
Chapter 8

Configuring Spanning Tree Protocol (STP) and Advanced STP Features

The Spanning Tree Protocol (STP) eliminates Layer 2 loops in networks, by selectively blocking some ports and allowing other ports to forward traffic, based on global (bridge) and local (port) parameters you can configure.

This chapter describes how to configure Spanning Tree Protocol (STP) parameters on HP ProCurve Routing Switches.

This chapter also describes advanced Layer 2 features that enable you to overcome limitations in the standard 802.1d Spanning Tree Protocol (STP). These are the advanced features:

- Fast Port Span
- Fast Uplink Span
- Single-instance STP
- SuperSpan
- STP per VLAN group
- Per VLAN Spanning Tree (PVST) and PVST+ Compatibility

Configuration procedures are provided for the standard STP bridge and port parameters as well as advanced STP parameters.

- To configure standard STP parameters, see “Configuring Standard STP Parameters”.
- To configure advanced parameters, see “Configuring Advanced STP Features” on page 8-19.

Configuring Standard STP Parameters

ProCurve Routing Switches support standard STP as described in the IEEE 802.1D specification. STP is disabled by default on Routing Switches.

By default, each port-based VLAN on an HP device runs a separate spanning tree (a separate instance of STP). An HP device has one port-based VLAN (VLAN 1) by default that contains all the device's ports. Thus, by default each HP device has one spanning tree. However, if you configure additional port-based VLANs on an HP device, then each of those VLANs on which STP is enabled and VLAN 1 all run separate spanning trees.

If you configure a port-based VLAN on the device, the VLAN has the same STP state as the default STP state on the device. On Routing Switches, new VLANs have STP disabled by default. You can enable or disable STP in each VLAN separately. In addition, you can enable or disable STP on individual ports.

STP Parameters and Defaults

Table 8.1 lists the default STP states for HP devices.

Table 8.1: Default STP States

Default STP Type	Default STP State	Default STP State of New VLANs ^a
MSTP	Disabled	Disabled

a. When you create a port-based VLAN, the new VLAN's STP state is the same as the default STP state on the device. The new VLAN does not inherit the STP state of the default VLAN.

Table 8.2 lists the default STP bridge parameters. The bridge parameters affect the entire spanning tree. If you are using MSTP, the parameters affect the VLAN. If you are using SSTP, the parameters affect all VLANs that are members of the single spanning tree.

Table 8.2: Default STP Bridge Parameters

Parameter	Description	Default and Valid Values
Forward Delay	The period of time a bridge will wait (the listen and learn period) before beginning to forward data packets.	15 seconds Possible values: 4 – 30 seconds
Maximum Age	The interval a bridge will wait for a hello packet from the root bridge before initiating a topology change.	20 seconds Possible values: 6 – 40 seconds
Hello Time	The interval of time between each configuration BPDU sent by the root bridge.	2 seconds Possible values: 1 – 10 seconds
Priority	A parameter used to identify the root bridge in a spanning tree (instance of STP). The bridge with the lowest value has the highest priority and is the root. A higher numerical value means a lower priority; thus, the highest priority is 0.	32768 Possible values: 0 – 65535

NOTE: If you plan to change STP bridge timers, HP recommends that you stay within the following ranges, from section 8.10.2 of the IEEE STP specification.

$$2 * (\text{forward_delay} - 1) \geq \text{max_age}$$

$$\text{max_age} \geq 2 * (\text{hello_time} + 1)$$

Table 8.3 lists the default STP port parameters. The port parameters affect individual ports and are separately configurable on each port.

Table 8.3: Default STP Port Parameters

Parameter	Description	Default and Valid Values
Priority	The preference that STP gives this port relative to other ports for forwarding traffic out of the spanning tree. A higher numerical value means a lower priority; thus, the highest priority is 8.	128 Possible values: 8 – 252 (configurable in increments of 4)
Path Cost	The cost of using the port to reach the root bridge. When selecting among multiple links to the root bridge, STP chooses the link with the lowest path cost and blocks the other paths. Each port type has its own default STP path cost.	10 Mbps – 100 100 Mbps – 19 Gigabit – 4 10 Gigabit – 2 Possible values are 0 – 65535

Enabling or Disabling the Spanning Tree Protocol (STP)

You can enable or disable STP on the following levels:

- Globally – Affects all ports on the device.
- Port-based VLAN – Affects all ports within the specified port-based VLAN. When you enable or disable STP within a port-based VLAN, the setting overrides the global setting. Thus, you can enable STP for the ports within a port-based VLAN even when STP is globally disabled, or disable the ports within a port-based VLAN when STP is globally enabled.
- Individual port – Affects only the individual port. However, if you change the STP state of the primary port in a trunk group, the change affects all ports in the trunk group.

Enabling or Disabling STP Globally

Use the following methods to enable or disable STP on a device on which you have not configured port-based VLANs.

NOTE: When you configure a VLAN, the VLAN inherits the global STP settings. However, once you begin to define a VLAN, you can no longer configure standard STP parameters globally using the CLI. From that point on, you can configure STP only within individual VLANs.

USING THE CLI

To enable STP for all ports in all VLANs on an HP device, enter the following command:

```
ProCurveRS(config)# spanning-tree
```

This command enables a separate spanning tree in each VLAN, including the default VLAN.

Syntax: [no] spanning-tree

USING THE WEB MANAGEMENT INTERFACE

1. Log on to the device using a valid user name and password for read-write access. The System configuration panel is displayed.
2. Select Enable next to Spanning Tree.

NOTE: For information about the Single and Fast checkboxes, see “Single Spanning Tree (SSTP)” on page 8-62 and “Fast Uplink Span” on page 8-21.

3. Click Apply to save the changes to the device’s running-config file.
4. Select the [Save](#) link at the bottom of the dialog. Select Yes when prompted to save the configuration change to the startup-config file on the device’s flash memory.

Enabling or Disabling STP in a Port-Based VLAN

Use the following procedure to disable or enable STP on a device on which you have configured a port-based VLAN. Changing the STP state in a VLAN affects only that VLAN.

USING THE CLI

To enable STP for all ports in a port-based VLAN, enter commands such as the following:

```
ProCurveRS(config)# vlan 10
ProCurveRS(config-vlan-10)# spanning-tree
```

Syntax: [no] spanning-tree

USING THE WEB MANAGEMENT INTERFACE

You cannot enable or disable STP on individual VLANs using the Web management interface.

Enabling or Disabling STP on an Individual Port

Use the following procedure to disable or enable STP on an individual port.

NOTE: If you change the STP state of the primary port in a trunk group, the change affects all ports in the trunk group.

USING THE CLI

To enable STP on an individual port, enter commands such as the following:

```
ProCurveRS(config)# interface 1/1
ProCurveRS(config-if-1/1)# spanning-tree
```

Syntax: [no] spanning-tree

USING THE WEB MANAGEMENT INTERFACE

You cannot enable or disable STP on individual ports using the Web management interface.

Changing STP Bridge and Port Parameters

Table 8.2 on page 8-2 and Table 8.3 on page 8-3 list the default STP parameters. If you need to change the default value for an STP parameter, use the following procedures.

Changing STP Bridge Parameters

To change STP bridge parameters, use either of the following methods.

NOTE: If you plan to change STP bridge timers, HP recommends that you stay within the following ranges, from section 8.10.2 of the IEEE STP specification.

$2 * (\text{forward_delay} - 1) \geq \text{max_age}$

$\text{max_age} \geq 2 * (\text{hello_time} + 1)$

USING THE CLI

To change an HP device’s STP bridge priority to the highest value to make the device the root bridge, enter the following command:

```
ProCurveRS(config)# spanning-tree priority 0
```

The command in this example changes the priority on a device on which you have not configured port-based VLANs. The change applies to the default VLAN. If you have configured a port-based VLAN on the device, you can configure the parameters only at the configuration level for individual VLANs. Enter commands such as the following:

```
ProCurveRS(config)# vlan 20
ProCurveRS(config-vlan-20)# spanning-tree priority 0
```

To make this change in the default VLAN, enter the following commands:

```
ProCurveRS(config)# vlan 1
ProCurveRS(config-vlan-1)# spanning-tree priority 0
```

Syntax: [no] spanning-tree [forward-delay <value>] | [hello-time <value>] | [maximum-age <value>] | [priority <value>]

The **forward-delay** <value> parameter specifies the forward delay and can be a value from 4 – 30 seconds. The default is 15 seconds.

NOTE: You can configure an HP device for faster convergence (including a shorter forward delay) using Fast Span or Fast Uplink Span. See “Configuring Advanced STP Features” on page 8-19.

The **hello-time** <value> parameter specifies the hello time and can be a value from 1 – 10 seconds. The default is 2 seconds.

NOTE: This parameter applies only when this device or VLAN is the root bridge for its spanning tree.

The **maximum-age** <value> parameter specifies the amount of time the device waits for receipt of a hello packet before initiating a topology change. You can specify from 6 – 40 seconds. The default is 20 seconds.

The **priority** <value> parameter specifies the priority and can be a value from 0 – 65535. A higher numerical value means a lower priority. Thus, the highest priority is 0. The default is 32768.

You can specify some or all of these parameters on the same command line. If you specify more than one parameter, you must specify them in the order shown above, from left to right.

USING THE WEB MANAGEMENT INTERFACE

To modify the STP parameters:

1. Log on to the device using a valid user name and password for read-write access. The System configuration panel is displayed.
2. Click on the plus sign next to Configure in the tree view to display the configuration options.
3. Select the STP link to display the STP bridge and port parameters.

- Click the Modify button in the STP bridge parameters table to display the STP configuration panel, as shown in the following example. If the device has multiple port-based VLANs, select the Modify button next to the VLAN on which you want to change the parameters. A dialog such as the following is displayed.

STP

VLAN ID:	<input type="text" value="1"/>
Bridge	
Forward Delay (Seconds):	<input type="text" value="15"/>
Maximum Age (Seconds):	<input type="text" value="20"/>
Hello Time (Seconds):	<input type="text" value="2"/>
Priority:	<input type="text" value="32768"/>
<input type="button" value="Apply"/>	
Port	
Priority:	<input type="text" value="128"/>
Path Cost:	<input type="text" value="0"/>
Slot:	<input type="text" value="1"/> Port: <input type="text" value="1"/>
<input type="button" value="Apply Port STP"/> <input type="button" value="Apply To All Ports"/>	

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- Modify the bridge STP parameters to the values desired.
- Click Apply to save the changes to the device's running-config file.
- Select the [Save](#) link at the bottom of the dialog. Select Yes when prompted to save the configuration change to the startup-config file on the device's flash memory.

Changing STP Port Parameters

To change STP port parameters, use either of the following methods.

USING THE CLI

To change the path and priority costs for a port, enter commands such as the following:

```
ProCurveRS(config)# vlan 10
ProCurveRS(config-vlan-10)# spanning-tree ethernet 1/5 path-cost 15 priority 64
```

Syntax: spanning-tree ethernet <portnum> path-cost <value> | priority <value> | disable | enable

The **ethernet** <portnum> parameter specifies the interface.

The **path-cost** <value> parameter specifies the port's cost as a path to the spanning tree's root bridge. STP prefers the path with the lowest cost. You can specify a value from 0 – 65535.

The default depends on the port type:

- 10 Mbps – 100
- 100 Mbps – 19
- Gigabit – 4
- 10 Gigabit – 2

The **priority** <value> parameter specifies the preference that STP gives this port relative to other ports for forwarding traffic out of the spanning tree. You can specify a value from 8 – 252, in increments of 4. If you enter a

value that is not divisible by four the software rounds to the nearest value that is. The default is 128. A higher numerical value means a lower priority; thus, the highest priority is 8.

NOTE: The range in software releases earlier than 07.5.04 is 0 – 255. If you are upgrading a device that has a configuration saved under an earlier software release, and the configuration contains a value from 0 – 7 for a port's STP priority, the software changes the priority to the default when you save the configuration while running the new release.

The **disable | enable** parameter disables or re-enables STP on the port. The STP state change affects only this VLAN. The port's STP state in other VLANs is not changed.

USING THE WEB MANAGEMENT INTERFACE

To modify the STP port parameters:

1. Log on to the device using a valid user name and password for read-write access. The System configuration panel is displayed.
2. Click on the plus sign next to Configure in the tree view to display the configuration options.
3. Select the STP link to display the STP bridge and port parameters.
4. Click the Modify button in the STP port parameters table to display the STP configuration panel, as shown in the following example. If the device has multiple port-based VLANs, select the Modify button next to the VLAN on which you want to change the parameters. A dialog such as the following is displayed.

STP	
VLAN ID:	<input type="text" value="1"/>
Bridge	
Forward Delay (Seconds):	<input type="text" value="15"/>
Maximum Age (Seconds):	<input type="text" value="20"/>
Hello Time (Seconds):	<input type="text" value="2"/>
Priority:	<input type="text" value="32768"/>
<input type="button" value="Apply"/>	
Port	
Priority:	<input type="text" value="128"/>
Path Cost:	<input type="text" value="0"/>
Slot:	<input type="text" value="1"/> Port: <input type="text" value="1"/>
<input type="button" value="Apply Port STP"/> <input type="button" value="Apply To All Ports"/>	

[\[Show\]](#)[\[Statistic\]](#)

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5. Select the port (and slot if applicable) from the Port and Slot pulldown lists.
6. Enter the desired changes to the priority and path cost fields.
7. Click Apply STP Port to apply the changes to only the selected port or select Apply To All Ports to apply the changes to all the ports.

NOTE: If you want to save the priority and path costs of one port to all other ports on the device or within the selected VLAN, you can click the Apply To All Ports button.

8. Select the Save link at the bottom of the dialog. Select Yes when prompted to save the configuration change to the startup-config file on the device's flash memory.

Displaying STP Information

You can display the following STP information:

- All the global and interface STP settings
- CPU utilization statistics
- Detailed STP information for each interface
- STP state information for a port-based VLAN
- STP state information for an individual interface

Displaying STP Information for an Entire Device

To display STP information for an entire device, use either of the following methods.

USING THE CLI

To display STP information, enter the following command at any level of the CLI:

```
ProCurveRS# show span

VLAN 1 BPDU cam_index is 3 and the Master DMA Are(HEX)
STP instance owned by VLAN 1

Global STP (IEEE 802.1D) Parameters:

VLAN Root          Root Root Prio Max He- Ho- Fwd Last      Chg  Bridge
ID   ID            Cost Port rity Age llo ld  dly Chang  cnt  Address
                Hex  sec sec  sec sec sec
   1 800000e0804d4a00 0   Root 8000 20  2   1   15  689    1   00e0804d4a00

Port STP Parameters:

Port  Prio Path  State      Fwd  Design  Designated  Designated
Num   rity Cost  State      Trans Cost  Root         Bridge
                Hex
  1    80  19   FORWARDING 1     0     800000e0804d4a00 800000e0804d4a00
  2    80  0    DISABLED   0     0     0000000000000000 0000000000000000
  3    80  0    DISABLED   0     0     0000000000000000 0000000000000000
  4    80  0    DISABLED   0     0     0000000000000000 0000000000000000
  5    80  19   FORWARDING 1     0     800000e0804d4a00 800000e0804d4a00
  6    80  19   BLOCKING   0     0     800000e0804d4a00 800000e0804d4a00
  7    80  0    DISABLED   0     0     0000000000000000 0000000000000000
<lines for remaining ports excluded for brevity>
```

Syntax: show span [vlan <vlan-id>] | [pvst-mode] | [<num>] | [detail [vlan <vlan-id> [ethernet <portnum>] | <num>]]

The **vlan <vlan-id>** parameter displays STP information for the specified port-based VLAN.

The **pvst-mode** parameter displays STP information for the device's Per VLAN Spanning Tree (PVST+) compatibility configuration. See "PVST/PVST+ Compatibility" on page 8-75.

The **<num>** parameter displays only the entries after the number you specify. For example, on a device with three port-based VLANs, if you enter 1, then information for the second and third VLANs is displayed, but information for the first VLAN is not displayed. Information is displayed according to VLAN number, in ascending order. The entry number is not the same as the VLAN number. For example, if you have port-based VLANs 1, 10, and 2024, then the command output has three STP entries. To display information for VLANs 10 and 2024 only, enter **show span 1**.

The **detail** parameter and its additional optional parameters display detailed information for individual ports. See “Displaying Detailed STP Information for Each Interface” on page 8-14.

The **show span** command shows the following information.

Table 8.4: CLI Display of STP Information

This Field...	Displays...
Global STP Parameters	
VLAN ID	The port-based VLAN that contains this spanning tree (instance of STP). VLAN 1 is the default VLAN. If you have not configured port-based VLANs on this device, all STP information is for VLAN 1.
Root ID	The ID assigned by STP to the root bridge for this spanning tree.
Root Cost	The cumulative cost from this bridge to the root bridge. If this device is the root bridge, then the root cost is 0.
Root Port	The port on this device that connects to the root bridge. If this device is the root bridge, then the value is “Root” instead of a port number.
Priority Hex	This device or VLAN's STP priority. The value is shown in hexadecimal format. Note: If you configure this value, specify it in decimal format. See “Changing STP Bridge Parameters” on page 8-4.
Max age sec	The number of seconds this device or VLAN waits for a hello message from the root bridge before deciding the root has become unavailable and performing a reconvergence.
Hello sec	The interval between each configuration BPDU sent by the root bridge.
Hold sec	The minimum number of seconds that must elapse between transmissions of consecutive Configuration BPDUs on a port.
Fwd dly sec	The number of seconds this device or VLAN waits following a topology change and consequent reconvergence.
Last Chang sec	The number of seconds since the last time a topology change occurred.
Chg cnt	The number of times the topology has changed since this device was reloaded.
Bridge Address	The STP address of this device or VLAN. Note: If this address is the same as the Root ID, then this device or VLAN is the root bridge for its spanning tree.
Port STP Parameters	
Port Num	The port number.
Priority Hex	The port's STP priority, in hexadecimal format. Note: If you configure this value, specify it in decimal format. See “Changing STP Port Parameters” on page 8-6.
Path Cost	The port's STP path cost.

