CHAPTER 7

Configuring Spanning Tree PortFast, UplinkFast, and BackboneFast

This chapter describes how to configure the spanning tree PortFast, UplinkFast, and BackboneFast features on the Catalyst 6000 family switches.

Note For information on configuring the Spanning Tree Protocol (STP), see Chapter 6, "Configuring Spanning Tree."

Note For complete syntax and usage information for the commands used in this chapter, refer to the *Catalyst 6000 Family Command Reference* publication.

This chapter consists of these sections:

Understanding How PortFast Works

Spanning tree PortFast causes a spanning tree port to enter the forwarding state immediately, bypassing the listening and learning states. You can use PortFast on switch ports connected to a single workstation or server to allow those devices to connect to the network immediately, rather than waiting for spanning tree to converge.

Caution PortFast should be used *only* when connecting a single end station to a switch port. Otherwise, you might create a network loop.

Understanding How PortFast BPDU Guard Works

To prevent loops in a network, the PortFast mode is supported on nontrunking access ports only, because these ports typically do not transmit or receive BPDUs. The most secure implementation of PortFast is to enable it only on ports that connect end stations to switches. However, because PortFast can be enabled on nontrunking ports connecting two switches, spanning tree loops can occur if BPDUs are still being transmitted and received on those ports.

PortFast BPDU guard can prevent loops by moving a nontrunking port into the errdisable state when a BPDU is received on that port. When the BPDU guard feature is enabled on the switch, spanning tree shuts down PortFast-configured interfaces that receive BPDUs, rather than putting them into the spanning tree blocking state. In a valid configuration, PortFast-configured interfaces do not receive BPDUs. Reception of a BPDU by a PortFast-configured interface signals an invalid configuration, such as connection of an unauthorized device. The BPDU guard feature provides a secure response to invalid configurations, because the administrator must manually put the interface back in service.

Note When enabled on the switch, spanning tree applies the PortFast BPDU guard feature to all PortFast-configured interfaces.

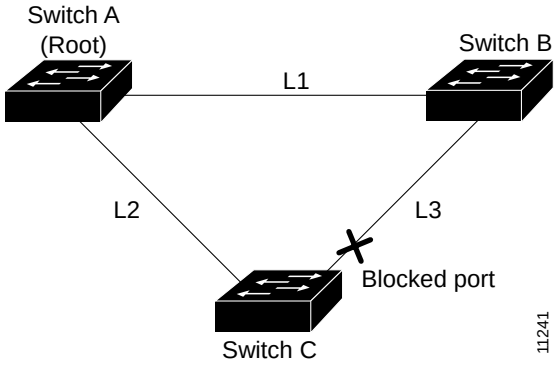
Understanding How UplinkFast Works

UplinkFast provides fast convergence after a spanning tree topology change and achieves load balancing between redundant links using uplink groups. An uplink group is a set of ports (per VLAN), only one of which is forwarding at any given time. Specifically, an uplink group consists of the root port (which is forwarding) and a set of blocked ports, except for self-looping ports. The uplink group provides an alternate path in case the currently forwarding link fails.

Note UplinkFast is most useful in wiring-closet switches. This feature may not be useful for other types of applications.

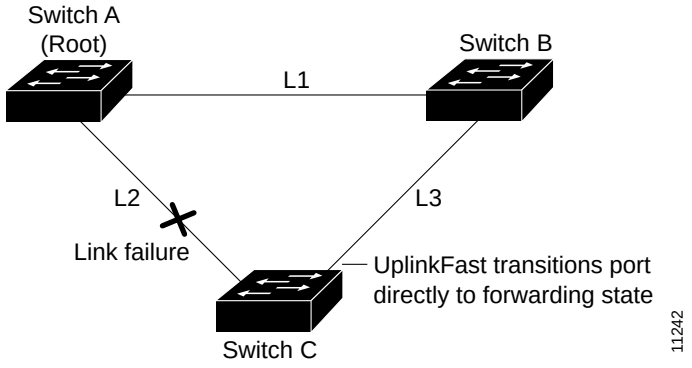
Figure 7-1 shows an example topology with no link failures. Switch A, the root switch, is connected directly to Switch B over link L1 and to Switch C over link L2. The port on Switch C that is connected directly to Switch B is in blocking state.

Figure 7-1 UplinkFast Example Before Direct Link Failure



If Switch C detects a link failure on the currently active link L2 (a *direct* link failure), UplinkFast unblocks the blocked port on Switch C and transitions it to the forwarding state without going through the listening and learning states, as shown in Figure 7-2. This switchover takes approximately one to five seconds.

Figure 7-2 UplinkFast Example After Direct Link Failure



Understanding How BackboneFast Works

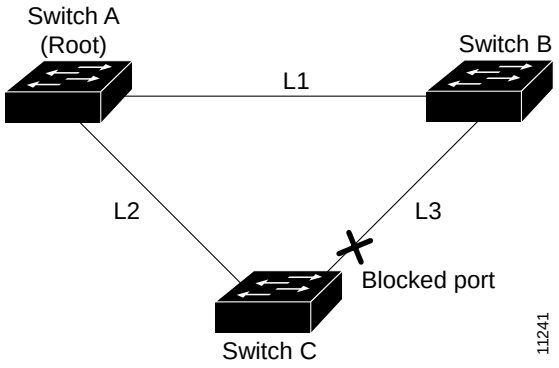
BackboneFast is initiated when a root port or blocked port on a switch receives inferior BPDUs from its designated bridge. An inferior BPDU identifies one switch as both the root bridge and the designated bridge. When a switch receives an inferior BPDU, it indicates that a link to which the switch is not directly connected (an *indirect* link) has failed (that is, the designated bridge has lost its connection to the root bridge). Under normal spanning tree rules, the switch ignores inferior BPDUs for the configured maximum aging time, as specified by the *agingtime* variable of the **set spantree maxage** command.

The switch tries to determine if it has an alternate path to the root bridge. If the inferior BPDU arrives on a blocked port, the root port and other blocked ports on the switch become alternate paths to the root bridge. (Self-looped ports are not considered alternate paths to the root bridge.) If the inferior BPDU arrives on the root port, all blocked ports become alternate paths to the root bridge. If the inferior BPDU arrives on the root port and there are no blocked ports, the switch assumes that it has lost connectivity to the root bridge, causes the maximum aging time on the root to expire, and becomes the root switch according to normal spanning tree rules.

If the switch has alternate paths to the root bridge, it uses these alternate paths to transmit a new kind of PDU called the Root Link Query PDU. The switch sends the Root Link Query PDU out all alternate paths to the root bridge. If the switch determines that it still has an alternate path to the root, it causes the maximum aging time on the ports on which it received the inferior BPDU to expire. If all the alternate paths to the root bridge indicate that the switch has lost connectivity to the root bridge, the switch causes the maximum aging times on the ports on which it received an inferior BPDU to expire. If one or more alternate paths can still connect to the root bridge, the switch makes all ports on which it received an inferior BPDU its designated ports and moves them out of the blocking state (if they were in blocking state), through the listening and learning states, and into the forwarding state.

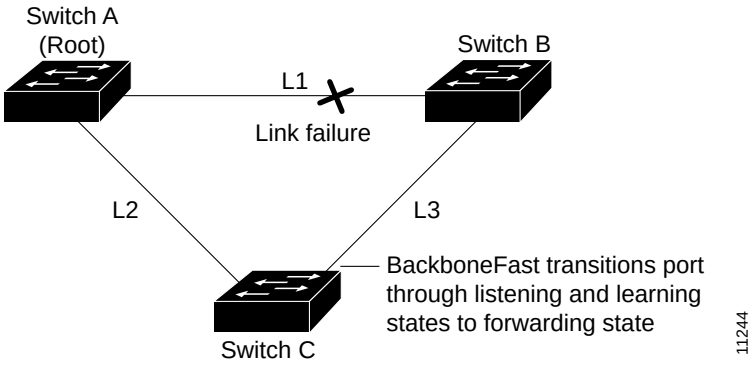
Figure 7-3 shows an example topology with no link failures. Switch A, the root switch, connects directly to Switch B over link L1 and to Switch C over link L2. The port on Switch C that connects directly to Switch B is in the blocking state.

Figure 7-3 BackboneFast Example Before Indirect Link Failure



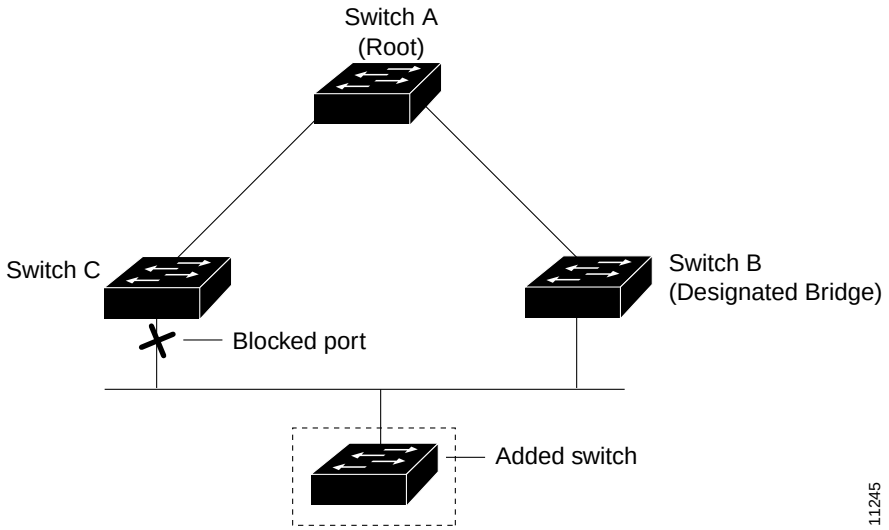
If link L1 fails, Switch C detects this failure as an indirect failure, since it is not connected directly to link L1. Switch B no longer has a path to the root switch. BackboneFast allows the blocked port on Switch C to move immediately to the listening state without waiting for the maximum aging time for the port to expire. BackboneFast then transitions the port on Switch C to the forwarding state, providing a path from Switch B to Switch A. This switchover takes approximately 30 seconds. Figure 7-4 shows how BackboneFast reconfigures the topology to account for the failure of link L1.

Figure 7-4 BackboneFast Example After Indirect Link Failure



If a new switch is introduced into a shared-medium topology, BackboneFast is not activated. Figure 7-5 shows a shared-medium topology in which a new switch is added. The new switch begins sending inferior BPDUs that say it is the root switch. However, the other switches ignore these inferior BPDUs and the new switch learns that Switch B is the designated bridge to Switch A, the root switch.

Figure 7-5 Adding a Switch in a Shared-Medium Topology



Configuring PortFast

These sections describe how to configure spanning tree PortFast on the switch:

Enabling Spanning Tree PortFast

Caution PortFast should be used *only* when connecting a single end station to a switch port. Otherwise, you might create a network loop.

To enable PortFast on a switch port, perform this task in privileged mode:

	Task	Command
Step 1	Enable PortFast on a switch port connected to a single workstation or server.	**set spantree portfast** *mod_num*/*port_num* **enable**
Step 2	Verify the PortFast setting.	**show spantree** *mod_num/port_num*

This example shows how to enable PortFast on a port and verify the configuration (the PortFast status is shown in the “Fast-Start” column):

```
Console> (enable) set spantree portfast 4/1 enable
Warning: Spantree port fast start should only be enabled on ports connected
to a single host.  Connecting hubs, concentrators, switches, bridges, etc. to
a fast start port can cause temporary spanning tree loops.  Use with caution.
Spantree port 4/1 fast start enabled.
```

```
Console> (enable) show spantree 4/1
Port      Vlan  Port-State     Cost   Priority  Fast-Start  Group-method
--------- ----  -------------  -----  --------  ----------  ------------
 4/1      1     blocking          19        20   enabled
 4/1      100   forwarding        10        20   enabled
 4/1      521   blocking          19        20   enabled
 4/1      522   blocking          19        20   enabled
 4/1      523   blocking          19        20   enabled
 4/1      524   blocking          19        20   enabled
 4/1      1003  not-connected     19        20   enabled
 4/1      1005  not-connected     19         4   enabled
Console> (enable)
```

Disabling Spanning Tree PortFast

To disable PortFast on a switch port, perform this task in privileged mode:

	Task	Command
Step 1	Disable PortFast on a switch port.	**set spantree portfast** *mod_num*/*port_num* **disable**
Step 2	Verify the PortFast setting.	**show spantree** *mod_num/port_num*

This example shows how to disable PortFast on a port:

```
Console> (enable) set spantree portfast 4/1 disable
Spantree port 4/1 fast start disabled.
Console> (enable)
```

Configuring PortFast BPDU Guard

These sections describe how to configure spanning tree PortFast BPDU guard on the switch:

Enabling PortFast BPDU Guard

Note Although the PortFast feature is configured on an individual port, the PortFast BPDU guard option is configured globally. When you disable PortFast on a port, PortFast BPDU guard becomes inactive.

To enable PortFast BPDU guard on a nontrunking switch port, perform this task in privileged mode:

	Task	Command
Step 1	Enable PortFast BPDU guard on the switch.	**set spantree portfast bpdu-guard enable**
Step 2	Verify the PortFast BPDU guard setting.	**show spantree summary**

This example shows how to enable PortFast BPDU guard on the switch and verify the configuration:

```
Console> (enable) set spantree portfast bpdu-guard enable
Spantree portfast bpdu-guard enabled on this switch.
Console> (enable) show spantree summary
Root switch for vlans: none.
Portfast bpdu-guard enabled for bridge.
Uplinkfast disabled for bridge.
Backbonefast disabled for bridge.

Vlan  Blocking Listening Learning Forwarding STP Active
----- -------- --------- -------- ---------- ----------
   1         0         0        0          4          4
   2         0         0        0          4          4
   3         0         0        0          4          4
   4         0         0        0          4          4
   5         0         0        0          4          4
   6         0         0        0          4          4
  10         0         0        0          4          4
  20         0         0        0          4          4
  50         0         0        0          4          4
 100         0         0        0          4          4
 152         0         0        0          4          4
 200         0         0        0          5          5
 300         0         0        0          4          4
 400         0         0        0          4          4
 500         0         0        0          4          4
 521         0         0        0          4          4
 524         0         0        0          4          4
 570         0         0        0          4          4
 801         0         0        0          0          0
 802         0         0        0          0          0
 850         0         0        0          4          4
 917         0         0        0          4          4
 999         0         0        0          4          4
1003         0         0        0          0          0
1005         0         0        0          0          0

      Blocking Listening Learning Forwarding STP Active
----- -------- --------- -------- ---------- ----------
Total        0         0        0         85         85
Console> (enable)
```

Disabling PortFast BPDU Guard

To disable PortFast BPDU guard on the switch, perform this task in privileged mode:

	Task	Command
Step 1	Disable PortFast BPDU guard on the switch.	**set spantree portfast bpdu-guard disable**
Step 2	Verify the PortFast BPDU guard setting.	**show spantree**

This example shows how to disable spanning tree PortFast BPDU guard on the switch and verify the configuration:

```
Console> (enable) set spantree portfast bpdu-guard disable
Spantree portfast bpdu-guard disabled on this switch.
Console> (enable) show spantree summary
Summary of connected spanning tree ports by vlan

Portfast bpdu-guard disabled for bridge.
Uplinkfast disabled for bridge.
Backbonefast disabled for bridge.

Vlan  Blocking Listening Learning Forwarding STP Active
----- -------- --------- -------- ---------- ----------
   1         0         0        0          4          4
   2         0         0        0          4          4
   3         0         0        0          4          4
   4         0         0        0          4          4
   5         0         0        0          4          4
   6         0         0        0          4          4
  10         0         0        0          4          4
  20         0         0        0          4          4
  50         0         0        0          4          4
 100         0         0        0          4          4
 152         0         0        0          4          4
 200         0         0        0          5          5
 300         0         0        0          4          4
 400         0         0        0          4          4
 500         0         0        0          4          4
 521         0         0        0          4          4
 524         0         0        0          4          4
 570         0         0        0          4          4
 801         0         0        0          0          0
 802         0         0        0          0          0
 850         0         0        0          4          4
 917         0         0        0          4          4
 999         0         0        0          4          4
1003         0         0        0          0          0
1005         0         0        0          0          0

      Blocking Listening Learning Forwarding STP Active
----- -------- --------- -------- ---------- ----------
Total        0         0        0         85         85
Console> (enable)
```

Configuring UplinkFast

These sections describe how to configure UplinkFast on the switch:

Enabling UplinkFast

The **set spantree uplinkfast enable** command increases the path cost of all ports on the switch, making it unlikely that the switch will become the root switch. The *station_update_rate* value represents the number of multicast packets transmitted per 100 milliseconds (the default is 15 packets per millisecond).

Note When you enable the **set spantree uplinkfast** command, it affects all VLANs on the switch. You cannot configure UplinkFast on an individual VLAN.

To enable UplinkFast on the switch, perform this task in privileged mode:

	Task	Command
Step 1	Enable UplinkFast on the switch.	**set spantree uplinkfast enable** [**rate** *station_update_rate*] [**all-protocols off** | **on**]
Step 2	Verify that UplinkFast is enabled.	**show spantree uplinkfast**

This example shows how to enable UplinkFast with a station-update rate of 40 packets per 100 milliseconds and how to verify that UplinkFast is enabled:

```
Console> (enable) set spantree uplinkfast enable
VLANs 1-1005 bridge priority set to 49152.
The port cost and portvlancost of all ports set to above 3000.
Station update rate set to 15 packets/100ms.
uplinkfast all-protocols field set to off.
uplinkfast enabled for bridge.
Console> (enable) show spantree uplinkfast
Station update rate set to 15 packets/100ms.
uplinkfast all-protocols field set to off.
VLAN          port list
-----------------------------------------------
1             1/1(fwd),1/2
100           1/2(fwd)
521           1/1(fwd),1/2
522           1/1(fwd),1/2
523           1/1(fwd),1/2
524           1/1(fwd),1/2
Console> (enable)
```

Disabling UplinkFast

The **set spantree uplinkfast disable** command disables the UplinkFast feature on the switch, but the switch priority and port cost values are not reset to the factory defaults.

Note When you enter the **set spantree uplinkfast disable** command, it affects all VLANs on the switch. You cannot disable UplinkFast on an individual VLAN.

To disable UplinkFast on the switch, perform this task in privileged mode:

	Task	Command
Step 1	Disable UplinkFast on the switch.	**set spantree uplinkfast disable**
Step 2	Verify that UplinkFast is enabled.	**show spantree uplinkfast**

This example shows how to disable UplinkFast on the switch and verify the configuration:

```
Console> (enable) set spantree uplinkfast disable
Uplinkfast disabled for switch.
Use clear spantree uplinkfast to return stp parameters to default.
Console> (enable) show spantree uplinkfast
Station update rate set to 15 packets/100ms.
uplinkfast all-protocols field set to off.
VLAN          port list
-----------------------------------------------
1             1/1(fwd),1/2
100           1/2(fwd)
521           1/1(fwd),1/2
522           1/1(fwd),1/2
523           1/1(fwd),1/2
524           1/1(fwd),1/2
Console> (enable)
```

Configuring BackboneFast

These sections describe how to configure BackboneFast:

Enabling BackboneFast

Note For BackboneFast to work, you must enable it on all switches in the network. BackboneFast is not supported on Token Ring VLANs. This feature is supported for use with third-party switches.

To enable BackboneFast on the switch, perform this task in privileged mode:

	Task	Command
Step 1	Enable BackboneFast on the switch.	**set spantree backbonefast enable**
Step 2	Verify that BackboneFast is enabled.	**show spantree backbonefast**

This example shows how to enable BackboneFast on the switch and how to verify the configuration:

```
Console> (enable) set spantree backbonefast enable
Backbonefast enabled for all VLANs
Console> (enable) show spantree backbonefast
Backbonefast is enabled.
Console> (enable)
```

Displaying BackboneFast Statistics

To display BackboneFast statistics, perform this task in privileged mode:

Task	Command
Display BackboneFast statistics.	**show spantree summary**

This example shows how to display BackboneFast statistics:

```
Console> (enable) show spantree summary
Summary of connected spanning tree ports by vlan

Uplinkfast disabled for bridge.
Backbonefast enabled for bridge.

Vlan  Blocking Listening Learning Forwarding STP Active
----- -------- --------- -------- ---------- ----------
   1         0         0        0          1          1

      Blocking Listening Learning Forwarding STP Active
----- -------- --------- -------- ---------- ----------
Total         0         0        0          1          1

BackboneFast statistics
-----------------------
Number of inferior BPDUs received (all VLANs)  : 0
Number of RLQ req PDUs received (all VLANs)    : 0
Number of RLQ res PDUs received (all VLANs)    : 0
Number of RLQ req PDUs transmitted (all VLANs) : 0
Number of RLQ res PDUs transmitted (all VLANs) : 0
Console> (enable)
```

Disabling BackboneFast

To disable BackboneFast on the switch, perform this task in privileged mode:

	Task	Command
Step 1	Disable BackboneFast on the switch.	**set spantree backbonefast disable**
Step 2	Verify that BackboneFast is disabled.	**show spantree backbonefast**

This example shows how to disable BackboneFast on the switch and how to verify the configuration:

```
Console> (enable) set spantree backbonefast disable
Backbonefast enabled for all VLANs
Console> (enable) show spantree backbonefast
Backbonefast is disable.
Console> (enable)
```