode trunk
set protocols mstp configuration-name region1
set protocols mstp bridge-priority 16k
set protocols mstp interface ge-0/0/23 cost 1000
set protocols mstp interface ge-0/0/23 mode point-to-point
set protocols mstp interface ge-0/0/19 cost 1000
set protocols mstp interface ge-0/0/19 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 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 interface-mode trunk
user@switch4# set ge-0/0/19 unit 0 family ethernet-switching interface-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 ge-0/0/23 cost 1000
user@switch4# mstp interface ge-0/0/23 mode point-to-point
user@switch4# mstp interface ge-0/0/19 cost 1000
user@switch4# mstp interface ge-0/0/19 mode point-to-point
user@switch4# mstp msti 1 bridge-priority 16k
user@switch4# mstp msti 1 vlan [10 20]
user@switch4# mstp msti 2 bridge-priority 32k
user@switch4# mstp msti 2 vlan [30 40]
```

Results Check the results of the configuration:

```
user@switch4> show configuration
interfaces {
  ge-0/0/23 {
    unit 0 {
      family ethernet-switching {
```

```
        interface-mode trunk;
        vlan {
            members 10;
            members 20;
            members 30;
            members 40;
        }
    }
}
ge-0/0/19 {
    unit 0 {
        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members 10;
                members 20;
                members 30;
                members 40;
            }
        }
    }
}
protocols {
    mstp {
        configuration-name region1;
        bridge-priority 16k;
        interface ge-0/0/23 {
            cost 1000;
            mode point-to-point;
        }
        interface ge-0/0/19 {
            cost 1000;
            mode point-to-point;
        }
        msti 1 {
            bridge-priority 16k;
            vlan [10 20];
        }
        msti 2 {
            bridge-priority 32k;
            vlan [30 40];
        }
    }
}
vllans {
    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 46](#)
- [Verifying MSTP Configuration on Switch 2 on page 47](#)
- [Verifying MSTP Configuration on Switch 3 on page 49](#)
- [Verifying MSTP Configuration on Switch 4 on page 50](#)

Verifying MSTP Configuration on Switch 1

Purpose Verify the MSTP configuration on Switch 1.

Action Issue the operational mode commands **show spanning-tree interface** and **show spanning-tree bridge**:

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

Spanning tree interface parameters for instance 0

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/9	128:490	128:490	16384.4c9614e9f841	1000	BLK	DIS
ge-0/0/11	128:491	128:491	16384.4c9614e9f841	1000	BLK	DIS
ge-0/0/13	128:492	128:492	16384.4c9614e9f841	1000	BLK	DIS

Spanning tree interface parameters for instance 1

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/9	128:490	128:490	16385.4c9614e9f841	1000	BLK	DIS
ge-0/0/11	128:491	128:491	16385.4c9614e9f841	1000	BLK	DIS
ge-0/0/13	128:492	128:492	16385.4c9614e9f841	1000	BLK	DIS

Spanning tree interface parameters for instance 2

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/9	128:490	128:490	8194.4c9614e9f841	1000	BLK	DIS
ge-0/0/11	128:491	128:491	8194.4c9614e9f841	1000	BLK	DIS
ge-0/0/13	128:492	128:492	8194.4c9614e9f841	1000	BLK	DIS

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

STP bridge parameters

```

Routing instance name      : GLOBAL
Context ID                 : 0
Enabled protocol           : MSTP

```

STP bridge parameters for CIST

```

Root ID                    : 16384.4c:96:14:e9:f8:41
CIST regional root        : 16384.4c:96:14:e9:f8:41

```

```

CIST internal root cost      : 0
Hello time                  : 2 seconds
Maximum age                 : 20 seconds
Forward delay               : 15 seconds
Number of topology changes  : 0
Local parameters
  Bridge ID                 : 16384.4c:96:14:e9:f8:41

STP bridge parameters for MSTI 1
MSTI regional root         : 16385.4c:96:14:e9:f8:41
Hello time                  : 2 seconds
Maximum age                 : 20 seconds
Forward delay               : 15 seconds
Number of topology changes  : 0
Local parameters
  Bridge ID                 : 16385.4c:96:14:e9:f8:41

STP bridge parameters for MSTI 2
MSTI regional root         : 8194.4c:96:14:e9:f8:41
Hello time                  : 2 seconds
Maximum age                 : 20 seconds
Forward delay               : 15 seconds
Number of topology changes  : 0
Local parameters
  Bridge ID                 : 8194.4c:96:14:e9:f8:41

```

Meaning The operational mode command **show spanning-tree interface** displays spanning-tree domain information such as the designated port and the port roles.

The operational mode command **show spanning-tree bridge** displays the spanning-tree domain information at either the bridge level or the interface level. If the optional interface name is omitted, all interfaces in the spanning-tree domain are displayed.

Verifying MSTP Configuration on Switch 2

Purpose Verify the MSTP configuration on Switch 2.

Action Issue the operational mode commands **show spanning-tree interface** and **show spanning-tree bridge**:

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

```
Spanning tree interface parameters for instance 0
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/14	128:513	128:513	32768.0019e2503d20	1000	FWD	DESG
ge-0/0/18	128:519	128:515	8192.0019e25051e0	1000	FWD	ROOT

```
Spanning tree interface parameters for instance 1
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/14	128:513	128:513	32769.0019e2503d20	1000	FWD	DESG
ge-0/0/18	128:519	128:515	4097.0019e25051e0	1000	FWD	ROOT

Spanning tree interface parameters for instance 2

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/14	128:513	128:513	4098.0019e2503d20	1000	FWD	DESG
ge-0/0/18	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            : 1000
Root port            : ge-0/0/18
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   : 4096.00:19:e2:50:51:e0
Root cost            : 1000
Root port            : ge-0/0/18
Hello time           : 2 seconds
Maximum age          : 20 seconds
Forward delay        : 15 seconds
Hop count            : 19
Local parameters
  Bridge ID          : 32768.00:19:e2:50:3d:20
  Extended system ID : 0
  Internal instance ID : 1
```

STP bridge parameters for MSTI 2

```
MSTI regional root   : 4096.00:19:e2:50:3d:20
Hello time           : 2 seconds
Maximum age          : 20 seconds
Forward delay        : 15 seconds
Local parameters
  Bridge ID          : 4096.00:19: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 spanning-tree interface parameters for instance 2 show that both ports are designated ports, which means Switch 2 is the root bridge for this instance.

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 Issue the operational mode commands **show spanning-tree interface** and **show spanning-tree bridge**:

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

Spanning tree interface parameters for instance 0

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/26	128:513	128:513	8192.0019e25051e0	1000	FWD	DESG
ge-0/0/28	128:515	128:515	8192.0019e25051e0	1000	FWD	DESG
ge-0/0/24	128:517	128:517	8192.0019e25051e0	1000	FWD	DESG

Spanning tree interface parameters for instance 1

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/26	128:513	128:513	4096.0019e25051e0	1000	FWD	DESG
ge-0/0/28	128:515	128:515	4096.0019e25051e0	1000	FWD	DESG
ge-0/0/24	128:517	128:517	4096.0019e25051e0	1000	FWD	DESG

Spanning tree interface parameters for instance 2

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/26	128:513	128:531	8192.0019e25044e0	1000	BLK	ALT
ge-0/0/28	128:515	128:519	4096.0019e2503d20	1000	FWD	ROOT
ge-0/0/24	128:517	128:517	16384.0019e25051e0	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   : 4096.00:19:e2:50:51:e0
```

```

Hello time                : 2 seconds
Maximum age               : 20 seconds
Forward delay             : 15 seconds
Local parameters
  Bridge ID               : 4096.00:19:e2:50:51:e0
  Extended system ID      : 0
  Internal instance ID    : 1

STP bridge parameters for MSTI 2
MSTI regional root       : 4096.00:19:e2:50:3d:20
Root cost                 : 1000
Root port                 : ge-0/0/28
Hello time                : 2 seconds
Maximum age               : 20 seconds
Forward delay             : 15 seconds
Hop count                 : 19
Local parameters
  Bridge ID               : 16384.00:19: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. Switch 3 is the root bridge for instance 0, which is the CIST, as well as for instance 1. In both instances, all ports on Switch 3 are designated ports.

The operational mode command **show spanning-tree bridge** displays the spanning-tree domain information at either the bridge level or the interface level. If the optional interface name is omitted, all interfaces in the spanning-tree domain are displayed.

Verifying MSTP Configuration on Switch 4

Purpose Verify the MSTP configuration on Switch 4.

Action Issue the operational mode commands **show spanning-tree interface** and **show spanning-tree bridge**:

```
user@switch4> show spanning-tree interface
```

```
Spanning tree interface parameters for instance 0
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/23	128:523	128:517	8192.0019e25051e0	1000	FWD	ROOT
ge-0/0/19	128:525	128:525	16384.0019e25040e0	1000	FWD	DESG

```
Spanning tree interface parameters for instance 1
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/23	128:523	128:517	4096.0019e25051e0	1000	FWD	ROOT
ge-0/0/19	128:525	128:525	16384.0019e25040e0	1000	FWD	DESG

```
Spanning tree interface parameters for instance 2
```

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

```

ge-0/0/23    128:523    128:517  16384.0019e25051e0    1000  BLK  ALT
ge-0/0/19    128:525    128:527  8192.0019e25044e0    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
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        : 4096.00:19:e2:50:51:e0
Root cost                  : 1000
Root port                  : ge-0/0/23
Hello time                 : 2 seconds
Maximum age                : 20 seconds
Forward delay              : 15 seconds
Hop count                  : 19
Local parameters
  Bridge ID                : 16384.00:19:e2:50:40:e0
  Extended system ID       : 0
  Internal instance ID     : 1

STP bridge parameters for MSTI 2
MSTI regional root        : 4096.00:19:e2:50:3d:20
Root cost                  : 2000
Root port                  : ge-0/0/19
Hello time                 : 2 seconds
Maximum age                : 20 seconds
Forward delay              : 15 seconds
Hop count                  : 18
Local parameters
  Bridge ID                : 32768.00:19:e2:50:40:e0
  Extended system ID       : 0
  Internal instance ID     : 2

```

Meaning The operational mode command **show spanning-tree interface** displays spanning-tree domain information such as the designated port and the port roles.

The operational mode command **show spanning-tree bridge** displays the spanning-tree domain information at either the bridge level or the interface level. If the optional interface name is omitted, all interfaces in the spanning-tree domain are displayed.

**Related
Documentation**

- [Example: Configuring Faster Convergence and Improved Network Stability with RSTP on page 8](#)
- [Understanding MSTP for EX Series and QFX Series Switches on page 29](#)

Configuring MSTP

You can configure the Multiple Spanning Tree Protocol (MSTP) under **[edit protocols]**.

To configure the Multiple Spanning Tree Protocol:

1. Enable MSTP as the version of spanning-tree protocol to be configured:

```
[edit]
user@switch# edit ... protocols mstp
```

2. Configure the interfaces that participate in the MSTP instance.

- Configure a specific interface:

- a. Enable MSTP on the specified interface:

```
[edit ... protocols mstp]
user@switch# edit interface interface-name
```

- b. Configure the interface priority:

```
[edit ... protocols mstp interface interface-name]
user@switch# set priority interface-priority
```

- c. (Optional) By default, the interface link cost is determined by the link speed. You can configure the interface link cost to control which bridge is the designated bridge and which port is the designated port:

```
[edit ... protocols mstp interface interface-name]
user@switch# set cost interface-link-cost
```

- d. Configure the interface link mode to identify point-to-point links:

```
[edit ... protocols mstp interface interface-name]
user@switch# set mode (p2p | shared)
```

Specify **p2p** if the link is point to point. Specify **shared** if the link is a shared media.

- e. (Optional) Configure the interface as an edge port:

```
[edit ... protocols mstp interface interface-name]
user@switch# set edge
```

Edge ports do not expect to receive bridge protocol data unit (BPDU) packets. If a BPDU packet is received for an edge port, the port becomes a nonedge port.

- f. (Optional) Disable MSTP on a specific interface:

```
[edit ... protocols mstp interface interface-name]
user@switch# set disable
```

- Enable MSTP on all the interfaces:



NOTE: You *cannot* disable MSTP on all the interfaces.

- a. Enable MSTP on all interfaces:

```
[edit ... protocols mstp]
user@switch# set interface all
```

You can also enable BPDU root protection for all spanning-tree protocol instances

on the interface. BPDU root protect ensures the port is the spanning-tree designated port. If the port receives superior BPDU packets, root protect moves this port to a root-prevented spanning-tree state. For configuration details, see *Checking the Status of Spanning-Tree Instance Interfaces*.

3. Configure the bridge priority

```
[edit ... protocols mstp]
user@switch# set bridge-priority bridge-priority
```

For more information, see *Bridge Priority for Election of Root Bridge and Designated Bridge*.

4. Configure hello BPDU timers.

a. Configure the maximum expected arrival time of hello BPDUs:

```
[edit ... protocols mstp]
user@switch# set max-age seconds
```

b. Configure the time interval at which the root bridge transmits configuration BPDUs:

```
[edit ... protocols mstp]
user@switch# set hello-time seconds
```

5. (Optional) By default, the bridge port remains in the listening and learning states for 15 seconds before transitioning to the forwarding state. You can specify a delay from 4 through 20 seconds instead:

```
[edit ... protocols mstp]
user@switch# set forward-delay seconds
```

6. Configure MSTP-specific options.

a. Configure the MSTP region configuration name:

```
[edit ... protocols mstp]
user@switch# set configuration-name configuration-name
```

b. Configure the MSTP revision level:

```
[edit ... protocols mstp]
user@switch# set revision-level revision-level
```

c. Configure the maximum number of hops a BPDU can be forwarded in the MSTP region:

```
[edit ... protocols mstp]
user@switch# set max-hops hops
```

**Related
Documentation**

- *Configuring MST Instances on a Physical Interface*

PART 3

VSTP

- [Configuring VSTP on page 57](#)

CHAPTER 3

Configuring VSTP

- [Understanding VSTP for EX Series Switches and QFX Series Switches on page 57](#)
- [Configuring VLAN Spanning Tree Protocol on page 60](#)

Understanding VSTP for EX Series Switches and QFX 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.

VSTP and RSTP are the only spanning-tree protocols that can be configured concurrently on a switch. The maximum number of VLANs that can be supported by VSTP depends upon whether you are using Junos OS for EX Series and QFX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style or Junos OS that does not support ELS. For ELS details, see *Getting Started with Enhanced Layer 2 Software*. For additional VLANs, use RSTP.

- On EX Series (except EX9200) and QFX Series switches running Junos OS that supports ELS—VSTP can support up to 510 VLANs.
- On EX9200 switches—VSTP can support up to 4000 VLANs.
- On an EX Series switch running Junos OS that does not support ELS—VSTP can support up to 253 VLANs.



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.



NOTE: The `vlan all` option is supported on all EX Series and QFX Series switches.



NOTE: If your EX Series or QFX Series switch interoperates with a Cisco device running Rapid per VLAN Spanning Tree (Rapid PVST+), we recommend that you enable both VSTP and RSTP on the EX Series or QFX Series interface.

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 7 on page 58](#).

Table 7: Selecting a Spanning-Tree Protocol

Protocol	Advantages	Disadvantages
RSTP	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Spanning Tree Protocol works with 802.1D 1998 bridges. RSTP is backward compatible with STP so switches do not all have to run STP. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Multiple Spanning Tree Protocol works with most VLANs. RSTP and STP are recognized as distinct Spanning Tree regions by MSTP. 	<ul style="list-style-type: none"> 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 7: Selecting a Spanning-Tree Protocol (*continued*)

Protocol	Advantages	Disadvantages
VSTP	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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](#)
 - [Understanding RSTP for EX Series and QFX Series Switches on page 3](#)
 - [Understanding MSTP for EX Series and QFX Series Switches on page 29](#)
 - [Configuring VLAN Spanning Tree Protocol on page 60](#)

Configuring VLAN Spanning Tree Protocol

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. This task describes the options for configuring VSTP on an EX Series or QFX Series switch.



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



NOTE: On EX Series (other than EX9200) and QFX switches running Junos OS that supports ELS—VSTP can support up to 510 VLANs. However, on EX9200 switches, VSTP can support only up to 253 VLANs.



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.

You can enable or disable VSTP as follows:

- Enabling VSTP as the version of spanning-tree protocol to be configured:

- Enable VSTP on an individual interface:

```
[edit]
user@switch@ set protocols vstp interface interface-name.
```

- Enable VSTP on all interfaces on the switch:

```
[edit]
user@switch@ set protocols vstp interface all
```

- Enable VSTP on a specific interface within a specific VLAN:

```
[edit]
user@switch@ set protocols vstp vlan vlan-id interface interface-name.
```

- Enable VSTP on all the interfaces within a specific VLAN:

```
[edit]
```

```
user@switch@ set protocols vstp vlan vlan-id interface all
```

- Enable VSTP on all the interfaces within all the VLANs on the switch:

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

- Enable VSTP on all the VLANs on the switch:

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

- Enable VSTP for a specific interface within a specified VLAN group:

```
[edit]
user@switch@ set protocols vstp vlan-group group group-name vlan (vlan-id |vlan-range |  
open-set-of-values) interface interface-name
```

- Enable VSTP for all the interfaces within a specified VLAN group:

```
[edit]
user@switch@ set protocols vstp vlan-group group group-name vlan (vlan-id |vlan-range |  
open-set-of-values) interface all
```

You can disable VSTP as follows:



NOTE: You *cannot* disable the VSTP VLAN parameters for *all* VSTP interfaces.

- Disable VSTP on an individual interface:

```
[edit]
user@switch@ set protocols vstp interface interface-name. disable
```

- Disable VSTP on a specific interface within a specific VLAN:

```
[edit]
user@switch@ set protocols vstp vlan vlan-id interface interface-name. disable
```

- Disable a specific VSTP interface on all the VLANs on the switch:

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

- Disable a specific VSTP interface within a specific VLAN group:

```
[edit]
user@switch@ set protocols vstp vlan-group group group-name vlan (vlan-id |vlan-range |  
open-set-of-values) interface interface-name disable
```

**Related
Documentation**

- [Understanding VSTP for EX Series Switches and QFX Series Switches on page 57](#)

PART 4

Tasks That Apply to Multiple Protocols

- [Using STPs on page 65](#)

CHAPTER 4

Using STPs

- [Configuring Spanning Tree Protocols \(J-Web Procedure\) on page 65](#)
- [Reverting to RSTP or VSTP from Forced IEEE 802.1D STP on page 70](#)
- [Forcing RSTP or VSTP to Run as IEEE 802.1D STP \(CLI Procedure\) on page 71](#)
- [Unblocking an Interface That Receives BPDUs in Error \(CLI Procedure\) on page 72](#)

Configuring Spanning Tree Protocols (J-Web Procedure)



NOTE: This topic applies only to the J-Web Application package.

For 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 by 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.



NOTE: In EX4300 switches, you can configure STP only by enabling RSTP and forcing it to act as STP. You need to select the Force STP check box from the RSTP configuration page.

To configure STP, MSTP, or RSTP for an EX Series switch by 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 on 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 of the following options:

- **Add**—Creates a spanning-tree protocol configuration.
 - a. Select a protocol name.
 - b. Enter information as described in [Table 8 on page 66](#).
 - 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 8 on page 66](#).
 - 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 8: 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 protocols 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 MSTIs. 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.

Table 8: Spanning Tree Protocol Configuration Parameters (*continued*)

Field	Function	Your Action
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.
Force STP Version	Enables or disables STP.	To enable this option, select the check box.
NOTE: This option is supported only on EX4300 switches.		
Ports		
Interface Name	Specifies an interface for the spanning-tree protocol.	<ol style="list-style-type: none"> Click the Ports tab. Choose one of the following options: <ul style="list-style-type: none"> 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.
NOTE: This option is not supported on EX4300 switches.		
Edge	Configures the interface as an edge interface. Edge interfaces immediately transition to a forwarding state.	To enable the option, select the check box.

Table 8: Spanning Tree Protocol Configuration Parameters (*continued*)

Field	Function	Your Action
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.	<ol style="list-style-type: none"> To enable the option, select the check box. Select one of the following: <ul style="list-style-type: none"> 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.	<p>Select one of the following options:</p> <ul style="list-style-type: none"> Log Block <p>NOTE: For EX4300 switches, you can select one of the following options:</p> <ul style="list-style-type: none"> Alarm Block
MSTI (MSTP only)		
MSTI Name	Specifies a name (an MSTI ID) for the MSTI.	<ol style="list-style-type: none"> Click the MSTI tab. Choose one of the following options: <ul style="list-style-type: none"> Click Add. Select an MSTI ID and click Edit. To delete an MSTI from the configuration, select the MSTI ID and click Remove. <p>NOTE: For EX4300 switches, the MSTI ID can be 1 through 64.</p>
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.

Table 8: Spanning Tree Protocol Configuration Parameters (*continued*)

Field	Function	Your Action
VLAN ID	Specifies the VLAN for the MSTI.	<p>In the VLAN box, choose one of the following options:</p> <ul style="list-style-type: none"> 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 MSTI.	<ol style="list-style-type: none"> In the Interfaces box, click Add and select an interface from the list, or select an interface from the list and click Edit. Specify the link cost to determine which bridge is the designated bridge and which interface is the designated interface. Specify the interface priority to determine which interface is elected as the root port. If you want to disable the interface, select the check box. Click OK. <p>To delete an interface configuration, select the interface, click Remove, and click OK.</p>

- Related Documentation**
- [Monitoring Spanning Tree Protocols on page 101](#)
 - [Unblocking an Interface That Receives BPDUs in Error \(CLI Procedure\)](#)
 - [Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches](#)
 - [Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on page 79](#)
 - [Example: Configuring Network Regions for VLANs with MSTP on page 32](#)
 - [Example: Configuring Faster Convergence and Improved Network Stability with RSTP on page 8](#)

Reverting to RSTP or VSTP from Forced IEEE 802.1D STP

On MX Series routers and EX Series and QFX Series switches on which Rapid Spanning Tree Protocol (RSTP) or VLAN Spanning Tree Protocol (VSTP) has been forced to run as the original IEEE 802.1D Spanning Tree Protocol (STP) version, you can revert back to RSTP or VSTP.

To revert from the forced instance of the original IEEE 802.1D STP version to the originally configured RSTP or VSTP version:

1. Remove the **force-version** statement from the following RSTP or VSTP configuration:

```
user@host# delete protocols rstp force-version stp
user@host# delete protocols vstp force-version stp
```

Include this statement at the following hierarchy levels:

- [edit logical-systems *routing-instance-name* protocols rstp]
- [edit protocols rstp]
- [edit protocols vstp]
- [edit routing-instances *routing-instance-name* protocols rstp]
- [edit routing-instances *routing-instance-name* protocols vstp]

2. Revert the forced IEEE 802.1D STP to run as the configured RSTP or VSTP:

```
user@host# clear spanning-tree protocol-migration <interface interface-name>
<routing-instance routing-instance-name>
```

To revert the STP protocol globally, issue the statement without options (**clear spanning-tree protocol-migration**).

To revert the STP protocol for the specified interface only, specify the **interface *interface-name*** option.

To revert the STP protocol for a particular routing instance only, specify the **routing-instance *routing-instance-name*** option.

Related Documentation

- [Spanning-Tree Protocols Supported](#)
- [RSTP or VSTP Forced to Run as IEEE 802.1D STP](#)
- [Configuring RSTP \(CLI Procedure\) on page 24](#)
- [Configuring VLAN Spanning Tree Protocol on page 60](#)

Forcing RSTP or VSTP to Run as IEEE 802.1D STP (CLI Procedure)



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

On EX Series switches running Rapid Spanning Tree Protocol (RSTP) (the default) or VLAN Spanning Tree Protocol (VSTP), you can force the original IEEE 802.1D Spanning Tree Protocol (STP) version to run in place of RSTP or VSTP. Configure the **force-version stp** statement for compatibility with older bridges that do not support RSTP or VSTP.

To force the spanning-tree protocol version to be the original IEEE 802.1D STP:

1. Enable IEEE 802.1D STP:

```
[edit protocols]
user@switch# set (rstp | vstp) force-version stp
```



NOTE: After using the **force-version** statement to enable xSTP globally, apply the **force-version** statement for specific Layer 2 ports.

Related Documentation

- [RSTP or VSTP Forced to Run as IEEE 802.1D STP](#)
- [Reverting to RSTP or VSTP from Forced IEEE 802.1D STP on page 70](#)

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

EX Series and QFX 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 protocols layer 2]
```

```
user@switch# set protocols layer2-control bpdv-block disable-timeout 30
```

All interfaces on the switch will be reenabled (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 error bpdv interface ge-0/0/6
```

This command will only reenable 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 page 79](#)
- [Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 84](#)
- [Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 75](#)

PART 5

BPDU Protection, Loop Protection, and Root Protection

- [Configuring BPDU Protection, Loop Protection, and Root Protection on page 75](#)

CHAPTER 5

Configuring BPDU Protection, Loop Protection, and Root Protection

- [Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 75](#)
- [Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 77](#)
- [Understanding Root Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 78](#)
- [Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on page 79](#)
- [Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 84](#)
- [Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches on page 89](#)
- [Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX Series Switches on page 93](#)
- [Configuring BPDU Protection on Spanning Tree Interfaces on page 98](#)

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 75](#)
- [Protecting Switches from Incompatible BPDUs on page 76](#)

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 such as 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 forwards BPDUs generated by spanning-tree protocols. In this case, you protect the device from BPDUs generated by the STP on the switch.

To prevent a switch from forwarding BPDUs generated by spanning-tree protocols to a device, you can enable **bpdu-block** on an interface.

- On Juniper Networks EX Series Ethernet Switches that run Juniper Networks Junos operating system (Junos OS) that supports the Enhanced Layer 2 Software (ELS) configuration style, enable **bpdu-block** at the **[edit protocols layer2-control]** hierarchy level. To clear the BPDU error, use [clear error bpdu interface](#).
- On EX Series switches that run Junos OS that does not support the ELS configuration style, enable **bpdu-block** at the **[edit ethernet-switching-options]** hierarchy level. To clear the BPDU error, use *clear bpdu-error*

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 depending on the configuration defined in the **bpdu-block** statement. If the interface continues to be open after dropping all incompatible BPDUs, all packets except incompatible BPDUs continue to ingress and egress through the interface.

If the interface shuts down after dropping all BPDUs, you can re-enable the interface as follows:

- On Juniper Networks EX Series and QFX Series switches running Juniper Networks Junos operating system (Junos OS) that supports the Enhanced Layer 2 Software (ELS) configuration style:
 - Include the **disable-timeout** statement at the **[edit protocols layer2-control bpdu-block]** hierarchy level to enable the interfaces to automatically return to service when the specified timer expires.
 - Issue the operational mode command [clear error bpdu interface](#) on the switch.

- On EX Series switches running Junos OS that does not support the ELS configuration style:
 - Include the **disable-timeout** statement at the [edit ethernet-switching-options bpd-block] hierarchy level to enable the interfaces to automatically return to service when the specified timer expires.
 - Issue the operational mode command **clear bpd-error** on the switch.

Related Documentation

- [Configuring BPDU Protection on Spanning Tree Interfaces on page 98](#)
- [Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches](#)
- [Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches](#)
- [Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on page 79](#)
- [Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches on page 84](#)
- [Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 77](#)
- [Understanding Root Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 78](#)

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 does not 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*
- [Understanding Root Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 78](#)
- [Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 75](#)
- [Understanding MSTP for EX Series and QFX Series Switches on page 29](#)
- [Understanding RSTP for EX Series and QFX Series Switches on page 3](#)
- [Understanding STP for EX Series Switches](#)
- [Understanding VSTP for EX Series Switches and QFX Series Switches on page 57](#)

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 must not receive superior BPDUs from the root bridge and must 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

- [Configuring BPDU Protection on Spanning Tree Interfaces on page 98](#)
- *Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX Series Switches*
- *Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches*
- *Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches*
- *Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches*
- [Understanding MSTP for EX Series and QFX Series Switches on page 29](#)
- [Understanding RSTP for EX Series and QFX Series Switches on page 3](#)
- [Understanding STP for EX Series Switches](#)
- [Understanding VSTP for EX Series Switches and QFX Series Switches on page 57](#)

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

EX Series and QFX Series switches provide Layer 2 loop prevention through 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 80](#)
- [Overview and Topology on page 80](#)
- [Configuration on page 81](#)
- [Verification on page 82](#)

Requirements

This example uses the following software and hardware components:

- Two EX Series switches in an RSTP topology
- Junos OS Release 13.2X50-D10 or later or later for EX Series or QFX 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 RSTP or MSTP topology, however, can lead to network outages by triggering an STP misconfiguration. To prevent such outages, enable BPDU protection on spanning tree 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 spanning tree interface.

[Figure 3 on page 81](#) 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** and interface **ge-0/0/6** 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

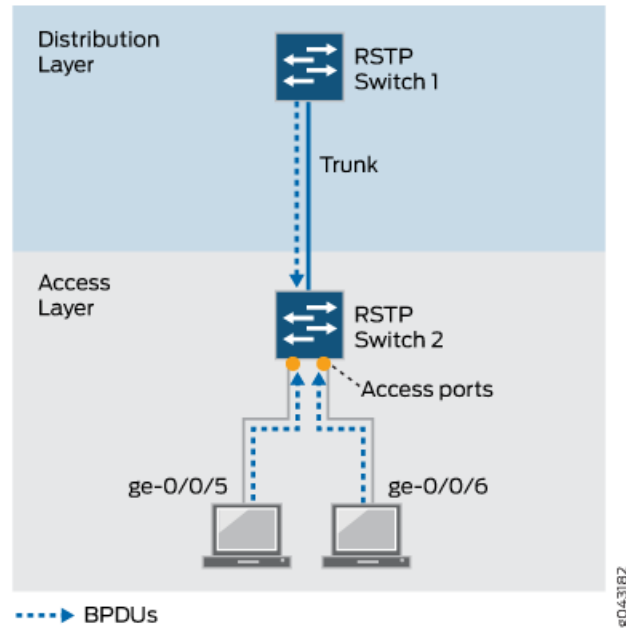


Table 9 on page 81 shows the components that will be configured for BPDU protection.

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: <ul style="list-style-type: none"> • ge-0/0/5 • ge-0/0/6

This configuration example uses RSTP topology. You also can configure BPDU protection for MSTP topologies at the `[edit protocols mstp]` 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:



NOTE: This example configures BPDU protection on specific interfaces. However, starting with Junos OS Release 15.1 for EX Series and QFX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style, you can configure BPDU protection globally on all spanning tree interfaces. See [“Configuring BPDU Protection on Spanning Tree Interfaces” on page 98](#) for additional information.

```
[edit]
set protocols rstp interface ge-0/0/5 edge
set protocols rstp interface ge-0/0/6 edge
set protocols rstp bpdv-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** and interface **ge-0/0/6**, and configure them as edge ports:

```
[edit protocols rstp]
user@switch# set interface ge-0/0/5 edge
user@switch# set interface ge-0/0/6 edge
```

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

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

Results Check the results of the configuration:

```
user@switch> show configuration protocols rstp
interface ge-0/0/5 {
  edge;
}
interface ge-0/0/6 {
  edge;
}
bpdv-block-on-edge;
```

Verification

To confirm that the configuration is working properly:

- [Displaying the Interface State Before BPDU Protection Is Triggered on page 82](#)
- [Verifying That BPDU Protection Is Working Correctly on page 83](#)

Displaying the Interface State Before BPDU Protection Is Triggered

Purpose Before BPDUs can be received from PCs connected to interface **ge-0/0/5** and interface **ge-0/0/6**, 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 port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/1	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/2	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/3	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/4	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/5	128:518	128:518	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/6	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** and interface **ge-0/0/6** 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** and interface **ge-0/0/6**. 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 port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/1	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/2	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/3	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/4	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/5	128:518	128:518	32768.0019e2503f00	20000	BLK	DIS
(Bpdu-Incon)						
ge-0/0/6	128:519	128:519	32768.0019e2503f00	20000	BLK	DIS
(Bpdu-Incon)						
ge-0/0/7	128:520	128:1	16384.00aabbcc0348	20000	FWD	ROOT
ge-0/0/8	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** and interface **ge-0/0/6** 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 reenables 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 error bpd**u to unblock and reenab

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: Faster Convergence and Improved Network Stability with RSTP on EX Series Switches*
- *Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches*
- *Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches*
- *Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX Series Switches*
- [Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 75](#)

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



NOTE: This example uses Junos OS for EX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Example: Configuring BPDU Protection on Interfaces to Prevent STP Miscalculations on EX Series Switches*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

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 when any incompatible BPDU is encountered, thereby preventing the BPDUs generated by spanning-tree protocols from reaching the switch.

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

- [Requirements on page 85](#)
- [Overview and Topology on page 85](#)

- [Configuration on page 86](#)
- [Verification on page 87](#)

Requirements

This example uses the following software and hardware components:

- One EX Series switch in an RSTP topology
- One EX Series switch that is not in any spanning-tree topology
- Junos OS Release 13.2X50-D10 or later 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 RSTP on Switch 2



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

Overview and Topology

EX Series switches provide Layer 2 loop prevention through 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. In this scenario, an interface is shutdown when it encounters an outside BPDU.

[Figure 3 on page 81](#) shows the topology for this example. Switch 1 and Switch 2 are connected through a trunk interface. Switch 1 is configured for RSTP and Switch 2 does not have a spanning-tree protocol configured on it.

This example configures downstream BPDU protection on Switch 2 interfaces **ge-0/0/5** and **ge-0/0/6**. When BPDU protection is enabled, the switch interfaces will shut down 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

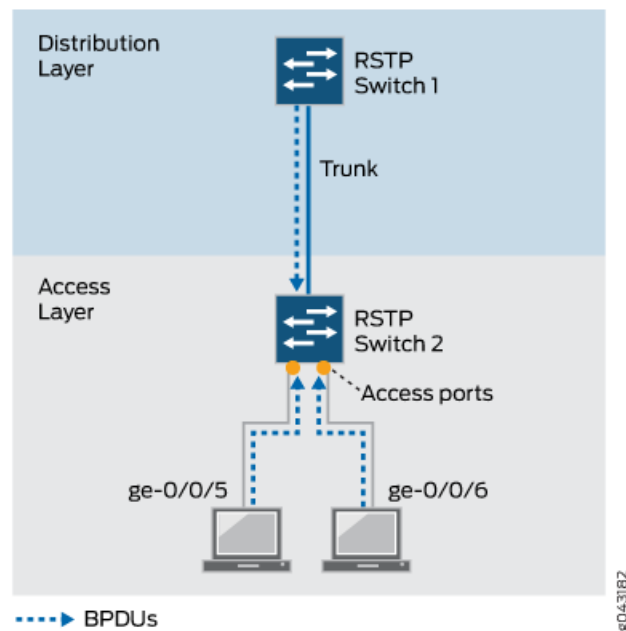


Table 10 on page 86 shows the components that will be configured for BPDU protection.

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.
Switch 2 (Access Layer)	Switch 2 has two downstream access ports connected to laptops: <ul style="list-style-type: none"> • <code>ge-0/0/5</code> • <code>ge-0/0/6</code>

Configuration

To configure BPDU protection on the interfaces:

CLI Quick Configuration This configuration causes the interface to automatically shutdown if it receives BPDUs. To quickly configure BPDU protection on Switch 2, copy the following commands and paste them into the switch terminal window:



NOTE: This example configures BPDU protection on specific interfaces. However, starting with Junos OS Release 15.1 for EX Series and QFX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style, you can configure BPDU protection globally on all spanning tree interfaces. See [“Configuring BPDU Protection on Spanning Tree Interfaces” on page 98](#) for additional information.

```
[edit]
user@switch# set protocols layer2-control bpd-block interface ge-0/0/5
[edit]
user@switch# set protocols layer2-control bpd-block interface ge-0/0/6
```

Step-by-Step Procedure

To configure BPDU protection for automatic shutdown.

1. To shutdown the BPDU interface on the downstream interface **ge-0/0/5** on Switch 2:

```
[edit protocol layer 2]
user@switch# set bpd-block interface ge-0/0/5
```
2. To shutdown the BPDU interface on the downstream interface **ge-0/0/6** on Switch 2:

```
[edit protocol layer 2]
user@switch# set bpd-block interface ge-0/0/6
```

Results Check the results of the configuration:

```
user@switch> show protocol layer 2
bpd-block {
  interface ge-0/0/5 {
  interface ge-0/0/6 {
}
```

Verification

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

- [Displaying the Interface State Before BPDU Protection Is Triggered on page 87](#)
- [Verifying That BPDU Shutdown Protection Is Working Correctly on page 88](#)

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** or interface **ge-0/0/6**, confirm the state of those interfaces.

Action Use the operational mode command **show interfaces extensive <interface name>**:

```
user@switch> show interfaces extensive ge-0/0/5
```

```
Physical interface: ge-0/0/5, Enabled, Physical link is Down
  Interface index: 659, SNMP ifIndex: 639, Generation: 161
  Link-level type: Ethernet, MTU: 1514, MRU: 0, Link-mode: Auto, Speed: Auto,
  BPDU Error: Detected, MAC-REWRITE Error: None, Loopback: Disabled,
  Source filtering: Disabled, Flow control: Disabled, Auto-negotiation: Enabled,

  Remote fault: Online, Media type: Copper,
  IEEE 802.3az Energy Efficient Ethernet: Disabled
  Device flags   : Present Running Down
  Interface flags: Hardware-Down SNMP-Traps Internal: 0x4000
  Link flags     : None
  CoS queues    : 12 supported, 12 maximum usable queues
  Hold-times    : Up 0 ms, Down 0 ms
```

Meaning The output from the operational mode command **show interfaces extensive** shows that **ge-0/0/5** is enabled.

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 interfaces extensive <interface name>** to see what happened when the BPDUs reached the two interfaces configured for BPDU protection on Switch 2:

```
user@switch> show interfaces extensive ge-0/0/5
Physical interface: ge-0/0/5, Enabled, Physical link is Down
  Interface index: 659, SNMP ifIndex: 639, Generation: 161
  Link-level type: Ethernet, MTU: 1514, MRU: 0, Link-mode: Auto, Speed: Auto,
  BPDU Error: Detected, MAC-REWRITE Error: None, Loopback: Disabled,
  Source filtering: Disabled, Flow control: Disabled, Auto-negotiation: Enabled,

  Remote fault: Online, Media type: Copper,
  IEEE 802.3az Energy Efficient Ethernet: Disabled
  Device flags   : Present Running Down
  Interface flags: Hardware-Down SNMP-Traps Internal: 0x4000
  Link flags     : None
  CoS queues    : 12 supported, 12 maximum usable queues
  Hold-times    : Up 0 ms, Down 0 ms
```

Meaning When the BPDUs sent from laptops reached interface **ge-0/0/5** on Switch 2, the interface transitioned to a BPDU inconsistent state, shutting down the interface to prevent BPDUs from reaching the laptops.

You need to reenabling the blocked interface. 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 error bpd interface interface-name** to unblock and reenabling **ge-0/0/5**. This command

will only reenable 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 interface on Switch 2 again, BPDU protection is triggered again and the interface shuts down. In such cases, you must find and repair the misconfiguration that is sending BPDUs to interface **ge-0/0/5**.

Related Documentation

- *Example: Faster Convergence and Improved Network Stability with RSTP on EX Series Switches*
- *Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on EX Series Switches*
- *Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches*
- *Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX Series Switches*
- [Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 75](#)

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



NOTE: This example uses Junos OS for EX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

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 90](#)
- [Overview and Topology on page 90](#)
- [Configuration on page 91](#)
- [Verification on page 92](#)

Requirements

This example uses the following software and hardware components:

- Junos OS Release 13.2X50-D10 or later 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 91](#). 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

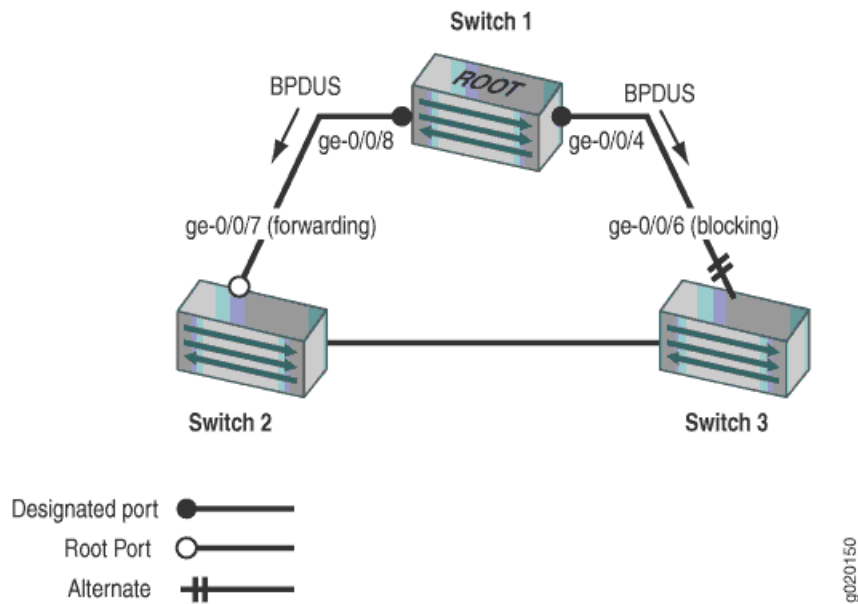


Table 11 on page 91 shows the components that will be configured for loop protection.

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 MSTP topologies at the `[edit protocols mstp]` 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 block
```

Results Check the results of the configuration:

```
user@switch> show configuration protocols rstp
interface ge-0/0/6 {
  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 92](#)
- [Verifying That Loop Protection Is Working on an Interface on page 92](#)

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 port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/1	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/2	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/3	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/4	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/5	128:518	128:518	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/6	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** 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 port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/1	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/2	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/3	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/4	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/5	128:518	128:518	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/6	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** 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. To clear the BPDU error, issue the operational mode command **clear error bpdv interface** on the switch. The interface recovers and transitions back to its original state as soon as it receives BPDUs.

- Related Documentation**
- [Example: Configuring Faster Convergence and Improved Network Stability with RSTP on page 8](#)
 - [Understanding Loop Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 77](#)

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



NOTE: This example uses Junos OS for EX Series switches with support for the Enhanced Layer 2 Software (ELS) configuration style. If your switch runs software that does not support ELS, see *Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX Series Switches*. For ELS details, see *Getting Started with Enhanced Layer 2 Software*.

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 94](#)
- [Overview and Topology on page 94](#)
- [Configuration on page 96](#)
- [Verification on page 96](#)

Requirements

This example uses the following software and hardware components:

- Junos OS Release 13.2X50-D10 or later 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 must not receive superior BPDUs from the root bridge and must 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.

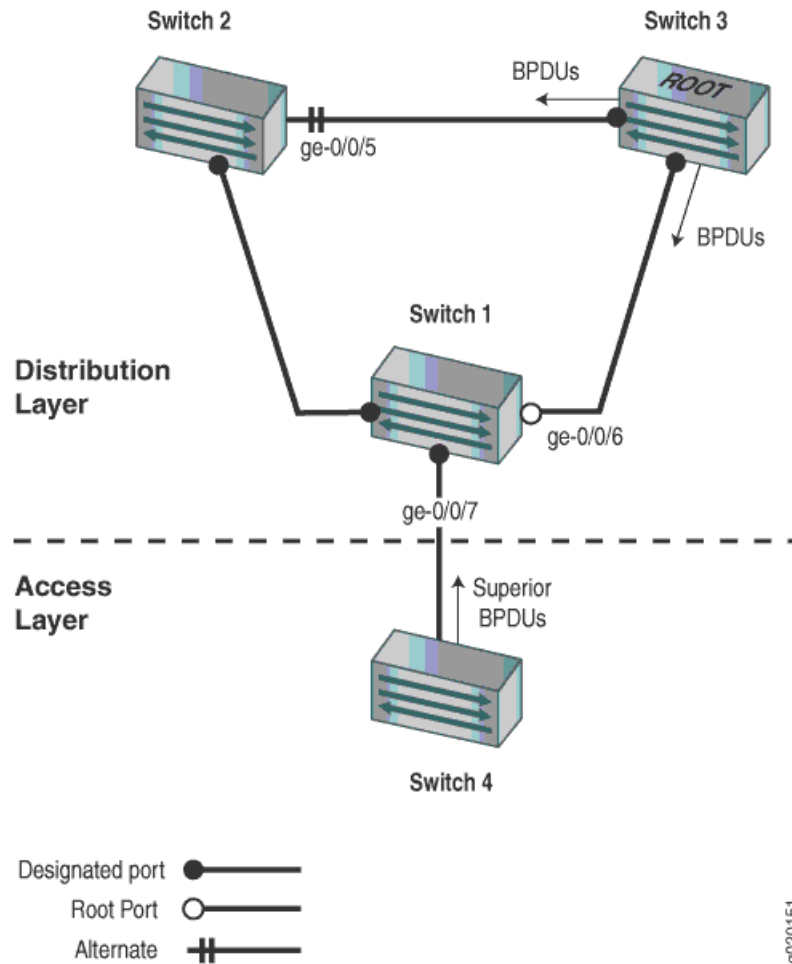


CAUTION: An interface can be configured for either root protection or loop protection, but not for both.

Four EX Series switches are displayed in [Figure 6 on page 95](#). 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 95](#) 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 root protection is configured on interface ge-0/0/7 , Switch 4 will send superior BPDUs that will trigger root 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]` 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
```

Results

Check the results of the configuration:

```
user@switch> show configuration protocols rstp
interface ge-0/0/7 {
    no-root-port;
}
```

Verification

To confirm that the configuration is working properly:

- [Displaying the Interface State Before Root Protection Is Triggered on page 96](#)
- [Verifying That Root Protection Is Working on the Interface on page 97](#)

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 port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/1	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/2	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/3	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/4	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/5	128:518	128:2	16384.00aabbcc0348	20000	BLK	ALT
ge-0/0/6	128:519	128:1	16384.00aabbcc0348	20000	FWD	ROOT
ge-0/0/7	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** 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 port ID	Designated bridge ID	Port Cost	State	Role
ge-0/0/0	128:513	128:513	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/1	128:514	128:514	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/2	128:515	128:515	32768.0019e2503f00	20000	BLK	DIS
ge-0/0/3	128:516	128:516	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/4	128:517	128:517	32768.0019e2503f00	20000	FWD	DESG
ge-0/0/5	128:518	128:2	16384.00aabbcc0348	20000	BLK	ALT
ge-0/0/6	128:519	128:1	16384.00aabbcc0348	20000	FWD	ROOT
ge-0/0/7	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** has transitioned to a root inconsistent state. The root inconsistent state makes the interface block, discarding any received BPDUs, 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 Improved Network Stability with RSTP on page 8](#)
- [Example: Configuring Loop Protection to Prevent Interfaces from Transitioning from Blocking to Forwarding in a Spanning Tree on EX Series Switches on page 89](#)
- [Understanding Root Protection for STP, RSTP, VSTP, and MSTP on EX Series Switches on page 78](#)

Configuring BPDU Protection on Spanning Tree Interfaces



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

You can configure BPDU protection to ignore BPDU received on interfaces where none should be expected. If a BPDU is received on a blocked interface, the interface is disabled and stops forwarding frames. By default, all BPDUs are accepted and processed on all interfaces.

To configure BPDU protection for spanning-tree instance interfaces:

- On a specific spanning-tree interface:

1. To enable BPDU protection on a specified spanning-tree interface:

```
[edit protocols layer2-control bpd-block ]
user@switch# set interface (aex | (ge-fpc/pic/port | xe-fpc/pic/port))
```

If a BPDU is received on the interface, the system will disable the interface and stop forwarding frames out the interface until the bridging process is restarted.

2. (Optional) Configure the amount of time the system waits before *automatically* unblocking this interface after it has received a BPDU.

```
[edit protocols layer2-control bpd-block interface interface-name]
user@switch# set disable-timeout seconds
```

The range of the *seconds* option value is from 10 through 3600 seconds (one hour). A *seconds* option value of 0 is allowed, but this results in the default behavior (the interface is blocked until the interface is cleared).

- To disable BPDU protection for a specific spanning-tree interface

```
[edit protocols layer2-control bpd-block interface interface-name]
user@switch# set disable-timeout seconds
```

Related Documentation

- [Understanding BPDU Protection for Spanning-Tree Instance Interfaces](#)
- [BPDU Protection for Individual Spanning-Tree Instance Interfaces](#)
- [clear error bpd interface on page 144](#)

PART 6

Troubleshooting Information

- [Monitoring and Troubleshooting Procedures on page 101](#)

CHAPTER 6

Monitoring and Troubleshooting Procedures

- [Monitoring Spanning Tree Protocols on page 101](#)

Monitoring Spanning Tree Protocols

Purpose



NOTE: This topic applies only to the J-Web Application package.

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 13 on page 101](#) summarizes the spanning-tree protocol parameters.

Table 13: Summary of Spanning Tree Protocols Output Fields

Field	Values
Bridge Parameters	
Routing instance name	Displays bridge information for the specified routing instance.
NOTE: The option is supported only on EX4300 switches.	
Context ID	An internally generated identifier.
Enabled Protocol	Spanning-tree protocol type enabled.

Table 13: Summary of Spanning Tree Protocols Output Fields (*continued*)

Field	Values
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.
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.
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.
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 spanning-tree protocol topology changes detected since the switch last booted.
Time since last topology change	Number of seconds elapsed since the last topology change.
NOTE: This option is supported only on EX4300 switches.	
Spanning Tree Interface Details	
Interface Name	Interface configured to participate in the spanning-tree protocol instance.
Port ID	Logical interface identifier configured to participate in the spanning-tree protocol 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.

Table 13: Summary of Spanning Tree Protocols Output Fields (*continued*)

Field	Values
Port State	Spanning-tree protocol port state: <ul style="list-style-type: none"> • 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*
 - *show spanning-tree bridge*
 - [Configuring Spanning Tree Protocols \(J-Web Procedure\) on page 65](#)

PART 7

Configuration Statements and Operational Commands

- Configuration Statements on page 107
- Operational Commands on page 143

CHAPTER 7

Configuration Statements

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- [vlan](#) (MSTP) on page 137
- [vlan](#) (VSTP) on page 138

- [vlan-group on page 139](#)
- [vstp on page 140](#)

bpdu-block

Syntax	<pre>bpdu-block { interface (<i>interface-name</i> disable all); disable-timeout <i>seconds</i>; }</pre>
Hierarchy Level	[edit protocols layer2-control]
Release Information	Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.
Description	<p>Enable BPDU blocking on an interface.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Understanding BPDU Protection for Spanning-Tree Instance Interfaces</i>• <i>BPDU Protection for Individual Spanning-Tree Instance Interfaces</i>• <i>Configuring BPDU Protection for Spanning-Tree Instance Interfaces</i>• <i>show spanning-tree bridge</i>• <i>show spanning-tree interface</i>• Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 75

bpdu-block-on-edge

Syntax	bpdu-block-on-edge;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols (mstp rstp vstp)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp)], [edit protocols (mstp rstp vstp)], [edit routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp)]
Release Information	Statement introduced in Junos OS Release 9.4. Support for logical systems added in Junos OS Release 9.6.
Description	Enable BPDU blocking on the edge ports of a virtual switch.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • <i>Understanding BPDU Protection for Spanning-Tree Instance Interfaces</i> • <i>BPDU Protection on All Edge Ports of the Bridge</i> • <i>Configuring BPDU Protection on All Edge Ports</i> • Configuring BPDU Protection on Spanning Tree Interfaces on page 98 • rstp on page 133 • mstp on page 126 • vstp on page 140

bpdu-timeout-action

Syntax	bpdu-timeout-action (log block);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols (mstp rstp vstp)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp)], [edit protocols (mstp rstp vstp) interface], [edit routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp)]
Release Information	Statement introduced in Junos OS Release 9.4. Support for logical systems added in Junos OS Release 9.6.
Description	Provide STP loop protection for a given STP family protocol interface.
Default	If the bpdu-timeout-action statement is not configured, an interface that stops receiving BPDUs will transition to the designated port (forwarding) state, creating a potential loop.
Options	log —The interface logs the fact that it has not received BPDUs during the timeout interval. block —The interface is blocked and the fact that the interface has not received BPDUs during the timeout interval is logged.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Understanding Loop Protection for Spanning-Tree Instance Interfaces</i>• <i>Configuring Loop Protection for a Spanning-Tree Instance Interface</i>• <i>Example: Enabling Loop Protection for Spanning-Tree Protocols</i>• rstp on page 133• mstp on page 126• vstp on page 140

bridge-priority (Spanning Trees)

Syntax	<code>bridge-priority <i>priority</i>;</code>
Hierarchy Level	[edit protocols mstp], [edit protocols mstp msti <i>msti-id</i>], [edit protocols rstp], [edit protocols vstp vlan <i>vlan-id</i>]
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	<i>priority</i> —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	<ul style="list-style-type: none"> • show spanning-tree bridge • show spanning-tree interface • Example: Configuring Network Regions for VLANs with MSTP on page 32 • Understanding MSTP for EX Series and QFX Series Switches on page 29 • Understanding VSTP for EX Series Switches and QFX Series Switches on page 57

configuration-name

Syntax	<code>configuration-name <i>configuration-name</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mstp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols mstp], [edit protocols mstp], [edit routing-instances <i>routing-instance-name</i> protocols mstp]
Release Information	Statement introduced in Junos OS Release 8.4. Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Support for logical systems added in Junos OS Release 9.6.
Description	Specify the configuration name , which 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	<ul style="list-style-type: none">• <i>Understanding BPDUs Used for Exchanging Information Among Bridges</i>• <i>Configuring Multiple Spanning Tree Protocol</i>• Configuring MSTP on page 53• <i>show spanning-tree bridge</i>• <i>show spanning-tree interface</i>• Example: Configuring Network Regions for VLANs with MSTP on page 32• Example: Configuring Faster Convergence and Improved Network Stability with RSTP on page 8• Understanding MSTP for EX Series and QFX Series Switches on page 29

cost

Syntax	<code>cost cost;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>]</p>
Release Information	<p>Statement introduced in Junos OS Release 8.4.</p> <p>Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p>
Description	Configure link cost to control which bridge is the designated bridge and which port is the designated port. By default, the link cost is determined by the link speed.
Options	<p>cost—(Optional) Link cost associated with the port.</p> <p>Range: 1 through 200,000,000</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>Spanning-Tree Instance Interface</i> • <i>Spanning-Tree Instance Interface Cost</i> • <i>show spanning-tree bridge</i> • <i>show spanning-tree interface</i> • Understanding RSTP for EX Series and QFX Series Switches on page 3 • Understanding MSTP for EX Series and QFX Series Switches on page 29 • Understanding VSTP for EX Series Switches and QFX Series Switches on page 57

disable (Spanning Trees)

Syntax	disable;
Hierarchy Level	[edit protocols mstp interface <i>interface-name</i> , [edit protocols mstp msti <i>msti-id</i> vlan (all <i>vlan-id</i> <i>vlan-name</i>) interface <i>interface-name</i>], [edit protocols rstp interface <i>interface-name</i>], [edit protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>]
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 updated in Junos OS Release 15.1 for EX Series switches.
Description	Disable MSTP, RSTP, or VSTP on a specific interface.



NOTE: You cannot disable spanning tree parameters for all interfaces.

Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring RSTP (CLI Procedure) on page 24• Configuring MSTP on page 53• Configuring MSTP on page 53• Configuring VLAN Spanning Tree Protocol on page 60• <i>show spanning-tree bridge</i>• <i>show spanning-tree interface</i>

disable-timeout (Spanning Trees)

Syntax	<code>disable-timeout <i>seconds</i>;</code>
Hierarchy Level	[edit protocols layer2-control 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 is disabled by BPDU blocking. If this option is not configured, the interface is not periodically checked and remains disabled.
Default	The disable timeout is not enabled.
Options	<i>seconds</i> —Amount of time, in seconds, the interface receiving BPDUs protect is disabled. The range is 10 through 3600 seconds.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • show spanning-tree bridge • show spanning-tree interface • Example: Configuring Network Regions for VLANs with MSTP on page 32 • Example: Configuring Network Regions for VLANs with MSTP on page 32 • Example: Configuring BPDU Protection on Edge Interfaces to Prevent STP Miscalculations on page 79 • Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 75

edge

Syntax	edge;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>]</p>
Release Information	<p>Statement introduced in Junos OS Release 8.4.</p> <p>Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p>
Description	Configure interfaces as edge ports. Edge ports do not expect to receive BPDUs. If a BPDU is received, the port becomes a nonedge port.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Spanning-Tree Instance Interface • Configuring a Spanning-Tree Instance Interface as an Edge Port for Faster Convergence • show spanning-tree bridge • show spanning-tree interface • Example: Configuring Network Regions for VLANs with MSTP on page 32 • Example: Configuring Faster Convergence and Improved Network Stability with RSTP on page 8 • Understanding VSTP for EX Series Switches and QFX Series Switches on page 57

force-version (IEEE 802.1D STP)

Syntax	force-version stp;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols (rstp vstp)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols (rstp vstp)], [edit protocols (rstp vstp)], [edit routing-instances <i>routing-instance-name</i> protocols (rstp vstp)]
Release Information	Statement introduced in Junos OS Release 8.4. Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Support for logical systems added in Junos OS Release 9.6.
Description	Force the spanning-tree protocol version to be the original IEEE 802.1D STP.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • <i>Spanning-Tree Protocols Supported</i> • <i>RSTP or VSTP Forced to Run as IEEE 802.1D STP</i> • Reverting to RSTP or VSTP from Forced IEEE 802.1D STP on page 70 • Understanding RSTP for EX Series and QFX Series Switches on page 3 • Understanding VSTP for EX Series Switches and QFX Series Switches on page 57

forward-delay

Syntax	<code>forward-delay seconds;</code>
Hierarchy Level	<code>[edit logical-systems <i>logical-system-name</i> protocols (mstp rstp)],</code> <code>[edit logical-systems <i>logical-system-name</i> protocols vstp vlan <i>vlan-id</i>],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols</code> <code> (mstp rstp)],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols</code> <code> vstp vlan <i>vlan-id</i>],</code> <code>[edit protocols (mstp rstp)],</code> <code>[edit protocols vstp vlan <i>vlan-id</i>],</code> <code>[edit routing-instances <i>routing-instance-name</i> protocols (mstp rstp)],</code> <code>[edit routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i>]</code>
Release Information	Statement introduced in Junos OS Release 8.4. Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Support for logical systems added in Junos OS Release 9.6.
Description	For 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.
Options	seconds —(Optional) Number of seconds the bridge port remains in the listening and learning states. Range: 4 through 30 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	<ul style="list-style-type: none">• Forward Delay Before Ports Transition to Forwarding State• show spanning-tree bridge• show spanning-tree interface• Example: Configuring Network Regions for VLANs with MSTP on page 32• Example: Configuring Faster Convergence and Improved Network Stability with RSTP on page 8• Understanding MSTP for EX Series and QFX Series Switches on page 29• Understanding VSTP for EX Series Switches and QFX Series Switches on page 57

hello-time

Syntax	<code>hello-time seconds;</code>
Hierarchy Level	<pre>[edit logical-systems <i>logical-system-name</i> protocols (mstp rstp)], [edit logical-systems <i>logical-system-name</i> protocols vstp vlan <i>vlan-id</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols (mstp rstp)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i>], [edit protocols (mstp rstp)], [edit protocols vstp vlan <i>vlan-id</i>], [edit routing-instances <i>routing-instance-name</i> protocols (mstp rstp)], [edit routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i>]</pre>
Release Information	<p>Statement introduced in Junos OS Release 8.4.</p> <p>Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p>
Description	Specify the number of seconds between transmissions of configuration BPDUs by the root bridge.
Options	<p>seconds—(Optional) Number of seconds between transmissions of configuration BPDUs.</p> <p>Range: 1 through 10</p> <p>Default: 2 seconds</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Hello Time for Root Bridge to Transmit Hello BPDUs • show spanning-tree bridge • show spanning-tree interface • Example: Configuring Network Regions for VLANs with MSTP on page 32 • Example: Configuring Faster Convergence and Improved Network Stability with RSTP on page 8 • Understanding MSTP for EX Series and QFX Series Switches on page 29 • Understanding VSTP for EX Series Switches and QFX Series Switches on page 57

interface (BPDU Blocking)

Syntax	<code>interface <i>interface-name</i>;</code>
Hierarchy Level	[edit protocols layer2-control bpdu-block]
Release Information	Statement introduced in Junos OS Release 9.4. Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.
Description	Configure the interface to participate in BPDU blocking.
Options	<i>interface-name</i> —Name of a Gigabit Ethernet or 10-Gigabit Ethernet interface.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Understanding BPDU Protection for Spanning-Tree Instance Interfaces</i>• <i>BPDU Protection for Individual Spanning-Tree Instance Interfaces</i>• <i>Configuring BPDU Protection for Spanning-Tree Instance Interfaces</i>• <i>show spanning-tree bridge</i>• <i>show spanning-tree interface</i>• Understanding BPDU Protection for STP, RSTP, and MSTP on EX Series Switches on page 75

interface (Spanning Tree)

Syntax	<pre>interface (<i>interface-name</i> disable all){ bpdu-timeout-action { alarm; block; } cost <i>cost</i>; edge; mode (p2p shared); no-root-port; priority <i>interface-priority</i>; }</pre>
Hierarchy Level	<pre>[edit protocols (<i>mstp</i> <i>rstp</i> <i>vstp</i>)], [edit protocols vstp vlan <i>vlan-id</i>], [edit protocols vstp <i>vlan-group</i> group <i>group-name</i> vlan (<i>vlan-id</i> <i>vlan-range</i> open-set-of-values)</pre>
Release Information	<p>Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.</p> <p>Statement updated in Junos OS Release 15.1 for EX Series switches to support configuration of spanning tree parameters globally on all interfaces.</p>



NOTE: You cannot disable spanning tree parameters globally on all interfaces.

Description	Configure the interface to participate in the RSTP, MSTP, or VSTP instance.
Options	<p><i>interface-name</i>—Name of a Gigabit Ethernet or 10-Gigabit Ethernet interface.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring RSTP (CLI Procedure) on page 24 • Configuring MSTP on page 53 • Configuring MSTP on page 53 • Configuring VLAN Spanning Tree Protocol on page 60 • show spanning-tree interface • Understanding RSTP for EX Series and QFX Series Switches on page 3 • Understanding MSTP for EX Series and QFX Series Switches on page 29 • Understanding VSTP for EX Series Switches and QFX Series Switches on page 57


max-age

Syntax	<code>max-age seconds;</code>
Hierarchy Level	<code>[edit logical-systems <i>logical-system-name</i> protocols (mstp rstp)],</code> <code>[edit logical-systems <i>logical-system-name</i> protocols vstp vlan <i>vlan-id</i>],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols</code> <code> (mstp rstp)],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols</code> <code> vstp vlan <i>vlan-id</i>],</code> <code>[edit protocols (mstp rstp)],</code> <code>[edit protocols vstp vlan <i>vlan-id</i>],</code> <code>[edit routing-instances <i>routing-instance-name</i> protocols (mstp rstp)],</code> <code>[edit routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i>]</code>
Release Information	Statement introduced in Junos OS Release 8.4. Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Support for logical systems added in Junos OS Release 9.6.
Description	Specify the maximum expected arrival time of hello BPDUs.
Options	seconds —(Optional) Number of seconds expected between hello BPDUs. Range: 6 through 40 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	<ul style="list-style-type: none">• <i>Maximum Age for Awaiting Arrival of Hello BPDUs</i>• <i>show spanning-tree bridge</i>• <i>show spanning-tree interface</i>• Example: Configuring Network Regions for VLANs with MSTP on page 32• Example: Configuring Faster Convergence and Improved Network Stability with RSTP on page 8• Understanding MSTP for EX Series and QFX Series Switches on page 29• Understanding VSTP for EX Series Switches and QFX Series Switches on page 57

max-hops

Syntax	<code>max-hops hops;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mstp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols mstp], [edit protocols mstp], [edit routing-instances <i>routing-instance-name</i> protocols mstp]
Release Information	Statement introduced in Junos OS Release 8.4. Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Support for logical systems added in Junos OS Release 9.6.
Description	Configure the maximum number of hops a BPDU can be forwarded in the MSTP region.
Options	hops —(Optional) Number of hops the BPDU can be forwarded. Range: 1 through 255 Default: 19 hops
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring Multiple Spanning Tree Protocol • Configuring MSTP on page 53 • show spanning-tree bridge • show spanning-tree interface • Example: Configuring Network Regions for VLANs with MSTP on page 32 • Understanding MSTP for EX Series and QFX Series Switches on page 29

mode

Syntax	<code>mode (p2p shared);</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>]</p>
Release Information	<p>Statement introduced in Junos OS Release 8.4.</p> <p>Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p>
Description	Configure link mode to identify point-to-point links.
Default	When the link is configured as full-duplex, the default link mode is p2p . When the link is configured half-duplex, the default link mode is shared .
<div>  NOTE: </div>	
Options	<p>p2p—The link is point to point.</p> <p>shared—The link is shared media.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Spanning-Tree Instance Interface • Spanning-Tree Instance Interface Point-to-Point Link Mode • show spanning-tree bridge • show spanning-tree interface • Example: Configuring Network Regions for VLANs with MSTP on page 32 • Example: Configuring Faster Convergence and Improved Network Stability with RSTP on page 8 • Understanding VSTP for EX Series Switches and QFX Series Switches on page 57

msti

Syntax `msti msti-id {
 bridge-priority priority;
 vlan (vlan-id | vlan-range|open-set-of-values);
 interface (interface-name | all) {
 cost cost;
 edge;
 priority interface-priority;
 }
 }`

Hierarchy Level [edit protocols [mstp](#)],
 [edit routing-instances *routing-instance-name* protocols mstp]

Release Information Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.
 Statement updated in Junos OS Release 15.1 for EX Series switches to support configuration of spanning tree parameters globally on all interfaces.



NOTE: You cannot disable spanning tree parameters globally on all interfaces.

Description Configure the multiple spanning-tree instance (MSTI) identifier.

Options *msti-id*—MSTI instance identifier.
Range: 1 through 4094

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

- [Configuring MST Instances on a Physical Interface](#)
- [Configuring MSTP on page 53](#)
- [Example: Configuring Network Regions for VLANs with MSTP on page 32](#)
- [Understanding MSTP for EX Series and QFX Series Switches on page 29](#)

mstp

```
Syntax  mstp {
    bpdu-block-on-edge;
    bridge-priority priority;
    configuration-name configuration-name;
    disable;
    forward-delay seconds;
    hello-time seconds;
    interface (interface-name disable | all){
    bpdu-timeout-action {
        alarm;
        block;
    }
    cost cost;
    edge;
    mode (p2p | shared);
    no-root-port;
    priority interface-priority;
    }
    max-age seconds;
    max-hops hops;
    priority-hold-time seconds;
    revision-level revision-level;
    interface (interface-name disable | all){
        bpdu-timeout-action {
            alarm;
            block;
        }
        cost cost;
        disable;
        edge;
        mode (p2p | shared);
        no-root-port;
        priority interface-priority;
    }
    msti msti-id {
        bridge-priority priority;
        interface (interface-name disable | all){
            cost cost;
            edge;
            priority interface-priority;
        }
        vlan (vlan-id | vlan-range | open-set-of-values);
        interface all
    }
    }
    traceoptions {
        file filename <files number> <size size> <world-readable | no-world-readable>;
        flag flag <flag-modifier> <disable>;
    }
}
```

Hierarchy Level [edit protocols]

Release Information Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Statement updated in Junos OS Release 15.1 for EX Series switches to support configuration of spanning tree parameters globally on all interfaces.



NOTE: You cannot disable spanning tree parameters globally on all interfaces.

Description Configure MSTP parameters.

Options The statements are explained separately.

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

Related Documentation

- [Configuring MSTP on page 53](#)
- [Example: Configuring Network Regions for VLANs with MSTP on page 32](#)

no-root-port

Syntax	no-root-port;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>]</p>
Release Information	<p>Statement introduced in Junos OS Release 9.1.</p> <p>Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p>
Description	Ensure the port is the spanning-tree designated port. If the port receives superior bridge protocol data unit (BPDU) packets, root protect moves this port to a root-prevented spanning-tree state.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none">• <i>Understanding Root Protection for Spanning-Tree Instance Interfaces in a Layer 2 Switched Network</i>• <i>Root Protect for a Spanning-Tree Instance Interface</i>• <i>Enabling Root Protection for a Spanning-Tree Instance Interface</i>

priority (Protocols STP)

Syntax	<code>priority interface-priority;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp) interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols mstp msti <i>msti-id</i> interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols vstp vlan <i>vlan-id</i> interface <i>interface-name</i>]</p>
Release Information	<p>Statement introduced in Junos OS Release 8.4.</p> <p>Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p>
Description	Use the interface priority to control which interface is elected as the root port. The interface priority must be set in increments of 16.
Options	<p>priority—(Optional) Interface priority.</p> <p>Range: 0 through 240</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>Spanning-Tree Instance Interface</i> • <i>Configuring a Spanning-Tree Instance Interface as an Edge Port for Faster Convergence</i> • <i>Spanning-Tree Instance Interface Priority</i> • <i>[edit protocols mstp] Configuration Statement Hierarchy on EX Series Switches</i> • <i>[edit protocols rstp] Configuration Statement Hierarchy on EX Series and QFX Series Switches</i> • <i>[edit protocols vstp] Configuration Statement Hierarchy on EX Series and QFX Series Switches</i>

protocol

Syntax	<code>protocol (cdp stp vtp pvstp);</code>
Hierarchy Level	[edit protocols layer2-control mac-rewrite interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 9.1. Statement introduced in Junos OS Release 13.2 for QFX series. Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Support for PVSTP introduced in Junos OS Release 13.3.
Description	Configure the protocol to be tunneled on an interface for Layer 2 protocol tunneling. To tunnel multiple protocols, include multiple protocol statements.
Options	cdp —Tunnel the Cisco discovery protocol. stp —Tunnel all versions of the spanning-tree protocol. vtp —Tunnel the VLAN trunk protocol. pvstp —Tunnel the Per-VLAN Spanning Tree Plus (PVST+) protocol
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Layer 2 Protocol Tunneling Through a Network Overview</i>• <i>Layer 2 Protocol Tunneling Configuration Guidelines</i>• <i>Layer 2 Protocol to be Tunneled</i>• <i>Configuring Layer 2 Protocol Tunneling</i>

protocols (STP Type)

Syntax	<pre> protocols { mstp { ... } rstp { ... } vstp { ... } } </pre>
Hierarchy Level	[edit], [edit logical-systems <i>logical-system-name</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i>], [edit routing-instances <i>routing-instance-name</i>]
Release Information	Statement introduced in Junos OS Release 8.4. Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Support for logical systems added in Junos OS Release 9.6.
Description	Configure the Spanning Tree Protocol type as MSTP, RSTP, or VSTP.
Options	mstp —Configure the protocol as Multiple Spanning Tree. rstp —Configure the protocol as Rapid Spanning Tree. vstp —Configure the protocol as VLAN Spanning Tree.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring RSTP (CLI Procedure) on page 24 • Configuring MSTP on page 53 • Configuring MST Instances on a Physical Interface • Configuring VLAN Spanning Tree Protocol on page 60 • Configuring Rapid Spanning Tree Protocol • Configuring Multiple Spanning Tree Protocol • Configuring VLAN Spanning Tree Protocol • Understanding MSTP for EX Series and QFX Series Switches on page 29

revision-level

Syntax	<code>revision-level <i>revision-level</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mstp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols mstp], [edit protocols mstp], [edit routing-instances <i>routing-instance-name</i> protocols mstp]
Release Information	Statement introduced in Junos OS Release 8.4. Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Support for logical systems added in Junos OS Release 9.6.
Description	Set the revision number of the MSTP configuration.
Options	<i>revision-level</i> —Configure the revision number of the MSTP region configuration. Range: 0 through 65,535
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Configuring Multiple Spanning Tree Protocol</i>• <i>show spanning-tree bridge</i>• <i>show spanning-tree interface</i>• Example: Configuring Network Regions for VLANs with MSTP on page 32• Understanding MSTP for EX Series and QFX Series Switches on page 29

rstp

Syntax

```
rstp {
  bpdublock-on-edge;
  bpdubdestination-mac-address provider-bridge-group;
  bridge-priority priority;
  disable;
  extended-system-id;
  force-version stp;
  forward-delay seconds;
  hello-time seconds;
  interface (interface-name disable | interface-range-name | all ){
    bpdubtimeout-action {
      alarm;
      block;
    }
    cost cost;
    edge;
    mode (p2p | shared);
    no-root-port;
    priority interface-priority;
  }
  max-age seconds;
  priority-hold-time seconds;
  traceoptions {
    file filename <files number> <size size> <world-readable | no-world-readable>;
    flag flag <flag-modifier> <disable>;
  }
}
```

Hierarchy Level [edit protocols]

Release Information Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.
Statement updated in Junos OS Release 15.1 for EX Series and QFX Series switches to support configuration of spanning tree parameters globally on all interfaces.



NOTE: You cannot disable spanning tree parameters globally on all interfaces.

Description Configure RSTP parameters.

Options 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

- [Configuring RSTP \(CLI Procedure\) on page 24](#)

traceoptions (Spanning Tree)

Syntax	<pre>traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols (mstp rstp vstp)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp)], [edit protocols (mstp rstp vstp vstp vlan <i>vlan-id</i>)], [edit routing-instances <i>routing-instance-name</i> protocols (mstp rstp vstp)]
Release Information	Statement introduced in Junos OS Release 8.4. Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Support for logical systems added in Junos OS Release 9.6.
Description	Set protocol-level tracing options for spanning-tree protocols.
Default	The default STP protocol-level trace options are inherited from the global traceoptions statement.
Options	<p>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.</p> <p>file <i>filename</i>—Name of the file to receive the output of the tracing operation. Enclose the name in quotation marks. We recommend that you place STP tracing output in the file <code>/var/log/stp-log</code>.</p> <p>files <i>number</i>—(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.</p> <p>If you specify a maximum number of files, you must also specify a maximum file size with the size option.</p> <p>Range: 2 through 1000 files Default: 1 trace file only</p> <p>flag—Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements. The following are the STP-specific tracing options:</p> <ul style="list-style-type: none">• all—Trace all operations.• all-failures—Trace all failure conditions.• bpdv—Trace BPDU reception and transmission.• 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-transit-state-machine**—Trace the port role transit state machine.
- **port-role-select-state-machine**—Trace the port role selection 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 ppm process.
- **state-machine-variables**—Trace when the state machine variables change.
- **timers**—Trace protocol timers.
- **topology-change-state-machine**—Trace the topology change state machine.

The following are the global tracing options:

- **all**—All tracing operations.
- **config-internal**—Trace configuration internals.
- **general**—Trace general events.
- **normal**—All normal events.

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **parse**—Trace configuration parsing.
- **policy**—Trace policy operations and actions.
- **regex-parse**—Trace regular-expression parsing.
- **route**—Trace routing table changes.
- **state**—Trace state transitions.
- **task**—Trace protocol task processing.
- **timer**—Trace protocol task timer processing.

no-world-readable—(Optional) Prevent any user from reading the log 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: **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

Range: 10 KB through the maximum file size supported on your system

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level	routing—To view this statement in the configuration.
	routing-control—To add this statement to the configuration.
Related Documentation	• <i>Spanning-Tree Protocol Trace Options</i>
	• <i>Tracing Spanning-Tree Operations</i>
	• <i>Example: Tracing Spanning-Tree Protocol Operations</i>

vlan (MSTP)

Syntax	<code>vlan <i>vlan-id</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols mstp msti <i>msti-id</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols mstp msti <i>msti-id</i>], [edit protocols mstp msti <i>msti-id</i>], [edit routing-instances <i>routing-instance-name</i> protocols mstp msti <i>msti-id</i>]</p>
Release Information	<p>Statement introduced in Junos OS Release 8.4.</p> <p>Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches.</p> <p>Support for logical systems added in Junos OS Release 9.6.</p>
Description	Configure the VLAN of an MSTI or VSTP instance or configure the VLAN range of an MSTI.
Options	<p><i>vlan-id</i>—The VLAN identifier associated with the MSTI.</p> <p><i>vlan-id-range</i>—Range of VLAN identifiers associated with the MSTI in the form <i>minimum-vlan-id-maximum-vlan-id</i>. VLAN identifier ranges are not supported for VSTP.</p> <p>Range: 1 through 4096</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring Multiple Spanning Tree Protocol • Configuring MSTP on page 53 • Understanding VSTP for EX Series Switches and QFX Series Switches on page 57

vlan (VSTP)

Syntax	<pre>vlan <i>vlan-id</i> { bridge-priority <i>priority</i>; forward-delay <i>seconds</i>; hello-time <i>seconds</i>; max-age <i>seconds</i>; interface <i>interface-name</i> { cost <i>cost</i>; edge; mode (p2p shared); no-root-port; priority <i>interface-priority</i>; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols vstp], [edit protocols vstp]
Release Information	Statement introduced in Junos OS Release 9.0. Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Support for logical systems added in Junos OS Release 9.6.
Description	Configure VSTP VLAN parameters.
Options	The statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Configuring VSTP (CLI Procedure)</i>• <i>Configuring VLAN Spanning Tree Protocol</i>• Understanding VSTP for EX Series Switches and QFX Series Switches on page 57

vlan-group

Syntax `vlan-group group group-name {
vlan (vlan-id |vlan-group |all) {
}`

Hierarchy Level [edit protocols [vstp](#)]

Release Information Statement introduced in Junos OS Release 15.1 for EX Series switches.

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



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 the maximum number of allowed VSTP VLANs.

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

- [vstp on page 140](#)
- *show spanning-tree bridge*
- *show spanning-tree interface*
- [Configuring VLAN Spanning Tree Protocol on page 60](#)
- [Understanding VSTP for EX Series Switches and QFX Series Switches on page 57](#)

vstp

```

Syntax  vstp {
        bpd-block-on-edge;
        disable;
        force-version stp;
        interface (interface-name disable | interface-range-name | all ){
            bpd-timeout-action {
                alarm;
                block;
            }
            cost cost;
            edge;
            mode (p2p | shared);
            no-root-port;
            priority interface-priority;
        }
        priority-hold-time seconds;
        vlan (vlan-id | all){
            bridge-priority priority;
            forward-delay seconds;
            hello-time seconds;
            max-age seconds;
            interface (interface-name disable | interface-range-name | all ){
                bpd-timeout-action {
                    alarm;
                    block;
                }
                cost cost;
                edge;
                mode (p2p | shared);
                no-root-port;
                priority interface-priority;
            }
        }
        traceoptions {
            file filename <files number> <size size> <world-readable | no-world-readable>;
            flag flag <flag-modifier> <disable>;
        }
        vlan-group group group-name {
            vlansvlan-name (vlan-id |vlan-range | open-set-of-values) {
                interface all;
                interface interface-name {
                    disable;
                }
            }
        }
    }

```

Hierarchy Level [edit protocols]

Release Information Statement introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Statement updated in Junos OS Release 15.1 for EX Series switches to support configuration of spanning tree parameters globally on all interfaces.



NOTE: You cannot disable spanning tree parameters globally on all interfaces.

Description	Configure VSTP parameters.
Options	The statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• <i>Configuring VSTP (CLI Procedure)</i>

CHAPTER 8

Operational Commands

- clear error bpdu interface
- clear spanning-tree protocol-migration
- clear spanning-tree statistics
- show spanning-tree bridge
- show spanning-tree interface
- show spanning-tree mstp configuration
- show spanning-tree statistics

clear error bpdu interface

Syntax	<code>clear error bpdu interface (all <i>interface-name</i>)</code>
Release Information	Command introduced in Junos OS Release 9.4. Command introduced in Junos OS Release 13.2X50-D10 for EX Series switches. Command supports all option in Junos OS Release 15.1 for EX Series switches.
Description	Clear a bridge protocol data unit (BPDU) error condition caused by the detection of a possible bridging loop from Spanning Tree Protocol (STP) operation.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• Configuring BPDU Protection on Spanning Tree Interfaces on page 98• Unblocking an Interface That Receives BPDUs in Error (CLI Procedure) on page 72
List of Sample Output	clear error bpdu interface on page 144
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear error bpdu interface

```
user@switch> clear error bpdu interface ge-1/1/1
```


clear spanning-tree protocol-migration


Syntax	<code>clear spanning-tree protocol-migration</code> <code><interface <i>interface-name</i>></code> <code><routing-instance <i>routing-instance-name</i>></code>
Release Information	Command introduced in Junos OS Release 9.0.
Description	Revert from the original IEEE 802.1D Spanning Tree Protocol (STP) back to the Rapid Spanning Tree Protocol after the force-version statement has been removed from the configuration.
Options	none —Reset the STP protocol for all interfaces and all routing instances. interface <i>interface-name</i> —(Optional) Reset the STP protocol for the specified interface only. routing-instance <i>routing-instance-name</i> —(Optional) Reset the STP protocol for a particular routing instance.
Additional Information	For information about the force-version statement, see the <i>Junos Routing Protocols Configuration Guide</i> .
Required Privilege Level	clear

Sample Output

clear spanning-tree protocol-migration

```
user@host> clear spanning-tree protocol-migration
```

clear spanning-tree statistics

List of Syntax	Syntax on page 146 Syntax (EX Series Switches and the QFX Series) on page 146
Syntax	clear spanning-tree statistics <interface <i>interface-name</i> > <logical-system <i>logical-system-name</i> >
Syntax (EX Series Switches and the QFX Series)	clear spanning-tree statistics <interface <i>interface-name</i> >
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 <i>interface-name</i> —(Optional) Clear STP statistics for the specified interface only. logical-system <i>logical-system-name</i> —(Optional) Clear STP statistics on a particular logical system.
<div> NOTE: The logical-system option is not available on QFabric systems.</div>	
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">show spanning-tree statistics on page 160
List of Sample Output	clear stp statistics on page 146

Sample Output

clear stp statistics

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

show spanning-tree bridge

List of Syntax [Syntax on page 147](#)
[Syntax \(QFX Series\) on page 147](#)

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 148](#)
[show spanning-tree bridge msti on page 149](#)
[show spanning-tree bridge vlan-id \(MSTP\) on page 150](#)
[show spanning-tree bridge \(RSTP\) on page 150](#)
[show spanning-tree bridge vlan-id \(RSTP\) on page 151](#)

Output Fields [Table 14 on page 147](#) lists the output fields for the **show spanning-tree bridge** command. Output fields are listed in the approximate order in which they appear.

Table 14: show spanning-tree bridge Output Fields

Field Name	Field Description
Routing instance name	Name of the routing instance under which the bridge is configured.
Enabled protocol	Spanning Tree Protocol type enabled.

Table 14: show spanning-tree bridge Output Fields (*continued*)

Field Name	Field Description
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.
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 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 1101 routing-instance vs1 detail
```

```
STP bridge parameters
Routing instance name          : vs1
Enabled protocol               : MSTP

STP bridge parameters for CIST
Root ID                        : 32768.00:13:c3:9e:c8:80
Root cost                      : 0
Root port                      : xe-10/2/0
CIST regional root             : 32768.00:13:c3:9e:c8:80
CIST internal root cost        : 22000
Hello time                     : 2 seconds
Maximum age                    : 20 seconds
Forward delay                   : 15 seconds
Hop count                      : 18
Message age                    : 0
Number of topology changes     : 0
Local parameters
  Bridge ID                     : 32768.00:90:69:0b:7f:d1
  Extended system ID            : 1
  Hello time                    : 2 seconds
  Maximum age                   : 20 seconds
  Forward delay                  : 15 seconds
  Path cost method               : 32 bit
  Maximum hop count              : 20
```

show spanning-tree bridge (RSTP)

```
user@host> show spanning-tree bridge
```

```
STP bridge parameters
Routing instance name          : GLOBAL
Enabled protocol               : RSTP
Root ID                        : 28672.00:90:69:0b:3f:d0
Hello time                     : 2 seconds
Maximum age                    : 20 seconds
Forward delay                   : 15 seconds
Message age                    : 0
Number of topology changes     : 58
Time since last topology change : 14127 seconds
Local parameters
  Bridge ID                     : 28672.00:90:69:0b:3f:d0
  Extended system ID            : 0

STP bridge parameters for bridge VLAN 10
Root ID                        : 28672.00:90:69:0b:3f:d0
Hello time                     : 2 seconds
Maximum age                    : 20 seconds
Forward delay                   : 15 seconds
Message age                    : 0
Number of topology changes     : 58
Time since last topology change : 14127 seconds
Local parameters
  Bridge ID                     : 28672.00:90:69:0b:3f:d0
```

```
Extended system ID          : 0

STP bridge parameters for bridge VLAN 20
Root ID                     : 28672.00:90:69:0b:3f:d0
Hello time                   : 2 seconds
Maximum age                  : 20 seconds
Forward delay                : 15 seconds
Message age                  : 0
Number of topology changes   : 58
Time since last topology change : 14127 seconds
Local parameters
  Bridge ID                  : 28672.00:90:69:0b:3f:d0
  Extended system ID         : 0
```

show spanning-tree bridge vlan-id (RSTP)

```
user@host> show spanning-tree bridge vlan-id 10
STP bridge parameters
Routing instance name        : GLOBAL
Enabled protocol             : RSTP

STP bridge parameters for VLAN 10
Root ID                     : 28672.00:90:69:0b:3f:d0
Hello time                   : 2 seconds
Maximum age                  : 20 seconds
Forward delay                : 15 seconds
Message age                  : 0
Number of topology changes   : 58
Time since last topology change : 14127 seconds
Local parameters
  Bridge ID                  : 28672.00:90:69:0b:3f:d0
  Extended system ID         : 0
```

show spanning-tree interface

List of Syntax	Syntax on page 152 Syntax (EX Series Switches and the QFX Series) on page 152
Syntax	<pre>show spanning-tree interface <brief detail> <msti <i>msti-id</i>> <routing-instance <i>routing-instance-name</i>> <vlan-id <i>vlan-id</i>></pre>
Syntax (EX Series Switches and the QFX Series)	<pre>show spanning-tree interface <brief detail> <msti <i>msti-id</i>> <vlan-id <i>vlan-id</i>></pre>
Release Information	<p>Command introduced in Junos OS Release 8.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.1 for the QFX Series.</p>
Description	Display the configured or calculated interface-level STP parameters.
Options	<p>none—Display brief STP interface information.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>msti <i>msti-id</i>—(Optional) Display STP interface information for the specified MST instance.</p> <p>routing-instance <i>routing-instance-name</i>—(Optional) Display STP interface information for the specified routing instance.</p> <p>vlan-id <i>vlan-id</i>—(Optional) Display STP interface information for the specified VLAN.</p>
Required Privilege Level	view
List of Sample Output	show spanning-tree interface on page 153 show spanning-tree interface (QFX Series) on page 154 show spanning-tree interface detail on page 154 show spanning-tree interface msti on page 156 show spanning-tree interface vlan-id on page 156 show spanning-tree interface (VSTP) on page 157 show spanning-tree interface vlan-id (VSTP) on page 157
Output Fields	<p>Table 15 on page 152 lists the output fields for the show spanning-tree interface command. Output fields are listed in the approximate order in which they appear.</p>

Table 15: 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 15: 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 port ID	Designated bridge ID	Port Cost	State	Role
ae1	128:1	128:1	32768.0090690b47d1	1000	FWD	DESG
ge-2/1/2	128:2	128:2	32768.0090690b47d1	20000	FWD	DESG
ge-2/1/5	128:3	128:3	32768.0090690b47d1	29999	FWD	DESG
ge-2/2/1	128:4	128:26	32768.0013c39ec880	20000	FWD	ROOT
xe-9/2/0	128:5	128:5	32768.0090690b47d1	2000	FWD	DESG
xe-9/3/0	128:6	128:6	32768.0090690b47d1	2000	FWD	DESG

```
Spanning tree interface parameters for instance 1
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ae1	128:1	128:1	32769.0090690b47d1	1000	FWD	DESG
ge-2/1/2	128:2	128:2	32769.0090690b47d1	20000	FWD	DESG
ge-2/1/5	128:3	128:3	32769.0090690b47d1	29999	FWD	DESG
ge-2/2/1	128:4	128:26	32769.0013c39ec880	20000	FWD	ROOT
xe-9/2/0	128:5	128:5	32769.0090690b47d1	2000	FWD	DESG
xe-9/3/0	128:6	128:6	32769.0090690b47d1	2000	FWD	DESG

Spanning tree interface parameters for instance 2

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ae1	128:1	128:1	32770.0090690b47d1	1000	FWD	DESG
ge-2/1/2	128:2	128:2	32770.0090690b47d1	20000	FWD	DESG
ge-2/1/5	128:3	128:3	32770.0090690b47d1	29999	FWD	DESG
ge-2/2/1	128:4	128:26	32770.0013c39ec880	20000	FWD	ROOT
xe-9/2/0	128:5	128:5	32770.0090690b47d1	2000	FWD	DESG
xe-9/3/0	128:6	128:6	32770.0090690b47d1	2000	FWD	DESG

show spanning-tree interface (QFX Series)

```
user@1f0> show spanning-tree interface routing-instance vs1 detail
```

```
Spanning tree interface parameters for instance 0
```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ae1	128:1	128:1	32768.0090690b47d1	1000	FWD	DESG
ge-2/1/2	128:2	128:2	32768.0090690b47d1	20000	FWD	DESG
ge-2/1/5	128:3	128:3	32768.0090690b47d1	29999	FWD	DESG
ge-2/2/1	128:4	128:26	32768.0013c39ec880	20000	FWD	ROOT
xe-9/2/0	128:5	128:5	32768.0090690b47d1	2000	FWD	DESG
xe-9/3/0	128:6	128:6	32768.0090690b47d1	2000	FWD	DESG

Spanning tree interface parameters for instance 1

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ae1	128:1	128:1	32769.0090690b47d1	1000	FWD	DESG
ge-2/1/2	128:2	128:2	32769.0090690b47d1	20000	FWD	DESG
ge-2/1/5	128:3	128:3	32769.0090690b47d1	29999	FWD	DESG
ge-2/2/1	128:4	128:26	32769.0013c39ec880	20000	FWD	ROOT
xe-9/2/0	128:5	128:5	32769.0090690b47d1	2000	FWD	DESG
xe-9/3/0	128:6	128:6	32769.0090690b47d1	2000	FWD	DESG

Spanning tree interface parameters for instance 2

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ae1	128:1	128:1	32770.0090690b47d1	1000	FWD	DESG
ge-2/1/2	128:2	128:2	32770.0090690b47d1	20000	FWD	DESG
ge-2/1/5	128:3	128:3	32770.0090690b47d1	29999	FWD	DESG
ge-2/2/1	128:4	128:26	32770.0013c39ec880	20000	FWD	ROOT
xe-9/2/0	128:5	128:5	32770.0090690b47d1	2000	FWD	DESG
xe-9/3/0	128:6	128:6	32770.0090690b47d1	2000	FWD	DESG

show spanning-tree interface detail

```
user@host> show spanning-tree interface routing-instance vs1 detail
```

```
Spanning tree interface parameters for instance 0
```

```
Interface name           : ae1
Port identifier          : 128.1
Designated port ID       : 128.1
Port cost                 : 1000
Port state                : Forwarding
Designated bridge ID      : 32768.00:90:69:0b:47:d1
Port role                 : Designated
Link type                 : Pt-Pt/NONEDGE
```

```

Boundary port                : No

Interface name                : ge-2/1/2
Port identifier               : 128.2
Designated port ID           : 128.2
Port cost                     : 20000
Port state                    : Forwarding
Designated bridge ID         : 32768.00:90:69:0b:47:d1
Port role                     : Designated
Link type                     : Pt-Pt/NONEDGE
Boundary port                 : No

Interface name                : ge-2/1/5
Port identifier               : 128.3
Designated port ID           : 128.3
Port cost                     : 29999
Port state                    : Forwarding
Designated bridge ID         : 32768.00:90:69:0b:47:d1
Port role                     : Designated
Link type                     : Pt-Pt/NONEDGE
Boundary port                 : No

Interface name                : ge-2/2/1
Port identifier               : 128.4
Designated port ID           : 128.26
Port cost                     : 20000
Port state                    : Forwarding
Designated bridge ID         : 32768.00:13:c3:9e:c8:80
Port role                     : Root
Link type                     : Pt-Pt/NONEDGE
Boundary port                 : No

Interface name                : xe-9/2/0
Port identifier               : 128.5
Designated port ID           : 128.5
Port cost                     : 2000
Port state                    : Forwarding
Designated bridge ID         : 32768.00:90:69:0b:47:d1
Port role                     : Designated
Link type                     : Pt-Pt/NONEDGE
Boundary port                 : No

Interface name                : xe-9/3/0
Port identifier               : 128.6
Designated port ID           : 128.6
Port cost                     : 2000
Port state                    : Forwarding
Designated bridge ID         : 32768.00:90:69:0b:47:d1
Port role                     : Designated
Link type                     : Pt-Pt/NONEDGE
Boundary port                 : No

```

Spanning tree interface parameters for instance 1

```

Interface name                : ae1
Port identifier               : 128.1
Designated port ID           : 128.1
Port cost                     : 1000
Port state                    : Forwarding
Designated bridge ID         : 32768.00:90:69:0b:47:d1

```

```

Port role           : Designated
Link type           : Pt-Pt/NONEDGE
Boundary port       : No

Interface name      : ge-2/1/2
Port identifier     : 128.2
Designated port ID  : 128.2
Port cost           : 20000
Port state          : Forwarding
Designated bridge ID : 32768.00:90:69:0b:47:d1
Port role           : Designated
Link type           : Pt-Pt/NONEDGE
Boundary port       : No

Interface name      : ge-2/1/5
Port identifier     : 128.3
Designated port ID  : 128.3
Port cost           : 29999
Port state          : Forwarding
Designated bridge ID : 32768.00:90:69:0b:47:d1
Port role           : Designated
Link type           : Pt-Pt/NONEDGE
Boundary port       : No

Interface name      : ge-2/2/1
Port identifier     : 128.4
Designated port ID  : 128.26
Port cost           : 20000
Port state          : Forwarding
Designated bridge ID : 32768.00:13:c3:9e:c8:80
Port role           : Root
Link type           : Pt-Pt/NONEDGE
Boundary port       : No

...

```

show spanning-tree interface msti

```

user@host> show spanning-tree interface msti 1 routing-instance vs1 detail
Spanning tree interface parameters for instance 1

```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
xe-7/0/0	128:1	128:1	32769.0090690b4fd1	2000	FWD	DESG
ge-5/1/0	128:2	128:2	32769.0090690b4fd1	20000	FWD	DESG
ge-5/1/1	128:3	128:3	32769.0090690b4fd1	20000	FWD	DESG
ae1	128:4	128:1	32769.0090690b47d1	10000	BLK	ALT
ge-5/1/4	128:5	128:3	32769.0090690b47d1	20000	BLK	ALT
xe-7/2/0	128:6	128:6	32769.0090690b47d1	2000	FWD	ROOT

show spanning-tree interface vlan-id

```

user@host> show spanning-tree interface vlan-id 101 routing-instance vs1 detail
Spanning tree interface parameters for instance 0

```

Interface	Port ID	Designated port ID	Designated bridge ID	Port Cost	State	Role
ge-11/0/5	128:1	128:1	32768.0090690b7fd1	20000	FWD	DESG
ge-11/0/6	128:2	128:1	32768.0090690b7fd1	20000	BLK	BKUP
ge-11/1/0	128:3	128:2	32768.0090690b4fd1	20000	BLK	ALT
ge-11/1/1	128:4	128:3	32768.0090690b4fd1	20000	BLK	ALT

ge-11/1/4	128:5	128:1	32768.0090690b47d1	20000	BLK	ALT
xe-10/0/0	128:6	128:5	32768.0090690b4fd1	2000	BLK	ALT
xe-10/2/0	128:7	128:4	32768.0090690b47d1	2000	FWD	ROOT

show spanning-tree interface (VSTP)

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

Spanning tree interface parameters for instance 0

Interface	Port ID	Designated port ID	Designated bridge ID	Cost	State	Role
ge-1/0/1	128:1	128:1	28672.0090690b3fe0	20000	FWD	DESG
ge-1/0/2	128:2	128:2	28672.0090690b3fe0	20000	FWD	DESG

Spanning tree interface parameters for VLAN 10

Interface	Port ID	Designated port ID	Designated bridge ID	Cost	State	Role
ge-1/0/1	128:1	128:1	28672.0090690b3fe0	20000	FWD	DESG
ge-1/0/2	128:2	128:2	28672.0090690b3fe0	20000	FWD	DESG

Spanning tree interface parameters for VLAN 20

Interface	Port ID	Designated port ID	Designated bridge ID	Cost	State	Role
ge-1/0/1	128:1	128:1	28672.0090690b3fe0	20000	FWD	DESG
ge-1/0/2	128:2	128:2	28672.0090690b3fe0	20000	FWD	DESG

show spanning-tree interface vlan-id (VSTP)

```
user@host> show spanning-tree interface vlan-id 10
```

Spanning tree interface parameters for VLAN 10

Interface	Port ID	Designated port ID	Designated bridge ID	Cost	State	Role
ge-1/0/1	128:1	128:1	28672.0090690b3fe0	20000	FWD	DESG
ge-1/0/2	128:2	128:2	28672.0090690b3fe0	20000	FWD	DESG

show spanning-tree mstp configuration

List of Syntax	Syntax on page 158 Syntax (EX Series Switch and the QFX Series) on page 158
Syntax	show spanning-tree mstp configuration <brief detail> <routing-instance <i>routing-instance-name</i> >
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 <i>routing-instance-name</i> —(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 159 show spanning-tree mstp configuration detail (QFX Series) on page 159
Output Fields	Table 16 on page 158 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 16: 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@1f0> show spanning-tree mstp configuration routing-instance vs1 detail
MSTP configuration information
Context identifier      : 1
Region name            : henry
Revision               : 3
Configuration digest    : 0x6da4b5c4fd587757eef35675365e1

MSTI      Member VLANs
  0 0-99,101-199,201-4094
  1 100
  2 200
```

show spanning-tree statistics

List of Syntax	Syntax on page 160 Syntax (EX Series Switch and the QFX Series) on page 160
Syntax	show spanning-tree statistics <brief detail> <interface <i>interface-name</i> > <routing-instance <i>routing-instance-name</i> >
Syntax (EX Series Switch and the QFX Series)	show spanning-tree statistics <brief detail> <interface <i>interface-name</i> vlan <i>vlan-id</i> >
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 <i>interface-name</i> —(Optional) Display STP statistics for the specified interface. routing-instance <i>routing-instance-name</i> —(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 161 show spanning-tree statistics interface routing-instance detail on page 161
Output Fields	Table 17 on page 160 lists the output fields for the show spanning-tree statistics command. Output fields are listed in the approximate order in which they appear.

Table 17: show spanning-tree statistics Output Fields

Field Name	Field Description
Message type	Type of message being counted.
BPDUs sent	Total number of BPDUs sent.
BPDUs received	Total number of BPDUs received.
BPDUs sent in last interval	Number of BPDUs sent within a specified interval.
BPDUs received in last interval	Number of BPDUs received within a specified interval.

Table 17: show spanning-tree statistics Output Fields (*continued*)

Field Name	Field Description
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 routing-instance

```

user@host> show spanning-tree statistics routing-instance vs1 detail
Routing instance level STP statistics
Message type           : bpdus
BPDUs sent             : 1396
BPDUs received         : 1027
BPDUs sent in last interval : 5      (duration: 4 sec)
BPDUs received in last interval: 4    (duration: 4 sec)

```

show spanning-tree statistics interface routing-instance detail

```

user@host> show spanning-tree statistics interface ge-11/1/4 routing-instance vs1 detail
Interface  BPDUs sent  BPDUs received  Next BPDU
                                     transmission
ge-11/1/4      7           190           0

```

