

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

EX-series switches provide Layer 2 loop prevention through Spanning Tree Protocol (STP), Rapid Spanning Tree protocol (RSTP), and Multiple Spanning Tree Protocol (MSTP). Loop protection increases the efficiency of STP, RSTP, and MSTP by preventing interfaces from moving into a forwarding state that would result in a loop opening up in the network.

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

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Requirements

This example uses the following hardware and software components:

- JUNOS Release 9.1 or later for EX-series switches
- Three EX-series switches in an RSTP topology

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

- RSTP operating on the switches.



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

Overview and Topology

A loop-free network in spanning-tree topologies is supported through the exchange of a special type of frame called bridge protocol data unit (BPDU). Peer STP applications running on the switch interfaces use BPDUs to communicate. Ultimately, the exchange of BPDUs determines which interfaces block traffic (preventing loops) and which interfaces become root ports and forward traffic.

A blocking interface can transition to the forwarding state in error if the interface stops receiving BPDUs from its designated port on the segment. Such a transition error can occur when there is a hardware error on the switch or software configuration error between the switch and its neighbor. When this happens, a loop opens up in the spanning tree. Loops in a Layer 2 topology cause broadcast, unicast, and multicast frames to continuously circle the looped network. As a switch processes a flood of frames in a looped network, its resources become depleted and the ultimate result is a network outage.



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

Three EX-series switches are displayed in Figure 1 on page 2. 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 1: Network Topology for Loop Protection

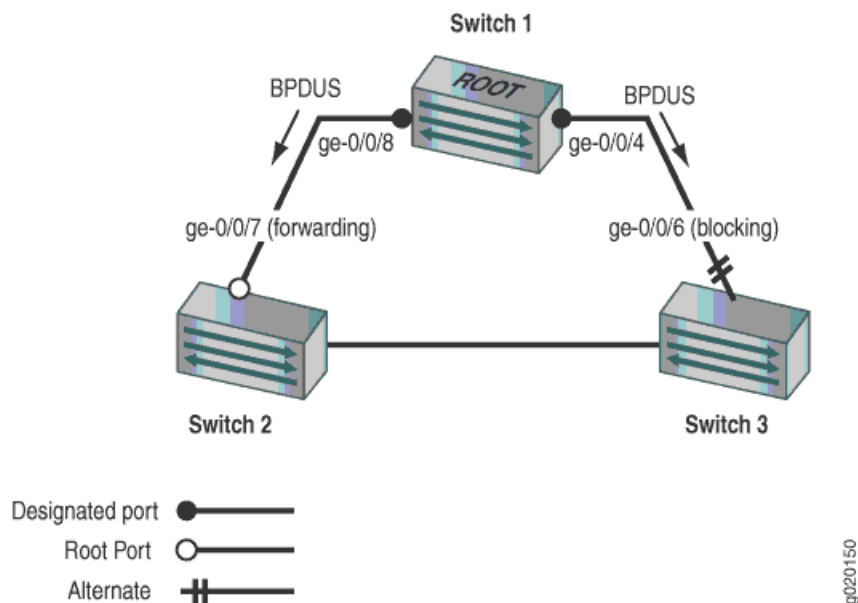


Table 1 on page 2 shows the components that will be configured for loop protection.

Table 1: 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 <code>ge-0/0/7</code> . |
| Switch 3 | Switch 3 is connected to Switch 1 through interface <code>ge-0/0/6</code> . |

A spanning-tree topology contains ports that have specific roles:

- The root port is responsible for forwarding data to the root bridge.
- The alternate port is a standby port for the root port. When a root port goes down, the alternate port becomes the active root port.
- The designated port forwards data to the downstream network segment or device.

This configuration example uses an RSTP topology. However, you also can configure loop protection for STP or MSTP topologies at the `[edit protocols (mstp | stp)]` hierarchy level.

Configuration

To configure loop protection on an interface:

CLI Quick Configuration To quickly configure loop protection on interface `ge-0/0/6`:

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

Step-by-Step Procedure To configure loop protection:

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

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

Results Check the results of the configuration:

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

Verification

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

- Displaying the Interface State Before Loop Protection Is Triggered on page 3
- Verifying That Loop Protection Is Working on an Interface on page 4

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-0/0/0.0 | 128:513 | 128:513 | 32768.0019e2503f00 | 20000 | BLK | DIS |
| ge-0/0/1.0 | 128:514 | 128:514 | 32768.0019e2503f00 | 20000 | BLK | DIS |
| ge-0/0/2.0 | 128:515 | 128:515 | 32768.0019e2503f00 | 20000 | BLK | DIS |
| ge-0/0/3.0 | 128:516 | 128:516 | 32768.0019e2503f00 | 20000 | FWD | DESG |
| ge-0/0/4.0 | 128:517 | 128:517 | 32768.0019e2503f00 | 20000 | FWD | DESG |
| ge-0/0/5.0 | 128:518 | 128:518 | 32768.0019e2503f00 | 20000 | FWD | DESG |
| ge-0/0/6.0 | 128:519 | 128:2 | 16384.00aabbcc0348 | 20000 | BLK | ALT |

[output truncated]

Meaning The output from the operational mode command `show spanning-tree interface` shows that `ge-0/0/6.0` is the alternate port and in a blocking state.

Verifying That Loop Protection Is Working on an Interface

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

Action Use the operational mode command:

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

Spanning tree interface parameters for instance 0

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

(Loop-Incon)
[output truncated]

Meaning The operational mode command `show spanning-tree interface` shows that interface `ge-0/0/6.0` has detected that BPDUs are no longer being forwarded to it and has moved into a loop-inconsistent state. The loop-inconsistent state prevents the interface from transitioning to a forwarding state. The interface recovers and transitions back to its original state as soon as it receives BPDUs.

- Related Topics**
- Example: Configuring Faster Convergence and Improving Network Stability with RSTP on EX-series Switches
 - Example: Configuring Root Protection to Enforce Root Bridge Placement in Spanning Trees on EX-series Switches
 - Example: Configuring BPDU Protection on STP Interfaces to Prevent STP Miscalculations on EX-series Switches

- Example: Configuring BPDU Protection on non-STP Interfaces to Prevent STP Miscalculations on EX-series Switches
- Understanding Loop Protection for STP, RSTP, and MSTP on EX-series Switches

