

STP Optional Characteristics Configuration Commands

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1 STP Optional Characteristics Configuration Commands

1.1 STP Optional Characteristic Introduction

The spanning tree protocol module of the switch supports seven additional features (the so-called optional features). These features are not configured by default. The supported condition of various spanning tree protocol modes towards the optional characteristics is as follows:

Optional Characteristic	Single STP	PVST	RSTP	MSTP
Port Fast	Yes	Yes	No	No
BPDU Guard	Yes	Yes	Yes	Yes
BPDU Filter	Yes	Yes	No	No
Uplink Fast	Yes	Yes	No	No
Backbone Fast	Yes	Yes	No	No
Root Guard	Yes	Yes	Yes	Yes
Loop Guard	Yes	Yes	Yes	Yes

1.1.1 Port Fast

Port Fast immediately brings an interface to the forwarding state from a blocking state, bypassing the listening and learning states. You can use Port Fast on interfaces connected to a single workstation or server, to allow those devices to immediately connect to the network.

The Port Fast feature is applicable to the ports of the directly connected hosts. These ports do not receive BPDUs and do not affect the network topology. Therefore, they can enter the forwarding state without waiting. If you enable Port Fast on an interface connecting to another switch, you risk creating a spanning-tree loop.

The Port Fast feature can be set in global or port configuration mode. If configured in global mode, all ports are considered to be Port Fast ports and enter the Forwarding state quickly. This is also more prone to loop. To prevent network loops due to the configuration of the Port Fast function, you can use the BPDU Guard or BPDU Filter feature to protect the ports.

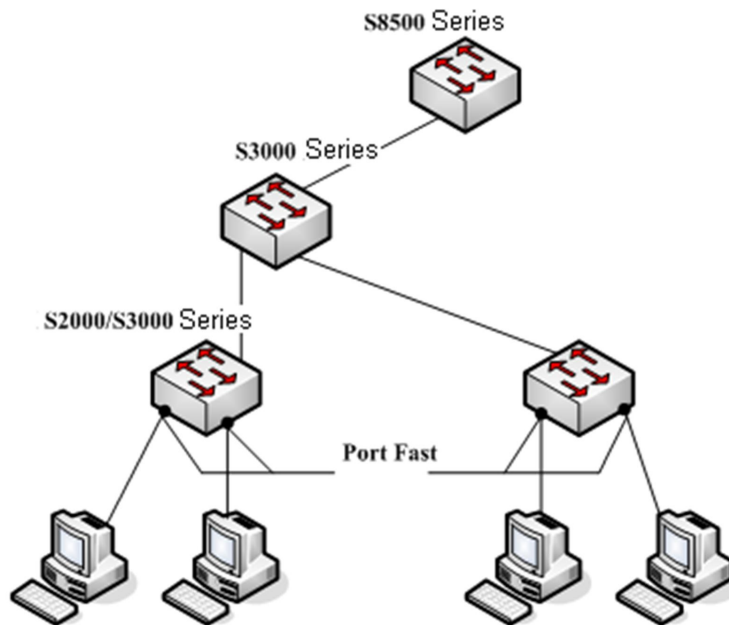


Figure 1.1 Port Fast

Note:

For the rapid convergent STP, RSTP and MSTP, can immediately bring an interface to the forwarding state, and therefore there is no need to use Port Fast feature.

1.1.2 BPDU Guard

If a Port Fast port receives a BPDU, it can be thought of as a result of the wrong network configuration. The BPDU Guard feature is protected passively after receiving a BPDU on a Port Fast port.

The BPDU Guard is different in different STP modes. In SSTP / PVST mode, a Port Fast port with BPDU guard configured. If a BPDU is received, the port is forced to shutdown. After that, the user can only restore it by manually configuring it. In RSTP / MSTP mode, a port configured with BPDU Guard will receive the BPDU and the port will be set to Blocking for a period of time.

The BPDU Guard feature can be configured independently of Port Fast. In all STP modes, ports configured with BPDU guard do not send BPDU, but the port can receive BPDU and do with them. In RSTP / MSTP mode, BPDUs cannot be received on devices connected to the switch by configuring BPDU Guard on the ports connected to the host.

The BPDU Guard feature can be configured in global or port configuration mode. In the global configuration mode, the spanning-tree portfast bpduguard command prevents all ports from sending BPDU. It should be noted that in a more complex network, improper use of BPDU Guard function may lead to loop.

1.1.3 BPDU Filter

The BPDU filtering feature allows the switch's ports to send BPDU in SSTP / PVST mode, as well as another protection for Port Fast ports.

In SSTP/PVST mode,.if a **Port Fast** port with BPDU filter configured receives the BPDU, the features BPDU Filter and Port Fast at the port will be automatically disabled, resuming the port as a normal port. Before entering the **Forwarding** state, the port must be in the **Listening** state and **Learning** state.

The BPDU Filter feature can be configured in global configuration mode or in port configuration mode. In global configuration mode, run the command **spanning-tree portfast bpdupfilter** to block all ports to send BPDU out. The port, however, can still receive and process BPDU.

1.1.4 Uplink Fast

The feature **Uplink Fast** enables new root ports to rapidly enter the **Forwarding** state when the connection between the switch and the root bridge is disconnected.

A complex network always contains multilayers of devices, as shown in figure 1.2. Both aggregation layer and the access layer of the switch have redundancy connections with the upper layer. These redundancy connections are normally blocked by the STP to avoid loops.

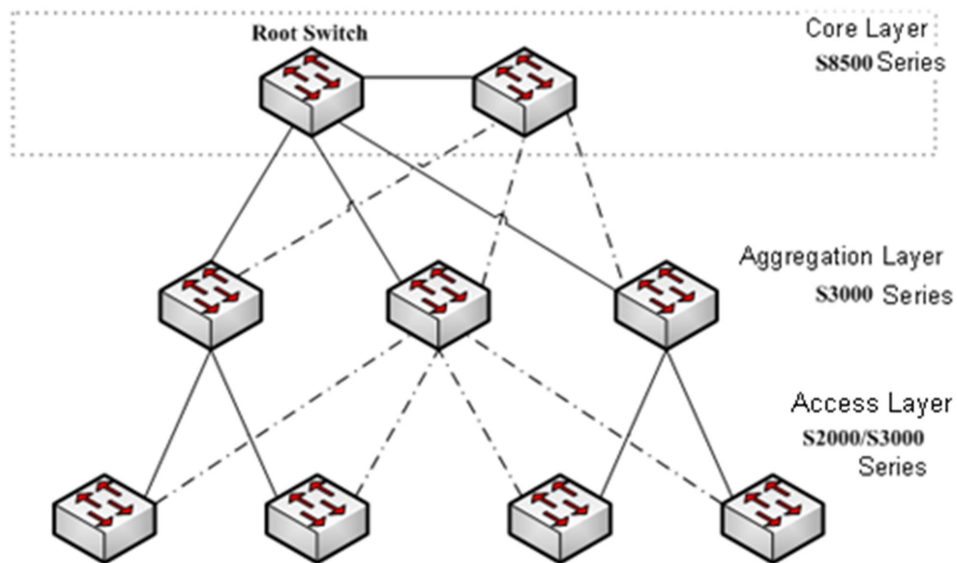


Figure 1.2 switching network topology

Suppose the connection between a switch and the upper layer is disconnected (called as Direct Link Failure), the STP chooses the Alternate port on the redundancy line as the root port. Before entering the **Forwarding** state, the Alternate port must be in the **Listening** state and **Learning** state. If the **Uplink Fast** feature is configured by running the command **spanning-tree uplinkfast** in global configuration mode, new root port can directly enter the forwarding state, resuming the connection between the switch and the upper layer.

Figure 1.3 shows the working principle of the **Uplink Fast** feature. The port for switch C to connect switch B is the standby port when the port is in the original state. When the connection between switch C and root switch A is disconnected, the previous Alternate port is selected as new root port and immediately be forwarding.

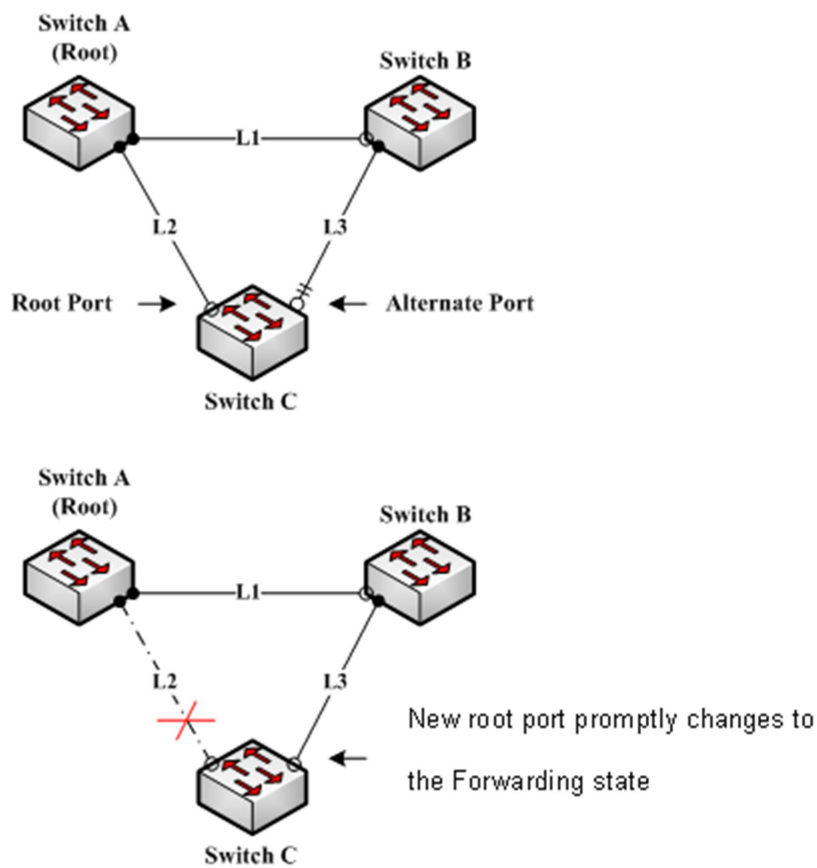


Figure 1.3 Uplink Fast

Note:

The **Uplink Fast** feature adjusts to the slowly convergent SSTP and PVST. In RSTP and MSTP mode, new root port can rapidly enter the Forwarding state without the **Uplink Fast** function.

1.1.5 Backbone Fast

The **Backbone Fast** feature is a supplement of the **Uplink Fast** technology. The **Uplink Fast** technology makes the redundancy line rapidly work in case the direct connection to the designated switch is disconnected, while the **Backbone Fast** technology detects the indirect-link network blackout in the upper-layer network and boosts the change of the port state.

In figure 1.3, Connection L2 between switch C and switch A is called as the direct link between switch C and root switch A. If the connection is disconnected, the **Uplink Fast**

function can solve the problem. Connection L1 between switches A and B is called as the indirect link of switch C. The disconnected indirect link is called as indirect failure, which is handled by the **Backbone Fast** function.

The working principle of the Backbone Fast function is shown in Figure 1.4.

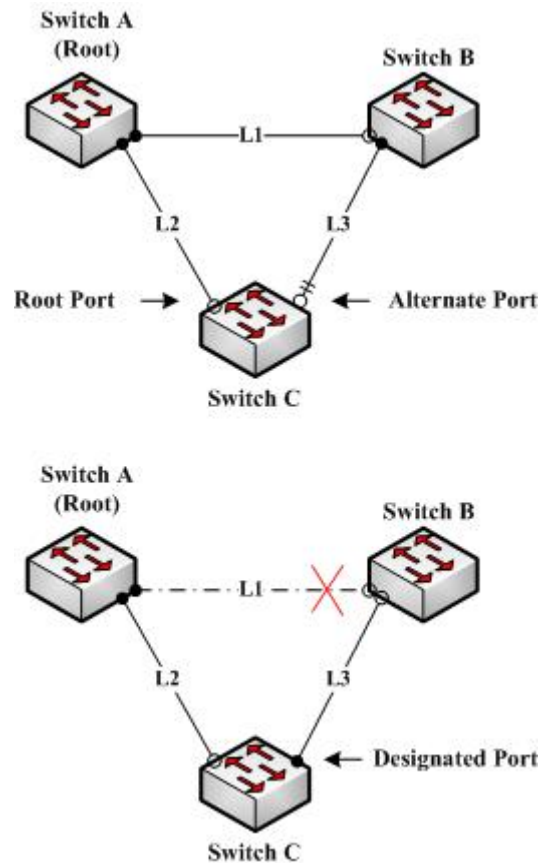


Figure 1.4 Backbone Fast

Suppose the bridge priority of switch C is higher than that of switch B. When L1 is disconnected, switch B is selected to send BPDU to switch C because the bridge priority is used as root priority. To switch C, the information contained by BPDU is not prior to information contained by its own. When Backbone Fast is not enabled, the port between switch C and switch B ages when awaiting the bridge information and then turns to be the designated port. The aging normally takes a few seconds. After the function is configured in global configuration mode by running the command **spanning-tree backbonefast**, when the Alternate port of switch C receives a BPDU with lower priority, switch C thinks that an indirect-link and root-switch-reachable connection on the port is disconnected. Switch C then promptly update the port as the designated port without waiting the aging information.

After the Backbone Fast function is enabled, if BPDU with low priority is received at different ports, the switch will perform different actions. If the Alternate port receives the message, the port is updated to the designated port. If the root port receives the low-priority message and there is no other standby port, the switch turns to be the root switch.

Note that the Backbone Fast feature just omits the time of information aging. New designated port still needs to follow the state change order: the listening state, then the learning state and finally the forwarding state.

Note:

Similar to Uplink Fast, the Backbone Fast feature is effective in SSTP and PVST modes.

1.1.6 Root Guard

The Root Guard feature prevents a port from turning into a root port because of receiving high-priority BPDU.

In a more complex two-tier network, the administrator may want a core layer of the switch as the root bridge of the network, but he cannot manage all the switch of the access layer (probably because the access layer switches belong to other customers). In this way, improper configuration of other switches may cause the core switch to fail to become a root.

You can prevent the root bridge role from being exploited by a switch outside the managed area by configuring the root guard function on the edge switch. If a port configured with a root guard receives a higher-level BPDU as Root Port, Root Guard automatically sets the port to a blocked state and restores it to an assigned port.

In PVST and MSTP mode, Root Guard can work independently in each spanning tree instance. In MSTP mode, if a border port is blocked in the CIST because the Root Guard is blocked, the port is blocked in all other MSTIs. A border port is a port that connects to a LAN host, an STP switch, an RSTP switch, or an MSTP switch outside the zone.

You can enable this feature by using the **spanning-tree guard root** interface configuration command.

Note:

Root Guard feature acts differently somehow in SSTP/PVST and RSTP/MSTP. In SSTP/PVST mode, Root port is always blocked by Root Guard. In RSTP/MSTP mode, Root port won't be blocked until receiving higher level BPDU. A port which formerly plays the Root role will not be blocked.

1.1.7 Loop Guard

The Loop Guard feature protects a Root Port or Alternate Port into a Designated Port, which prevents loops due to the failure of the port to receive BPDUs continuously.

You can use the spanning-tree loopguard default global configuration command to enable the loopback function of the switch. After a boot, a Root port or alternate port will be set to a blocked state if it becomes a designated port. If the port re-receives the high priority BPDU after a period of time, it will automatically recover from the Loop Guard.

In PVST and MSTP mode, Loop Guard can work independently in each spanning tree instance. In MSTP mode, if a border port is blocked in the CIST because Loop Guard is blocked, the port is blocked in all other MSTIs.

Note:

Loop Guard feature acts differently somehow in SSTP/PVST and RSTP/MSTP. In SSTP/PVST mode, the designated port is always be blocked by Loop Guard. In RSTP/MSTP mode, the port will be blocked only when it changes into the designated port because of inaccessibility to receiving BPDU. Loop Guard will not block a port, which is provided with the designated role due to receiving the lower level BPDU.

1.2 Configuring STP Optional Characteristic

1.2.1 STP Optional Characteristic Configuration Task

- Configuring Port Fast
- Configuring BPDU Guard
- Configuring BPDU Filter
- Configuring Uplink Fast
- Configuring Backbone Fast

- Configuring Root Guard
- Configuring Loop Guard
- Configuring Loop Fast
- Configuring Address Table Aging Protection
- Configuring FDB-Flush

1.2.2 Configuring Port Fast

Port Fast feature in SSTP / PVST mode can make a port immediately into the Forwarding state without having to wait from Listening to Learning state. This function is invalid in other spanning tree mode.

Use the following command to configure the port fast feature in the global configuration mode:

command	purpose
spanning-tree portfast default	Globally enables port fast feature. It is valid to all interfaces.
no spanning-tree portfast default	Globally disables port fast feature. It has no effect on the interface configuration.

Note:

The port fast feature only applies to the interface that connects to the host. The BPDU Guard or BPDU Filter must be configured at the same time when the port fast feature is configured globally.

Use the following command to configure the port fast feature in the interface configuration mode:

command	purpose
spanning-tree portfast	Enables port fast feature on the interface.
no spanning-tree portfast	Disables port fast feature on the interface. It has no effect on the global configuration.

1.2.3 Configuring BPDU Guard

The BPDU Guard feature performs a protection action when a port receives a BPDU. The port configured with the feature does not send BPDUs.

BPDU Guard is different in different spanning tree protocol modes. In SSTP / PVST mode, a port with BPDU Guard and Port Fast features is forced to shut down if a BPDU is received. After that, the user can only restore it by manually configuring it. In RSTP / MSTP mode, a port configured with BPDU Guard will receive the BPDU and the port will be set to Blocking for a period of time.

Follow these steps to globally enable the BPDU guard feature:

command	purpose
spanning-tree portfast bpduguard	Globally enables bpdu guard feature. It is valid to all interfaces.
no spanning-tree portfast bpduguard	Globally disables bpdu guard feature.

Note:

Globally enabling port fast feature may result in broadcast storm. The BPDU Guard or BPDU Filter should be configured for protection sake.

Follow these steps to enable the BPDU guard feature in interface configuration mode:

command	purpose
spanning-tree bpduguard enable	Enables bpdu guard feature on the interface.
spanning-tree bpduguard disable	Disables bpdu guard feature on the interface. It has no effect on the global configuration.
no spanning-tree bpduguard	Disable bpdu guard feature on the interface. It has no effect on the global configuration.

1.2.4 Configuring BPDU Filter

The BPDU Filter feature makes the switch's ports not to send BPDUs in the SSTP / PVST mode, as well as another means of protection for Port Fast ports.

Follow these steps to enable the BPDU filter feature in global configuration mode.:

command	purpose
spanning-tree portfast bpdupfilter	Globally enables bpdu filter feature. It is valid to all interfaces.
no spanning-tree portfast bpdupfilter	Globally disables bpdu filter feature.

Note:

Globally enabling port fast feature may result in broadcast storm. The BPDU Guard or BPDU Filter should be configured for protection sake.

Follow these steps to enable the BPDU filter feature in the interface configuration mode :

command	purpose
spanning-tree bpdupfilter enable	Enables bpdu filter feature on the interface.
spanning-tree bpdupfilter disable	Disables bpdu filter feature. It has no effect on the global configuration.
no spanning-tree bpdupfilter	Disables bpdu filter feature. It has no influence on the global configuration.

1.2.5 Configuring Uplink Fast

The Uplink Fast feature can make the new root port to enter the Forwarding state quickly when the connection between the switch and the network root bridge is interrupted.

Uplink Fast feature is only valid in SSTP/PVST mode.

Use the following command to enable UplinkFast in global configuration mode:

command	purpose
spanning-tree uplinkfast	Enables uplink fast feature.
no spanning-tree uplinkfast	Disables uplink fast feature.

1.2.6 Configuring Backbone Fast

The Backbone Fast feature is a complement to Uplink Fast technology. Uplink Fast makes the redundant lines work quickly when the direct connection to the assigned

switch is interrupted. And Backbone Fast can detect the non-directly connected network outages in the upper layer and accelerate the status of the port.

Backbone fast feature is only valid in SSTP/PVST mode.

Use the following command to enable BackboneFast in global configuration mode:

command	purpose
spanning-tree backbonefast	Enables backbone fast feature.
no spanning-tree backbonefast	Disables backbone fast feature.

1.2.7 Configuring Root Guard

The Root Guard feature prevents a port from becoming a root port because it receives a high priority BPDU.

Root Guard feature acts differently somehow in SSTP/PVST and RSTP/MSTP. In SSTP/PVST mode, Root port is always blocked by Root Guard. In RSTP/MSTP mode, Root port won't be blocked until receiving higher level BPDU. A port which formerly plays the Root role will not be blocked.

Use the following command to enable root guard on an interface in global configuration mode:

command	purpose
spanning-tree guard root	Enables root guard feature on the interface.
no spanning-tree guard	Disables root guard and loop guard features on the interface.
spanning-tree guard none	Disables root guard and loop guard features on the interface.

1.2.8 Configuring Loop Guard

The Loop Guard feature protects a Root Port or Alternate Port into a Designated Port, which prevents loops due to the failure of the port to receive BPDUs continuously.

Loop Guard feature acts differently somehow in SSTP/PVST. In SSTP/PVST mode,, the designated port is always blocked by Loop Guard. In RSTP/MSTP, the designated port is always blocked by Loop Guard. In RSTP/MSTP mode, the port will be blocked only when it changes into the designated port because of inaccessibility to receiving BPDU. A port

which is provided with the designated role due to receiving the lower level BPDU will not be blocked by Loop Guard.

Use the following command to enable loop guard in global configuration mode:

command	purpose
spanning-tree loopguard default	Globally enables loop guard feature. It is valid to all interfaces.
no spanning-tree loopguard default	Globally disables loop guard.

Use the following command to enable loop guard in the interface configuration mode.:

Command	Purpose
spanning-tree guard loop	Enables loop guard feature on the interface.
no spanning-tree guard	Disables root guard and loop guard feature on the interface.
spanning-tree guard none	Disables root guard and loop guard on the interface.

1.2.9 Configuring Loop Fast

Note:

Please use the configuration commands described in this section under the guidance of the technician.

The Loop Fast feature is used to increase the convergence of the network in a particular network environment. For example, in a ring composed of dozens of switches for each of the ring network to enable the characteristics of the port.

Use the following command to enable loop fast in global configuration mode:

Command	Purpose
spanning-tree loopfast	Enable loop fast globally which is valid for all ports.
no spanning-tree loopfast	Disable loop fast globally.

Use the following command to enable loop fast in interface configuration mode:

Command	Purpose
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spanning-tree loopfast	Enable loop fast for port.
no spanning-tree loopfast	Cancel loop fast for port. If Loop Fast is configured globally, it is still valid on the port.
spanning-tree loopfast disable	Disable loop fast for port.

1.2.10 Configuring Address Table Aging Protection

In the case of frequent network topology changes, configuring the address table aging protection function can avoid STP affecting the communication due to frequent update of MAC address table.

Fast convergence of spanning tree protocols, such as RSTP and MSTP, will perform a cleanup on the MAC address table of the switch when the spanning tree topology changes, delete the old MAC address, and update the MAC address to ensure fast communication restore. By default, the switch performs the cleanup operation through the MAC address table. For most models of switches, the rapid aging of the address table can be completed within 1 second, and have almost no effect on the performance of the device CPU.

After the address table aging protection function is enabled, the STP protocol will start the protection timer after the first aging. The timer will not be aged before the timer expires (default is 15 seconds). If the network topology changes within 15 seconds, the protocol will automatically perform a second aging after the timer expires

Note:

By **no spanning-tree fast-aging**, the STP protocol can completely disable the aging of the address table. Before executing this configuration, make sure that there is no loop on the network. Otherwise, it may take 5 minutes or more for the terminal device to resume communication after the network topology changes.

Use the following command to configure the address table aging protection in global configuration mode:

Command	Purpose
Spanning-tree fast-aging	Enable/disable the address table aging.

Spanning-tree fast-aging protection	Enable/disable the address table aging protection.
Spanning-tree fast-aging protection time	Configure the address table for aging protection. Within this time, the STP can only perform an address table aging. The default value is 15s.

Add no before the command to cancel the corresponding configuration.

1.2.11 Configuring FDB-Flush

Note:

Please use the configuration commands described in this section under the guidance of the technician.

The Rapid Spanning Tree Protocol (RSTP and MSTP) of the switch clears the old MAC address, rather than FDB-Flush, using the address table for quick aging by default.

Use the following command to configure FDB-Flush in global configuration mode:

Command	Purpose
Spanning-tree fast-aging flush-fdb	Enable FDB-Flush.
No spanning-tree fast-aging flush-fdb	Disable FDB-Flush.

Note that FDB-Flush is independent of fast aging, and you can configure **FDB-Flush** while configuring **no spanning-tree fast-aging**. But the fast aging protection function is not valid for FDB-Flush.