

# Sun Ethernet Fabric Operating System

STP Administration Guide



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# Using This Documentation

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This document describes a sample topology of STP on switches running SEFOS, and includes examples of how to configure MSTP and RSTP.

- “Product Notes” on page 1
- “Related Documentation” on page 2
- “Acronyms and Abbreviations” on page 2
- “CLI Command Modes” on page 3
- “Feedback” on page 4
- “Support and Accessibility” on page 4

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## Product Notes

For late-breaking information and known issues about the following products, refer to the product notes at:

Sun Blade 6000 Ethernet Switched NEM 24p 10GbE:

<http://www.oracle.com/pls/topic/lookup?ctx=SB6K-24p-10GbE>

Sun Network 10GbE Switch 72p:

<http://www.oracle.com/pls/topic/lookup?ctx=SN-10GbE-72p>

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## Related Documentation

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Documentation	Links
All Oracle products	<a href="http://oracle.com/documentation">http://oracle.com/documentation</a>
Sun Blade 6000 Ethernet Switched NEM 24p 10GbE	<a href="http://www.oracle.com/pls/topic/lookup?ctx=SB6K-24p-10GbE">http://www.oracle.com/pls/topic/lookup?ctx=SB6K-24p-10GbE</a>
Sun Network 10GbE Switch 72p	<a href="http://www.oracle.com/pls/topic/lookup?ctx=SN-10GbE-72p">http://www.oracle.com/pls/topic/lookup?ctx=SN-10GbE-72p</a>
Sun Blade 6000 modular system	<a href="http://www.oracle.com/pls/topic/lookup?ctx=sb6000">http://www.oracle.com/pls/topic/lookup?ctx=sb6000</a>
Oracle Integrated Lights Out Manager (Oracle ILOM) 3.0	<a href="http://www.oracle.com/pls/topic/lookup?ctx=ilom30">http://www.oracle.com/pls/topic/lookup?ctx=ilom30</a>

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For detailed information about the commands and options described in this document, refer to the *Sun Ethernet Fabric Operating System CLI Base Reference Manual*.

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## Acronyms and Abbreviations

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Acronym or Abbreviation	Explanation
BPDU	Bridge protocol data unit
CEP	Customer edge port
CIST	Common internal spanning tree
CLI	Command-line interface
CST	Common spanning tree
C-VLAN	Customer VLAN
IST	Internal spanning tree
L2GP	Layer 2 gateway port
MAC	Media access control

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Acronym or Abbreviation	Explanation
MI	Multiple instance
MST	Multiple spanning tree
MSTI	Multiple spanning tree instance
MSTP	Multiple Spanning Tree Protocol
PEP	Provider edge port
RSTP	Rapid Spanning Tree Protocol
SEFOS	Sun Ethernet Fabric Operating System
SST	Single spanning tree
STI	Spanning tree instance
S-VLAN	Service VLAN
TC	Topology change
VLAN	Virtual LAN

## CLI Command Modes

The following table lists the configuration modes used in this document with their access and exit methods.

Command Mode	Access Method	Prompt	Exit Method
User EXEC	Access SEFOS from Oracle ILOM with read-only rights (privilege level 1).	SEFOS>	Use the <code>logout</code> or <code>exit</code> command to return to the Oracle ILOM prompt.
Privileged EXEC	Access SEFOS from Oracle ILOM with full administrative rights (privilege level 15).	SEFOS#	Use the <code>logout</code> or <code>exit</code> command to return to the Oracle ILOM prompt.
Global Configuration	From User EXEC mode, use the <code>enable</code> command.	SEFOS (config) #	Use the <code>end</code> command to return to Privileged EXEC mode.
Interface Configuration	From Global Configuration mode, use the <code>interface interface-type interface-id</code> command.	SEFOS (config-if) #	Use the <code>exit</code> command to return to Global Configuration mode, or use the <code>end</code> command to return to Privileged EXEC mode.

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# Feedback

Provide feedback on this documentation at:

<http://www.oracle.com/goto/docfeedback>

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# Support and Accessibility

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Description	Links
Access electronic support through My Oracle Support	<a href="http://support.oracle.com">http://support.oracle.com</a>  For hearing impaired: <a href="http://www.oracle.com/accessibility/support.html">http://www.oracle.com/accessibility/support.html</a>
Learn about Oracle's commitment to accessibility	<a href="http://www.oracle.com/us/corporate/accessibility/index.html">http://www.oracle.com/us/corporate/accessibility/index.html</a>

---

# STP Overview

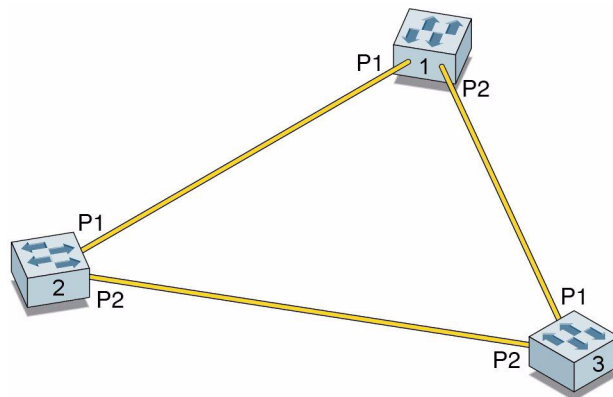
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These topics describe the configuration of STP.

- "STP Topology Example" on page 5
- "STP Overview" on page 6
- "Bridge ID and Switch Priority" on page 7
- "Root Switch Election" on page 8

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## STP Topology Example



Switch 1:

- **MAC address** - 00:01:02:03:04:01
- **VLAN 1** - 10.0.0.1/255.0.0.0

Switch 2:

- **MAC address** - 00:02:02:03:04:01
- **VLAN 1** - 10.0.0.2/255.0.0.0

Switch 3:

- **MAC address** - 00:03:02:03:04:01
- **VLAN 1** - 10.0.0.3/255.0.0.0

---

## STP Overview

The bridge allows interconnection of end stations attached to separate LANs and enables the end stations to communicate as if they were attached to a single LAN. The bridge operates below the MAC service boundary and is transparent to the protocols operating above this boundary.

In complex networks, a loop can occur when there are two or more paths between two end points. This situation leads to the duplication of frames, which in turn leads to heavy traffic in the network. To avoid this situation, STP is used in the SEFOS software. STP forms a logical, loop-free topology from the physical topology and forwards the frames without duplication. To avoid prolonged stabilization time following a reconfiguration event in the Spanning Tree algorithm, SEFOS provides support for RSTP. RSTP provides for rapid recovery of connectivity following the failure of a bridge/bridge port or a LAN.

To isolate link fluctuations specific to a particular VLAN segments and to provide for load balancing, SEFOS provides support for multiple spanning trees. These spanning trees can be configured on a per-VLAN basis, or multiple VLANs can be mapped to the same spanning tree.

A switch can take the role of either a root or a designated switch.

STP calculates the best loop free path by assigning port roles to the port of switch as follows:

- **Root** - The port that offers the lowest cost path towards the root bridge.
- **Designated** - A forwarding port elected for every switched LAN segment.
- **Alternate** - A blocked port providing an alternate path to the root bridge of the spanning tree.
- **Backup** - A blocked port that acts as a backup for the path provided by a designated port.

The stable, active STP of a switched network is determined by the following elements:

- Bridge ID (switch priority and MAC address)
- Path cost to the root switch
- Port identifier (port priority and the port number)

When switches in a network come up, each switch assumes itself to be the root bridge and starts sending configuration messages through all its ports. BPDUs are used to communicate and compute the spanning tree topology. These BPDUs contain the following information:

- Unique bridge ID of the switch that has been identified as the root
- The spanning-tree path cost to the root
- The bridge ID of the sending switch
- Message age
- The identifier of the sending interface (port priority and port number)
- Values for the hello, forward-delay, and max-age protocol timers

When a switch receives a superior configuration BPDU on a port, the switch stores the received information for that port. If the port is a root port, the switch forwards the updated message to all the attached LANs for which this switch is the designated bridge.

If the switch receives a BPDU with a configuration inferior to the BPDU currently stored for that port, the switch discards the BPDU. If the switch is a designated switch for that LAN from which the inferior information was received, then the switch sends up-to-date information stored for that port, thus discarding inferior information and propagating superior information in the network. Each layer 2 interface in the switch running STP can be in one of the following states:

- **Blocking** - The interface in this state discards the frames and does not learn the MAC addresses.
- **Listening** - This is the first state that a port can transition to after blocking. The interface enters this state when spanning tree decides that the interface must participate in frame forwarding.
- **Learning** - An interface enters this state from listening state. In this state, the interface gets ready to participate in frame forwarding and learns MAC addresses from the packet received.
- **Forwarding** - In this state, the interface receives and forwards frames received on that port or forwards frames switched from another port. This transition from blocking to forwarding takes 30 seconds.

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## Bridge ID and Switch Priority

Each switch has a unique bridge identifier that determines the selection of the root switch. The bridge identifier is an 8-byte field that is composed of two subfields.

Bridge Identifier 8 bytes

Bridge Priority	MAC
-----------------	-----

2 bytes Range-0-65535 Default:32768      6 bytes MAC address

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## Root Switch Election

All switches in the layer 2 network participating in STP gather information on other switches in the network through an exchange of data messages called BPDUs. The exchange of messages results in the following actions:

- Election of a unique root switch for each spanning tree instance
- Election of a designated switch for every switched LAN segment
- Removal of loops in the switched network by blocking layer 2 interfaces connected to redundant links

The switch with the highest switch priority (the lowest numerical priority value) is elected as the root switch. If all switches are configured with the default priority (32768), then the switch with the lowest MAC address becomes the root switch. The switch priority value occupies the most significant bits of the bridge ID. The root switch is the logical center of the STP topology in a switched network. Redundant paths to the root are put in STP blocking mode.

BPDUs contain information about the sending switch and its ports, including switch and port MAC addresses, switch priority, port priority, and path cost. The STP uses this information to elect the root switch and the root port for the switched network, and the root port and the designated port for each switched segment.



# Configuring RSTP

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Examples in this document use interfaces 0/1, 0/2, and 0/3. Variables such as interfaces, IP addresses, and other ID numbers might be different based on your site configuration.

- [“Understanding RSTP” on page 9](#)
- [“Default STP Settings” on page 13](#)
- [“Set Spanning Tree Compatibility to STP” on page 14](#)
- [“Restore Spanning Tree Compatibility” on page 15](#)
- [“Configuring Bridge Priority” on page 15](#)
- [“Configuring STP Cost” on page 17](#)
- [“Configuring the STP Port Priority” on page 20](#)
- [“Configuring the Spanning Tree Link Type” on page 24](#)
- [“Configuring the Spanning Tree Portfast Port” on page 26](#)
- [“Configuring Spanning Tree Timers” on page 28](#)
- [“Configuring the Pseudo Root ID” on page 30](#)
- [“Spanning Tree Status Overview” on page 31](#)

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## Understanding RSTP

These sections provide an understanding of RSTP.

- [“RSTP Overview” on page 10](#)
- [“Port States” on page 10](#)
- [“Port Roles” on page 10](#)
- [“Rapid Convergence” on page 11](#)
- [“Proposal Agreement Sequence” on page 11](#)
- [“Topology Change and Topology Change Detection” on page 13](#)

# RSTP Overview

The RSTP module is based on the IEEE 802.1D rapid reconfiguration specification. The existing STP implementation requires significant time to reconfigure and restore service when a link failure occurs and restoration is required. Faster convergence, compared to the legacy spanning tree algorithm, is the most important feature in RSTP. RSTP avoids reconvergence delay by calculating an alternate root port and then immediately switching over to the alternate port, if the root port becomes unavailable.

## Port States

STP (802.1D) Port State	RSTP Port State	Is Port Included in Active Topology?	Is Port Learning MAC Address?
Disabled	Discarding	No	No
Blocking	Discarding	No	No
Listening	Discarding	No	No
Learning	Learning	No	Yes
Forwarding	Forwarding	Yes	Yes

## Port Roles

Port Role	Description
Root	Provides the best path to the root. This port receives the best BPDU on a bridge.
Designated	A port is designated if it can send the best BPDU on a segment to which it is connected. Bridges connected to a given segment listen to the BPDUs of other bridges, and agree on the bridge sending the best BPDU as the designated bridge for that segment and the port as designated port.
Alternate	A port blocked since another port on the bridge receives superior information from another bridge. This port corresponds to the blocking state of 802.1D.

Port Role	Description
Back-up	A port blocked because another port receives superior information from the same bridge. This port also corresponds to the blocking state of 802.1D.

A port with the root or a designated port role is included in the active topology. A port with the alternate or backup port is excluded from the active topology.

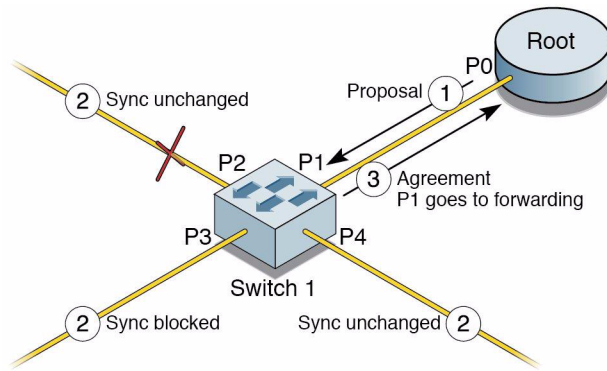
## Rapid Convergence

RSTP relies on two new variables for achieve faster convergence than the legacy spanning tree algorithm.

- **Edge port** - Ports that are directly connected to end stations cannot create bridging loops, so these ports can rapidly transition to forwarding, which skips the learning and listening states. When the link toggles on an edge port, the topology change is not triggered. When a BPDU is received on an edge port, the BPDU loses its edge port status and becomes a normal spanning tree port. SEFOS RSTP uses the `portfast` keyword to configure edge ports.
- **Link types** - RSTP can achieve rapid transition on point-to-point links. The link type is automatically derived from the duplex mode of a port. A port operating in full-duplex mode is assumed to be point-to-point, while a half-duplex port is considered to be a shared port, by default. You can override this automatic link type setting by changing the configuration settings.

## Proposal Agreement Sequence

In the spanning tree algorithm, a port selected as a designated port waits for  $2 \times$  forward-delay ( $2 \times 15$ ) seconds before transitioning to the forwarding state. In RSTP, this port corresponds to a designated role and blocking state.



- P0 - Designated port
- P1 - New root port
- P2 - Alternate port
- P3 - Designated port
- P4 - Edge port

If a new link is created between root and switch 1, both ports go into a designated blocking state until they receive a BPDU from their counterpart. The proposal bit on the BPDUs is set and sent out only when a designated port is in discarding or learning state. This process occurs for port P0 of the root bridge. Because switch 1 receives superior information, switch 1 immediately knows that port P1 is the new root port. Switch 1 then ensures that all of the ports are in sync with this new information.

A port is in sync only if the port meets one of the following criteria:

- The port is in the blocking state.
- The port is an edge port.

If an alternate port P2, a designated forwarding port P3, and an edge port P4 exist on switch 1, P2 and P4 already meet one of the listed criteria. To be in sync, switch 1 must block port P3, assigning it the discarding state. If all ports are in sync, switch 1 can unblock its newly selected root port P1 and reply to the root by sending an agreement message. This message is a copy of the proposal BPDU with the agreement bit set instead of the proposal bit. This copy ensures that port P0 knows exactly which proposal that the agreement it receives corresponds to.

When port P0 receives the agreement, port P0 can immediately transition to forwarding. Port P3, which was left in a designated discarding state after the sync, is in exactly the same state as port P0 before receiving the agreement. Port P0 then starts proposing to its neighbor, attempting to quickly transition to forwarding. This handshake mechanism propagates quickly towards the edge of the network, and quickly restores connectivity after a change in the topology.

# Topology Change and Topology Change Detection

When an 802.1D bridge detects a topology change, the bridge first notifies the root bridge using a reliable mechanism. Once the root bridge is aware of a change in the topology of the network, the root bridge sets the topology change flag on the BPDUs sent out, which are then relayed to all the bridges in the network. When a bridge receives a BPDU with the TC flag bit set, the bridge reduces its bridging-table aging time to forward delay seconds, which ensures a relatively quick flushing of stale information.

In RSTP, only non-edge ports moving to the forwarding state cause a topology change. Consequently, a loss of connectivity is no longer considered a topology change, which is contrary to 802.1D. That is, a port moving to a blocking state no longer generates a TC. When an RSTP bridge detects a topology change, the following happens:

1. RSTP bridge starts the TC while the timer with a value equal to twice the hello time for all the non-edge designated ports and its root port, if necessary.
2. RSTP bridge flushes the MAC addresses associated with all these non-edge designated ports.
3. When the TC while timer is running on a port, the BPDUs sent out of that port have the TC bit set. The BPDUs are also sent on the root port while the timer is active.

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## Default STP Settings

Feature	Default Setting
Spanning tree mode	MSTP
Spanning tree status	Enabled
Spanning tree timers	Hello time: 2 seconds Forward-delay time: 15 seconds. Maximum-aging time: 20 seconds.
Switch priority	32768
Spanning tree port priority (configurable on a per-interface basis)	128
Spanning tree port cost (configurable on a per-interface basis)	200000 (For RSTP, the default value is 65535)

---

## ▼ Set Spanning Tree Compatibility to STP

When the switch comes up, spanning tree is enabled by default with MSTP operating in the switch.

1. Enter Global Configuration mode and set the spanning tree compatibility version for STP.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree compatibility stp
SEFOS(config)# end
```

2. View the new spanning tree mode.

```
SEFOS# show spanning-tree

Root Id      Priority    32768
Address     00:01:02:03:04:05
Cost        0
Port        0 [0]
This bridge is the root
Max age 20 Sec, forward delay 15 Sec
Hello Time 2 Sec
MST00
Spanning Tree Protocol Enabled.
MST00 is executing the stp compatible Multiple Spanning Tree
Protocol
Bridge Id      Priority    32768
              Address    00:01:02:03:04:05
              Max age is 20 sec, forward delay is 15 sec
              Hello Time is 2 sec
              Dynamic Path Cost is Disabled
              Dynamic Path Cost Lag-Speed Change is Disabled

Name          Role        State        Cost        Prio        Type
----          -
Ex0/1        Designated Forwarding    65535        128         SharedLan
```

---

## ▼ Restore Spanning Tree Compatibility

- In Global Configuration mode, set the default compatibility version.

```
SEFOS(config)# no spanning-tree compatibility
```

---

## Configuring Bridge Priority

When setting the bridge priority, you can specify a value of 0 to 61440, in increments of 4096. Valid priority values are 0, 4096, 8192, 12288, 16384, 20480, 24576, 28672, 32768, 36864, 40960, 45056, 49152, 53248, 57344, and 61440. All other values are rejected. The default value is 32768. The lower the number, the more likely the switch is chosen as the root switch.

- [“Configure the Bridge Priority” on page 15](#)
- [“Restore the Default Bridge Priority” on page 17](#)

## ▼ Configure the Bridge Priority

See [“STP Topology Example” on page 5](#) for the sample topology referenced in this section. All switches must have the default settings. After the topology stabilizes, switch 1 is elected as root since it has the lowest MAC address. All ports, except port 2 of switch 3, are in forwarding state. Port 2 of switch 3 is detected as an alternate port and is in discarding state.

In this example, after the bridge priority for switch 3 is set, switch 3 is detected as the root and port 1 of switch 2 to be the alternate port.

1. In Global Configuration mode, set the spanning tree priority in switch 3.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree priority 4096
SEFOS(config)# end
```

2. View the spanning tree information.

**a. In Switch 1, type.**

```
SEFOS# show spanning-tree
Root Id          Priority    4096
                Address    00:03:02:03:04:01
                Cost      200000
                Port      2 [Ex0/2]
                Max age 20 Sec, forward delay 15 Sec
                Hello Time is 2 Sec

MST00
Spanning Tree Protocol Enabled.
MST000 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id        Priority    32768
                Address    00:01:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
                Hello Time is 2 sec
                Dynamic Path Cost is Disabled
                Dynamic Path Cost Lag-Speed Change is Disabled

Name            Role            State            Cost            Prio            Type
----            -
Ex0/1           Designated     Forwarding       200000          128             SharedLan
Ex0/2           Root           Forwarding       200000          128             SharedLan
```

**b. In Switch 2, type.**

```
SEFOS# show spanning-tree
Root Id          Priority    4096
                Address    00:03:02:03:04:01
                Cost      200000
                Port      2 [Ex0/2]
                Max age 20 Sec, forward delay 15 Sec
                Hello Time is 2 Sec

MST00
Spanning Tree Protocol Enabled.
MST000 is executing the mstp compatible Mutiple Spanning Tree
Protocol
Bridge Id        Priority    32768
                Address    00:02:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
                Hello Time is 2 sec
                Dynamic Path Cost is Disabled
                Dynamic Path Cost Lag-Speed Change is Disabled

Name            Role            State            Cost            Prio            Type
----            -
Ex0/1           Alternate     Discarding       200000          128             SharedLan
Ex0/2           Root           Forwarding       200000          128             SharedLan
```



c. In Switch 3, type.

```
SEFOS# show spanning-tree
Root Id          Priority  4096
                Address  00:03:02:03:04:01
                Cost    0
                Port    0 [0]
                This bridge is the root
                Max age 20 Sec, forward delay 15 Sec
                Hello Time is 2 Sec

MST00
Spanning Tree Protocol Enabled.
MST000 is executing the mstp compatible Mutiple Spanning Tree
Protocol
Bridge Id        Priority  4096
                Address  00:03:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
                Hello Time is 2 sec
                Dynamic Path Cost is Disabled
                Dynamic Path Cost Lag-Speed Change is Disabled

Name      Role      State      Cost      Prio      Type
----      -
Ex0/1     Designated Forwarding  200000    128      SharedLan
Ex0/2     Designated Forwarding  200000    128      SharedLan
```

## ▼ Restore the Default Bridge Priority

- From Global Configuration mode, set the priority to its default value.

```
SEFOS(config)# no spanning-tree priority
```

---

## Configuring STP Cost

These sections explain how to configure STP cost.

- [“STP Cost Overview” on page 18](#)
- [“Configure the Cost” on page 18](#)
- [“Restore the Default Cost” on page 20](#)

# STP Cost Overview

When a loop occurs in the network topology, you can use the STP path cost to determine the spanning-tree states of the ports. Path cost is obtained from the speed of the interface. You can configure a lower path cost for an interface if the port needs to be selected first. Alternatively, you can configure a higher path cost if the port needs to be selected last to place it in forwarding state.

Path cost is used to determine the topology only if the loop in the network cannot be resolved using only the bridge IDs. If all ports have the same path cost values, the lowest numbered port is put into forwarding state by the spanning tree first.

Valid interfaces include physical interfaces and port-channel logical interfaces (`port-channel` *port-channel-number*). Acceptable cost values range from 1 to 200000000. The default value is derived from the media speed of the interface.

## ▼ Configure the Cost

In this example, all switches are configured to be STP compatible using `spanning-tree compatibility stp` in Global Configuration mode. After the topology stabilizes and switch 1 is elected as root, the ports, except port 2 of switch 3, are in forwarding state. Port 2 of switch 3 is an alternate port and is in discarding state.

After the path cost for port 1 in switch 3 is set, port 2 of switch 2 is the alternate port, and port 2 of switch 3 is the designated port.

This example configures the path cost associated with port 0/1 to 2000.

See “STP Topology Example” on page 5 for the sample topology referenced in this section.

### 1. Specify the interface for path cost and configure the cost in switch 3.

```
SEFOS# configure terminal
SEFOS(config)# interface extreme-ethernet 0/1
SEFOS(config-if)# spanning-tree cost 2000
SEFOS(config-if)# end
```

### 2. View the spanning tree properties of an interface.

#### a. In Switch 1, type.

```
SEFOS# show spanning-tree
Root Id          Priority    32768
```

```

Address    00:01:02:03:04:01
Cost       0
Port       0 [0]
This bridge is the root
Max age 20 Sec, forward delay 15 Sec
Hello Time is 2 Sec

MST00
Spanning Tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id      Priority  32768
Address 00:01:02:03:04:01
Max age is 20 sec, forward delay is 15 sec
Hello Time is 2 sec
Dynamic Path Cost is Disabled
Dynamic Path Cost Lag-Speed Change is Disabled
Name      Role      State      Cost      Prio      Type
----      -
Ex0/1     Designated Forwarding  200000    128      SharedLan
Ex0/2     Designated Forwarding  200000    128      SharedLan

```

**b. In Switch 2, type.**

```

SEFOS# show spanning-tree

Root Id      Priority  32768
Address 00:01:02:03:04:01
Cost       200000
Port       1 [Ex0/1]
Max age 20 Sec, forward delay 15 Sec
Hello Time is 2 Sec

MST00
Spanning Tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol

Bridge Id      Priority  32768
Address 00:02:02:03:04:01
Max age is 20 sec, forward delay is 15 sec
Hello Time is 2 sec
Dynamic Path Cost is Disabled
Dynamic Path Cost Lag-Speed Change is Disabled
Name      Role      State      Cost      Prio      Type
----      -
Ex0/1     Root      Forwarding  200000    128      SharedLan
Ex0/2     Alternate Discarding  200000    128      SharedLan

```

c. In Switch 3, type.

```
SEFOS# show spanning-tree

Root Id          Priority    32768
                Address    00:01:02:03:04:01
                Cost      2000
                Port      1 [Ex0/1]
                Max age 20 Sec, forward delay 15 Sec
                Hello Time is 2 Sec

MST00

Spanning Tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id        Priority    32768
                Address    00:03:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
                Hello Time is 2 sec
                Dynamic Path Cost is Disabled
                Dynamic Path Cost Lag-Speed Change is Disabled

Name            Role          State          Cost      Prio      Type
----            -
Ex0/1           Root          Forwarding     2000      128      SharedLan
Ex0/2           Designated    Forwarding     200000    128      SharedLan
```

## ▼ Restore the Default Cost

This example restores the default cost of 20,000.

- Set the default value of STP cost.

```
SEFOS(config)# no spanning-tree cost
```

---

## Configuring the STP Port Priority

These sections explain how to configure the STP port priority.

- [“STP Port Priority Overview” on page 21](#)
- [“Port Priority Configuration Topology Example” on page 21](#)

- “Configure the Port Priority” on page 22
- “Restore the Default Port Priority” on page 24

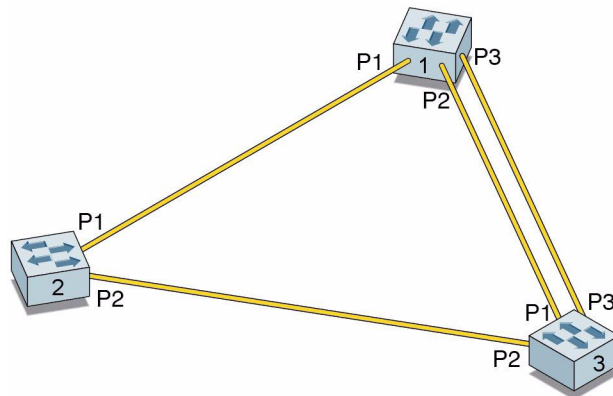
## STP Port Priority Overview

When a loop occurs in a network topology, spanning tree can use the port priority value for the ports to decide which port must be put in forwarding state. The port priority is only used to determine the topology if the loop in the network cannot be resolved using bridge IDs or path cost.

If a higher priority (lower numerical value) is assigned to a port, STP uses forwarding first. When a lower priority (higher numerical value) is assigned to a port, STP uses forwarding last. If all ports have the same priority values, spanning tree puts the lowest numbered interface in forwarding state and blocks all other interfaces.

Valid interfaces include physical interfaces and port-channel logical interfaces (`port-channel port-channel-number`). Acceptable priority values range from 0 to 240, in increments of 16. The default is 128. Valid priority values are 0, 16, 32, 48, 64, 80, 96, 112, 128, 144, 160, 176, 192, 208, 224, and 240. All other values are rejected. The lower the the number, the higher the priority.

## Port Priority Configuration Topology Example



- **Switch 1** - VLAN 1 - 10.0.0.1/255.0.0.0
- **Switch 2** - VLAN 1 - 10.0.0.2 /255.0.0.0
- **Switch 3** - VLAN 1 - 10.0.0.3/255.0.0.0

## ▼ Configure the Port Priority

See “STP Topology Example” on page 5 for the topology for this procedure. All switches are configured to be STP compatible using the spanning-tree compatibility stp command in Global Configuration mode. After the topology stabilizes, switch 1 is elected as root and all ports of all switches except port 2 and 3 (alternate, discarding) of switch 3 are in forwarding.

This example configures port 0/3 with a port priority of 32. Ports 1 and 2 of switch 2 become the alternate ports, and port 3 becomes the root port.

1. In switch 1, specify the interface for the port priority and configure the port priority for spanning tree.

```
SEFOS# configure terminal
SEFOS(config)# interface extreme-ethernet 0/3
SEFOS(config-if)# spanning-tree port-priority 32
SEFOS(config-if)# end
```

2. View the spanning tree properties of an interface.

- a. In Switch 1, type.

```
SEFOS# show spanning-tree

Root Id          Priority  32768
                Address  00:01:02:03:04:01
                Cost    0
                Port    0 [0]
                This bridge is the root
                Max age 20 Sec, forward delay 15 Sec
                Hello Time is 2 Sec

MST00
Spanning Tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id          Priority  32768
                Address  00:01:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
                Hello Time is 2 sec
                Dynamic Path Cost is Disabled
                Dynamic Path Cost Lag-Speed Change is Disabled

Name      Role      State      Cost      Prio      Type
----      -
Ex0/1     Designated Forwarding  200000    128      SharedLan
Ex0/2     Designated Forwarding  200000    128      SharedLan
Ex0/3     Designated Forwarding  200000    32       SharedLan
```

**b. In Switch 2, type.**

```
SEFOS# show spanning-tree

Root Id          Priority    32768
                 Address     00:01:02:03:04:01
                 Cost       200000
                 Port       2 [Ex0/2]
                 Max age 20 Sec, forward delay 15 Sec
                 Hello Time is 2 Sec

MST00
Spanning Tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id        Priority    32768
                 Address     00:02:02:03:04:01
                 Max age is 20 sec, forward delay is 15 sec
                 Hello Time is 2 sec
                 Dynamic Path Cost is Disabled
                 Dynamic Path Cost Lag-Speed Change is Disabled
Name            Role          State          Cost          Prio          Type
----            -
Ex0/1           Root          Forwarding     200000        128          SharedLan
Ex0/2           Designated    Forwarding     200000        128          SharedLan
```

**c. In Switch 3, type.**

```
SEFOS# show spanning-tree

Root Id          Priority    32768
                 Address     00:01:02:03:04:01
                 Cost       200000
                 Port       2 [Ex0/2]
                 Max age 20 Sec, forward delay 15 Sec
                 Hello Time is 2 Sec

MST00
Spanning Tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id        Priority    32768
                 Address     00:03:02:03:04:01
                 Max age is 20 sec, forward delay is 15 sec
                 Hello Time is 2 sec
                 Dynamic Path Cost is Disabled
                 Dynamic Path Cost Lag-Speed Change is Disabled
Name            Role          State          Cost          Prio          Type
----            -
Ex0/1           Root          Forwarding     200000        128          SharedLan
Ex0/2           Designated    Forwarding     200000        128          SharedLan
```

Ex0/1	Alternate	Discarding	200000	128	SharedLan
Ex0/2	Alternate	Discarding	200000	128	SharedLan
Ex0/3	Root	Forwarding	200000	128	SharedLan

## ▼ Restore the Default Port Priority

This example restores the default cost of 128.1.

- Set the STP priority to its default value.

```
SEFOS(config)# no spanning-tree port-priority
```

---

## Configuring the Spanning Tree Link Type

These sections explain how to configure the spanning tree link type.

- [“Spanning Tree Link Type Overview” on page 24](#)
- [“Configure the Interface Link Type” on page 24](#)
- [“Restore the Default Interface Link Type” on page 26](#)

### Spanning Tree Link Type Overview

If a port is configured as a point-to-point link and its port role is designated, SEFOS STP negotiates a rapid transition to forwarding with the other port using a proposal-handshake agreement mechanism to ensure that the topology is loop free. By default, if the interface is full duplex, the interface is considered to have a point-to-point connection. If the interface is half duplex, then the interface is considered to have a shared connection. You can override the default setting of link type to enable the rapid transition to forwarding.

Valid interfaces include physical interfaces and port-channel logical interfaces (`port-channel port-channel-number`).

## ▼ Configure the Interface Link Type

This example configures port 0/1 as a point-to-point link.



1. Specify the interface for link type and configure the interface link type as point-to-point.

```
SEFOS# configure terminal
SEFOS(config)# interface extreme-ethernet 0/1
SEFOS(config-if)# spanning-tree link-type point-to-point
SEFOS(config-if)# end
```

2. View the spanning tree properties of an interface.

```
SEFOS# show spanning-tree detail

Spanning tree Protocol Enabled.

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Identifier has Priority 32768, Address 00:01:02:03:04:01
Configured Max age 20 sec, Forward delay 15 sec
Configured Hello Time 2 sec
Dynamic Path Cost Disabled
Flush Interval 0 centi-sec, Flush Invocations 72
Flush Indication threshold 0
Current Root has priority 32768, address 00:02:02:03:04:01
cost of root path is 2000
Number of Topology Changes 1, Time since topology Change 89 seconds
ago
Transmit Hold-Count 3
Root Times : Max age 20 Sec Forward delay 15 Sec

Port 45 [Ex0/45] of MST00 is Root , Forwarding
Ex0/45 is operating in the MSTP Mode
Port path cost 2000, Port priority 128,
Port Identifier 128.45. Port HelloTime 2,
Timers: Hello - 1, Forward Delay - 0, Topology Change - 0
Designated root has priority 32768, address 00:02:02:03:04:01
```

```
Designated Bridge has priority 32768, address 00:02:02:03:04:01
Designated Port Id is 128.45, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Received Hello Time 2 Sec
Number of Transitions to forwarding State : 1
Auto-Edge is enabled
PortFast is disabled, Oper-Edge is disabled
Link type is point to Point
BPDUs : sent 4, recieved 4466
Restricted Role is disabled.
Restricted TCN is disabled.
bpdu-transmit enabled
bpdu-receive enabled
Loop Guard is disabled
```

## ▼ Restore the Default Interface Link Type

This example restores the default link type as shared.

- **Set the default link type for an interface.**

```
SEFOS(config)# no spanning-tree link-type
```

---

## Configuring the Spanning Tree Portfast Port

These sections explain how to configure the spanning tree portfast port.

- [“Spanning Tree Portfast Port Overview” on page 26](#)
- [“Configure a Portfast Port” on page 27](#)
- [“Restore the Default Portfast Port” on page 28](#)

## Spanning Tree Portfast Port Overview

All ports that are directly connected to end stations cannot create bridging loops and can rapidly transition to forwarding, skipping the learning and listening states.

You can configure a switch to automatically detect the presence of another switch connected to one of its port. If a switch receives configuration BPDUs from other switch, it can detect the presence of the other switch connected to one of its ports. On configuring a port with the `portfast` command, if the switch does not receive any BPDUs for a certain interval, spanning tree rapidly sets the port to forwarding state.

Valid interfaces include physical interfaces and port-channel logical interfaces (`port-channel` *port-channel-number*).

## ▼ Configure a Portfast Port

This example configures port 0/1 as a port that has only hosts connected and can transition to forwarding rapidly.

1. **Specify the interface for auto edge configuration and shut down the interface.**

```
SEFOS# configure terminal
SEFOS(config)# interface extreme-ethernet 0/1
SEFOS(config-if)# shutdown
```

2. **Transition the port to forwarding rapidly and bring the interface up.**

```
SEFOS(config-if)# spanning-tree portfast
SEFOS(config-if)# no shutdown
SEFOS(config-if)# end
```

3. **View the spanning tree properties of an interface.**

```
SEFOS# show spanning-tree detail

Spanning tree Protocol Enabled.

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Identifier has Priority 32768, Address 00:01:02:03:04:01
Configured Max age 20 sec, Forward delay 15 sec
Configured Hello Time 2 sec
Dynamic Path Cost Disabled
Flush Interval 0 centi-sec, Flush Invocations 72
Flush Indication threshold 0
```

```
Current Root has priority 32768, address 00:02:02:03:04:01
cost of root path is 2000
Number of Topology Changes 1, Time since topology Change 89 seconds
ago
Transmit Hold-Count 3
Root Times : Max age 20 Sec Forward delay 15 Sec

Port 45 [Ex0/45] of MST00 is Root , Forwarding
Ex0/45 is operating in the MSTP Mode
Port path cost 2000, Port priority 128,
Port Identifier 128.45. Port HelloTime 2,
Timers: Hello - 1, Forward Delay - 0, Topology Change - 0
Designated root has priority 32768, address 00:02:02:03:04:01

Designated Bridge has priority 32768, address 00:02:02:03:04:01
Designated Port Id is 128.45, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Received Hello Time 2 Sec
Number of Transitions to forwarding State : 1
Auto-Edge is enabled
PortFast is disabled, Oper-Edge is disabled
Link type is point to Point
BPDUs : sent 4, recieved 4466
Restricted Role is disabled.
Restricted TCN is disabled.
bpdu-transmit enabled
bpdu-receive enabled
Loop Guard is disabled
```

## ▼ Restore the Default Portfast Port

This example restores the default cost of the port to not be identified as a portfast port.

- Set the default spanning tree portfast port for an interface.

```
SEFOS(config)# no spanning-tree portfast
```

---

## Configuring Spanning Tree Timers

These sections explain how to configure spanning tree timers.

- “Spanning Tree Timers Overview” on page 29
- “Configure Timers” on page 29
- “Restore the Default Timer Values” on page 30

## Spanning Tree Timers Overview

You can specify these spanning tree timers for a given interface:

- `forward-time` controls how fast a port changes its spanning tree state from blocking state to forwarding state. The range is 4-30 seconds. The default value is 15 seconds.
- `hello-time` determines how often the switch broadcasts its hello message to other switches when it is the root of the spanning tree.
- `Max-age` is the maximum time allowed for the STP information learned from the network on any port to be retained before it is discarded.

### ▼ Configure Timers

This example specifies that the port changes from blocking to forwarding state in 11 seconds.

#### 1. Configure the forward time in the switch.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree forward-time 11
SEFOS(config)# end
```

#### 2. View the spanning tree properties of an interface.

```
SEFOS# show spanning-tree

Root Id          Priority    32768
Address         00:01:02:03:04:01
Cost            0
Port            0 [0]
This bridge is the root
Max age 20 Sec, forward delay 11 Sec
Hello Time is 2 Sec

MST00
Spanning tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
```

Bridge Id	Priority	32768			
	Address	00:01:02:03:04:01			
	Max age is	20 sec,	forward delay is	11 sec	
	Hello Time is	2 sec			
	Dynamic Path Cost is	Disabled			
	Dynamic Path Cost Lag-Speed Change is	Disabled			
Name	Role	State	Cost	Prio	Type
----	----	-----	----	----	-----
Ex0/1	Designated	Forwarding	200000	128	P2P
Ex0/2	Designated	Forwarding	200000	128	SharedLan

## ▼ Restore the Default Timer Values

This example restores the default timer value of 15 seconds.

- Set the spanning tree timers to their default values.

```
SEFOS(config)# no spanning-tree forward-time
```

## Configuring the Pseudo Root ID

If a port is configured as a layer 2 gateway port, you can use `PseudoRootId` to generate and present the pseudo BPDU to RSTP state machines as if received from another bridge.

Valid interfaces include physical interfaces and `port-channel` logical interfaces (`port-channel port-channel-number`).

- [“Configure the Pseudo Root ID” on page 30](#)
- [“Display the Pseudo Root ID” on page 31](#)

## ▼ Configure the Pseudo Root ID

- Specify the interface for the BPDU transmit status and configure the pseudo root ID of the L2GP.

```
SEFOS# configure terminal
SEFOS(config)# interface extreme-ethernet 0/1
SEFOS(config)# spanning-tree pseudoRootId priority 4096
mac-address 00:01:02:03:04:01
```

## ▼ Display the Pseudo Root ID

This example displays the configured pseudo root ID if the port is configured as a L2GP only.

- **Display the pseudo BPDU.**

```
SEFOS# show spanning-tree layer2-gateway-port

Switch default
Port Ex0/1
    PseudoRootId
Priority      MacAddress
-----      -
4096         00:01:02:03:04:01
```

---

## Spanning Tree Status Overview

You can use any of these procedures to display the spanning tree status.

- “Display Spanning Tree Information for Active Ports” on page 31
- “Display Detailed Spanning Tree Information” on page 32
- “Display the Spanning Tree Port-Specification Configuration” on page 33
- “Display a Summary of the Spanning Tree Information for the Configuration” on page 34

## ▼ Display Spanning Tree Information for Active Ports

This command displays the bridge and details of the active ports (ports that are participating in the spanning-tree).

- **Type.**

```
SEFOS# show spanning-tree active

Root Id      Priority  32768
Address      00:01:02:03:04:01
Cost         0
Port         0 [0]
```

```

This bridge is the root
Max age 20 Sec, forward delay 11 Sec
Hello Time is 2

MST00
Spanning tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id          Priority 32768
                   Address 00:01:02:03:04:01
                   Max age is 20 sec, forward delay is 11 sec
                   Hello Time is 2 sec
                   Dynamic Path Cost is Disabled
                   Dynamic Path Cost Lag-Speed Change is Disabled

Name      Role      State      Cost      Prio      Type
----      -
Ex0/1     Designated Forwarding 200000    128      P2P
Ex0/2     Designated Forwarding 200000    128      SharedLan

```

## ▼ Display Detailed Spanning Tree Information

This command displays detailed information about the port and bridge, including designated bridge details, designated port details, timer values, root bridge, and so on.

- **Type.**

```

SEFOS# show spanning-tree detail

Spanning tree Protocol Enabled.

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Identifier has Priority 32768, Address 00:01:02:03:04:01
Configured Max age 20 sec, Forward delay 15 sec
Configured Hello Time 2 sec
Dynamic Path Cost Disabled
Flush Interval 0 centi-sec, Flush Invocations 72
Flush Indication threshold 0

```



```

Current Root has priority 32768, address 00:02:02:03:04:01
cost of root path is 2000
Number of Topology Changes 1, Time since topology Change 89 seconds
ago
Transmit Hold-Count 3
Root Times : Max age 20 Sec Forward delay 15 Sec

Port 45 [Ex0/45] of MST00 is Root , Forwarding
Ex0/45 is operating in the MSTP Mode
Port path cost 2000, Port priority 128,
Port Identifier 128.45. Port HelloTime 2,
Timers: Hello - 1, Forward Delay - 0, Topology Change - 0
Designated root has priority 32768, address 00:02:02:03:04:01

Designated Bridge has priority 32768, address 00:02:02:03:04:01
Designated Port Id is 128.45, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Received Hello Time 2 Sec
Number of Transitions to forwarding State : 1
Auto-Edge is enabled
PortFast is disabled, Oper-Edge is disabled
Link type is point to Point
BPDUs : sent 4, recieved 4466
Restricted Role is disabled.
Restricted TCN is disabled.
bpdu-transmit enabled
bpdu-receive enabled
Loop Guard is disabled

```

## ▼ Display the Spanning Tree Port-Specification Configuration

This command displays spanning tree information for the specified interface.

- **Type.**

```

SEFOS# show spanning-tree interface extreme-ethernet 0/1

Instance Role          State          Cost          Prio          type
-----  ----  -----  -----  -----  -----
MST00    Designated Forwarding    200000    128.1    P2P

```

## ▼ Display a Summary of the Spanning Tree Information for the Configuration

This command displays a summary of port states or the total lines of the STP state section.

- **Type.**

```
SEFOS# show spanning-tree summary

Spanning Tree port pathcost method is Long
Spanning tree enabled protocol is MSTP

MST00 Port Roles and States
Port-Index  Port-Role  Port-State  Port-Status
-----
1           Designated Forwarding  Enabled
2           Disabled   Discarding  Enabled
3           Disabled   Discarding  Enabled
4           Disabled   Discarding  Enabled
5           Disabled   Discarding  Enabled
6           Disabled   Discarding  Enabled
7           Disabled   Discarding  Enabled
8           Disabled   Discarding  Enabled
9           Disabled   Discarding  Enabled
10          Disabled   Discarding  Enabled
11          Disabled   Discarding  Enabled
12          Disabled   Discarding  Enabled
13          Disabled   Discarding  Enabled
14          Disabled   Discarding  Enabled
15          Disabled   Discarding  Enabled
16          Disabled   Discarding  Enabled
17          Disabled   Discarding  Enabled
18          Disabled   Discarding  Enabled
19          Disabled   Discarding  Enabled
20          Disabled   Discarding  Enabled
21          Disabled   Discarding  Enabled
22          Disabled   Discarding  Enabled
23          Disabled   Discarding  Enabled
24          Disabled   Discarding  Enabled
```

# Configuring MSTP

---

These sections explain how to configure MSTP.

- “Specify MST Forward Time, Hello Time, and Max Age” on page 35
- “Understanding MSTP” on page 39
- “Configuring MSTP Modes” on page 42
- “Configuring the Spanning Tree Switch Priority” on page 44
- “Configuring the Interval Between Generation of Configuration Messages” on page 51
- “Configuring the Maximum Hop Count” on page 53
- “Configuring the Pseudo Root ID” on page 54

## ▼ Specify MST Forward Time, Hello Time, and Max Age

The syntax for this command is as follows:

```
spanning-tree mst { forward-time short_4-30 | hello-time short_1-2 | max-age short_6-40 }
```

1. Set the forward time as 30.

```
SEFOS(config)# spanning-tree mst forward-time 30
```

## 2. View the output in switch 1.

```
SEFOS# sh spanning-tree
Root Id      Priority  32768
             Address   00:01:02:03:04:01
             Cost     0
             Port     0 [0]
             This bridge is the root
             Max age 20 Sec, forward delay 30 Sec
             Hello Time 2 Sec

MST00

Spanning tree Protocol has been enabled

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id      Priority  32768
             Address   00:01:02:03:04:01
             Max age is 20 sec, forward delay is 30 sec
             Hello Time is 2 sec
             Dynamic Path Cost is Disabled
             Dynamic Path Cost Lag-Speed Change is Disabled
```

## 3. Reset the forward time.

```
SEFOS(config)# no spanning-tree mst forward-time
```

## 4. View the output in switch 1

```
SEFOS# show spanning-tree
Root Id      Priority  32768
             Address   00:01:02:03:04:01
             Cost     0
             Port     0 [0]
             This bridge is the root
             Max age 20 Sec, forward delay 15 Sec
             Hello Time 2 Sec

MST00

Spanning tree Protocol has been enabled
```

```
MST00 is executing the mstp comp. Multiple Spanning Tree Protocol
Bridge Id      Priority  32768
                Address  00:01:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
                Hello Time is 2 sec
                Dynamic Path Cost is Disabled
                Dynamic Path Cost Lag-Speed Change is Disabled
```

#### 5. Set the hello time.

```
SEFOS(config)# spanning-tree mst hello-time 1
```

#### 6. View the output in switch 1.

```
SEFOS# show spanning-tree
Root Id      Priority  32768
                Address  00:01:02:03:04:01
                Cost      0
                Port      0 [0]
                This bridge is the root
                Max age 20 Sec, forward delay 15 Sec
                Hello Time 1 Sec

MST00

Spanning tree Protocol has been enabled

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id      Priority  32768
                Address  00:01:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
                Hello Time is 1 sec
                Dynamic Path Cost is Disabled
                Dynamic Path Cost Lag-Speed Change is Disabled
```

#### 7. Reset the hello time.

```
SEFOS(config)# no spanning-tree mst hello-time
```

## 8. View the output in switch 1.

```
SEFOS# show spanning-tree
Root Id      Priority 32768
             Address 00:01:02:03:04:01
             Cost    0
             Port    0 [0]
             This bridge is the root
             Max age 20 Sec, forward delay 15 Sec
             Hello Time 2 Sec

MST00

Spanning tree Protocol has been enabled

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id      Priority 32768
              Address 00:01:02:03:04:01
              Max age is 20 sec, forward delay is 15 sec
              Hello Time is 2 sec
              Dynamic Path Cost is Disabled
              Dynamic Path Cost Lag-Speed Change is Disabled
```

## 9. Set the max age.

```
SEFOS(config)# spanning-tree mst max-age 6
```

## 10. View the output in switch 1.

```
SEFOS# sh spanning-tree
Root Id      Priority 32768
             Address 00:01:02:03:04:01
             Cost    0
             Port    0 [0]
             This bridge is the root
             Max age 6 Sec, forward delay 15 Sec
             Hello Time 2 Sec

MST00

Spanning tree Protocol has been enabled
```

```
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id      Priority  32768
               Address  00:01:02:03:04:01
               Max age is 6 sec, forward delay is 15 sec
               Hello Time is 2 sec
               Dynamic Path Cost is Disabled
               Dynamic Path Cost Lag-Speed Change is Disabled
```

#### 11. Reset the max age.

```
SEFOS(config)# no spanning-tree mst max-age
```

#### 12. View the output in switch 1.

```
SEFOS# sh spanning-tree
Root Id      Priority  32768
             Address  00:01:02:03:04:01
             Cost      0
             Port      0 [0]
             This bridge is the root
             Max age 20 Sec, forward delay 15 Sec
             Hello Time 2 Sec

MST00

Spanning tree Protocol has been enabled

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id      Priority  32768
               Address  00:01:02:03:04:01
               Max age is 20 sec, forward delay is 15 sec
               Hello Time is 2 sec
               Dynamic Path Cost is Disabled
               Dynamic Path Cost Lag-Speed Change is Disabled
```

---

## Understanding MSTP

These topics describe MSTP concepts.

- [“MSTP Overview” on page 40](#)

- “MST Region” on page 40
- “IST, CIST, and CST” on page 40
- “Operations in an MST Region” on page 41
- “Hop Count” on page 41
- “Default MSTP Settings” on page 41
- “MSTP Configuration Guidelines” on page 41

## MSTP Overview

SEFOS MSTP enables you to group VLANs into an STI, with each instance having a spanning-tree topology independent of other STIs. You can group VLANs, or you can associate them to spanning tree instances. The topology of one instance can be independent of other instances. This situation provides multiple forwarding paths for data traffic and enables load balancing, thereby improving the fault tolerance of the overall network, since failure in one instance does not affect the other instances. This situation facilitates VLAN bridges to use multiple spanning trees, providing for traffic belonging to different VLANs to flow over potentially different paths within the virtual bridged LAN.

## MST Region

Switches participating in MST instances must be constantly configured with the same MST configuration information. The collection of switches which have the same MST information form an MST region. This MST configuration determines the region to which each switch belongs. The configuration includes the name of the region, the revision number, and the MST VLAN-to-instance assignment map. A region can have one member or multiple members with the same MST configuration. The number of MST regions in a network is not limited, but each region can support up to 16 spanning-tree instances. A VLAN can be assigned to only one STI at a time.

## IST, CIST, and CST

The IST runs in an MST region. Within each MST region MSTP maintains multiple STIs. Instance 0 is known as IST. All other instances are numbered from 1 to 15. The IST is the only spanning tree instance that sends and receives the MST configuration messages, all other instance information are encapsulated in MST BPDUs. Thus, in MSTP there are two contexts of operation, one in the context of the entire topology called CIST and the other in the context of the each individual spanning tree context, that is, MSTI.



# Operations in an MST Region

All bridges in a single MST region have the same regional configuration. The communication among bridges inside the MST region is through the IST. The communication across bridges is taken care of by the CIST (common internal spanning tree that spans across the entire topology irrespective of MST and SST regions). All bridge ports are part of all instances available in the system. Thus, when the MSTP protocol operates, the port role and port state are calculated for the CIST (common spanning tree context) and separately for each instance. The operation of the protocol arrives at a single common/active topology consisting of all the bridges in the topology, which is the CIST. The bridge with the best bridge ID is chosen as the CIST root. Apart from the CIST root, the regions also calculate MSTI regional roots for each of the MST instances active inside the region and a CIST regional root towards the CIST root. The port on the CIST regional root towards the CIST root is selected as the master port.

## Hop Count

The hop count and path cost are used by the IST and the MST to compute the spanning tree topology. SEFOS MSTP provides a command to configure the hop count inside the region, which is applicable to all the IST and MST instances in that region. When a switch receives a BPDU with the hop count set to a maximum value from the root, the switch decrements the received remaining hop count value and propagates the new hop count value in the BPDU the switch generates. When the count reaches zero, the switch discards the BPDU.

## Default MSTP Settings

MSTP has the following default configurations:

Feature	Default Setting
Maximum hop count	20
Spanning-tree port cost (configurable on a per-interface basis)	200000

## MSTP Configuration Guidelines

MSTP configuration guidelines are as follows:

- The switch supports up to 16 MST instances. The number of VLANs that can be mapped to a particular MST instance is 1024. SEFOS MSTP software can support 64 MSTI instances and each instance can be mapped to 4094 VLANs.
- In a spanning tree network, the switches can be in the same MST region only when they have the same VLAN-to-instance map, configuration revision number, and name.

---

## Configuring MSTP Modes

These topics describe how to configure MSTP Modes.

- [“Set the Spanning Tree Operating Mode” on page 42](#)
- [“Specify MST Mode Configurations” on page 43](#)

### ▼ Set the Spanning Tree Operating Mode

When the switch comes up, spanning tree is enabled by default with MSTP operating in the switch.

If the input for the spanning tree mode is different from the specified mode of operation, the switch shuts down the operational spanning-tree and starts the spanning-tree as specified.

#### 1. Configure the spanning tree operating mode.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree mode mst
SEFOS(config)# end
```

#### 2. View the spanning tree information.

```
SEFOS# show spanning-tree

Root Id          Priority    32768
                Address    00:01:02:03:04:01
                Cost      0
                Port     0 [0]
                This bridge is the root
                Max age 20 Sec, forward delay 15 Sec
                Hello Time is 2 Sec

MST00
```

```
Spanning tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id          Priority 32768
                  Address 00:01:02:03:04:01
                  Max age is 20 sec, forward delay is 15 sec
                  Hello Time is 2 sec
                  Dynamic Path Cost is Disabled
                  Dynamic Path Cost Lag-Speed Change is Disabled
Name      Role      State      Cost      Prio      Type
----      -
Ex0/1     Designated Forwarding 200000    128      SharedLan
```

**3. Set the default spanning tree operating mode.**

```
SEFOS(config)# spanning-tree compatibility stp
```

## ▼ Specify MST Mode Configurations

You can specify the properties of an interface for MSTP. Values for the instance range are 1-16. Values for VLAN range are 1-4096. Values for the configuration revision number for the MST region can be 0-200000.

**1. Configure the MST configuration submode.**

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree mst configuration
```

The MST configuration submode is used to make only instance-specific and MST region configurations.

**2. Map VLANs to an MST instance.**

```
SEFOS(config-mst)# instance 1 vlan 1
```

**3. Make the switch STP compatible with the spanning-tree compatibility stp command.**

**4. Specify a configuration name for an MST region.**

```
SEFOS(config-mst)# name region1
```

5. Specify the configuration revision number for the MST region.

```
SEFOS(config-mst)# revision 100  
SEFOS(config-mst)# end
```

The spanning tree mode is changed based on your input.

6. View the spanning tree MST configuration information.

```
SEFOS# show spanning-tree mst configuration  
  
Name                [region1]  
Revision            100  
Instance            Vlans mapped  
-----  
0                   2-1024,1025-2048,2049-3072,3073-4094  
1                   1  
-----
```

---

## Configuring the Spanning Tree Switch Priority

These topics describe how to configure the spanning tree switch priority.

- [“Configure the Spanning Tree Switch Priority” on page 44](#)
- [“Restore the Default Spanning Tree Priority” on page 47](#)
- [“Configure MST Properties of an Interface” on page 48](#)
- [“Restore the Default MSTP Priority” on page 51](#)

### ▼ Configure the Spanning Tree Switch Priority

See [“STP Topology Example” on page 5](#) for the topology for this procedure.

- Values for the instance range are 1-16.
- Values for the VLAN range are 1-4096.
- Values for the instance ID are 1-64.

**1. Map VLANs to an MST instance and specify a configuration name for an MST region.**

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree mst configuration
SEFOS(config-mst)# instance 1 vlan 1
SEFOS(config-mst)# name region1
SEFOS(config-mst)# end
```

**2. After the topology stabilizes, verify the MST information for the CIST instance or the specified MST instance.**

- The range for the instance ID is 1-64.
- detail displays spanning tree MST instance-specific details.

**a. In switch 1, type.**

```
SEFOS# show spanning-tree mst 1

## MST01
Vlans mapped: 1
Bridge Address 00:01:02:03:04:01 Priority 32768
Root Address 00:01:02:03:04:01 Priority 32768
Root this switch for MST01
Interface Role Sts Cost Prio.Nbr Type
-----
Ex0/1 Designated Forwarding 200000 128.1 Link Type is
Shared
Ex0/2 Designated Forwarding 200000 128.2 Link Type is
Shared
```

**b. In switch 2, type.**

```
SEFOS# show spanning-tree mst 1

## MST01
Vlans mapped: 1
Bridge Address 00:02:02:03:04:01 Priority 32768
Root Address 00:01:02:03:04:01 Priority 32768
Interface Role Sts Cost Prio.Nbr Type
-----
Ex0/1 Root Forwarding 200000 128.1 Link Type is
Shared
Ex0/2 Designated Forwarding 200000 128.2 Link Type is
Shared
```

**c. In switch 3, type.**

```
SEFOS# show spanning-tree mst 1

## MST01
Vlans mapped:    1
Bridge    Address 00:03:02:03:04:01    Priority 32768
Root      Address 00:01:02:03:04:01    Priority 32768
Interface Role          Sts          Cost          Prio.Nbr Type
-----
Ex0/1    Root            Forwarding    200000        128.1        Link Type is
Shared
Ex0/2    Alternate       Discarding    200000        128.2        Link Type is
Shared
```

**d. In switch 3, type.**

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree mst 1 priority 4096
```

- The instance ID range is 1 to 64.
- The priority range is 0 to 61440 in increments of 4096. The default is 32768. The lower the number the more likely the switch will be chosen as the root switch. Valid priority values are multiples of 4096.
- Spanning-tree priority *xxx* configures the priority in RSTP if RSTP is running, or configures the CIST priority if MSTP is running. The spanning-tree MST instance priority configures the priority in MSTI and is supported only if MSTP is running.
- After configuring the switch Priority for switch 2, switch 2 becomes the root bridge. Port 2 of switch 3 becomes the root port and port 1 of switch 3 becomes the alternate port. Switch 1 becomes the designated bridge with port 1 as the root port and port 2 as the designated port.

**e. Complete the verification.**

```
SEFOS(config)# end
```

**3. After the topology stabilizes, type this command in all the switches.**

**a. In switch 1, type.**

```
SEFOS# show spanning-tree mst 1

## MST01
Vlans mapped:    1
```

Bridge	Address	00:01:02:03:04:01	Priority	32768	
Root	Address	00:02:02:03:04:01	Priority	4096	
Interface	Role	Sts	Cost	Prio.Nbr	Type
-----	----	---	----	-----	----
Ex0/1	Root	Forwarding	200000	128.1	Link Type is Shared
Ex0/2	Designated	Forwarding	200000	128.2	Link Type is Shared

**b. In switch 2, type.**

```
SEFOS# show spanning-tree mst 1

## MST01
Vlans mapped: 1
Bridge Address 00:02:02:03:04:01 Priority 4096
Root Address 00:02:02:03:04:01 Priority 4096
Root this switch for MST01
Interface Role Sts Cost Prio.Nbr Type
----- ---- --- ---- -
Ex0/1 Designated Forwarding 200000 128.1 Link Type is Shared
Ex0/2 Designated Forwarding 200000 128.2 Link Type is Shared
```

**c. In switch 3, type.**

```
SEFOS# show spanning-tree mst 1

## MST01
Vlans mapped: 1
Bridge Address 00:03:02:03:04:01 Priority 32768
Root Address 00:02:02:03:04:01 Priority 4096
Interface Role Sts Cost Prio.Nbr Type
----- ---- --- ---- -
Ex0/1 Alternate Discarding 200000 128.1 Link Type is Shared
Ex0/2 Root Forwarding 200000 128.2 Link Type is Shared
```

## ▼ Restore the Default Spanning Tree Priority

- Set the default for the spanning tree switch priority.

```
SEFOS(config)# no spanning-tree mst 1 priority
```

## ▼ Configure MST Properties of an Interface

See “STP Topology Example” on page 5 for the topology for this procedure. You must perform this procedure before creating MST instances and regions in all the switches.

### 1. Create MST instances and regions in all the switches.

```
SEFOS# configure terminal  
SEFOS(config)# spanning-tree mst configuration
```

### 2. Map VLANs to an MST instance.

```
SEFOS(config-mst)# instance 1 vlan 1
```

### 3. Specify a configuration name for an MST region.

```
SEFOS(config-mst)# name region1
```

Instance range is 1-16 and VLAN range is 1-4096.

### 4. Return to Privileged EXEC mode.

```
SEFOS(config-mst)# end
```

### 5. After the topology stabilizes, type this command in all the switches:

#### a. In switch 1, type.

```
SEFOS# show spanning-tree mst 1  
  
#MST01  
Vlans mapped:    1  
Bridge          Address 00:01:02:03:04:01    Priority 32768  
Root            Address 00:01:02:03:04:01    Priority 32768  
Root            this switch for MST01  
Interface Role          Sts          Cost  Prio.Nbr Type  
-----  
Ex0/1  Designated  Forwarding  200000  128.1  Link Type is Shared  
Ex0/2  Designated  Forwarding  200000  128.2  Link Type is Shared  
Ex0/3  Designated  Forwarding  200000  128.3  Link Type is Shared
```



**b. In switch 2, type.**

```
SEFOS# show spanning-tree mst 1

## MST01
Vlans mapped: 1
Bridge Address 00:02:02:03:04:01 Priority 32768
Root Address 00:01:02:03:04:01 Priority 32768
Interface Role Sts Cost Prio.Nbr Type
-----
Ex0/1 Root Forwarding 200000 128.1 Link Type is
Shared
Ex0/2 Designated Forwarding 200000 128.2 Link Type is
Shared
```

**c. In switch 3, type.**

```
SEFOS# show spanning-tree mst 1

## MST01
Vlans mapped: 1
Bridge Address 00:03:02:03:04:01 Priority 32768
Root Address 00:01:02:03:04:01 Priority 32768
Interface Role Sts Cost Prio.Nbr Type
-----
Ex0/1 Root Forwarding 200000 128.1 Link Type is Shared
Ex0/2 Alternate Discarding 200000 128.2 Link Type is Shared
Ex0/3 Alternate Discarding 200000 128.3 Link Type is Shared
```

**6. In switch 1, specify the interface for which the port priority is to be configured.**

Interfaces can be physical interfaces and port-channel logical interfaces (port-channel *port-channel-number*).

```
SEFOS# configure terminal
SEFOS(config)# interface extreme-ethernet 0/3
```

## 7. In switch 1, configure the port priority for spanning tree.

After you configure the port priority for port 3 in switch 1, port 1 and port 2 of switch 2 are alternate ports. Port 3 is the root port.

```
SEFOS(config-if)# spanning-tree mst 1 port-priority 32
SEFOS(config)# end
```

For priority, the range is 0 to 240 in increments of 16. The default is 128. The lower the number, the higher the priority.

Valid priority values are 0, 16, 32, 48, 64, 80, 96, 112, 128, 144, 160, 176, 192, 208, 224, and 240. All other values are rejected.

## 8. View the multiple spanning tree information for the CIST instance or specified MST instance.

For *instance id*, the range is 1-64. `detail` displays spanning tree MST instance specific details.

### a. In switch 1, type.

```
SEFOS# show spanning-tree mst 1

#MST01
Vlans mapped:    1
Bridge           Address 00:01:02:03:04:01   Priority 32768
Root             Address 00:01:02:03:04:01   Priority 32768
Root             this switch for MST01
Interface Role           Sts           Cost       Prio.Nbr   Type
-----
Ex0/1   Designated   Forwarding  200000     128.1     Link Type is Shared
Ex0/2   Designated   Forwarding  200000     128.2     Link Type is Shared
Ex0/3   Designated   Forwarding  200000     32.3      Link Type is Shared
```

### b. In switch 2, type.

```
SEFOS# show spanning-tree mst 1

## MST01
Vlans mapped:    1
Bridge           Address 00:02:02:03:04:01   Priority 32768
Root             Address 00:01:02:03:04:01   Priority 32768
Interface Role           Sts           Cost       Prio.Nbr   Type
-----
Ex0/1   Root           Forwarding  200000     128.1     Link Type is Shared
Ex0/2   Designated     Forwarding  200000     128.2     Link Type is
Shared
```

c. In switch 3, type.

```
SEFOS# show spanning-tree mst 1

## MST01
Vlans mapped: 1
Bridge Address 00:03:02:03:04:01 Priority 32768
Root Address 00:01:02:03:04:01 Priority 32768
Interface Role Sts Cost Prio.Nbr Type
-----
Ex0/1 Alternate Discarding 200000 128.1 Link Type is
Shared
Ex0/2 Alternate Discarding 200000 128.2 Link Type is
Shared
Ex0/3 Root Forwarding 200000 128.3 Link Type is Shared
```

## ▼ Restore the Default MSTP Priority

This example restores the MST priority to 32768.

- From Interface Configuration mode, restore the default setting.

```
SEFOS(config)# no spanning-tree mst 1 priority
```

---

## Configuring the Interval Between Generation of Configuration Messages

These topics describe how to configure the interval between generation of configuration messages.

- [“Configure the MST Interval Between Generation of Configuration Messages” on page 52](#)
- [“Restore the Default Interval Between Generation of Configuration Messages” on page 52](#)

## ▼ Configure the MST Interval Between Generation of Configuration Messages

Hello time must be configured if it is required to configure the interval between generation of configuration messages by the root switch.

1. Specify the interface for the interval and configure the MST interval.

```
SEFOS# configure terminal  
SEFOS(config)# interface extreme-ethernet 0/1  
SEFOS(config-if)# spanning-tree mst hello-time 1
```

The hello-time value range is 1-2 seconds. The default is 2.

```
SEFOS(config-if)# end
```

2. View the MST port-specific configuration.

```
SEFOS# show spanning-tree mst interface extreme-ethernet 0/1  
  
Ex0/1 of MST00 is Designated, Forwarding  
Edge port: no  
Link type: Shared  
Port Hello Timer: 4 Sec  
Bpdus sent 271 , Received 308  
Instance  Role          Sts          Cost      Prio.Nbr  
-----  ----          ---          ----      -  
0         Designated  Forwarding  200000    128.1  
1         Designated  Forwarding  200000    128.1
```

## ▼ Restore the Default Interval Between Generation of Configuration Messages

- Set the default value for the interval.

```
SEFOS(config-if)# no spanning-tree mst hello-time
```

---

# Configuring the Maximum Hop Count

These topics describe how to configure the maximum hop count.

- [“Configure the Maximum Hop Count” on page 53](#)
- [“Restore the Default Maximum Hop Count” on page 54](#)

## ▼ Configure the Maximum Hop Count

The max hop count is the maximum number of hops the BPDU can traverse before getting discarded and also before the information held for a port is aged out.

### 1. Configure the maximum hop count.

```
SEFOS# configure terminal  
SEFOS(config)# spanning-tree mst max-hops 10
```

The maximum hop range is 6-40. The default is 20.

```
SEFOS(config)# end
```

### 2. View the MST port-specific configuration.

```
SEFOS# show spanning-tree mst detail  
  
## MST00  
Bridge      Address 00:04:02:03:04:01      Priority 32768  
Root        Address 00:04:02:03:04:01      Priority 32768  
            We are the Root for CST  
            Port 0          , path cost 0  
IST Root    Address 00:04:02:03:04:01      Priority 32768  
            Path cost 0  
Configured Forward delay 15, Max age 20, Max hops 10  
Operational Forward delay 15, Max age 20  
Ex0/1 of MST00 is Designated, Forwarding  
Port info           port id 128.1           priority 128 cost 200000  
Designated root     address 00:04:02:03:04:01      priority 32768  
cost 0  
Designated ist master address 00:04:02:03:04:01      priority 32768  
cost 0  
Designated bridge   address 00:04:02:03:04:01      priority 32768  
portid 128.1
```

```
Configured Forward delay 15, Max age 20, Max hops 10
Operational Forward delay 15, Max age 20
Bpdus sent 36 , Received 0
```

## ▼ Restore the Default Maximum Hop Count

- Configure the maximum hop count to its default value.

```
SEFOS(config)# no spanning-tree mst max-hops
```

---

## Configuring the Pseudo Root ID

These topics describe how to configure the pseudo root ID.

- [“Configure the Pseudo Root ID” on page 54](#)
- [“Display the Pseudo Root ID” on page 55](#)

## ▼ Configure the Pseudo Root ID

If a port is configured as a L2GP, the configured pseudo root ID is used to generate and present the Pseudo BPDU to MSTP state machines, as if received from another bridge.

- Map VLANs to an MST instance, specify the BPDU transmit status interface, and configure the pseudo root ID of the L2GP.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree mst configuration
SEFOS(config-mst)# instance 1 vlan 1
SEFOS(config-if)# exit
SEFOS(config)# interface extreme-ethernet 0/1
```

Valid interfaces include physical interfaces and port-channel logical interfaces (port-channel *port-channel-number*).

```
SEFOS(config-if)# spanning-tree pseudoRootId priority 4096
mac-address 00:01:02:03:04:01
SEFOS(config-if)# spanning-tree mst 1 pseudoRootId priority 8192
mac-address 00:01:02:03:04:02
```

## ▼ Display the Pseudo Root ID

- Display the configured pseudo root ID.

This command displays the port configured as a L2GP only.

```
SEFOS# show spanning-tree layer2-gateway-port

Switch default
Port Ex0/1

Instance      Priority      PseudoRootId      State
-----      -
MST00         4096         00:01:02:03:04:01 Forwarding
MST01         8192         00:01:02:03:04:02 Forwarding
```





# Configuring Features Common to RSTP and MSTP

---

These sections explain how to configure features common to RSTP and MSTP.

- “Clear Spanning Tree MSTP Counters” on page 57
- “Configuring the Transit Hold Count” on page 60
- “Configuring the Dynamic Path Cost” on page 61
- “Configuring Automatic Detection of Edge Devices or Bridges” on page 72
- “Configuring the Restricted Role” on page 74
- “Configuring the Topology Change” on page 78
- “Restart the Protocol Migration Process” on page 80
- “Configuring the Spanning Tree BPDU Receive Status” on page 80
- “Configuring the Spanning Tree BPDU Transmit Status” on page 81
- “Configuring the Spanning Tree L2GP Status” on page 82
- “Display the Spanning Port Information” on page 83
- “Display the MST Configuration and Status” on page 84

## ▼ Clear Spanning Tree MSTP Counters

1. View output in switch 1 before clearing the counters.

```
SEFOS# show spanning-tree detail

Spanning tree Protocol Enabled.

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Identifier has Priority 32768, Address 00:01:02:03:04:01
Configured Max age 20 sec, Forward delay 15 sec
Configured Hello Time 2 sec
Dynamic Path Cost Disabled
Flush Interval 0 centi-sec, Flush Invocations 72
```

```
Flush Indication threshold 0
Current Root has priority 32768, address 00:02:02:03:04:01
cost of root path is 2000
Number of Topology Changes 1, Time since topology Change 89 seconds
ago
Transmit Hold-Count 3
Root Times : Max age 20 Sec Forward delay 15 Sec

Port 45 [Ex0/45] of MST00 is Root , Forwarding
Ex0/45 is operating in the MSTP Mode
Port path cost 2000, Port priority 128,
Port Identifier 128.45. Port HelloTime 2,
Timers: Hello - 1, Forward Delay - 0, Topology Change - 0
Designated root has priority 32768, address 00:02:02:03:04:01

Designated Bridge has priority 32768, address 00:02:02:03:04:01
Designated Port Id is 128.45, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Received Hello Time 2 Sec
Number of Transitions to forwarding State : 1
Auto-Edge is enabled
PortFast is disabled, Oper-Edge is disabled
Link type is point to Point
BPDUs : sent 4, recieved 4466
Restricted Role is disabled.
Restricted TCN is disabled.
bpdu-transmit enabled
bpdu-receive enabled
Loop Guard is disabled
```

## 2. Clear the counters for instance 1.

```
SEFOS(config)# clear spanning-tree mst 1 counters
SEFOS(config)# end
```

## 3. View output in switch 1 after clearing the counters.

```
SEFOS# sh spanning-tree detail

Spanning tree Protocol has been enabled

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
```

```

Bridge Identifier has Priority 32768, Address 00:01:02:03:04:01
Configured Max age 20 sec, Forward delay 15 sec
Configured Hello Time 2 sec
Dynamic Path Cost Disabled
Flush Interval 0 centi-sec, Flush Invocations 219
Flush Indication threshold 0
Current Root has priority 32768, address 00:02:02:03:04:01
cost of root path is 2000
Number of Topology Changes 6, Time since topology Change 2 secs ago
Transmit Hold-Count 3
Root Times : Max age 20 Sec      Forward delay 15 Sec

Port 46 [Ex0/46] of MST00 is Root      , Forwarding
Ex0/46 is operating in the MSTP Mode
Port path cost 2000, Port priority 128,
Port Identifier 128.46. Port HelloTime 2,
Timers: Hello - 0, Forward Delay - 0, Topology Change - 0
Designated root has priority 32768, address 00:02:02:03:04:01
Designated Bridge has priority 32768, address 00:02:02:03:04:01
Designated Port Id is 128.46, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Received Hello Time 2 Sec
Number of Transitions to forwarding State : 2
Auto-Edge is enabled
PortFast is disabled, Oper-Edge is disabled
Link type is point to Point
BPDUs : sent 19, recieved 282
Restricted Role is disabled.
Restricted TCN is disabled.
bpdu-transmit enabled
bpdu-receive enabled

Loop Guard is disabled

MST01 is executing mstp compatible spanning-tree protocol
Flush Invocations 0
Flush Indication threshold 0

Port 46 [Ex0/46]of MST01 is Master, Forwarding
Port cost 2000, Port priority 128,
Port Identifier 128.46. Port HelloTime 2,
Timers: Hello - 0,Forward Delay - 0, Topology Change - 0
Designated Root has priority 32768, address 00:01:02:03:04:01
Designated Bridge has priority 32768, address 00:01:02:03:04:01
Designated Port Id is 128.46, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Number of Transitions to forwarding State : 0
BPDUs : sent 0, recieved 0

```

---

# Configuring the Transit Hold Count

These topics describe how to configure the transit hold count.

- [“Configure the Transmit Hold Count” on page 60](#)
- [“Restore the Default Transmit Hold Count Value” on page 61](#)

## ▼ Configure the Transmit Hold Count

Transmit hold count value is a counter that limits the maximum transmission rate of the switch.

---

**Note** – The number of BPDUs that can be transmitted during every hello time period ranges from a minimum of one and a maximum of not more than TxHoldCount values.

---

### 1. Configure the transmit hold count.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree transmit hold-count 9
```

The transmit hold count ranges from 1-10. The default is 3.

```
SEFOS(config)# end
```

### 2. View the spanning tree details.

```
SEFOS# show spanning-tree detail

Spanning tree Protocol Enabled.

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Identifier has Priority 32768, Address 00:01:02:03:04:01
Configured Max age 20 sec, Forward delay 15 sec
Configured Hello Time 2 sec
Dynamic Path Cost Disabled
Flush Interval 0 centi-sec, Flush Invocations 72
Flush Indication threshold 0
```

```
Current Root has priority 32768, address 00:02:02:03:04:01
cost of root path is 2000
Number of Topology Changes 1, Time since topology Change 89 seconds
ago
Transmit Hold-Count 3
Root Times : Max age 20 Sec Forward delay 15 Sec

Port 45 [Ex0/45] of MST00 is Root , Forwarding
Ex0/45 is operating in the MSTP Mode
Port path cost 2000, Port priority 128,
Port Identifier 128.45. Port HelloTime 2,
Timers: Hello - 1, Forward Delay - 0, Topology Change - 0
Designated root has priority 32768, address 00:02:02:03:04:01

Designated Bridge has priority 32768, address 00:02:02:03:04:01
Designated Port Id is 128.45, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Received Hello Time 2 Sec
Number of Transitions to forwarding State : 1
Auto-Edge is enabled
PortFast is disabled, Oper-Edge is disabled
Link type is point to Point
BPDUs : sent 4, recieved 4466
Restricted Role is disabled.
Restricted TCN is disabled.
bpdu-transmit enabled
bpdu-receive enabled
Loop Guard is disabled
```

## ▼ Restore the Default Transmit Hold Count Value

- Configure the transmit hold count to its default value.

```
SEFOS(config)# no spanning-tree transmit hold-count
```

---

## Configuring the Dynamic Path Cost

These topics describe how to configure the dynamic path cost.

- [“Dynamic Path Cost Topology Example” on page 62](#)
- [“Configure the Dynamic Path Cost” on page 62](#)

- “Configure the Dynamic Path Cost in an Aggregate Port” on page 64
- “Disable the Dynamic Path Cost Calculation” on page 67

## Dynamic Path Cost Topology Example



The path cost of all the ports can be calculated dynamically based on the speed of the interface. By default, dynamic path cost calculation is disabled.

### ▼ Configure the Dynamic Path Cost

---

**Note** – If the path cost is already configured for a CIST or RSTP interface, this procedure has no effect on such ports. If the cost has been configured previously for an MST instance on a particular interface, this command has no effect on that instance in the specified interface. The path cost of all the other instances on the same interface are calculated dynamically.

---

#### 1. View the spanning tree configuration before configuring the dynamic path cost.

##### a. In switch 1, type.

```
SEFOS# show spanning-tree

Root Id          Priority    32768
                Address    00:01:02:03:04:01
                Cost      0
                Port      0 [0]
                This bridge is the root
                Max age 20 Sec, forward delay 15 Sec
                Hello Time is 2 Sec

MST00
Spanning tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id        Priority    32768
                Address    00:01:02:03:04:01
```

```

Max age is 20 sec, forward delay is 15 sec
Hello Time is 2 sec
Dynamic Path Cost is Disabled
Dynamic Path Cost Lag-Speed Change is Disabled
Name      Role      State      Cost      Prio      Type
----      -
Ex0/1     Designated Forwarding  20000    128      SharedLan
Ex0/2     Designated Forwarding  20000    128      SharedLan

```

**b. In switch 2, type.**

```

SEFOS# show spanning-tree

Root Id      Priority  32768
            Address  00:01:02:03:04:01
            Cost    200000
            Port    1 [Ex0/1]
Max age 20 Sec, forward delay 15 Sec
Hello Time is 2 Sec

MST00
Spanning tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id    Priority  32768
            Address  00:02:02:03:04:01
Max age is 20 sec, forward delay is 15 sec
Hello Time is 2 sec
Dynamic Path Cost is Disabled
Dynamic Path Cost Lag-Speed Change is Disabled
Name      Role      State      Cost      Prio      Type
----      -
Ex0/1     Root      Forwarding  20000    128      SharedLan
Ex0/2     Alternate Discarding  20000    128      SharedLan

```

**2. Configure the dynamic path cost in switch 2.**

```

SEFOS# configure terminal
SEFOS(config)# spanning-tree pathcost dynamic

```

**3. Reduce the speed of the extreme-ethernet 0/1 interface to 10 Mbps in switch 2.**

```

SEFOS(config)# interface extreme-ethernet 0/1
SEFOS(config-if)# no negotiation
SEFOS(config-if)# speed 10

```

#### 4. View the spanning tree details in switch 2.

```
SEFOS# show spanning-tree

Root Id          Priority    32768
                Address    00:01:02:03:04:01
                Cost      200000
                Port      2 [Ex0/2]
                Max age 20 Sec, forward delay 15 Sec
                Hello Time is 2 Sec

MST00
Spanning tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id        Priority    32768
                Address    00:02:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
                Hello Time is 2 sec
                Dynamic Path Cost is Disabled
                Dynamic Path Cost Lag-Speed Change is Disabled

Name      Role      State      Cost      Prio      Type
----      -
Ex0/1     Alternate Discarding 2000000   128      P2P
Ex0/2     Root      Forwarding 20000     128      P2P
```

## ▼ Configure the Dynamic Path Cost in an Aggregate Port

The path cost of a port channel is the path cost corresponding to the aggregated speed of all the member ports of the port channel. The path cost of a port channel is determined when there is an operational status change for the port channel. There is no port channel path cost recalculation for operational status changes on individual member ports.

See “[Dynamic Path Cost Topology Example](#)” on page 62 for the topology for this procedure. P1 and P2 are aggregated into a port channel interface.

#### 1. View the spanning tree information in switch 2.

```
SEFOS# show spanning-tree

Root Id          Priority    32768
                Address    00:01:02:03:04:01
                Cost      200000
```



```

Port          1 [Ex0/1]
Max age 20 Sec, forward delay 15 Sec
Hello Time is 2 Sec

MST00
Spanning tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id      Priority  32768
                Address  00:02:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
                Hello Time is 2 sec
                Dynamic Path Cost is Disabled
                Dynamic Path Cost Lag-Speed Change is Disabled
Name           Role           State           Cost           Prio           Type
----           -
Ex0/1          Root           Forwarding      200000         128           SharedLan
Ex0/2          Alternate      Discarding      200000         128           SharedLan

```

## 2. Configure the path cost as dynamic in both switches.

```

SEFOS# configure terminal
SEFOS(config)# spanning-tree pathcost dynamic

```

## 3. Create and enable port channel in both switches.

```

SEFOS(config)# set port-channel enable
SEFOS(config)# interface port-channel 1
SEFOS(config-if)# no shutdown
SEFOS(config-if)# exit
SEFOS(config)# interface extreme-ethernet 0/1
SEFOS(config-if)# channel-group 1 mode active
SEFOS(config-if)# exit
SEFOS(config)# interface extreme-ethernet 0/2
SEFOS(config-if)# channel-group 1 mode active
SEFOS(config-if)# exit

```

## 4. View the spanning tree information in switch 2.

```

SEFOS# show spanning-tree

Root Id      Priority  32768
                Address  00:01:02:03:04:01
                Cost      99900
                Port      25 [po1]
                Max age 20 Sec, forward delay 15 Sec
                Hello Time is 2 Sec

```

```

MST00
Spanning tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id          Priority 32768
                  Address 00:02:02:03:04:01
                  Max age is 20 sec, forward delay is 15 sec
                  Hello Time is 2 sec
                  Dynamic Path Cost is Disabled
                  Dynamic Path Cost Lag-Speed Change is Disabled
Name      Role      State      Cost      Prio      Type
----      -
po1       Root      Forwarding 99900     128      P2P

```

5. Disconnect the cable connecting port 2 of both the switches.

6. View the spanning tree information in switch 2.

```

SEFOS# show spanning-tree

Root Id          Priority 32768
                Address 00:01:02:03:04:01
                Cost      0
                Port      0 [0]
                This bridge is the root
                Max age 20 Sec, forward delay 15 Sec
                Hello Time is 2 Sec

MST00
Spanning tree Protocol Enabled.
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id          Priority 32768
                  Address 00:01:02:03:04:01
                  Max age is 20 sec, forward delay is 15 sec
                  Hello Time is 2 sec
                  Dynamic Path Cost is Disabled
                  Dynamic Path Cost Lag-Speed Change is Disabled
Name      Role      State      Cost      Prio      Type
----      -
po1       Designated Forwarding 99900     128      P2P

```

---

**Note** – Even after the cable is removed, the path cost is not changed. The path cost will be recalculated only when there is an operational status change of the port channel interface, and not when the operational status of a port in a bundle changes.

---

7. In switch 2, change the administrative status of the port channel interface to down and then up.

```
SEFOS(config)# interface port-channel 1
SEFOS(config-if)# shutdown
SEFOS(config-if)# no shutdown
SEFOS(config-if)# end
SEFOS# show spanning-tree
Root Id          Priority    32768
                 Address    00:02:02:03:04:01
                 Cost      1900
                 Port      73 [po1]
                 Max age 20 Sec, forward delay 15 Sec
                 Hello Time 2 Sec

MST00

Spanning tree Protocol has been enabled

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id        Priority    32768
                 Address    00:01:02:03:04:01
                 Max age is 20 sec, forward delay is 15 sec
                 Hello Time is 2 sec
                 Dynamic Path Cost is Disabled
                 Dynamic Path Cost Lag-Speed Change is Enabled
Name             Role        State        Cost      Prio     Type
-----
po1              Root        Forwarding   1900      128     P2P
```

## ▼ Disable the Dynamic Path Cost Calculation

- Type.

```
SEFOS(config)# no spanning-tree pathcost dynamic
```

---

**Note** – The path cost will be recalculated when there is an administrative status change.

---

## ▼ Configure the Dynamic Path Cost Lag Speed in an Aggregate Port

1. Configure dynamic path cost calculation for Lagg in both the switches.
  - a. Configure the dynamic path cost lag-speed.

```
SEFOS(config)# spanning-tree pathcost dynamic lag-speed
```

- b. Create and enable port channel in both the switches.

```
SEFOS(config)# set port-channel enable  
SEFOS(config)# interface port-channel 1  
SEFOS(config-if)# no shutdown  
SEFOS(config-if)# exit  
SEFOS(config)# interface extreme-ethernet 0/45  
SEFOS(config-if)# channel-group 1 mode on  
SEFOS(config-if)# exit
```

2. View the output in Switch 1.

```
SEFOS# show spanning-tree  
Root Id          Priority    32768  
Address          00:02:02:03:04:01  
Cost             1900  
Port             73 [po1]  
Max age 20 Sec, forward delay 15 Sec  
Hello Time 2 Sec  
  
MST00  
  
Spanning tree Protocol has been enabled  
  
MST00 is executing the mstp compatible Multiple Spanning Tree  
Protocol  
Bridge Id        Priority    32768  
Address          00:01:02:03:04:01  
Max age is 20 sec, forward delay is 15 sec  
Hello Time is 2 sec  
Dynamic Path Cost is Disabled  
Dynamic Path Cost Lag-Speed Change is Enabled  
Name             Role        State        Cost        Prio        Type  
----             -  
Ex0/46           Alternate   Discarding   2000        128         P2P  
po1              Root        Forwarding   1900        128         P2P
```

### 3. Make Port 46 as member of Port Channel on both switches.

```
SEFOS(config)# interface extreme-ethernet 0/46  
SEFOS(config-if)# channel-group 1 mode on  
SEFOS(config-if)# exit
```

### 4. View the output in Switch 1.

```
SEFOS# show spanning-tree  
Root Id          Priority    32768  
                Address    00:02:02:03:04:01  
                Cost      1900  
                Port      73 [po1]  
                Max age 20 Sec, forward delay 15 Sec  
                Hello Time 2 Sec  
  
MST00  
  
Spanning tree Protocol has been enabled  
  
MST00 is executing the mstp compatible Multiple Spanning Tree  
Protocol  
Bridge Id        Priority    32768  
                Address    00:01:02:03:04:01  
                Max age is 20 sec, forward delay is 15 sec  
                Hello Time is 2 sec  
                Dynamic Path Cost is Disabled  
                Dynamic Path Cost Lag-Speed Change is Enabled  
Name             Role          State          Cost      Prio    Type  
----             -
```

### 5. Remove Port 46 from Port Channel on both the switches.

```
SEFOS(config)# interface extreme-ethernet 0/46  
SEFOS(config-if)# no channel-group  
SEFOS(config-if)# exit
```

## 6. View the output in Switch 1.

```
SEFOS# show spanning-tree
Root Id          Priority 32768
                Address 00:02:02:03:04:01
                Cost   1900
                Port   73 [po1]
                Max age 20 Sec, forward delay 15 Sec
                Hello Time 2 Sec

MST00

Spanning tree Protocol has been enabled

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id        Priority 32768
                Address 00:01:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
                Hello Time is 2 sec
                Dynamic Path Cost is Disabled
                Dynamic Path Cost Lag-Speed Change is Enabled

Name            Role          State          Cost      Prio    Type
----            -
Ex0/46          Alternate   Discarding     2000      128    P2P
po1             Root        Forwarding     1900      128    P2P
```

## ▼ Disable the Dynamic Path Cost Lag Speed Calculation

- Type.

```
SEFOS(config)# no spanning-tree pathcost dynamic lag-speed
```

---

**Note** – The path cost will be recalculated when there is an administrative status change.

---

## ▼ Enable Spanning Tree Loop Guard

### 1. Enable loop guard in switch 1.

```
SEFOS(config)# interface extreme-ethernet 0/46  
SEFOS(config-if)# spanning-tree link-type point-to-point  
SEFOS(config-if)# spanning-tree loop-guard  
SEFOS(config-if)# end
```

### 2. View the output in Switch 1

```
SEFOS# show spanning-tree interface extreme-ethernet 0/46 detail  
Port 46 [Ex0/46] of MST00 is Alternate , Discarding  
Ex0/46 is operating in the MSTP Mode  
Port path cost 2000, Port priority 128,  
Port Identifier 128.46. Port HelloTime 2,  
Timers: Hello - 1, Forward Delay - 0, Topology Change - 0  
Designated root has priority 32768, address 00:02:02:03:04:01  
Designated Bridge has priority 32768, address 00:02:02:03:04:01  
Designated Port Id is 128.46, Designated pathcost is 0  
Operational Forward delay 15, Max age 20  
Received Hello Time 2 Sec  
Received Hello Time 2 Sec  
Number of Transitions to forwarding State : 1  
Auto-Edge is disabled  
PortFast is disabled, Oper-Edge is disabled  
Link type is point to Point  
BPDUs : sent 19, recieved 484  
Restricted Role is disabled.  
Restricted TCN is disabled.  
bpdu-transmit enabled  
bpdu-receive enabled  
Loop Guard is enabled
```

## ▼ Show Spanning Tree Performance Data

### ● View the output in Switch 1

```
SEFOS# show spanning-tree performance-data  
STP Performance data  
=====  
Received Event : PORT_UP  
Received Event Time Stamp(In millisecs) : 1948678214  
Port State Change Time Stamp(In millisecs) : 1948713428
```

```
SEFOS# show spanning-tree performance-data interface
extreme-ethernet 0/46
STP Performance data at Port 46
=====
Rcvd Event Time Stamp(In millisecs) : 1948678214
Rcvd Event                          : PORT_UP
```

---

## Configuring Automatic Detection of Edge Devices or Bridges

These topics describe how to configure automatic detection of edge devices or bridges.

- [“Configure Automatic Detection of Edge Devices or Bridges” on page 72](#)
- [“Disable Automatic Detection of Edge Devices or Bridges” on page 74](#)

### ▼ Configure Automatic Detection of Edge Devices or Bridges

The auto edge feature enables automatic detection of edge devices or bridges connected to an interface. See [“Dynamic Path Cost Topology Example” on page 62](#) for the topology for this procedure.

#### 1. Configure the automatic detection.

```
SEFOS(config)# interface extreme-ethernet 0/1
SEFOS(config-if)# spanning-tree auto-edge
SEFOS(config-if)# end
```

#### 2. View the spanning tree details for port 1 connected to a host.

```
SEFOS# show spanning-tree detail

Spanning tree Protocol Enabled.

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Identifier has Priority 32768, Address 00:01:02:03:04:01
```



```
Configured Max age 20 sec, Forward delay 15 sec
Configured Hello Time 2 sec
Dynamic Path Cost Disabled
Flush Interval 0 centi-sec, Flush Invocations 72
Flush Indication threshold 0
Current Root has priority 32768, address 00:02:02:03:04:01
cost of root path is 2000
Number of Topology Changes 1, Time since topology Change 89 seconds
ago
Transmit Hold-Count 3
Root Times : Max age 20 Sec Forward delay 15 Sec

Port 45 [Ex0/45] of MST00 is Root , Forwarding
Ex0/45 is operating in the MSTP Mode
Port path cost 2000, Port priority 128,
Port Identifier 128.45. Port HelloTime 2,
Timers: Hello - 1, Forward Delay - 0, Topology Change - 0
Designated root has priority 32768, address 00:02:02:03:04:01

Designated Bridge has priority 32768, address 00:02:02:03:04:01
Designated Port Id is 128.45, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Received Hello Time 2 Sec
Number of Transitions to forwarding State : 1
Auto-Edge is enabled
PortFast is disabled, Oper-Edge is disabled
Link type is point to Point
BPDUs : sent 4, recieved 4466
Restricted Role is disabled.
Restricted TCN is disabled.
bpdu-transmit enabled
bpdu-receive enabled
Loop Guard is disabled
```

### 3. View the spanning tree details for port 1 connected to a switch.

```
SEFOS# show spanning-tree detail

Spanning tree Protocol Enabled.

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Identifier has Priority 32768, Address 00:01:02:03:04:01
Configured Max age 20 sec, Forward delay 15 sec
Configured Hello Time 2 sec
Dynamic Path Cost Disabled
Flush Interval 0 centi-sec, Flush Invocations 72
Flush Indication threshold 0
```

```

Current Root has priority 32768, address 00:02:02:03:04:01
cost of root path is 2000
Number of Topology Changes 1, Time since topology Change 89 seconds
ago
Transmit Hold-Count 3
Root Times : Max age 20 Sec Forward delay 15 Sec

Port 45 [Ex0/45] of MST00 is Root , Forwarding
Ex0/45 is operating in the MSTP Mode
Port path cost 2000, Port priority 128,
Port Identifier 128.45. Port HelloTime 2,
Timers: Hello - 1, Forward Delay - 0, Topology Change - 0
Designated root has priority 32768, address 00:02:02:03:04:01

Designated Bridge has priority 32768, address 00:02:02:03:04:01
Designated Port Id is 128.45, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Received Hello Time 2 Sec
Number of Transitions to forwarding State : 1
Auto-Edge is enabled
PortFast is disabled, Oper-Edge is disabled
Link type is point to Point
BPDUs : sent 4, recieved 4466
Restricted Role is disabled.
Restricted TCN is disabled.
bpdu-transmit enabled
bpdu-receive enabled
Loop Guard is disabled

```

## ▼ Disable Automatic Detection of Edge Devices or Bridges

- Type.

```
SEFOS(config-if)# no spanning-tree auto-edge
```

---

## Configuring the Restricted Role

These topics describe how to configure the restricted role.

- [“Configure the Restricted Role” on page 75](#)

- [“Disable the Restricted Role” on page 78](#)

## ▼ Configure the Restricted Role

Whenever a port is configured with a restricted role, the port cannot be root port. The spanning tree information received on the configured port is subjected to role selection. If the received information is superior, the port is selected as the alternate port or backup port. If the received information is inferior, the port is selected as the designated port. By default, the restricted-role feature is disabled.

On provider bridges, the restricted-role feature is enabled for all customer network ports.

### 1. View the restricted role status.

```
SEFOS# show spanning-tree detail

Spanning tree Protocol Enabled.

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Identifier has Priority 32768, Address 00:01:02:03:04:01
Configured Max age 20 sec, Forward delay 15 sec
Configured Hello Time 2 sec
Dynamic Path Cost Disabled
Flush Interval 0 centi-sec, Flush Invocations 72
Flush Indication threshold 0
Current Root has priority 32768, address 00:02:02:03:04:01
cost of root path is 2000
Number of Topology Changes 1, Time since topology Change 89 seconds
ago
Transmit Hold-Count 3
Root Times : Max age 20 Sec Forward delay 15 Sec

Port 45 [Ex0/45] of MST00 is Root , Forwarding
Ex0/45 is operating in the MSTP Mode
Port path cost 2000, Port priority 128,
Port Identifier 128.45. Port HelloTime 2,
Timers: Hello - 1, Forward Delay - 0, Topology Change - 0
Designated root has priority 32768, address 00:02:02:03:04:01
```

```
Designated Bridge has priority 32768, address 00:02:02:03:04:01
Designated Port Id is 128.45, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Received Hello Time 2 Sec
Number of Transitions to forwarding State : 1
Auto-Edge is enabled
PortFast is disabled, Oper-Edge is disabled
Link type is point to Point
BPDUs : sent 4, recieved 4466
Restricted Role is disabled.
Restricted TCN is disabled.
bpdu-transmit enabled
bpdu-receive enabled
Loop Guard is disabled
```

## 2. Configure root guard or restricted role on the port in both the switches.

```
SEFOS# configure terminal
SEFOS(config)# interface extreme-ethernet 0/1
```

## 3. Configure the restricted role feature.

```
SEFOS(config-if)# spanning-tree restricted-role
```

## 4. Exit Interface Configuration mode.

```
SEFOS(config-if)# end
```

5. View the restricted role configuration using the following command.

```
SEFOS# show spanning-tree detail
Spanning tree Protocol has been enabled

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Identifier has Priority 32768, Address 00:01:02:03:04:01

Configured Max age 20 sec, Forward delay 15 sec
Configured Hello Time 2 sec
Dynamic Path Cost Disabled
Flush Interval 0 centi-sec, Flush Invocations 72
Flush Indication threshold 0
Current Root has priority 32768, address 00:02:02:03:04:01
cost of root path is 2000
Number of Topology Changes 1, Time since topology Change 89 seconds
ago
Transmit Hold-Count 3
Root Times : Max age 20 Sec Forward delay 15 Sec

Port 45 [Ex0/45] of MST00 is Root , Forwarding
Ex0/45 is operating in the MSTP Mode
Port path cost 2000, Port priority 128,
Port Identifier 128.45. Port HelloTime 2,
Timers: Hello - 1, Forward Delay - 0, Topology Change - 0
Designated root has priority 32768, address 00:02:02:03:04:01

Designated Bridge has priority 32768, address 00:02:02:03:04:01

Designated Port Id is 128.45, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Received Hello Time 2 Sec
Number of Transitions to forwarding State : 1
Auto-Edge is enabled
PortFast is disabled, Oper-Edge is disabled
Link type is point to Point
BPDUs : sent 4, recieved 4466
Restricted Role is disabled.
Restricted TCN is disabled.
bpdu-transmit enabled
bpdu-receive enabled
Loop Guard is disabled
```

## ▼ Disable the Restricted Role

- Type.

```
SEFOS(config-if)# no spanning-tree restricted-role
```

---

## Configuring the Topology Change

These topics describe how to configure the topology change.

- [“Enable the Topology Change” on page 78](#)
- [“Disable the Topology Change” on page 79](#)

## ▼ Enable the Topology Change

See [“Dynamic Path Cost Topology Example” on page 62](#) for the topology for this procedure. When a port is configured as restricted TCN, the port does not process and propagate any topology change information received on the configured port. Enabling this configuration could cause temporary connectivity loss after changes in active spanning tree topology. The connectivity loss is due to incorrect learned station location information.

By default, the restricted TCN feature is disabled. For provider bridges, restricted TCN is always enabled on customer network ports.

1. **Configure the restricted TCN feature on the port.**

```
SEFOS# configure terminal
SEFOS(config)# interface extreme-ethernet 0/1
SEFOS(config-if)# spanning-tree restricted-tcn
SEFOS(config-if)# end
```

2. **View the restricted TCN configuration.**

```
SEFOS# show spanning-tree detail

Spanning tree Protocol Enabled.

MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
```

```

Bridge Identifier has Priority 32768, Address 00:01:02:03:04:01
Configured Max age 20 sec, Forward delay 15 sec
Configured Hello Time 2 sec
Dynamic Path Cost Disabled
Flush Interval 0 centi-sec, Flush Invocations 72
Flush Indication threshold 0
Current Root has priority 32768, address 00:02:02:03:04:01
cost of root path is 2000
Number of Topology Changes 1, Time since topology Change 89 seconds
ago
Transmit Hold-Count 3
Root Times : Max age 20 Sec Forward delay 15 Sec

Port 45 [Ex0/45] of MST00 is Root , Forwarding
Ex0/45 is operating in the MSTP Mode
Port path cost 2000, Port priority 128,
Port Identifier 128.45. Port HelloTime 2,
Timers: Hello - 1, Forward Delay - 0, Topology Change - 0
Designated root has priority 32768, address 00:02:02:03:04:01

Designated Bridge has priority 32768, address 00:02:02:03:04:01
Designated Port Id is 128.45, Designated pathcost is 0
Operational Forward delay 15, Max age 20
Received Hello Time 2 Sec
Number of Transitions to forwarding State : 1
Auto-Edge is enabled
PortFast is disabled, Oper-Edge is disabled
Link type is point to Point
BPDUs : sent 4, recieved 4466
Restricted Role is disabled.
Restricted TCN is disabled.
bpdu-transmit enabled
bpdu-receive enabled
Loop Guard is disabled

```

## ▼ Disable the Topology Change

- Type.

```
SEFOS(config-if)# no spanning-tree restricted-tcn
```

---

## ▼ Restart the Protocol Migration Process

SEFOS MSTP detects the spanning tree version on a LAN and sends out the equivalent BPDU. If this switch receives a legacy IEEE 802.1D configuration BPDU (a BPDU with the protocol version set to 0), MSTP sends only IEEE 802.1D BPDUs on that port.

SEFOS MSTP supports the force version feature, where a switch supporting MSTP is forced to behave as STP or RSTP. However, the switch does not automatically revert to the MSTP mode if it does not receive IEEE 802.1D BPDUs, because the switch cannot determine whether the legacy switch has been removed from the link unless the legacy switch is the designated switch.

- **Type one of these commands.**
  - To restart the protocol migration process on the switch, type.

```
SEFOS# clear spanning-tree detected-protocols
```

This command forces renegotiation with neighboring switches.

- To restart the protocol migration process on a specific interface, type.

```
SEFOS# clear spanning-tree detected-protocols interface  
interface-id
```

---

## Configuring the Spanning Tree BPDU Receive Status

These topics describe how to configure the spanning tree BPDU receive status.

- [“Configure the Spanning Tree BPDU Receive Status” on page 81](#)
- [“Disable the Spanning Tree BPDU Receive Status” on page 81](#)



## ▼ Configure the Spanning Tree BPDU Receive Status

If the BPDU receive function is disabled, the BPDUs received on that port are ignored.

- **Specify the BPDU receive status interface and configure the BPDU receive status.**

```
SEFOS# configure terminal  
SEFOS(config)# interface extreme-ethernet 0/1
```

Valid interfaces include physical interfaces and `port-channel` logical interfaces (`port-channel` *port-channel-number*).

## ▼ Disable the Spanning Tree BPDU Receive Status

- **Type.**

```
SEFOS(config)# spanning-tree bpdu-receive disabled
```

---

## Configuring the Spanning Tree BPDU Transmit Status

These topics describe how to configure the spanning tree BPDU transmit status.

- [“Configure the Spanning Tree BPDU Transmit Status” on page 81](#)
- [“Disable the Spanning Tree BPDU Transmit Status” on page 82](#)

## ▼ Configure the Spanning Tree BPDU Transmit Status

If the BPDU transmit status on a port is disabled, no BPDUs are transmitted through that port.

- Specify the BPDU transmit status interface and configure the BPDU transmit status.

```
SEFOS# configure terminal  
SEFOS(config)# interface extreme-ethernet 0/1
```

Valid interfaces include physical interfaces and `port-channel` logical interfaces (`port-channel` *port-channel-number*).

## ▼ Disable the Spanning Tree BPDU Transmit Status

- Type.

```
SEFOS(config)# spanning-tree bpdu-transmit disabled
```

---

# Configuring the Spanning Tree L2GP Status

This topic describes how to configure the spanning tree L2GP status.

- [“Configure the Spanning Tree L2GP Status” on page 82](#)

## ▼ Configure the Spanning Tree L2GP Status

To configure a port as L2GP, you must disable the BPDU transmit status.

1. Disable the BPDU transmit status.

```
SEFOS# configure terminal  
SEFOS(config)# interface extreme-ethernet 0/1
```

Valid interfaces include physical interfaces and `port-channel` logical interfaces (`port-channel` *port-channel-number*).

```
SEFOS(config)# spanning-tree bpdu-transmit disabled
```

## 2. Configure the port as L2GP.

```
SEFOS(config)# spanning-tree layer2-gateway-port
```

---

# ▼ Display the Spanning Port Information

- Display the port information.

```
SEFOS# show spanning-tree interface extreme-ethernet 0/1 detail  
Port 46 [Ex0/46] of MST00 is Root , Forwarding  
Ex0/46 is operating in the MSTP Mode  
Port path cost 2000, Port priority 128,  
Port Identifier 128.46. Port HelloTime 2,  
Timers: Hello - 0, Forward Delay - 0, Topology Change - 0  
Designated root has priority 32768, address 00:02:02:03:04:01  
Designated Bridge has priority 32768, address 00:02:02:03:04:01  
Designated Port Id is 128.46, Designated pathcost is 0  
Operational Forward delay 15, Max age 20  
Received Hello Time 2 Sec  
Number of Transitions to forwarding State : 2  
Auto-Edge is enabled  
PortFast is disabled, Oper-Edge is disabled  
Link type is point to Point  
BPDUs : sent 21, recieved 1331  
Restricted Role is disabled.  
Restricted TCN is disabled.  
bpdu-transmit enabled  
bpdu-receive enabled  
Loop Guard is disabled
```

## ▼ Display the MST Configuration and Status

### 1. Display the status and configuration details of MST.

```
SEFOS# show spanning-tree mst configuration

Name          [00:04:02:03:04:01]
Revision      0
Instance      Vlans mapped
-----
0             1-1024,1025-2048,2049-3072,3073-4094
-----
```

### 2. View the spanning tree details for when an instance is not created on a port.

```
SEFOS# show spanning-tree mst detail

## MST00
Bridge      Address 00:04:02:03:04:01   Priority 32768
Root        Address 00:04:02:03:04:01   Priority 32768
            We are the Root for CST
            Port 0           , path cost 0
IST Root    Address 00:04:02:03:04:01   Priority 32768
            Path cost 0
Configured Forward delay 15, Max age 20, Max hops 20
Operational Forward delay 15, Max age 20

Ex0/1 of MST00 is Designated, Forwarding
Port info      port id 128.1           priority 128 cost 200000
Designated root      address 00:04:02:03:04:01   priority 32768
cost 0
Designated ist master address 00:04:02:03:04:01   priority 32768
cost 0
Designated bridge    address 00:04:02:03:04:01   priority 32768
portid 128.1
Configured Forward delay 15, Max age 20, Max hops 20
Operational Forward delay 15, Max age 20
Bpdus sent 36 , Received 0
```

### 3. View the spanning tree details for when instance 1 is mapped to VLAN 1.

```
SEFOS# show spanning-tree mst detail

## MST00
Bridge      Address 00:01:02:03:04:01   Priority 32768
Root       Address 00:01:02:03:04:01   Priority 32768
           We are the Root for CST
           Port 0           , path cost 0
IST Root   Address 00:01:02:03:04:01   Priority 32768
           Path cost 0
Configured Forward delay 15, Max age 20, Max hops 20
Operational Forward delay 15, Max age 20

Ex0/1 of MST00 is Designated, Forwarding
Port info      port id 128.1           priority 128
cost 200000
Designated root      address 00:01:02:03:04:01   priority 32768
cost 0
Designated ist master address 00:01:02:03:04:01   priority 32768
cost 0
Designated bridge    address 00:01:02:03:04:01   priority 32768
portid 128.1
Configured Forward delay 15, Max age 20, Max hops 20
Operational Forward delay 15, Max age 20
Bpdus sent 127 , Received 0

## MST01
Vlans mapped:      1
Bridge      Address 00:01:02:03:04:01   Priority 32768
Root       Address 00:01:02:03:04:01   Priority 32768
Root       this switch for MST01

Ex0/1 of MST01 is Designated, Forwarding
Port info      port id 128.1           priority 128   cost 200000
Designated root      address 00:01:02:03:04:01   priority 32768 cost 0
Designated bridge    address 00:01:02:03:04:01   priority 32768 port
id 128.1

SEFOS# show spanning-tree mst 1
```

```

## MST01
Vlans mapped:    1
Bridge          Address 00:01:02:03:04:01    Priority 32768
Root           Address 00:01:02:03:04:01    Priority 32768
Root           this switch for MST01
Interface Role      Sts          Cost      Prio.Nbr Type
-----
Ex0/1  Designated  Discarding  200000    128.1    Link Type is
Shared
Ex0/2  Designated  Discarding  200000    128.2    Link Type is
Shared

SEFOS# show spanning-tree mst interface extreme-ethernet 0/1

Ex0/1 of MST00 is Designated, Forwarding
Edge port: no
Link type: Shared
Port Hello Timer: 2 Sec
Bpdus sent 233 , Received 270
Instance Role      Sts          Cost      Prio.Nbr
-----
0        Designated  Forwarding  200000    128.1
1        Designated  Forwarding  200000    128.1

```

# Flow-Based Configurations

---

These sections describe flow-based configurations.

- [“Topology After Configuring the Bridge Priority and Port Path Cost in RSTP”](#) on page 87
- [“Topology Convergence for MSTP”](#) on page 91

---

## Topology After Configuring the Bridge Priority and Port Path Cost in RSTP

These topics describe topology after configuring the bridge priority and port path cost in RSTP.

- [“RSTP Configuration Guidelines”](#) on page 87
- [“Default RSTP Settings”](#) on page 87
- [“Configure the Topology”](#) on page 88

## RSTP Configuration Guidelines

To achieve topology convergence with RSTP, the bridge with the lowest bridge priority in the topology becomes the root bridge.

## Default RSTP Settings

For the default settings on the STP, see [“Default STP Settings”](#) on page 13.

## ▼ Configure the Topology

See “RSTP Configuration Guidelines” on page 87 for the topology setup. By default, all the switches run MSTP.

### 1. Change the STP mode to RSTP in switches 1 and 2.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree mode rstp
SEFOS(config)# end
```

### 2. Change the STP mode to RSTP in switch 3.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree mode rstp
SEFOS(config)# spanning-tree priority 0
SEFOS(config)# end
```

---

**Note** – Switch 3 is now the root of the spanning tree because the bridge priority is lesser than the other bridges on the spanning tree.

---

### 3. View the spanning tree port roles and port states after 22 seconds.

#### a. In switch 1, type.

```
SEFOS# show spanning-tree

Root Id          Priority    0
                Address   00:03:02:03:04:01
                Cost     200000
                Port     Ex0/2
                Hello Time 2 Sec, Max Age 20 Sec, Forward Delay 15 Sec
Bridge is executing the rstp compatible Spanning Tree Protocol
Bridge Id        Priority 32768
                Address 00:01:02:03:04:01
                Hello Time 2 sec, Max Age 20 sec, Forward Delay 15 sec
  Name           Role           State           Cost      Prio     Type
  ----           -
Ex0/1           Designated    Forwarding      200000    128     SharedLan
Ex0/2           Root          Forwarding      200000    128     SharedLan
```



**b. In switch 2, type.**

```
SEFOS# show spanning-tree

Root Id          Priority    0
                Address    00:03:02:03:04:01
                Cost      200000
                Port      Ex0/2
                Hello Time 2 Sec, Max Age 20 Sec, Forward Delay 15 Sec
Bridge is executing the rstp compatible Spanning Tree Protocol
Bridge Id        Priority 32768
                Address 00:02:02:03:04:01
                Hello Time 2 sec, Max Age 20 sec, Forward Delay 15 sec
Name            Role          State          Cost          Prio          Type
----            -
Ex0/1           Alternate  Discarding    200000        128           SharedLan
Ex0/2           Root      Forwarding    200000        128           SharedLan
```

**c. In switch 3, type.**

```
SEFOS# show spanning-tree

We are the root of the Spanning Tree
Root Id          Priority    0
                Address    00:03:02:03:04:01
                Cost      0
                Port      0
                Hello Time 2 Sec, Max Age 20 Sec, Forward Delay 15 Sec
Bridge is executing the rstp compatible Spanning Tree Protocol
Bridge Id        Priority 0
                Address 00:03:02:03:04:01
                Hello Time 2 sec, Max Age 20 sec, Forward Delay 15 sec
Name            Role          State          Cost          Prio          Type
----            -
Ex0/1           Designated  Forwarding    200000        128           SharedLan
Ex0/2           Designated  Forwarding    200000        128           SharedLan
```

**4. Configure the port path cost for port P2 on switch 2 as 4094.**

```
SEFOS# configure terminal
SEFOS(config)# interface extreme-ethernet 0/2
SEFOS(config-if)# spanning-tree cost 4094
SEFOS(config-if)# end
```

---

**Note** – This command configures port P1 of switch 2 as designated and port P1 of switch 1 as alternate.

---

**5. View the spanning tree port roles and port states after 22 seconds.**

**a. In switch 1, type.**

```
SEFOS# show spanning-tree

Root Id          Priority    0
                Address    00:03:02:03:04:01
                Cost      200000
                Port      Ex0/2
                Hello Time 2 Sec, Max Age 20 Sec, Forward Delay 15 Sec
Bridge is executing the rstp compatible Spanning Tree Protocol
Bridge Id        Priority 32768
                Address 00:01:02:03:04:01
                Hello Time 2 sec, Max Age 20 sec, Forward Delay 15 sec
  Name          Role          State          Cost          Prio          Type
  ----          -
Ex0/1          Alternate  Discarding    200000        128           SharedLan
Ex0/2          Root      Forwarding    200000        128           SharedLan
```

**b. In switch 2, type.**

```
SEFOS# show spanning-tree

Root Id          Priority    0
                Address    00:03:02:03:04:01
                Cost      4094
                Port      Ex0/2
                Hello Time 2 Sec, Max Age 20 Sec, Forward Delay 15 Sec
Bridge is executing the rstp compatible Spanning Tree Protocol
Bridge Id        Priority 32768
                Address 00:02:02:03:04:01
                Hello Time 2 sec, Max Age 20 sec, Forward Delay 15 sec
  Name          Role          State          Cost          Prio          Type
  ----          -
Ex0/1          Designated  Forwarding    200000        128           SharedLan
Ex0/2          Root      Forwarding    4094          128           SharedLan
```

c. In switch 3, type.

```
SEFOS# show spanning-tree

We are the root of the Spanning Tree
Root Id          Priority    0
                Address    00:03:02:03:04:01
                Cost      0
                Port      0
                Hello Time 2 Sec, Max Age 20 Sec, Forward Delay 15 Sec
Bridge is executing the rstp compatible Spanning Tree Protocol
Bridge Id        Priority    0
                Address    00:03:02:03:04:01
                Hello Time 2 sec, Max Age 20 sec, Forward Delay 15 sec
   Name          Role          State          Cost          Prio          Type
   ----          -
Ex0/1    Designated    Forwarding    200000    128    SharedLan
Ex0/2    Designated    Forwarding    200000    128    SharedLan
```

---

## Topology Convergence for MSTP

These topics describe topology convergence for MSTP.

- [“MSTP Configuration Guidelines” on page 91](#)
- [“Default MSTP Settings” on page 92](#)
- [“Configure the Topology” on page 92](#)

## MSTP Configuration Guidelines

Guidelines for configuring MSTP:

1. Create multiple VLANs with member ports on all switches.
2. Create multiple instances of spanning tree on all switches.
3. Assign VLANs to the instance of spanning tree on all switches.
4. Assign region names in all switches.

# Default MSTP Settings

By default, only one spanning tree is running on the bridge. For other default configurations of MSTP, see [“Default MSTP Settings” on page 41](#).

## ▼ Configure the Topology

See [“MSTP Configuration Guidelines” on page 91](#) for the topology setup. By default, all switches run MSTP.

1. On switches 1, 2, and 3, create VLAN 2, 3, and 4 with member ports as P1 and P2.

```
SEFOS# configure terminal
SEFOS(config)# vlan 2
SEFOS(config-vlan)# ports extreme-ethernet 0/1,0/2
SEFOS(config-vlan)# exit
SEFOS(config)# vlan 3
SEFOS(config-vlan)# ports extreme-ethernet 0/1,0/2
SEFOS(config-vlan)# exit
SEFOS(config)# vlan 4
SEFOS(config-vlan)# ports extreme-ethernet 0/1,0/2
SEFOS(config-vlan)# end
```

2. View the VLAN information on all switches.

- a. In switch 1, type.

```
SEFOS# show spanning-tree

Vlan database
-----
Vlan ID          : 1
Member Ports     : Ex0/1, Ex0/2, Ex0/3, Ex0/4, Ex0/5, Ex0/6
                  Ex0/7, Ex0/8, Ex0/9, Ex0/10, Ex0/11, Ex0/12
                  Ex0/13, Ex0/14, Ex0/15, Ex0/16, Ex0/17, Ex0/18
                  Ex0/19, Ex0/20, Ex0/21, Ex0/22, Ex0/23, Ex0/24
Untagged Ports   : Ex0/1, Ex0/2, Ex0/3, Ex0/4, Ex0/5, Ex0/6
                  Ex0/7, Ex0/8, Ex0/9, Ex0/10, Ex0/11, Ex0/12
                  Ex0/13, Ex0/14, Ex0/15, Ex0/16, Ex0/17, Ex0/18
                  Ex0/19, Ex0/20, Ex0/21, Ex0/22, Ex0/23, Ex0/24
Forbidden Ports  : None
Name             :
Status           : Permanent
-----
```

```

Vlan ID          : 2
Member Ports     : Ex0/1, Ex0/2
Untagged Ports   : None
Forbidden Ports  : None
Name             :
Status           : Permanent
-----
Vlan ID          : 3
Member Ports     : Ex0/1, Ex0/2
Untagged Ports   : None
Forbidden Ports  : None
Name             :
Status           : Permanent
-----
Vlan ID          : 4
Member Ports     : Ex0/1, Ex0/2
Untagged Ports   : None
Forbidden Ports  : None
Name             :
Status           : Permanent
-----

```

**b. In switch 2, type.**

```

SEFOS# show spanning-tree

Vlan database
-----
Vlan ID          : 1
Member Ports     : Ex0/1, Ex0/2, Ex0/3, Ex0/4, Ex0/5, Ex0/6
                  Ex0/7, Ex0/8, Ex0/9, Ex0/10, Ex0/11, Ex0/12
                  Ex0/13, Ex0/14, Ex0/15, Ex0/16, Ex0/17, Ex0/18
                  Ex0/19, Ex0/20, Ex0/21, Ex0/22, Ex0/23, Ex0/24
Untagged Ports   : Ex0/1, Ex0/2, Ex0/3, Ex0/4, Ex0/5, Ex0/6
                  Ex0/7, Ex0/8, Ex0/9, Ex0/10, Ex0/11, Ex0/12
                  Ex0/13, Ex0/14, Ex0/15, Ex0/16, Ex0/17, Ex0/18
                  Ex0/19, Ex0/20, Ex0/21, Ex0/22, Ex0/23, Ex0/24
Forbidden Ports  : None
Name             :
Status           : Permanent
-----
Vlan ID          : 2
Member Ports     : Ex0/1, Ex0/2
Untagged Ports   : None
Forbidden Ports  : None
Name             :
Status           : Permanent
-----

```

```

Vlan ID          : 3
Member Ports     : Ex0/1, Ex0/2
Untagged Ports   : None
Forbidden Ports  : None
Name             :
Status           : Permanent

```

```

-----
Vlan ID          : 4
Member Ports     : Ex0/1, Ex0/2
Untagged Ports   : None
Forbidden Ports  : None
Name             :
Status           : Permanent

```

**c. In switch 3, type.**

```

SEFOS# show spanning-tree

Vlan database
-----
Vlan ID          : 1
Member Ports     : Ex0/1, Ex0/2, Ex0/3, Ex0/4, Ex0/5, Ex0/6
                  Ex0/7, Ex0/8, Ex0/9, Ex0/10, Ex0/11, Ex0/12
                  Ex0/13, Ex0/14, Ex0/15, Ex0/16, Ex0/17, Ex0/18
                  Ex0/19, Ex0/20, Ex0/21, Ex0/22, Ex0/23, Ex0/24
Untagged Ports   : Ex0/1, Ex0/2, Ex0/3, Ex0/4, Ex0/5, Ex0/6
                  Ex0/7, Ex0/8, Ex0/9, Ex0/10, Ex0/11, Ex0/12
                  Ex0/13, Ex0/14, Ex0/15, Ex0/16, Ex0/17, Ex0/18
                  Ex0/19, Ex0/20, Ex0/21, Ex0/22, Ex0/23, Ex0/24
Forbidden Ports  : None
Name             :
Status           : Permanent
-----
Vlan ID          : 2
Member Ports     : Ex0/1, Ex0/2
Untagged Ports   : None
Forbidden Ports  : None
Name             :
Status           : Permanent
-----
Vlan ID          : 3
Member Ports     : Ex0/1, Ex0/2
Untagged Ports   : None
Forbidden Ports  : None
Name             :
Status           : Permanent
-----
Vlan ID          : 4

```

```
Member Ports      : Ex0/1, Ex0/2
Untagged Ports    : None
Forbidden Ports   : None
Name              :
Status            : Permanent
-----
```

3. On all switches, create instances 1, 2, and 3 and assign VLANs 2, 3, and 4 respectively.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree mst configuration
SEFOS(config-mst)# instance 1 vlan 2
SEFOS(config-mst)# instance 2 vlan 3
SEFOS(config-mst)# instance 3 vlan 4
SEFOS(config-mst)# end
```

4. Configure the bridge priority for each instance on each switch as follows:

- Switch 1 is root for spanning tree instance 1.
- Switch 2 is root for spanning tree instance 2.
- Switch 3 is root for spanning tree instance 3.

- a. In switch 1, type.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree mst 1 priority 0
SEFOS(config-mst)# spanning-tree mst configuration
SEFOS(config-mst)# name reg1
SEFOS(config-mst)# end
```

- b. In switch 2, type.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree mst 2 priority 0
SEFOS(config-mst)# name reg1
SEFOS(config-mst)# end
```

- c. In switch 3, type.

```
SEFOS# configure terminal
SEFOS(config)# spanning-tree mst 3 priority 0
SEFOS(config-mst)# name reg1
SEFOS(config-mst)# end
```

5. View the spanning tree instance information of MSTI in all switches.

a. In switch 1, type.

```
SEFOS# show spanning-tree

Root Id          Priority    32768
                Address    00:01:02:03:04:01
                Cost      0
                Port     0 [0]
                This bridge is the root
                Max age 20 Sec, forward delay 15 Sec

MST00
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id        Priority    32768
                Address    00:01:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec

Name            Role          State          Cost        Prio        Type
-----
Ex0/1           Designated   Forwarding     200000      128         SharedLan
Ex0/2           Designated   Forwarding     200000      128         SharedLan

MST01
Root Id          Priority    0
                Address    00:01:02:03:04:01
                This bridge is the root
                Max age 20 Sec, forward delay 15 Sec

Bridge Id        Priority    0
                Address    00:01:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec

Name            Role          State          Cost        Prio        type
-----
Ex0/1           Designated   Forwarding     200000      128         SharedLan
Ex0/2           Designated   Forwarding     200000      128         SharedLan

MST02
Root Id          Priority    0
                Address    00:02:02:03:04:01
                Max age 20 Sec, forward delay 15 Sec

Bridge Id        Priority    32768
                Address    00:01:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec

Name            Role          State          Cost        Prio        type
-----
Ex0/1           Root          Forwarding     200000      128         SharedLan
Ex0/2           Designated   Forwarding     200000      128         SharedLan

MST03
```



Root Id	Priority	0			
	Address	00:03:02:03:04:01			
	Max age	20 Sec, forward delay	15 Sec		
Bridge Id	Priority	32768			
	Address	00:01:02:03:04:01			
	Max age	is 20 sec, forward delay	is 15 sec		
Name	Role	State	Cost	Prio	type
-----	----	-----	----	----	-----
Ex0/1	Designated	Forwarding	200000	128	SharedLan
Ex0/2	Root	Forwarding	200000	128	SharedLan

**b. In switch 2, type.**

```
SEFOS# show spanning-tree

Root Id          Priority    32768
Address         00:01:02:03:04:01
Cost            0
Port            1 [Ex0/1]
Max age 20 Sec, forward delay 15 Sec

MST00
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id        Priority    32768
Address         00:02:02:03:04:01
Max age is 20 sec, forward delay is 15 sec
Name            Role          State      Cost      Prio      Type
-----
Ex0/1           Root          Forwarding 200000    128      SharedLan
Ex0/2           Designated    Forwarding 200000    128      SharedLan

MST01
Root Id          Priority    0
Address         00:01:02:03:04:01
Max age 20 Sec, forward delay 15 Sec
Bridge Id        Priority    32768
Address         00:02:02:03:04:01
Max age is 20 sec, forward delay is 15 sec
Name            Role          State      Cost      Prio      type
-----
Ex0/1           Root          Forwarding 200000    128      SharedLan
Ex0/2           Designated    Forwarding 200000    128      SharedLan

MST02
Root Id          Priority    0
Address         00:02:02:03:04:01
This bridge is the root
```

```

Max age 20 Sec, forward delay 15 Sec
Bridge Id      Priority 0
                Address 00:02:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
Name          Role          State          Cost          Prio          type
-----
Ex0/1        Designated  Forwarding    200000        128          SharedLan
Ex0/2        Designated  Forwarding    200000        128          SharedLan

MST03
Root Id      Priority 0
                Address 00:03:02:03:04:01
                Max age 20 Sec, forward delay 15 Sec
Bridge Id    Priority 32768
                Address 00:02:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
Name          Role          State          Cost          Prio          type
-----
Ex0/1        Alternate   Discarding    200000        128          SharedLan
Ex0/2        Root        Forwarding    200000        128          SharedLan

```

**c. In switch 3, type.**

```

SEFOS# show spanning-tree

Root Id      Priority 32768
                Address 00:01:02:03:04:01
                Cost    0
                Port    1 [Ex0/1]
                Max age 20 Sec, forward delay 15 Sec

MST00
MST00 is executing the mstp compatible Multiple Spanning Tree
Protocol
Bridge Id    Priority 32768
                Address 00:03:02:03:04:01
                Max age is 20 sec, forward delay is 15 sec
Name          Role          State          Cost          Prio          Type
-----
Ex0/1        Root        Forwarding    200000        128          SharedLan
Ex0/2        Alternate   Discarding    200000        128          SharedLan

MST01
Root Id      Priority 0
                Address 00:01:02:03:04:01
                Max age 20 Sec, forward delay 15 Sec
Bridge Id    Priority 32768
                Address 00:03:02:03:04:01

```

Max age is 20 sec, forward delay is 15 sec						
Name	Role	State	Cost	Prio	type	
-----	----	-----	----	----	-----	
Ex0/1	Root	Forwarding	200000	128	SharedLan	
Ex0/2	Alternate	Discarding	200000	128	SharedLan	
MST02						
Root Id		Priority	0			
		Address	00:02:02:03:04:01			
Max age 20 Sec, forward delay 15 Sec						
Bridge Id		Priority	32768			
		Address	00:03:02:03:04:01			
Max age is 20 sec, forward delay is 15 sec						
Name	Role	State	Cost	Prio	type	
-----	----	-----	----	----	-----	
Ex0/1	Alternate	Discarding	200000	128	SharedLan	
Ex0/2	Root	Forwarding	200000	128	SharedLan	
MST03						
Root Id		Priority	0			
		Address	00:03:02:03:04:01			
This bridge is the root						
Max age 20 Sec, forward delay 15 Sec						
Bridge Id		Priority	0			
		Address	00:03:02:03:04:01			
Max age is 20 sec, forward delay is 15 sec						
Name	Role	State	Cost	Prio	type	
-----	----	-----	----	----	-----	
Ex0/1	Designated	Forwarding	200000	128	SharedLan	
Ex0/2	Designated	Forwarding	200000	128	SharedLan	

