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

EX Series switches use Rapid Spanning Tree Protocol (RSTP) to provide a loop-free topology. RSTP identifies certain links as point to point. When a point-to-point link fails, the alternate link can transition to the forwarding state. RSTP provides better reconvergence time than original STP because it uses protocol handshake messages rather than fixed timeouts. Eliminating the need to wait for timers to expire makes RSTP more efficient than STP.

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

Requirements

This example uses the following hardware and software components:

- JUNOS Release 9.0 or later for EX Series switches
- Four EX Series switches

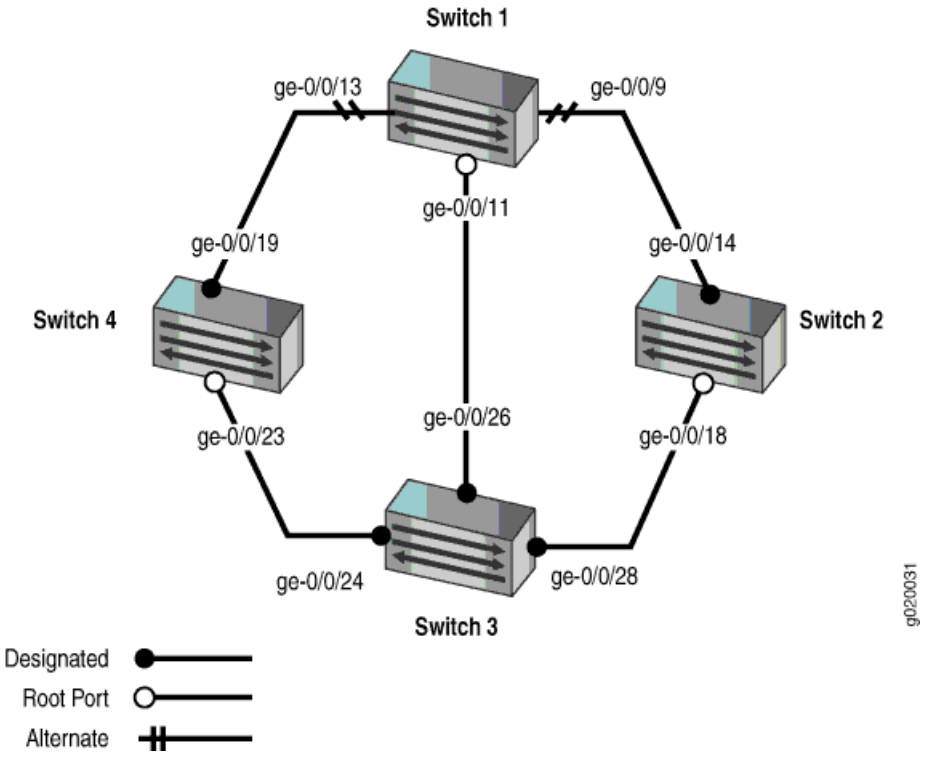
Before you configure the switches for RSTP, be sure you have:

- Installed the four switches. See Connecting and Configuring an EX Series Switch (J-Web Procedure).
- Performed the initial software configuration on all switches. See Installing and Connecting an EX3200 or EX4200 Switch.

Overview and Topology

In this example, four EX Series switches are connected in the topology displayed in Figure 1 to create a loop-free topology.

Figure 1: Network Topology for RSTP



The interfaces shown in Table 1 will be configured for RSTP.

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

Table 1: Components of the Topology for Configuring RSTP on EX Series Switches

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

Table 1: Components of the Topology for Configuring RSTP on EX Series Switches *(continued)*

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

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 on Switch 1

To configure RSTP on Switch 1, perform these tasks:

CLI Quick Configuration

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

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

```
set interfaces ge-0/0/13 unit 0 family ethernet-switching vlan members [10 20 30
40]
set interfaces ge-0/0/9 unit 0 family ethernet-switching vlan members [10 20 30
40]
set interfaces ge-0/0/11 unit 0 family ethernet-switching vlan members [10 20 30
40]
set interfaces ge-0/0/13 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/9 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/11 unit 0 family ethernet-switching port-mode trunk
set protocols rstp bridge-priority 16k
set protocols rstp interface ge-0/0/13.0 cost 1000
set protocols rstp interface ge-0/0/13.0 mode point-to-point
set protocols rstp interface ge-0/0/9.0 cost 1000
set protocols rstp interface ge-0/0/9.0 mode point-to-point
set protocols rstp interface ge-0/0/11.0 cost 1000
set protocols rstp interface ge-0/0/11.0 mode point-to-point
```

Step-by-Step Procedure To configure interfaces and RSTP on Switch 1:

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

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

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

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

3. Configure the port mode for the interfaces:

```
[edit interfaces]
user@switch1# set ge-0/0/13 unit 0 family ethernet-switching port-mode
trunk
user@switch1# set ge-0/0/9 unit 0 family ethernet-switching port-mode
trunk
user@switch1# set ge-0/0/11 unit 0 family ethernet-switching port-mode
trunk
```

4. Configure RSTP on the switch:

```
[edit protocols]
user@switch1# rstp bridge-priority 16k
user@switch1# rstp interface ge-0/0/13.0 cost 1000
```

```
user@switch1# rstp interface ge-0/0/13.0 mode point-to-point
user@switch1# rstp interface ge-0/0/9.0 cost 1000
user@switch1# rstp interface ge-0/0/9.0 mode point-to-point
user@switch1# rstp interface ge-0/0/11.0 cost 1000
user@switch1# rstp interface ge-0/0/11.0 mode point-to-point
```

Results Check the results of the configuration:

```
user@switch1> show configuration
interfaces {
    ge-0/0/13 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
        }
    }
    ge-0/0/9 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
        }
    }
    ge-0/0/11 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
        }
    }
}
protocols {
    rstp {
        bridge-priority 16k;
            interface ge-0/0/13.0 {
                cost 1000;
                mode point-to-point;
            }
            interface ge-0/0/9.0 {
                cost 1000;
                mode point-to-point;
            }
            interface ge-0/0/11.0 {
                cost 1000;
```

```
            mode point-to-point;
          }
        }
      }
    }
    vlans {
      voice-vlan {
        vlan-id 10;
      }
      employee-vlan {
        vlan-id 20;
      }
      guest-vlan {
        vlan-id 30;
      }
      camera-vlan {
        vlan-id 40;
      }
    }
```

Configuring RSTP on Switch 2

To configure RSTP on switch 2, perform these tasks:

CLI Quick Configuration To quickly configure interfaces and RSTP on Switch 2, copy the following commands and paste them into the switch terminal window:

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

Step-by-Step Procedure To configure interfaces and RSTP on Switch 2:

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

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

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

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

3. Configure the port mode for the interfaces:

```
[edit interfaces]
user@switch2# set ge-0/0/14 unit 0 family ethernet-switching port-mode
trunk
user@switch2# set ge-0/0/18 unit 0 family ethernet-switching port-mode
trunk
```

4. Configure RSTP on the switch:

```
[edit protocols]
user@switch2# rstp bridge-priority 32k
user@switch2# rstp interface ge-0/0/14.0 cost 1000
user@switch2# rstp interface ge-0/0/14.0 mode point-to-point
user@switch2# rstp interface ge-0/0/18.0 cost 1000
user@switch2# rstp interface ge-0/0/18.0 mode point-to-point
```

Results Check the results of the configuration:

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

```
    ge-0/0/18 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
        }
    }
}
protocols {
    rstp {
        bridge-priority 32k;
            interface ge-0/0/14.0 {
                cost 1000;
                mode point-to-point;
            }
            interface ge-0/0/18.0 {
                cost 1000;
                mode point-to-point;
            }
        }
    }
}
vlans {
    voice-vlan {
        vlan-id 10;
    }
    employee-vlan {
        vlan-id 20;
    }
    guest-vlan {
        vlan-id 30;
    }
    camera-vlan {
        vlan-id 40;
    }
}
```

Configuring RSTP on Switch 3

To configure RSTP on switch 3, perform these tasks:

CLI Quick Configuration To quickly configure interfaces and RSTP on Switch 3, copy the following commands and paste them into the switch terminal window:

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

```
set vlans camera-vlan vlan-id 40
set interfaces ge-0/0/26 unit 0 family ethernet-switching vlan members [10 20 30
40]
set interfaces ge-0/0/28 unit 0 family ethernet-switching vlan members [10 20 30
40]
set interfaces ge-0/0/24 unit 0 family ethernet-switching vlan members [10 20 30
40]
set interfaces ge-0/0/26 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/28 unit 0 family ethernet-switching port-mode trunk
set interfaces ge-0/0/24 unit 0 family ethernet-switching port-mode trunk
set protocols rstp bridge-priority 8k
set protocols rstp interface ge-0/0/26.0 cost 1000
set protocols rstp interface ge-0/0/26.0 mode point-to-point
set protocols rstp interface ge-0/0/28.0 cost 1000
set protocols rstp interface ge-0/0/28.0 mode point-to-point
set protocols rstp interface ge-0/0/24.0 cost 1000
set protocols rstp interface ge-0/0/24.0 mode point-to-point
```

Step-by-Step Procedure To configure interfaces and RSTP on Switch 3:

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

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

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

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

3. Configure the port mode for the interfaces:

```
[edit interfaces]
user@switch3# set ge-0/0/26 unit 0 family ethernet-switching port-mode
trunk
user@switch3# set ge-0/0/28 unit 0 family ethernet-switching port-mode
trunk
user@switch3# set ge-0/0/24 unit 0 family ethernet-switching port-mode
trunk
```

4. Configure RSTP on the switch:

```
[edit protocols]
user@switch3# rstp bridge-priority 8k
```

```
user@switch3# rstp interface ge-0/0/26.0 cost 1000
user@switch3# rstp interface ge-0/0/26.0 mode point-to-point
user@switch3# rstp interface ge-0/0/28.0 cost 1000
user@switch3# rstp interface ge-0/0/28.0 mode point-to-point
user@switch3# rstp interface ge-0/0/24.0 cost 1000
user@switch3# rstp interface ge-0/0/24.0 mode point-to-point
```

Results Check the results of the configuration:

```
user@switch3> show configuration
  interfaces {
    ge-0/0/26 {
      unit 0 {
        family ethernet-switching {
          port-mode trunk;
          vlan {
            members [10 20 30 40];
          }
        }
      }
    }
    ge-0/0/28 {
      unit 0 {
        family ethernet-switching {
          port-mode trunk;
          vlan {
            members [10 20 30 40];
          }
        }
      }
    }
    ge-0/0/24 {
      unit 0 {
        family ethernet-switching {
          port-mode trunk;
          vlan {
            members [10 20 30 40];
          }
        }
      }
    }
  }
}
protocols {
  rstp {
    bridge-priority 8k;
      interface ge-0/0/26.0 {
        cost 1000;
        mode point-to-point;
      }
      interface ge-0/0/28.0 {
        cost 1000;
        mode point-to-point;
      }
```

```
            interface ge-0/0/24.0 {
               cost 1000;
               mode point-to-point;
            }
         }
         bridge-priority 8k;
            }
         }
      }
   }
   vlans {
      voice-vlan {
         vlan-id 10;
      }
      employee-vlan {
         vlan-id 20;
      }
      guest-vlan {
         vlan-id 30;
      }
      camera-vlan {
         vlan-id 40;
      }
   }
```

Configuring RSTP on Switch 4

To configure RSTP on switch 4, perform these tasks:

CLI Quick Configuration To quickly configure interfaces and RSTP on Switch 4, copy the following commands and paste them into the switch terminal window:

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

Step-by-Step Procedure To configure interfaces and RSTP on Switch 4:

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

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

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

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

3. Configure the port mode for the interfaces:

```
[edit interfaces]
user@switch4# set ge-0/0/23 unit 0 family ethernet-switching port-mode
trunk
user@switch4# set ge-0/0/19 unit 0 family ethernet-switching port-mode
trunk
```

4. Configure RSTP on the switch:

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

Results Check the results of the configuration:

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

```
    }
    ge-0/0/19 {
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
                vlan {
                    members [10 20 30 40];
                }
            }
        }
    }
}
protocols {
    rstp {
        bridge-priority 16k;
            interface ge-0/0/23.0 {
                cost 1000;
                mode point-to-point;
            }
            interface ge-0/0/19.0 {
                cost 1000;
                mode point-to-point;
            }
        }
    }
}
vlans {
    voice-vlan {
        vlan-id 10;
    }
    employee-vlan {
        vlan-id 20;
    }
    guest-vlan {
        vlan-id 30;
    }
    camera-vlan {
        vlan-id 40;
    }
}
```

Verification

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

- Verifying RSTP Configuration on Switch 1 on page 13
- Verifying RSTP Configuration on Switch 2 on page 14
- Verifying RSTP Configuration on Switch 3 on page 14
- Verifying RSTP Configuration on Switch 4 on page 15

Verifying RSTP Configuration on Switch 1

Purpose Verify the RSTP configuration on Switch 1.

Action Use the operational mode command:

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

Spanning tree interface parameters for instance 0

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

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

Verifying RSTP Configuration on Switch 2

Purpose Verify the RSTP configuration on Switch 2.

Action Use the operational mode command:

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


Spanning tree interface parameters for instance 0

Interface    Port ID    Designated      Designated         Port    State  Role
                         port ID        bridge ID          Cost
ge-0/0/14.0     128:513      128:513  32768.0019e2503d20      1000  BLK    DESG
ge-0/0/18.0     128:519      128:515   8192.0019e25051e0      1000  FWD    ROOT
```

Meaning Refer to the topology in Figure 1. The operational mode command show spanning-tree interface shows that ge-0/0/18.0 is in a forwarding state and the root port. The other interface on Switch 2 is blocking.

Verifying RSTP Configuration on Switch 3

Purpose Verify the RSTP configuration on Switch 3.

Action Use the operational mode commands:

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

Spanning tree interface parameters for instance 0

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

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

Verifying RSTP Configuration on Switch 4

Purpose Verify the RSTP configuration on Switch 4.

Action Use the operational mode commands:

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

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

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

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

Related Topics

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

Published: 2009-07-28