

802.1w Rapid Spanning Tree Protocol (RSTP)

802.1d Spanning Tree Protocol (STP)

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Overview

STP Features

802.1d Spanning Tree Protocol	Default	Menu	CLI	Web
viewing the STP configuration	n/a	page 13-20	page 13-11	—
enable/disable STP	disabled	page 13-20	page 13-24	page 13-42
reconfiguring general operation	priority: 32768 max age: 20 s hello time: 2 s fwd. delay: 15 s	page 13-20	page 13-25	
reconfiguring per-port STP	path cost: var priority: 128 mode: norm	page 13-20	page 13-26	
monitoring STP	n/a	page B-16	page B-16	n/a
802.1w Spanning Tree Protocol	Default	Menu	CLI	Web
Viewing the RSTP/STP configuration	--	page 13-17	page 13-11	n/a
enable/disable RSTP/STP (RSTP is selected as the default protocol)	disabled	page 13-17	page 13-12	page 13-19
reconfiguring whole-switch values	Protocol Version: RSTP Force Version: RSTP-operation Switch Priority: 8 Hello Time: 2 s Max Age: 20 s Forward Delay: 15 s	page 13-17	page 13-13	n/a
reconfiguring per-port values	Path Cost: Depends on port type Priority: 8 Edge Port: Yes Point-to-point: Force-true MCheck: Yes	page 13-17	page 13-15	n/a

Use spanning tree to ensure that only one active path at a time exists between any two nodes on the network. In networks where there is more than one physical, active path between any two nodes, enabling spanning tree ensures a single active path between such nodes by blocking all redundant paths. Without spanning tree, having more than one active path between a pair of nodes causes loops in the network, which can result in duplication of messages, leading to a “broadcast storm” that can bring down the network.

Note

You should enable spanning tree operation in any switch that is part of a redundant physical link (loop topology). (It is recommended that you do so on all switches belonging to a loop topology.) This topic is covered in more detail under “How Spanning Tree Operates” on page 13-4.

As recommended in the IEEE 802.1Q VLAN standard, the Series 5300XL switches use **single-instance STP**. (As a result, the switch generates untagged Bridge Protocol Data Units—BPDUs.) This implementation creates a single spanning tree to make sure there are no network loops associated with any of the connections to the switch, regardless of whether multiple VLANs are configured on the switch. Thus, these switches do not distinguish between VLANs when identifying redundant physical links. If VLANs are configured on the switch, see “STP Operation with 802.1Q VLANs” on page “Spanning Tree Operation with 802.1Q VLANs” on page 13-4.

How Spanning Tree Operates

The switch automatically senses port identity and type, and automatically defines spanning-tree parameters for each type, as well as parameters that apply across the switch. You can use the default values for these parameters, or adjust them as needed.

While allowing only one active path through a network at any time, spanning tree retains any redundant physical path to serve as a backup (blocked) path in case the existing active path fails. Thus, if an active path fails, spanning tree automatically activates (unblocks) an available backup to serve as the new active path for as long as the original active path is down. For example:

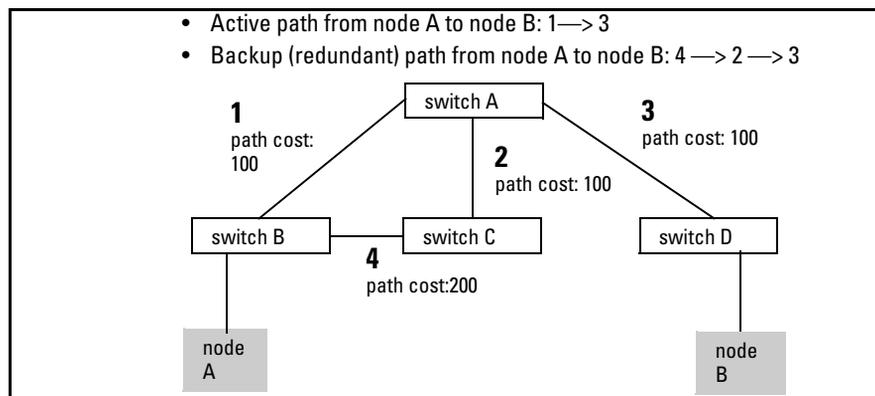


Figure 13-1. General Example of Redundant Paths Between Two Nodes

In the factory default configuration, spanning tree operation is off. If a redundant link (loop) exists between nodes in your network, you should enable the spanning tree operation of your choice.

Note

Spanning tree retains its current parameter settings when disabled. Thus, if you disable spanning tree, then later re-enable it, the parameter settings will be the same as before spanning tree was disabled.

Spanning Tree Operation with 802.1Q VLANs. As recommended in the IEEE 802.1Q VLAN standard, when spanning tree is enabled on the switch, a single spanning tree is configured for all ports across the switch, including those in separate VLANs (that is, single-instance spanning tree, which gener-

ates untagged BPDUs). This means that if redundant physical links exist in separate VLANs, spanning tree will block all but one of those links. However, if you need to use spanning tree on the Series 5300XL switches in a VLAN environment with redundant physical links, you can prevent blocked redundant links by using a port trunk. The following example shows how you can use a port trunk with 802.1Q (tagged) VLANs and spanning tree without unnecessarily blocking any links or losing any bandwidth.

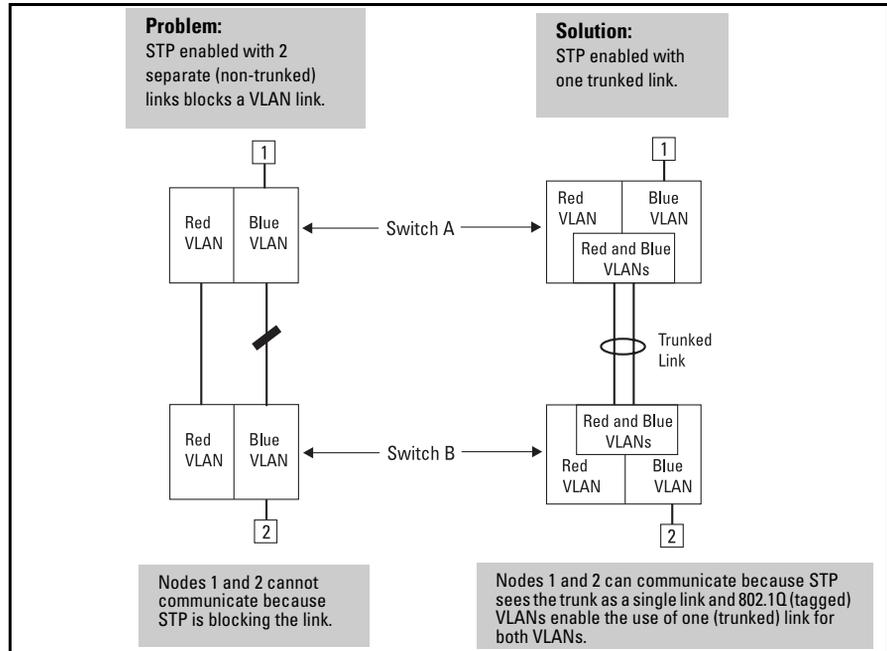


Figure 13-2. Example of Using a Trunked Link with STP and VLANs

For more information, refer to “Spanning Tree Operation with 802.1Q VLANs” on page 13-4.

Spanning Tree Options: RSTP (802.1w) and STP (802.1d)

Caution

Spanning tree interprets a switch mesh as a single link. Because the switch automatically gives faster links a higher priority, the default STP or RSTP parameter settings are usually adequate for spanning tree operation. Also, because incorrect STP or RSTP settings can adversely affect network performance, you should not make changes unless you have a strong understanding of how spanning tree operates.

In a mesh environment, the default RSTP timer settings (**Hello Time** and **Forward Delay**) are usually adequate for RSTP operation. Because a packet crossing a mesh may traverse several links within the mesh, using smaller-than-default settings for the RSTP **Hello Time** and **Forward Delay** timers can cause unnecessary topology changes and end-node connectivity problems.

For more on STP and RSTP, see the IEEE 802.1d and 802.1w standards.

RSTP (802.1w)

The IEEE 802.1d version of spanning tree (STP) can take a fairly long time to resolve all the possible paths and to select the most efficient path through the network. The IEEE 802.1w Rapid Reconfiguration Spanning Tree (RSTP) significantly reduces the amount of time it takes to establish the network path. The result is reduced network downtime and improved network robustness.

In addition to faster network reconfiguration, RSTP also implements greater ranges for port path costs to accommodate the higher and higher connection speeds that are being implemented.

RSTP is designed to be compatible with IEEE 802.1d STP, and HP recommends that you employ it in your network. For more information, refer to “Transitioning from STP to RSTP” on page 13-9.

STP (802.1d)

The IEEE 802.1d version of spanning tree has been in wide use and can coexist in a network in which RSTP (802.1w) has been introduced. If your network currently uses 802.1d STP and you are not yet ready to implement RSTP, you

can apply STP to the Series 5300XL switches until such time as you are ready to move ahead with RSTP. STP on the Series 5300XL switches offers the full range of STP features found in earlier product releases, including:

- **STP Fast Mode for Overcoming Server Access Failures:** If an end node is configured to automatically access a server, the duration of the STP startup sequence can result in a “server access failure”. On ports where this is a problem, configuring STP Fast Mode can eliminate the failure. For more information, see “STP Fast Mode” on page 13-27. The next sections describe how to configure STP on the switch. For more information on STP operation, see “How Spanning Tree Operates” on page 13-4.
- **Fast-Uplink STP for Improving the Recovery (Convergence) Time in Wiring Closet Switches with Redundant Uplinks:** This means that a Series 5300XL switch having redundant links toward the root device can decrease the convergence time to a new uplink port to as little as ten seconds. For more information, refer to “Fast-Uplink Spanning Tree Protocol (STP)” on page 13-28.

Configuring Rapid Reconfiguration Spanning Tree (RSTP)

This section describes the operation of the IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)

Overview

RSTP Feature	Default	Menu	CLI	Web
Viewing the RSTP/STP configuration	<i>n/a</i>	page 13-17	page 13-11	n/a
enable/disable RSTP/STP (RSTP is selected as the default protocol)	disabled	page 13-17	page 13-12	page 13-19
reconfiguring whole-switch values	ProtocolVersion: RSTP Force Version: RSTP-operation Switch Priority: 8 Hello Time: 2 s Max Age: 20 s Forward Delay: 15 s	page 13-17	page 13-13	n/a
reconfiguring per-port values	Path Cost: <i>depends on port type</i> Priority: 8 Edge Port: Yes Point-to-point: Force-true MCheck: Yes	page 13-17	page 13-15	n/a

As indicated in the manual, the spanning tree protocol is used to ensure that only one active path at a time exists between any two end nodes in the network in which your switch is installed. Multiple paths cause a loop in the network over which broadcast and multicast messages are repeated continuously, which floods the network with traffic creating a broadcast storm.

In networks where there is more than one physical path between any two nodes, enabling spanning tree ensures a single active path between two such nodes by selecting the one most efficient path and blocking the other redundant paths. If a switch or bridge in the path becomes disabled, spanning tree activates the necessary blocked segments to create the next most efficient path.

Transitioning from STP to RSTP

IEEE 802.1w RSTP is designed to be compatible with IEEE 802.1d STP. Even if all the other devices in your network are using STP, you can enable RSTP on your switch, and even using the default configuration values, your switch will interoperate effectively with the STP devices. If any of the switch ports are connected to switches or bridges on your network that do not support RSTP, RSTP can still be used on this switch. RSTP automatically detects when the switch ports are connected to non-RSTP devices in the spanning tree and communicates with those devices using 802.1d STP BPDU packets.

Because RSTP is so much more efficient at establishing the network path, though, that it is highly recommended that all your network devices be updated to support RSTP. RSTP offers convergence times of less than one second under optimal circumstances. To make the best use of RSTP and achieve the fastest possible convergence times, though, there are some changes that you should make to the RSTP default configuration. See “Optimizing the RSTP Configuration” below, for more information on these changes.

Note

Under some circumstances, it is possible for the rapid state transitions employed by RSTP to result in an increase in the rates of frame duplication and misordering in the switched LAN. In order to allow RSTP switches to support applications and protocols that may be sensitive to frame duplication and misordering, setting the Force Protocol Version parameter to **STP-compatible** allows RSTP to be operated with the rapid transitions disabled. The value of this parameter applies to all ports on the switch. See information on Force Version on page 13-13.

As indicated above, one of the benefits of RSTP is the implementation of a larger range of port path costs, which accommodates higher network speeds. New default values have also been implemented for the path costs associated with the different network speeds. This can create some incompatibility between devices running the older 802.1d STP and your switch running RSTP. Please see the “Note on Path Cost” on page 13-16 for more information on adjusting to this incompatibility.

Configuring RSTP

The default switch configuration has spanning tree disabled with RSTP as the selected protocol. That is, when spanning tree is enabled, RSTP is the version of spanning tree that is enabled, by default.

Optimizing the RSTP Configuration

To optimize the RSTP configuration on your switch, follow these steps (note that for the **Menu** method, all of these steps can be performed at the same time by making all the necessary edits on the “Spanning Tree Operation” screen and then saving the configuration changes):

1. Set the switch to support RSTP (RSTP is the default):

CLI: spanning-tree protocol-version rstp

Menu: Main Menu —> 2. Switch Configuration —> 4. Spanning Tree Operation —> select Protocol Version: RSTP

2. Set the “point-to-point-mac” value to false on all ports that are connected to shared LAN segments (that is, to connections to hubs):

CLI: spanning-tree [ethernet] <port-list> point-to-point-mac force-false

Menu: Main Menu —> 2. Switch Configuration —> 4. Spanning Tree Operation —> for each appropriate port, select Point-to-Point: Force-False

3. Set the “edge-port” value to false for all ports connected to other switches, bridges, and hubs:

CLI: no spanning-tree [ethernet] <port-list> edge-port

Menu: Main Menu —> 2. Switch Configuration —> 4. Spanning Tree Operation —> for each appropriate port, select Edge: No

4. Set the “mcheck” value to false for all ports that are connected to devices that are known to be running IEEE 802.1d spanning tree:

CLI: no spanning-tree [ethernet] <port-list> mcheck

Menu: Main Menu —> 2. Switch Configuration —> 4. Spanning Tree Operation —> for each appropriate port, select MCheck: No

5. Enable RSTP Spanning Tree:

CLI: spanning-tree

Menu: Main Menu —> 2. Switch Configuration —> 4. Spanning Tree Operation —> select STP Enabled: Yes

CLI: Configuring RSTP

Spanning Tree Commands in This Section	Applicable Protocol Version	Location
show spanning-tree config	both	Below on this page
spanning-tree	both	page 13-12
protocol-version <rstp stp>	both	page 13-13
force-version <rstp-operation stp-compatible>	RSTP	page 13-13
forward-delay <4 - 30>	both	page 13-13
hello-time <1 - 10>	both	page 13-13
maximum-age <6 - 40>	both	page 13-13
priority <0 - 15 0 - 65535>	RSTP STP	page 13-13
<[ethernet] port-list>	both	page 13-15
path-cost <1 - 200 000 000>	both	page 13-15
priority <0 - 15 0 - 65535>	RSTP STP	page 13-15
edge-port	RSTP	page 13-15
point-to-point-mac	RSTP	page 13-15
mcheck	RSTP	page 13-15
mode <norm fast>	STP	Refer to “802.1p Spanning-Tree Protocol (STP)” on page 13-20.
show spanning-tree	This command lists additional RSTP/STP monitoring data that is not covered in this section. See “Spanning Tree Protocol Information” on page B-16	

Viewing the Current Spanning Tree Configuration. Even if spanning tree is disabled (the default configuration), the show spanning-tree config command lists the switch’s full spanning tree configuration, including whole-switch and per-port settings.

Syntax: show spanning-tree configuration

Abbreviation: sho span config

In the default configuration, the output from this command appears similar to the following:

```
Spanning Tree Operation

Protocol Version : RSTP
STP Enabled [No] : Yes
Force Version [RSTP-operation] : RSTP-operation
Switch Priority [8] : 8                Hello Time [2] : 2
Max Age [20] : 20                     Forward Delay [15] : 15

Port Type      | Cost      Priority Edge Point-to-Point MCheck
-----+-----+-----+-----+-----+-----
A1  10/100TX  | 200000    8        Yes  Force-True  Yes
A2  10/100TX  | 200000    8        Yes  Force-True  Yes
A3  10/100TX  | 200000    8        Yes  Force-True  Yes
A4  10/100TX  | 200000    8        Yes  Force-True  Yes
A5  10/100TX  | 200000    8        Yes  Force-True  Yes
A6  10/100TX  | 200000    8        Yes  Force-True  Yes
A7  10/100TX  | 200000    8        Yes  Force-True  Yes
A8  10/100TX  | 200000    8        Yes  Force-True  Yes
A9  10/100TX  | 200000    8        Yes  Force-True  Yes
A10 10/100TX  | 200000    8        Yes  Force-True  Yes
A11 10/100TX  | 200000    8        Yes  Force-True  Yes
A12 10/100TX  | 200000    8        Yes  Force-True  Yes
-- MORE --, next page: Space, next line: Enter, quit: Control-C
```

Figure 13-3. Example of the Spanning Tree Configuration Display

Enabling or Disabling RSTP. Issuing the command to enable spanning tree on the switch implements, by default, the RSTP version of spanning tree for all physical ports on the switch. Disabling spanning tree removes protection against redundant network paths.

Syntax: [no] spanning-tree

Abbreviation: [no] span

This command enables spanning tree with the current parameter settings or disables spanning tree, using the “no” option, without losing the most-recently configured parameter settings.

Enabling STP Instead of RSTP. If you decide, for whatever reason, that you would prefer to run the IEEE 802.1d (STP) version of spanning tree, then issue the following command:

Syntax: spanning-tree protocol-version stp

Abbreviation: span prot stp

For the STP version of spanning tree, the rest of the information in this section does not apply. Refer to “802.1p Spanning-Tree Protocol (STP)” on page 13-20 for more information on the STP version and its parameters.

Reconfiguring Whole-Switch Spanning Tree Values. You can configure one or more of the following parameters, which affect the spanning tree operation of the whole switch:

Table 13-1. Whole-Switch RSTP Parameters

Parameter	Default	Description
protocol-version	RSTP	Identifies which of the spanning tree protocols will be used when spanning tree is enabled on the switch.
force-version	rstp-operation	Sets the spanning tree compatibility mode. Even if rstp-operation is selected though, if the switch detects STP BPDU packets on a port, it will communicate to the attached device using STP BPDU packets. If errors are encountered, as described in the Note on page 9, the Force-Version value can be set to stp-compatible , which forces the switch to communicate out all ports using operations that are compatible with IEEE 802.1d STP.
priority	32768 (8 as a step value)	Specifies the protocol value used along with the switch MAC address to determine which device in the spanning tree is the root. The lower the priority value, the higher the priority. The value you enter has changed from the STP value. The range is 0 - 61440, but for RSTP the value is entered as a multiple (a step) of 4096. You enter a value in the range 0 - 15. The default value of 32768 is derived by the default setting of 8. Displaying the RSTP configuration (show spanning-tree config) shows 8, but displaying the RSTP operation (show spanning-tree) shows 32768.
*maximum-age	20 seconds	Sets the maximum age of received spanning tree information before it is discarded. The range is 6 to 40 seconds.
*hello-time	2 seconds	Sets the time between transmission of spanning tree messages. Used only when this switch is the root. The range is 1 to 10 seconds.
*forward-delay	15 seconds	Sets the time the switch waits between transitioning ports from listening to learning and from learning to forwarding states. The range is 4 to 30 seconds.

*These parameters are the same for RSTP as they are for STP. The switch uses its own maximum-age, hello-time, and forward-delay settings only if it is operating as the root device in the spanning tree. If another device is the root device, then the switch uses the other device’s settings for these parameters.

Note

Executing the **spanning-tree** command alone enables spanning tree. Executing the command with one or more of the whole-switch RSTP parameters shown in the table on the previous page, or with any of the per-port RSTP parameters shown in the table on page 15, does not enable spanning tree. It only configures the spanning tree parameters, regardless of whether spanning tree is actually running (enabled) on the switch.

Using this facility, you can completely configure spanning tree the way you want and then enable it. This method minimizes the impact on the network operation.

Syntax:

```
spanning-tree
  protocol-version <rstp | stp>
  force-version <rstp-operation | stp-compatible>
  priority <0 - 15>
  maximum-age <6 - 40 seconds>
  hello-time <1- 10 seconds>
  forward-delay <4 - 30 seconds>
```

Abbreviations:

```
span
  prot <rstp | stp>
  forc <rstp | stp>
  pri <0 - 15>
  max <6 - 40>
  hello <1 - 10>
  forw <4 - 30>
```

Defaults: see the table on the previous page.

Multiple parameters can be included on the same command line. For example, to configure a maximum-age of 30 seconds and a hello-time of 3 seconds, you would issue the following command:

```
HPswitch (config)# span max 30 hello 3
```

Reconfiguring Per-Port Spanning Tree Values. You can configure one or more of the following parameters, which affect the spanning tree operation of the specified ports only:

Table 13-2.Per-Port RSTP Parameters

Parameter	Default	Description
edge-port	Yes	Identifies ports that are connected to end nodes. During spanning tree establishment, these ports transition immediately to the Forwarding state. In this way, the ports operate very similarly to ports that are configured in “fast mode” under the STP implementation in previous HP switch software. Disable this feature on all switch ports that are connected to another switch, or bridge, or hub. Use the “no” option on the spanning tree command to disable edge-port.
mcheck	Yes	Ports with mcheck set to true are forced to send out RSTP BPDUs for 3 seconds. This allows for switches that are running RSTP to establish their connection quickly and for switches running 802.1d STP to be identified. If the whole-switch parameter Force-Version is set to “stp-compatible”, the mcheck setting is ignored and STP BPDUs are sent out all ports. Disable this feature on all ports that are known to be connected to devices that are running 802.1d STP. Use the “no” option on the spanning tree command to disable mcheck.
path-cost	10 Mbps – 2 000 000 100 Mbps – 200 000 1 Gbps – 20 000	Assigns an individual port cost that the switch uses to determine which ports are the forwarding ports. The range is 1 to 200,000,000 or auto. By default, this parameter is automatically determined by the port type, as shown by the different default values. If you have previously configured a specific value for this parameter, you can issue the command with the auto option to restore the automatic setting feature. Please see the Note on Path Cost on page 13-16 for information on compatibility with devices running 802.1d STP for the path cost values.
point-to-point-mac	force-true	This parameter is used to tell the port if it is connected to a point-to-point link, such as to another switch or bridge or to an end node (force-true). This parameter should be set to force-false for all ports that are connected to a hub, which is a shared LAN segment. You can also set this parameter to auto and the switch will automatically set the force-false value on all ports that it detects are not running at full duplex. All connections to hubs are not full duplex.
priority	128 (8 as a step value)	This parameter is used by RSTP to determine the port(s) to use for forwarding. The port with the lowest number has the highest priority. The range is 0 to 240, but you configure the value by entering a multiple of 16. You enter a value in the range 0 - 15. The default value of 128 is derived by the default setting of 8. Displaying the RSTP configuration (show spanning-tree config) shows 8, but displaying the RSTP operation (show spanning-tree) shows 128.

802.1w Rapid Spanning Tree Protocol (RSTP) 802.1d Spanning Tree Protocol (STP)
Configuring Rapid Reconfiguration Spanning Tree (RSTP)

Syntax:	Abbreviations:
spanning-tree [ethernet] <port-list> path-cost <1 - 200000000> point-to-point-mac <force-true force-false auto> priority <0 - 15>	span <port-list> path <1 - 200000000> forc <force-t force-f auto> pri <0 - 15>
[no] spanning-tree [ethernet] <port-list> edge-port mcheck	[no] span <port-list> edge mch

Defaults: see the table on the previous page.

Note on Path Cost

RSTP implements a greater range of path costs and new default path cost values to account for higher network speeds. These values are different than the values defined by 802.1d STP as shown below.

Port Type	802.1d STP Path Cost	RSTP Path Cost
10 Mbps	100	2 000 000
100 Mbps	10	200 000
1 Gbps	5	20 000
10 Gbps	?	2000

Because the maximum value for the path cost allowed by 802.1d STP is 65535, devices running that version of spanning tree cannot be configured to match the values defined by RSTP, at least for 10 Mbps and 100 Mbps ports. In LANs where there is a mix of devices running 802.1d STP and RSTP, you should reconfigure the devices so the path costs match for ports with the same network speeds.

Menu: Configuring RSTP

1. From the console CLI prompt, enter the menu command.
HP Procurve Switch # **menu**
2. From the switch console Main Menu, select
2. Switch Configuration ...
4. Spanning Tree Operation
3. Press [E] (for **E**dit) to highlight the **Protocol Version** parameter field.
4. Press the Space bar to select the version of spanning tree you wish to run:
RSTP or **STP**.
Note: If you change the protocol version, you will have to reboot the switch for the change to take effect. See step 9 and step 10.
5. Press the [Tab] or down arrow key to go to the **STP Enabled** field. Note that when you do this, the remaining fields on the screen will then be appropriate for the version of spanning tree that was selected in step 3. The screen image below is for RSTP.
6. Press the Space bar to select **Yes** to enable spanning tree.

```

===== TELNET - MANAGER MODE =====
                Switch Configuration - Spanning Tree Operation

Protocol Version : RSTP
STP Enabled [No] : No
Force Version [RSTP-operation] : RSTP-operation
Switch Priority [8] : 8                Hello Time [2] : 2
Max Age [20] : 20                    Forward Delay [15] : 15

Port   Type      Cost   Priority  Edge  Point-to-Point  MCheck
-----
A1    10/100TX | 200000  8        Yes   Force-True     Yes
A2    10/100TX | 200000  8        Yes   Force-True     Yes
A3    10/100TX | 200000  8        Yes   Force-True     Yes
A4    10/100TX | 200000  8        Yes   Force-True     Yes
A5    10/100TX | 200000  8        Yes   Force-True     Yes
A6    10/100TX | 200000  8        Yes   Force-True     Yes

Actions->  Cancel   Edit   Save   Help

Cancel changes and return to previous screen.
Use arrow keys to change action selection and <Enter> to execute action.
    
```

Figure 13-4. Example of the RSTP Configuration Screen

7. Press the [Tab] key or use the arrow keys to go to the next parameter you want to change, then type in the new value or press the Space bar to select a value. (To get help on this screen, press [Enter] to select the **Actions ->** line, then press [H], for **Help**, to display the online help.)
8. Repeat step 6 for each additional parameter you want to change.
 Please see “Optimizing the RSTP Configuration” on page 13-10 for recommendations on configuring RSTP to make it operate the most efficiently.
9. When you are finished editing parameters, press [Enter] to return to the **Actions ->** line and press [S] to save the currently displayed spanning tree settings and return to the Main Menu.
10. If you have changed the Protocol Version, in step 1, reboot the switch now by selecting

6. Reboot Switch

Web: Enabling or Disabling RSTP

In the web browser interface, you can enable or disable spanning tree on the switch. If the default configuration is in effect such that RSTP is the selected protocol version, enabling spanning tree through the web browser interface will enable RSTP with its current configuration. To configure the other spanning tree features, telnet to the switch console and use the CLI or menu.

To enable or disable spanning tree using the web browser interface:

1. Click on the **Configuration** tab.
2. Click on **[Device Features]**.
3. Enable or disable spanning tree.
4. Click on **[Apply Changes]** to implement the configuration change.

802.1p Spanning-Tree Protocol (STP)

Menu: Configuring 802.1D STP

1. From the Main Menu, select:
 2. **Switch Configuration ...**
 4. **Spanning Tree Operation**

```
----- CONSOLE - MANAGER MODE -----
Switch Configuration - Spanning Tree Operation

Protocol Version : RSTP ← Use this field to select the 802.1d version of STP.
STP Enabled [No] : No
Force Version [RSTP-operation] : RSTP-operation
Switch Priority [8] : 8           Hello Time [2] : 2
Max Age [20] : 20                Forward Delay [15] : 15

Port   Type      Cost      Priority  Edge  Point-to-Point  MCheck
-----
A1     10/100TX    200000    8         Yes   Force-True      Yes
A2     10/100TX    200000    8         Yes   Force-True      Yes
A3     10/100TX    200000    8         Yes   Force-True      Yes
A4     10/100TX    200000    8         Yes   Force-True      Yes
A5     10/100TX    200000    8         Yes   Force-True      Yes
A6     10/100TX    200000    8         Yes   Force-True      Yes

Actions->  Cancel   Edit   Save   Help

Cancel changes and return to previous screen.
Use arrow keys to change action selection and <Enter> to execute action.
```

Figure 13-5. The Default “Spanning Tree Operation” Screen

2. Press [E] (for **Edit**) to highlight the **Protocol Version** field. In the default configuration this field is set to **RSTP**.
3. Press the Space bar once to change the field to STP. This changes the Protocol Version selection to the 802.1d Spanning Tree Protocol.
4. Press [↓] to highlight the **STP Enabled** field.
5. Press the Space bar to select **Yes**. (**Yes** in this field means to enable spanning-tree operation.)

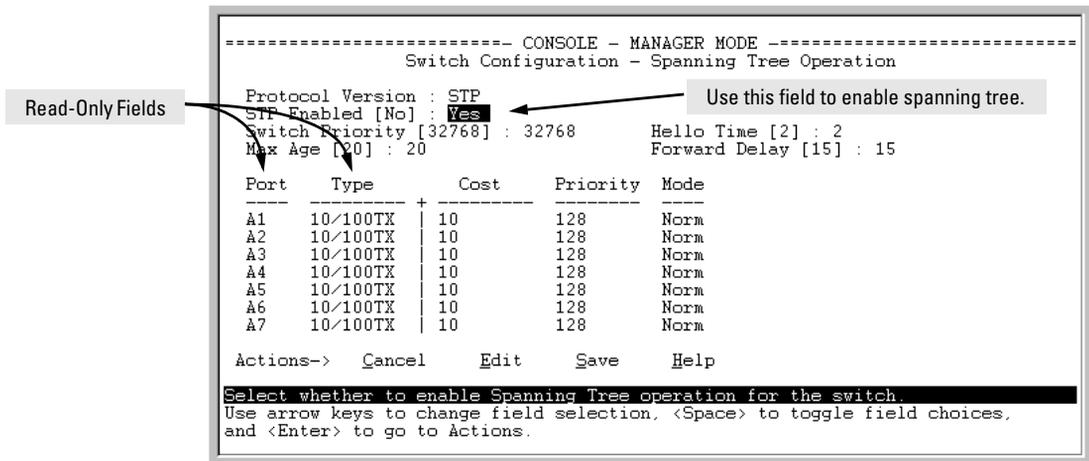


Figure 13-6. Enabling Spanning-Tree Operation

6. If the remaining STP parameter settings are adequate for your network, go to step 10.
7. Use **[Tab]** or the arrow keys to select the next parameter you want to change, then type in the new value or press the Space Bar to select a value. (If you need information on STP parameters, press **[Enter]** to select the **Actions** line, then press **H** to get help.)
8. Repeat step 7 for each additional parameter you want to change.
Note: For information on the **Mode** parameter, see “STP Fast Mode” on page 13-27.
9. When you are finished editing parameters, press **[Enter]** to return to the **Actions** line.
10. Press **[S]** to save the currently displayed STP parameter settings. You will then see the “Switch Configuration Menu” with an asterisk (*) at the **Spanning Tree Operation** line, indicating that you must reboot the switch before the Protocol Version change (step 5) takes effect.

```
----- CONSOLE - MANAGER MODE -----  
Switch Configuration Menu  
  
1. System Information  
2. Port/Trunk Settings  
3. Network Monitoring Port  
*4. Spanning Tree Operation  
5. IP Configuration  
6. SNMP Community Names  
7. IP Authorized Managers  
8. VLAN Menu...  
0. Return to Main Menu...  
  
Configures the switch and port Spanning Tree parameters.  
To select menu item, press item number, or highlight item and press <Enter>.  
(*Needs reboot to activate changes.)
```

Figure 13-7. The Configuration Menu Indicating a Reboot Is Needed to Implement a Configuration Change

11. Press [0] to return to the Main menu.

```
----- CONSOLE - MANAGER MODE -----  
Main Menu  
  
1. Status and Counters...  
*2. Switch Configuration...  
3. Console Passwords...  
4. Event Log  
5. Command Line (CLI)  
6. Reboot Switch  
7. Download OS  
8. Run Setup  
9. Stacking...  
0. Logout  
  
Displays the menu for customizing the switch configuration.  
To select menu item, press item number, or highlight item and press <Enter>.  
(*Needs reboot to activate changes.)
```

Figure 13-8. The Main Menu Indicating a Reboot Is Needed To Implement a Configuration Change

12. Press [6] to reboot the switch. This implements the Protocol Version change (steps 2 and 3 on page 13-20).

CLI: Configuring 802.1D STP

STP Commands Used in This Section

show spanning-tree config	Below
spanning-tree	
protocol-version	page 13-24
forward-delay <4 - 30>	page 13-25
hello-time <1 - 10>	page 13-25
maximum-age <6 - 40>	page 13-25
priority <0 - 65535>	page 13-25
ethernet <port-list>	page 13-26
path-cost <1 - 65535>	page 13-26
priority <0 - 255>	page 13-26
mode <norm / fast>	page 13-26
show spanning tree	Lists additional STP data not covered in this chapter. See “Spanning Tree Protocol (STP) Information” on page B-16

Viewing the Current STP Configuration. Regardless of whether STP is disabled (the default), this command lists the switch’s full STP configuration, including general settings and port settings.

Syntax: show spanning-tree config

When the switch is configured for 802.1d STP, this command displays information similar to the following:

```
HPswitch(config)# show spanning-tree config
Spanning Tree Operation
Protocol Version : STP
STP Enabled [No] : No
Switch Priority [32768] : 32768      Hello Time [2] : 2
Max Age [20] : 20                  Forward Delay [15] : 15
```

Port	Type	Cost	Priority	Mode
A1	10/100TX	10	128	Norm
A2	10/100TX	10	128	Norm
A3	10/100TX	10	128	Norm
A4	10/100TX	10	128	Norm
A5	10/100TX	10	128	Norm
.
.
.

Command Listing when STP is the Protocol Version (See also page 13-11)

Figure 13-9. Example of the Default STP Configuration Listing with 802.1d STP Configured at the Protocol Version

Configuring the Switch To Use the 802.1d Spanning Tree Protocol (STP). In the default configuration, the switch is set to **RSTP** (that is, 802.1w Rapid Spanning Tree), and spanning tree operation is disabled. To reconfigure the switch to 802.1d spanning tree, you must:

1. Change the spanning tree protocol version to **stp**.
2. Use **write memory** to save the change to the startup-configuration.
3. Reboot the switch.
4. If you have not previously enabled spanning-tree operation on the switch, use the **spanning-tree** command again to enable STP operation.

Syntax: spanning-tree protocol-version stp
write memory
boot

For example:

```
HPswitch(config)# spanning-tree protocol-version stp
STP version was changed. To activate the change you must
save the configuration to flash and reboot the device.
HPswitch(config)# write memory
HPswitch(config)# boot
Device will be rebooted, do you want to continue [y/n]? y
Rebooting the System
```

Figure 13-10. Steps for Changing Spanning-Tree Operation to the 802.1d Protocol

Enabling (or Disabling) Spanning Tree Operation on the Switch.

This command enables (or disables) spanning tree operation for either spanning tree version—STP/802.1d or RSTP/802.1w (the default). Before using this command, ensure that the version of spanning tree you want to use is active on the switch. (See the preceding topic, “Configuring the Switch To Use the 802.1d Spanning Tree Protocol (STP)” on page 13-24.)

Syntax: [no] spanning-tree

Default: Disabled

For example:

```
HPswitch spanning-tree
```

Enabling STP implements the spanning tree protocol for all physical ports on the switch, regardless of whether multiple VLANs are configured. Disabling STP removes protection against redundant loops that can significantly slow or halt a network.

This command enables STP with the current parameter settings or disables STP without losing the most-recently configured parameter settings. (To learn how the switch handles parameter changes, how to test changes without losing the previous settings, and how to replace previous settings with new settings, see Chapter 5, “Switch Memory and Configuration”.) When enabling STP, you can also include the STP general and per-port parameters described in the next two sections. When you use the “no” form of the command, you can do so only to disable STP. (STP parameter settings are not changed when you disable STP.)

Caution

Because incorrect STP settings can adversely affect network performance, HP recommends that you use the default STP parameter settings. You should not change these settings unless you have a strong understanding of how STP operates. For more on STP, see the IEEE 802.1d standard.

Reconfiguring General STP Operation on the Switch. You can configure one or more of the following parameters:

Table 13-3. General STP Operating Parameters

Name	Default	Range	Function
priority	32768	0 - 65535	Specifies the priority value used along with the switch MAC address to determine which device is root. The lower a priority value, the higher the priority.
*maximum-age	20 seconds	6 - 40 seconds	Maximum received message age the switch allows for STP information before discarding the message.
*hello-time	2 seconds	1 - 10	Time between messages transmitted when the switch is the root.
*forward-delay	15 seconds	4 - 30 seconds	Time the switch waits before transitioning from the listening to the learning state, and between the learning state to the forwarding state.

*The switch uses its own maximum-age, hello-time, and forward-delay settings only if it is operating as the root device. If another device is operating as the root device, then the switch uses the other device's settings for these parameters.

Note

Executing **spanning-tree** alone enables STP. Executing **spanning-tree** with one or more of the above “STP Operating Parameters” does not enable STP. It only configures the STP parameters (regardless of whether STP is actually running (enabled) on the switch).

Syntax: spanning-tree
 priority <0 - 65355>
 maximum-age <6 - 40 seconds>
 hello-time <1 - 10 seconds>
 forward-delay <4 - 30 seconds>

Default: See table 13-3, above.

For example, to configure a **maximum-age** of 30 seconds and a **hello-time** of 3 seconds for STP:

```
HPswitch(config)# spanning-tree maximum-age 30 hello-time 3
```

Reconfiguring Per-Port STP Operation on the Switch. This command enables STP (if not already enabled) and configures the following per-port parameters:

Table 13-4.Per-Port STP Parameters

Name	Default	Range	Function
path-cost	Ethernet: 100 10/100Tx: 10 100 Fx: 10 Gigabit: 5	1 - 65355	Assigns an individual port cost that the switch uses to determine which ports are the forwarding ports.
priority	128	0 - 255	Used by STP to determine the port(s) to use for forwarding. The port with the lowest number has the highest priority.
mode	norm	norm - <i>or</i> - fast - <i>or</i> - uplink	Specifies whether a port progresses through the listening, learning, and forwarding (or blocking) states (“norm” mode) or transitions directly to the forwarding state (“fast” mode). <ul style="list-style-type: none">• For information on when to use Fast mode, see “STP Fast Mode” on page 13-27.)• For information on Uplink mode, see “Fast-Uplink Spanning Tree Protocol (STP)” on page 13-28

You can also include STP general parameters in this command. See “Reconfiguring General STP Operation on the Switch” on page 13-25.

Syntax: spanning-tree [ethernet] <port-list>
path-cost <1 - 65535>
priority <0 - 255>
mode <norm / fast>

Default: See table 13-4, above.

For example, the following configures ports C5 and C6 to a path cost of **15**, a priority of **100**, and **fast** mode:

```
HPswitch(config)# spanning-tree c5-c6 path-cost 15  
priority 100 mode fast
```

STP Fast Mode

For standard STP operation, when a network connection is established on a device that is running STP, the port used for the connection goes through a sequence of states (Listening and Learning) before getting to its final state (Forwarding or Blocking, as determined by the STP negotiation). This sequence takes two times the forward delay value configured for the switch. The default is 15 seconds on HP switches, per the IEEE 802.1D standard recommendation, resulting in a total STP negotiation time of 30 seconds. Each switch port goes through this start-up sequence whenever the network connection is established on the port. This includes, for example, when the switch or connected device is powered up, or the network cable is connected.

A problem can arise from this long STP start-up sequence because some end nodes are configured to automatically try to access a network server whenever the end node detects a network connection. Typical server access includes to Novell servers, DHCP servers, and X terminal servers. If the server access is attempted during the time that the switch port is negotiating its STP state, the server access will fail. To provide support for this end node behavior, the Series 5300XL switches offers a configuration mode, called “Fast Mode”, that causes the switch port to skip the standard STP start-up sequence and put the port directly into the “Forwarding” state, thus allowing the server access request to be forwarded when the end node needs it.

If you encounter end nodes that repeatedly indicate server access failure when attempting to bring up their network connection, and you have enabled STP on the switch, try changing the configuration of the switch ports associated with those end nodes to STP Fast Mode.

Caution

The Fast Mode configuration should be used only on switch ports connected to end nodes. Changing the Mode to Fast on ports connected to hubs, switches, or routers may cause loops in your network that STP may not be able to immediately detect, in all cases. This will cause temporary loops in your network. After the fast start-up sequence, though, the switch ports operate according to the STP standard, and will adjust their state to eliminate continuing network loops.

To Enable or Disable Fast Mode for a Switch Port:

You can use either the CLI or the menu interface to toggle between STP Fast mode and STP Normal mode. (To use the menu interface, see “Menu: Configuring 802.1D STP” on page 13-20.)

Syntax: spanning-tree <port list> mode <fast | norm>

For example, to configure Fast mode for ports C1-C3 and C5:

```
HPswitch(config)# spanning-tree c1-c3,c5 mode fast
```

Fast-Uplink Spanning Tree Protocol (STP)

Fast-Uplink STP is an option added to the switch’s 802.1d STP to improve the recovery (convergence) time in wiring closet switches with redundant uplinks. Specifically, a Series 5300XL switch having redundant links toward the root device can decrease the convergence time (or failover) to a new uplink (STP root) port to as little as ten seconds. To realize this performance, the switch must be:

- Used as a wiring closet switch (also termed an *edge switch* or a *leaf switch*).
- Configured for fast-uplink STP mode on two or more ports intended for redundancy in the direction of the root switch, so that at any time only one of the redundant ports is expected to be in the forwarding state.

Note

Fast-Uplink STP operates only with 802.1d STP and is not available with the Rapid STP (802.1w) feature (page 13-8).

Caution

In general, fast-uplink spanning tree on the Series 5300XL switches is useful when running STP in a tiered topology that has well-defined edge switches. Also, ensure that an interior switch is used for the root switch and for any logical backup root switches. You can accomplish this by using the Spanning Tree Priority (sometimes termed bridge priority) settings that define the primary STP root switch and at least one failover root switch (in the event that the primary root switch fails). Inappropriate use of Fast-Uplink STP can cause intermittent loops in a network topology. For this reason, the Fast-Uplink STP feature should be used only by experienced network administrators who have a strong understanding of the IEEE 802.1D standard and STP interactions and operation. If you want to learn more about STP operation, you may find it helpful to refer to publications such as:

Perlman, Radia, Interconnections, Second Edition; Bridges, Routers, Switches, and Internetworking Protocols, Addison-Wesley Professional Computing Series, October 1999

Note

When properly implemented, fast-uplink STP offers a method for achieving faster failover times than standard STP, and is intended for this purpose for instances where 802.1d STP has been chosen over 802.1w RSTP.

To use fast-uplink STP, configure fast-uplink (**Mode = Uplink**) only on the switch's upstream ports; (that is, two or more ports forming a group of redundant links in the direction of the STP root switch). If the active link in this group goes down, fast-uplink STP selects a different upstream port as the root port and resumes moving traffic in as little as ten seconds. The device(s) on the other end of the links must be running STP. However, because fast uplink should be configured only on the Series 5300XL switch uplink ports, the device(s) on the other end of the links can be either HP devices or another vendor's devices, regardless of whether they support fast uplink. For example:

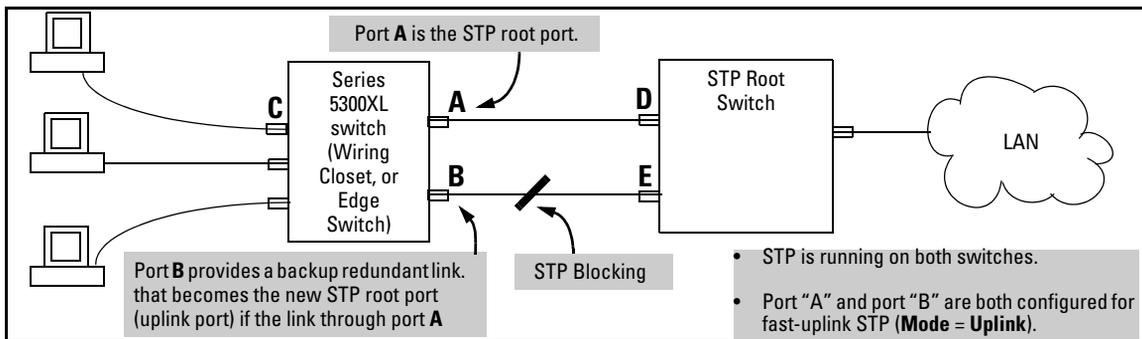


Figure 13-11. Example of How To Implement Fast-Uplink STP

Terminology

Term	Definition
downlink port (downstream port)	A switch port that is linked to a port on another switch (or to an end node) that is sequentially further away from the STP root device. For example, port "C" in figure 13-11, above, is a downlink port.
edge switch	For the purposes of fast-uplink STP, this is a switch that has no other switches connected to its downlink ports. An edge switch is sequentially further from the root device than other switches to which it is connected. Also termed <i>wiring closet switch</i> or <i>leaf switch</i> . For example, switch "4" in figure 13-12 (page 30) is an edge switch.
interior switch	In an STP environment, a switch that is sequentially closer to the STP root device than one or more other switches to which it is connected. For example, switches "1", "2", and "3" in figure 13-12 (page 30) are interior switches.
single-instance spanning tree	A single spanning-tree ensuring that there are no logical network loops associated with any of the connections to the switch, regardless of whether there are any VLANs configured on the switch. For more information, see "Spanning Tree Protocol (STP)" in chapter 9, "Configuring Advanced Features", in the Management and Configuration Guide for your switch.
uplink port (upstream port)	A switch port linked to a port on another switch that is sequentially closer to the STP root device. For example, ports "A" and "B" in figure 13-11 on page 29 are uplink ports.
wiring closet switch	Another term for an "edge" or "leaf" switch.

When single-instance spanning tree (STP) is running in a network and a forwarding port goes down, a blocked port typically requires a period of $(2 \times (\text{forward delay}) + \text{link down detection})$

to transition to forwarding. In a normal spanning tree environment, this transition is usually 30 seconds (with the **Forward Delay** parameter set to its default of 15 seconds). However, by using the fast-uplink spanning tree feature, a port on a Series 5300XL switch used as an *edge switch* can make this transition in as little as ten seconds. (In an STP environment, an *edge switch* is a switch that is connected only to switches that are closer to the STP root switch than the edge switch itself, as shown by switch "4" in figure 13-12, below.)

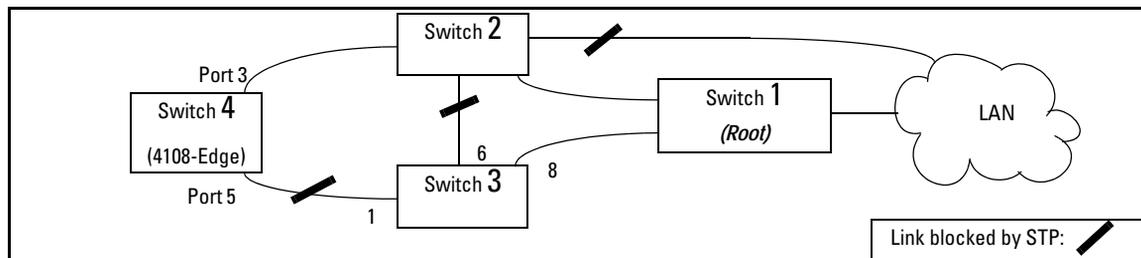


Figure 13-12. Example of an Edge Switch in a Topology Configured for STP Fast Uplink

In figure 13-12, STP is enabled and in its default configuration on all switches, unless otherwise indicated in table 13-13-5, below:

Table 13-5.STP Parameter Settings for Figure 13-12

STP Parameter	Switch "1"	Switch "2"	Switch "3"	Switch "4"
Switch Priority	0 ¹	1 ²	32,768 (default)	32,768 (default)
(Fast) Uplink	No	No	No	Ports 3 & 5

¹This setting ensures that Switch "1" will be the primary root switch for STP in figure 13-12.
²This setting ensures that Switch "2" will be the backup root switch for STP in figure 13-12.

With the above-indicated topology and configuration:

- **Scenario 1:** If the link between switches "4" and "2" goes down, then the link between switches "4" and "3" will begin forwarding in as little as ten seconds.
- **Scenario 2:** If Switch "1" fails, then:
 - Switch "2" becomes the root switch.
 - The link between Switch "3" and Switch "2" begins forwarding.
 - The link between Switch "2" and the LAN begins forwarding.

Operating Rules for Fast Uplink

- A switch with ports configured for fast uplink must be an edge switch and not either an interior switch or the STP root switch.

Configure fast-uplink on only the edge switch ports used for providing redundant STP uplink connections in a network. (Configuring Fast-Uplink STP on ports in interior switches can create network performance problems.) That is, a port configured for STP uplink should not be connected to a switch that is sequentially further away from the STP root device. For example, switch "4" in figure 13-12 (page 13-30) is an edge switch.

- Configure fast uplink on a group (two or more) of redundant edge-switch uplink ports where only one port in the group is expected to be in the forwarding state at any given time.

- Edge switches cannot be directly linked together using fast-uplink ports. For example, the connection between switches 4 and 5 in figure 13-13 is not allowed for fast-uplink operation.

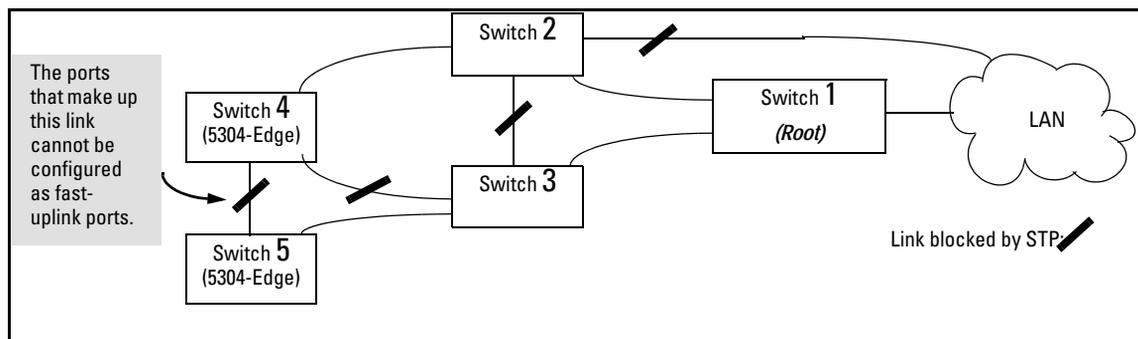


Figure 13-13. Example of a Disallowed Connection Between Edge Switches

- Apply fast-uplink only on the uplink ports of an edge switch. For example, on switch “4” (an edge switch) in figure 13-13 above, only the ports connecting switch “4” to switches “2” and “3” are upstream ports that would use fast uplink. Note also that fast uplink should *not* be configured on both ends of a point-to-point link, but only on the uplink port of an edge switch.
- Ensure that the switch you intend as a backup root device will in fact become the root if the primary root fails, and that no ports on the backup root device are configured for fast-uplink operation. For example, if the **STP Priority** is the same on all switches—default: 32768—then the switch with the lowest MAC address will become the root switch. If that switch fails, then the switch with the next-lowest MAC address will become the root switch. Thus, you can use **STP Priority** to control which switch STP selects as the root switch and which switch will become the root if the first switch fails.
- Fast-Uplink STP requires a minimum of two uplink ports.

Menu: Viewing and Configuring Fast-Uplink STP

You can use the menu to quickly display the entire STP configuration and to make any STP configuration changes.

To View and/or Configure Fast-Uplink STP. This procedure uses the Spanning Tree Operation screen to enable STP and to set the Mode for fast-uplink STP operation.

1. From the Main Menu select:

2. Switch Configuration ...

4. Spanning Tree Operation

2. In the default STP configuration, RSTP is the selected protocol version. If this is the case on your switch, you must change the Protocol Version to STP in order to use Fast-Uplink STP:

If the **Protocol Version** is set to RSTP (the default, as shown in this example, go to step 3.

If the **Protocol Version** is set to STP, the rest of the screen will appear as shown in figure 13-16. In this case, go to step 4 on page 13-35.

```
----- CONSOLE - MANAGER MODE -----
Switch Configuration - Spanning Tree Operation

Protocol Version : RSTP
STP Enabled [No] : No
Force Version [RSTP-operation] : RSTP-operation
Switch Priority [8] : 8           Hello Time [2] : 2
Max Age [20] : 20                Forward Delay [15] : 15

Port      Type      Cost      Priority  Edge  Point-to-Point  MCheck
-----+-----
A3      10/100TX | 200000    8        Yes   Force-True      Yes
A4      10/100TX | 200000    8        Yes   Force-True      Yes
A5      10/100TX | 200000    8        Yes   Force-True      Yes
A6      10/100TX | 200000    8        Yes   Force-True      Yes
A7      10/100TX | 200000    8        Yes   Force-True      Yes
A8      10/100TX | 200000    8        Yes   Force-True      Yes

Actions->  Cancel   Edit   Save   Help

Cancel changes and return to previous screen.
Use arrow keys to change action selection and <Enter> to execute action.
```

Figure 13-14. The Default STP Screen With the Protocol Version Field Set to "RSTP"

3. If the Protocol Version is set to RSTP (as shown in figure 13-14), do the following:
 - a. Press **[E]** (**Edit**) to move the cursor to the **Protocol Version** field.
 - b. Press the Space bar once to change the **Protocol Version** field to STP.
 - c. Press **[Enter]** to return to the command line.
 - d. Press **[S]** (for **Save**) to save the change and exit from the Spanning Tree Operation screen. you will then see a screen with the following:

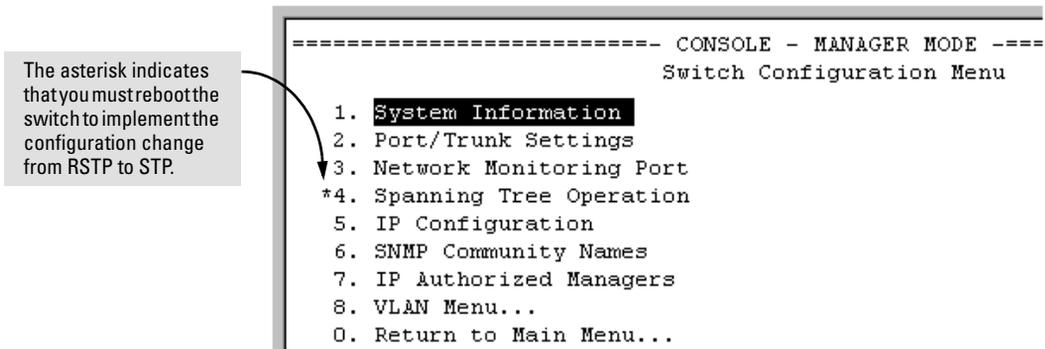


Figure 13-15. Changing from RSTP to STP Requires a System Reboot

- e. Press **[0]** (zero) to return to the Main Menu, then **[6]** to reboot the switch.
- f. After you reboot the switch, enter the menu command at the CLI to return to the Main Menu, then select:

2. Switch Configuration ...
4. Spanning Tree Operation

You will then see the Spanning Tree screen with **STP** (802.1d) selected in the **Protocol Version** field (figure 13-16).

```

----- CONSOLE - MANAGER MODE -----
Switch Configuration - Spanning Tree Operation

Protocol Version : STP
STP Enabled [No] : No
Switch Priority [32768] : 32768      Hello Time [2] : 2
Max Age [20] : 20                   Forward Delay [15] : 15

Port      Type          Cost      Priority  Mode
-----
A1 10/100TX | 100      128      Norm
A4 10/100TX | 100      128      Norm
A5 10/100TX | 100      128      Norm
A6 10/100TX | 100      128      Norm
A7 10/100TX | 100      128      Norm
A3 10/100TX | 100      128      Norm
A9 10/100TX | 100      128      Norm

Actions->  Cancel  Edit   Save   Help

```

In this example, ports 2 and 3 have already been configured as a port trunk (Trk1), which appears at the end of the port listing.

All ports (and the trunk) are in their default STP configuration.

Note: In the actual menu screen, you must scroll the cursor down the port list to view the trunk configuration (ports A2 and A3).

Cancel changes and return to previous screen.
Use arrow keys to change action selection and <Enter> to execute action.

Figure 13-16. The Spanning Tree Operation Screen

4. On the ports and/or trunks you want to use for redundant fast uplink connections, change the mode to **Uplink**. In this example, port A1 and Trk1 (using ports A2 and A3) provide the redundant uplinks for STP:
 - a. Press **[E]** (for **Edit**), then enable STP on the switch by using the Space bar to select **Yes** in the Spanning Tree Enabled field.
 - b. Use **[Tab]** to move to the Mode field for port A1.
 - c. Use the Space bar to select **Uplink** as the mode for port A1.
 - d. Use **[↓]** to move to the Mode field for Trk1.
 - e. Use the Space bar to select **Uplink** as the Mode for Trk1.
 - f. Press **[Enter]** to return the cursor to the Actions line.

```

----- CONSOLE - MANAGER MODE -----
Switch Configuration - Spanning Tree Operation

Protocol Version : STP
STP Enabled [No] : No
Switch Priority [32768] : 32768
Max Age [20] : 20
Hello Time [2] : 2
Forward Delay [15] : 15

Port      Type      Cost      Priority  Mode
-----+-----
A1      10/100TX | 100      128      Uplink
A4      10/100TX | 100      128      Norm
A5      10/100TX | 100      128      Norm
.      .      .      .      .
.      .      .      .      .
A24    10/100TX | 100      128      Norm
Trk1    | 100      64      Uplink

Actions->  Cancel  Edit  Save  Help

Cancel changes and return to previous screen.
Use arrow keys to change action selection and <Enter> to execute action.
    
```

Figure 13-17. Example of STP Enabled with Two Redundant Links Configured for Fast-Uplink STP

5. Press **[S]** (for **Save**) to save the configuration changes to flash (non-volatile) memory.

To View Fast-Uplink STP Status. Continuing from figures 13-16 and 13-17 in the preceding procedure, this task uses the same screen that you would use to view STP status for other operating modes.

1. From the Main Menu, select:
 1. Status and Counters ...
 7. Spanning Tree Information

```

=====-- CONSOLE - MANAGER MODE -----
                Status and Counters - Spanning Tree Information
STP Enabled      : Yes
Switch Priority   : 32,768
Hello Time       : 2
Max Age          : 20
Forward Delay    : 15

Topology Change Count : 2
Time Since Last Change : 15 mins

Root MAC Address : 0060b0-889e00
Root Path Cost   : 20
Root Port        : Trk1
Root Priority     : 16000

Actions->  Back  Show ports  Help

Return to previous screen.
Use arrow keys to change action selection and <Enter> to execute action.
    
```

Indicates which uplink is the active path to the STP root device.
Note: A switch using fast-uplink STP must never be the STP root device.

Figure 13-18. Example of STP Status with Trk1 (Trunk 1) as the Path to the STP Root Device

2. Press [S] (for **Show ports**) to display the status of individual ports.

```

=====-- CONSOLE - MANAGER MODE -----
                Status and Counters - Spanning Tree - Port Information
Port    Type    Cost    Priority    State    Designated Bridge
-----
A1      10/100TX   10      128    Blocking 0030c1-7fcc40
A4      10/100TX   10      128    Disabled
A5      10/100TX   10      128    Forwarding 0030c1-a914c0
A6      10/100TX   10      128    Forwarding 0030c1-a919c1
.       .           .       .       .
A24    10/100TX   10      128    Forwarding 0030c1-c884c0
Trk1    Trunk       10      64     Forwarding 0030c1-7fcc40

Actions->  Back  Help

Return to previous screen.
Use up/down arrow keys to scroll to other entries, left/right arrow keys to
change action selection, and <Enter> to execute action.
    
```

Redundant STP Link in (Fast) Uplink Mode
Links to PC or Workstation End Nodes
Redundant STP Link in (Fast) Uplink Mode

Figure 13-19. Example of STP Port Status with Two Redundant STP Links

In figure 13-19:

- Port A1 and Trk1 (trunk 1; formed from ports 2 and 3) are redundant fast-uplink STP links, with trunk 1 forwarding (the active link) and port A1 blocking (the backup link). (To view the configuration for port A1 and Trk1, see figure 13-17 on page 13-36.)
- If the link provided by trunk 1 fails (on both ports), then port A1 begins forwarding in fast-uplink STP mode.
- Ports A5, A6, and A24 are connected to end nodes and do not form redundant links.

CLI: Viewing and Configuring Fast-Uplink STP

Using the CLI to View Fast-Uplink STP. You can view fast-uplink STP using the same **show** commands that you would use for standard STP operation:

Syntax:

<code>show spanning-tree</code>	Lists STP status.
<code>show spanning-tree config</code>	Lists STP configuration for the switch and for individual ports.

For example, figures 13-20 and 13-21 illustrate a possible topology, STP status listing, and STP configuration for a Series 5300XL switch with:

- STP enabled and the switch operating as an Edge switch
- Port A1 and trunk 1 (Trk1) configured for fast-uplink STP operation
- Several other ports connected to PC or workstation end nodes

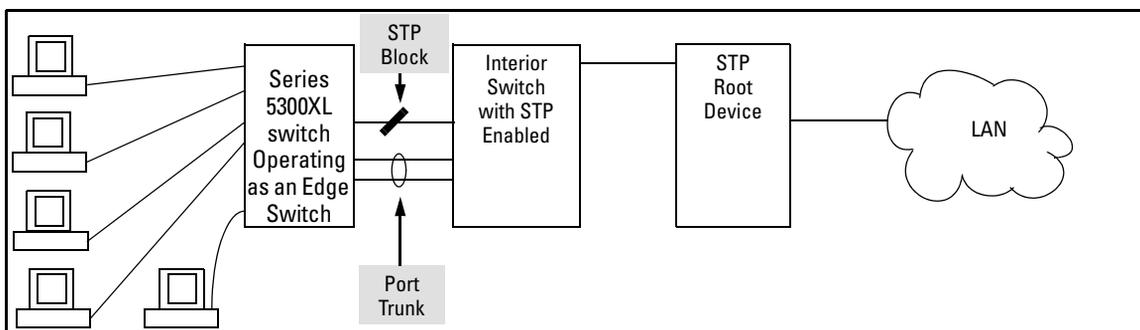


Figure 13-20. Example Topology for the Listing Shown in Figure 13-21

```

HPswitch (config)# show spanning-tree
Status and Counters - Spanning Tree Information

STP Enabled           : Yes
Switch Priority       : 32,768
Hello Time           : 2
Max Age              : 20      HPswitch
Forward Delay        : 15

Topology Change Count : 25
Time Since Last Change : 13 mins

Root MAC Address     : 0001e7-a09900
Root Path Cost       : 20
Root Port            : Trk1
Root Priority         : 16768

Port   Type      Cost  Priority  State      Designated Bridge
-----
A1     10/100TX  10    128     Blocking   0030c1-a9c800
A4     10/100TX  10    128     Disabled   |
A5     10/100TX  10    128     Forwarding | 0030c1-7fec40
A6     10/100TX  10    128     Forwarding | 0030c1-a9c800
- MORE --
A7     10/100TX  10    128     Forwarding | 0030c1-a9c822
A8     10/100TX  10    128     Disabled   |
A9     10/100TX  10    128     Forwarding | 00a0c9-a234c3
A10    10/100TX  10    128     Forwarding | 0030c1-449bc0
A11    10/100TX  10    128     Disabled   |
A12    10/100TX  10    128     Disabled   |
Trk1   10          10    64      Forwarding | 0030c1-a9c800
  
```

Indicates that Trk1 (Trunk 1) provides the currently active path to the STP root device.

Redundant STP link in the Blocking state.

Links to PC or Workstation End Nodes

Redundant STP link in the Forwarding state. (See the "Root Port" field, above. This is the currently active path to the STP root device.)

Indicates that Trk1 (Trunk 1) provides the currently active path to the STP root device.

Redundant STP link in the Blocking state.

Links to PC or Workstation End Nodes

Redundant STP link in the Forwarding state. (See the "Root Port" field, above. This is the currently active path to the STP root device.)

Figure 13-21. Example of a Show Spanning-Tree Listing for the Topology Shown in Figure 13-20

```
HPswitch(config)# show spanning-tree config
Spanning Tree Operation
Spanning Tree Enabled : Yes
STP Priority : 32768
Max Age : 20
Hello Time : 2
Forward Delay : 15

Port Type      | Cost  Pri  Mode
-----+-----+-----+-----
A1  10/100TX  | 10   128 Uplink
A4  10/100TX  | 10   128 Norm
A5  10/100TX  | 10   128 Norm
A6  10/100TX  | 10   128 Norm
A7  10/100TX  | 10   128 Norm
A8  10/100TX  | 10   128 Norm
A9  10/100TX  | 10   128 Norm
A10 10/100TX  | 10   128 Norm
A11 10/100TX  | 10   128 Norm
A12 10/100TX  | 10   128 Norm
Trk1 Trunk    | 10   64  Uplink
```

Figure 13-22. Example of a Configuration Supporting the STP Topology Shown in Figure 13-20

Using the CLI To Configure Fast-Uplink STP. This example uses the CLI to configure the switch for the fast-uplink operation shown in figures 13-20, 13-21, and 13-22. (The example assumes that ports A2 and A3 are already configured as members of the port trunk—Trk1, and all other STP parameters are left in their default state.)

Note that the default STP Protocol Version is RSTP (Rapid STP, or 802.1w). Thus, if the switch is set to the STP default, you must change it to the STP (802.1d) Protocol Version before you can configure Fast-Uplink. For example:

```

HPswitch(config)# show spanning-tree
Status and Counters - Spanning Tree Information
Protocol Version : RSTP
STP Enabled : No
Port Type      Cost      Priority State | Designated Bridge
-----+-----+-----+-----+-----+
HPswitch(config)# spanning-tree protocol-version stp
STP version was changed. To activate the change you must
save the configuration to flash and reboot the device.
HPswitch(config)# write mem
HPswitch(config)# boot
Device will be rebooted, do you want to continue [y/n]? y
Boot from primary flash

```

Lists STP configuration.

Shows the default STP protocol

1. Changes the Spanning-Tree protocol to STP (required for Fast-Uplink).
2. Saves the change to the startup-configuration
3. Reboots the switch. (Required for this configuration change.)

Figure 13-23. Example of Changing the STP Configuration from the Default RSTP (802.1w) to STP (802.1d)

Syntax: spanning-tree e <port/trunk-list> mode uplink Enables STP on the switch and configures fast-uplink STP on the designated interfaces (port or trunk).

For example:

```
HPswitch(config)# spanning-tree e A1,trk1 mode uplink
```

Operating Notes

Effect of Reboots on Fast-Uplink STP Operation. When configured, fast-uplink STP operates on the designated ports in a running switch. However, if the switch experiences a reboot, the fast-uplink ports (Mode = **Uplink**) use the longer forwarding delay used by ports on standard 802.1D STP (non fast-uplink). This prevents temporary loops that could otherwise result while the switch is determining the STP status for all ports. That is, on ports configured for fast-uplink STP, the first STP state transition after a reboot takes the same amount of time as for redundant ports that are not configured for fast-uplink STP.

Using Fast Uplink with Port Trunks. To use a port trunk for fast-uplink STP, configure it in the same way that you would an individual port for the same purpose. A port trunk configured for fast uplink operates in the same way as an individual, non-trunked port operates; that is, as a logical port.

Note

When you add a port to a trunk, the port takes on the STP mode configured for the trunk, regardless of which STP mode was configured on the port before it was added to the trunk. Thus, all ports belonging to a trunk configured with **Uplink** in the STP **Mode** field will operate in the fast-uplink mode. (If you remove a port from a trunk, the port reverts to the STP Mode setting it had before you added the port to the trunk.)

To use fast uplink over a trunk, you must:

1. Create the trunk.
2. Configure the trunk for fast uplink in the same way that you would configure an individual port for fast uplink.

When you first create a port trunk, its STP Mode setting will be **Norm**, regardless of whether one or more ports in the trunk are set to fast uplink (Mode = **Uplink**). You must still specifically configure the trunk Mode setting to **Uplink**. Similarly, if you eliminate a trunk, the Mode setting on the individual ports in the trunk will return to their previous settings.

For Troubleshooting Information on Fast Uplink. Refer to “Spanning-Tree Protocol (STP) and Fast-Uplink Problems” on page C-19 (in the “Troubleshooting” appendix).

Web: Enabling or Disabling STP

In the web browser interface you can enable or disable STP on the switch. To configure other STP features, telnet to the switch console and use the CLI.

To enable or disable STP on the switch:

1. Click on the **Configuration** tab
2. Click on **[Device Features]**.
3. Enable or disable STP.
4. Click on **[Apply Changes]** to implement the configuration change.

For web-based help on how to use the web browser interface screen, click on the **[?]** button provided on the web browser screen.