

Fast Ethernet Ring Protection Configuration Command

Table of Contents

| | | |
|----------|--|--------------|
| 1 | Fast Ethernet Ring Protection Configuration Commands..... | - 1 - |
| 1.1 | Overview..... | - 1 - |
| 1.2 | Related Concepts of Fast Ethernet Ring Protection..... | - 2 - |
| 1.2.1 | Roles of Ring's Nodes..... | - 2 - |
| 1.2.2 | Role of the Ring's Port..... | - 2 - |
| 1.2.3 | Control VLAN and Data VLAN..... | - 3 - |
| 1.2.4 | MAC Address Table Aging..... | - 4 - |
| 1.2.5 | Symbol of a Complete Ring Network..... | - 4 - |
| 1.3 | Type of Fast Ethernet Ring Protection..... | - 4 - |
| 1.4 | Fast Ethernet Ring Protection Mechanism..... | - 4 - |
| 1.4.1 | Ring Detection and Control of Master Node..... | - 4 - |
| 1.4.2 | Notification of Invalid Link of Transit Node..... | - 5 - |
| 1.4.3 | Resuming the Link of the Transit Node..... | - 5 - |
| 2 | Fast Ethernet Ring Protection Settings..... | - 7 - |
| 2.1 | Fast Ethernet Ring Protection Default Configuration..... | - 7 - |
| 2.2 | Reading before Fast Ethernet Ring Protection Configuration..... | - 7 - |
| 2.3 | Fast Ethernet Ring Protection Configuration Tasks..... | - 8 - |
| 2.4 | Fast Ethernet Ring Protection Settings..... | - 8 - |
| 2.4.1 | Configuring the Master Node..... | - 8 - |
| 2.4.2 | Configuring the Transit Node..... | - 9 - |
| 2.4.3 | Configuring the Port of Ethernet Ring..... | - 9 - |
| 2.4.4 | Browsing the State of the Ring Protection Protocol..... | - 10 - |
| 2.5 | Fast Ethernet Ring Protection Configuration Example..... | - 11 - |
| 2.5.1 | Configuration Example..... | - 11 - |

1 Fast Ethernet Ring Protection Configuration Commands

1.1 Overview

Ethernet ring protection protocol is a special type of link-layer protocol specially designed for constructing the ring Ethernet topology. The Ethernet protection protocol can shut down one link in a complete ring topology, preventing the data loop from forming the broadcast storm. If a link is broken, the protocol immediately resumes the link that is previously shut down. In this way, the nodes among the ring network can communicate with each other.

The ring protection protocol and STP are both used for topology control on the link layer. STP is suitable for all kinds of complicated networks, which transmits the change of network topology hop by hop. The ring protection protocol is used for ring topology and adopts the pervasion mechanism to transmit the change of network topology. Therefore, the convergence of the ring protection protocol in the ring network is better than STP. In a sound network, the ring protection protocol can resume network communication within less than 50ms.

Note:

Ring protection protocol supports that one switch is set to the node of multiple physical ring network, so that the tangency ring can be formed.

1.2 Related Concepts of Fast Ethernet Ring Protection

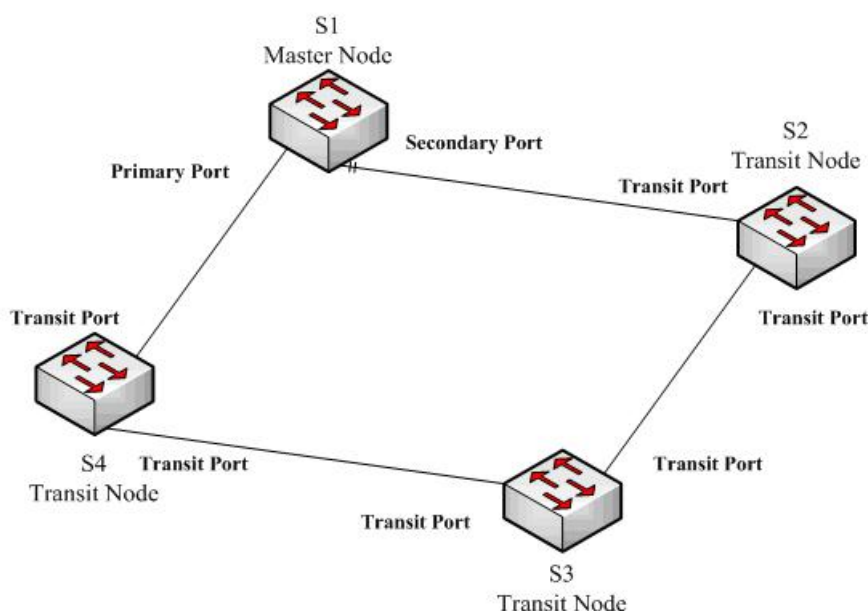


Figure1- 1 Ethernet Ring of Fast Ethernet Ring Protection

1.2.1 Roles of Ring's Nodes

Each switch on an Ethernet ring is a ring node. The ring nodes are classified into master nodes and transit nodes. Only one switch on the Ethernet ring can serve as a mere master node and other switches are worked as transit nodes.

Master node: It positively knows whether the ring's topology is complete, removes loopback, control other switches to update topology information.

Transit node: It only checks the state of the local port of the ring, and notifies the master node of the invalid link.

The role of each node can be specified by user through configuration. The thing is that each switch in the same ring can be set to only one kind of node. In figure 1.1, switch S1 is the master node of ring network, while switches S2, S3 and S4 are transit nodes.

1.2.2 Role of the Ring's Port

Fast Ethernet Ring Protection demands each switch has two ports to connect the ring network. Each port of the ring network also needs to be specified through configuration and the protocol supports the following kinds of port roles:

Primary port: the primary port can be configured only on the master node. The master node transmits the ring detection packets through the primary port.

Secondary port: the secondary port can be configured only on the master node. The master node receives the ring detection packets from the secondary port and judges whether the topology of the ring network is complete. In complete topology, the master node blocks the data packets on the secondary port, and prevents loopback from occurring; after a link on the ring network is interrupted, the master node removes the blocking state of the secondary port.

Transit port: the transit port can only be configured on the transit node. Both ports through which the transit node connects the ring network are all transit ports.

Each port of the ring network can be configured as only one port role after the node's role of the switch and the control VLAN are configured. As shown in figure 1.1, the port through which master node S1 connects transit node S4 is a primary port, the port through which S1 connects S2 is a secondary port, and the ports through which other switches connect the ring network are all transit ports.

Note:

To configure a same switch to belong to multiple rings, the switch must connect different rings through different physical ports.

1.2.3 Control VLAN and Data VLAN

A private control VLAN is used between master node and transit node to transmit protocol packets. This control VLAN is specified by user through configuration and ring's ports are added also by user to the control VLAN, which guarantees that the protocol packets can be normally forwarded. In general, each port of the ring network is in the forwarding state in the control VLAN and the ports which do not belong to the ring network cannot forward the packets of control VLAN.

Note:

You can specify different control VLAN for each ring on a switch. The control VLAN is only used to forward the control packets of the ring network, not for L2/L3 communication. For example, if the VLAN port that corresponds to the control VLAN is established, the IP address of the VLAN port cannot be pinged through other devices.

The VLANs except the control VLAN are all data VLANs, which are used to transmit the packets of normal services or the management packets. It is the ring protection protocol that controls whether the port of the Ethernet ring can forward the packets of the data VLAN; the forwarding state of the non-ring port is controlled by STP.

Note:

The data VLAN can be used for normal L2/L3 communication. For example, you can establish a VLAN port corresponding to data VLAN and configure dynamic routing protocols.

1.2.4 MAC Address Table Aging

The Fast Ethernet Ring Protection can ensure that the data packets can be sent to the correct link by controlling the aging of the MAC address table of the switch when the topology changes. In general, the aging time of the MAC address in the address table is 300 seconds. Fast Ethernet Ring Protection can control the aging of the switch MAC address table in a very short period of time.

1.2.5 Symbol of a Complete Ring Network

Both the master node and the transit node can show whether the current ring network is complete through the state symbol "COMPLETE". On the master node, only when all links of the ring network are normal, the primary port is in forwarding state and the secondary port is in blocking state, can the "COMPLETE" symbol be real; on the transit node, only when its two transit ports are in forwarding state, can the "COMPLETE" symbol be true.

The state symbol of the ring network helps user to judge the topology state of the current network.

1.3 Type of Fast Ethernet Ring Protection

The Fast Ethernet Ring Protection packets can be classified into the following types, as shown in chart 1.1.

chart 1.1 Type of Fast Ethernet Ring Protection

| Type of the packet | Description |
|---------------------|---|
| HEALTH | It is transmitted by the master node to detect whether the topology of the ring network is complete. |
| LINK-DOWN | It is transmitted by the transit node to indicate that link interruption occurs in the ring network. |
| RING-DOWN-FLUSH-FDB | It is transmitted by the master node after interruption of the ring network is detected and the packets show the MAC address aging table of the transit node. |
| RING-UP-FLUSH-FDB | It is transmitted by the master node after interruption of the ring network is resumed and the packets show the MAC address aging table of the transit node. |

1.4 Fast Ethernet Ring Protection Mechanism

1.4.1 Ring Detection and Control of Master Node

The master node transmits the HEALTH packets to the control VLAN through the primary port in a configurable period. In normal case, the HEALTH packets will pass through all

other nodes of the ring network and finally arrive at the secondary port of the master node.

The secondary port blocks all data VLANs in primitive condition. When receiving the HEALTH packets continuously, the secondary port keeps blocking data VLANs and blocking the loop. If the secondary port does not receive the HEALTH packets from the primary port in a certain time (which can be configured), it will regard the ring network is out of effect. Then the master node removes the blocking of data VLANs on the secondary port, ages the local MAC address table, and transmits the RING-DOWN-FLUSH-FDB packets to notify other nodes.

If the master node receives the HEALTH packets at the secondary port that is open to data VLANs, the ring network is resumed. In this case, the master node immediately blocks data VLANs on the secondary port, updates the local topology information and reports other nodes to age the MAC address table through RING-UP-FLUSH-FDB packets.

You can configure related commands on the Hello-time node and the Fail-time node to modify the interval for the primary port to transmit the HEALTH packets and the time limit for the secondary port to wait for the HEALTH packets.

1.4.2 Notification of Invalid Link of Transit Node

After the transit port of the transit node is out of effect, the LINK-DOWN packet will be immediately transmitted by the other transit port to notify other nodes. In normal case, the packet passes through other transit nodes and finally arrives at one port of the master node.

After the master node receives the LINK-DOWN packet, it thinks that the ring network is invalid. In this case, the master node removes the blocking of data VLANs on its secondary port, ages the local MAC address table, transmits the RING-DOWN-FLUSH-FDB packet and notifies other nodes.

1.4.3 Resuming the Link of the Transit Node

After the transit port is resumed, it does not immediately transmit the packets of data VLANs, but enters the Pre-Forwarding state. A transit port in pre-forwarding state only transmits and receives the control packets from the control VLAN.

If there is only one transit port invalid in the ring network and when the port enters the pre-forwarding state, the secondary port of the master node can receive the HEALTH packet from the primary port again. In this case, the master node blocks data VLANs on the secondary port again and transmits the notification of ageing address table outside. After the node with a transit port in pre-forwarding state receives the notification of aging

address table, the node will first modify the pre-forwarding port to the forwarding port and then ages the local MAC address table.

If a transit mode does not receives the notification of aging address table from the master node, it thinks that the link to the master node is already out of effect, the transit node will automatically set the pre-forwarding port to be a forwarding one.

You can configure the related commands through the pre-forward-time node to modify the time for the transit port to keep the pre-forwarding state.

2 Fast Ethernet Ring Protection Settings

2.1 Fast Ethernet Ring Protection Default Configuration

Note:

Fast Ethernet Ring Protection and STP can be configured at the same time.

After the STP is shut down, it is recommended to configure the spanning-tree bpduterminal function to prevent the ring nodes from forwarding BPDU.

The default configuration of Fast Ethernet Ring Protection and STP is shown in chart 2-1.

Chart 2- 1 the default configuration of Fast Ethernet Ring Protection and STP

| | |
|-------------------------------|-------------------------|
| STP | Spanning-tree mode rstp |
| Fast Ethernet Ring Protection | none |

2.2 Reading before Fast Ethernet Ring Protection Configuration

Before configuring Fast Ethernet Ring Protection, please read the following items carefully:

- Blocking broadcast storms is an important function of the ring protection protocol. Make sure that the ring network links are connected when all ring nodes are configured. For example, after configuring the master node and all the transport nodes, connect the network cable to the secondary port of the primary node. It will easily lead to broadcast storm when the connection of the ring network is done before all nodes are configured.
- The configuration of Fast Ethernet Ring Protection is now compatible with STP of the switch, but the ports controlled by Fast Ethernet Ring Protection are not controlled by STP.
- The Fast Ethernet Ring Protection supports the switch to configure multiple ring network instances.
- The configuration of the control VLAN of the ring network does not automatically establish the corresponding systematic VLAN.
- Only the ring ports of each ring can forward packets in the control VLAN of the ring. And other ports, if they are configured as Trunk mode, they cannot be forwarded in the control VLAN.

- By default, Fail-time of the master node is triple longer than Hello-time, so that packet delay is avoided from shocking the ring protection protocol. After Hello-time is modified, Fail-time need be modified accordingly.
- By default, Pre-Forward-Time of the transit node is triple longer than Hello-time of the master node so that it is ensured that the master node can detect the recovery of the ring network before the transit port enters the pre-forwarding state. If Hello-time configured on the master node is longer than Pre-Forward-Time of the transit node, it is easily to generate loopback and trigger the broadcast storm.
- Physical ports, Interface FastEthernet, Interface GigaEthernet, and aggregation ports can be configured as ring ports. If the link aggregation, 802.1X, or port security is configured on the physical port, the port cannot be configured as a ring port. Note: The version of the switch software 2.0.1L and the previous version of the high-end switch 4.0.0M do not support the configuration of the aggregation port.

2.3 Fast Ethernet Ring Protection Configuration Tasks

- Configuring the Master Node
- Configuring the Transit Node
- Configuring the Port of Ethernet Ring
- Browsing the State of the Ring Protection Protocol

2.4 Fast Ethernet Ring Protection Settings

2.4.1 Configuring the Master Node

Configure a switch to be the master node of a ring network according to the following steps:

| Command | Purpose |
|--|--|
| Switch# configure | Enters the switch configuration mode. |
| Switch_config# ether-ring <i>id</i> | Configure the node instance and enter the node configuration mode. Id: instance number. |
| Switch_config# control-vlan <i>vlan-id</i> | Configure control VLAN. Vlan-id: control vlan number. |
| Switch_config# master-node | Configure the node type to the master node. |
| Switch_config_ring# hello-time <i>value</i> | Optional. Configure the period in which the master node sends probe packets. |

| | |
|---|--|
| | Value: Time value, 1 to 10 seconds, defaults value to 1 second. |
| Switch_config_ring# fail-time <i>value</i> | Optional. Configure the time limit for the secondary port to wait for probe packets. Value: Time value, 3 to 30 seconds, defaults value is 3 seconds. |
| Switch_config_ring# exit | Save the current configuration and back to the node configuration mode. |

Note:

Use **no ether-ring id** command to delete the node settings and port settings of the Ethernet ring.

2.4.2 Configuring the Transit Node

Configure a switch to be the transit node of a ring network according to the following steps:

| Command | Purpose |
|--|--|
| Switch# config | Enter the switch configuration mode. |
| Switch_config# ether-ring <i>id</i> | Set a node and enters the node configuration mode. <i>id</i> : Instances number. |
| Switch_config_ring# control-vlan <i>vlan-id</i> | Configure the control VLAN. <i>vlan-id</i> : ID of the control VLAN |
| Switch_config_ring# transit-node | Configure the node type to be a transit node. |
| Switch_config_ring# pre-forward-time <i>value</i> | Optional. Configures the time of maintaining the pre-forward state on the transit port. <i>value</i> : It is a time value ranging from 3 to 30 seconds and the default value is 3 second. |
| Switch_config_ring# exit | Save the current settings and exits the node configuration mode. |

2.4.3 Configuring the Port of Ethernet Ring

Configure a port of a switch to be the port of Ethernet ring according to the following steps:

| Command | Purpose |
|--------------------------|--------------------------------------|
| Switch# configure | Enter the switch configuration mode. |

| | |
|---|--|
| Switch_config# interface <i>intf-name</i> | Enter the interface configuration mode. <i>intf-name</i> : Stands for the name of an interface. |
| Switch_config_intf# ether-ring <i>id</i> primary-port { secondary-port transit-port } | Configure the type of the port of Ethernet ring. <i>id</i> : ID of the node of Ethernet ring |
| Switch_config_intf# exit | Back to interface configuration mode. |

Node:

Use **no ether-ring *id* primary-port { secondary-port | transit-port }** command to cancel the port settings of Ethernet ring.

2.4.4 Browsing the State of the Ring Protection Protocol

Run the following command to browse the state of the ring protection protocol:

| Command | Purpose |
|--|--|
| show ether-ring <i>id</i> | Browse the summary information about the ring protection protocol and the port of Ethernet ring. <i>id</i> : Instance number. |
| show ether-ring <i>id</i> detail | Browse the detailed information about the ring protection protocol and the port of Ethernet ring. |
| show ether-ring <i>id</i> interface <i>intf-name</i> | Browse the state of the Ether-ring port or the common port. |

2.5 Fast Ethernet Ring Protection Configuration Example

2.5.1 Configuration Example

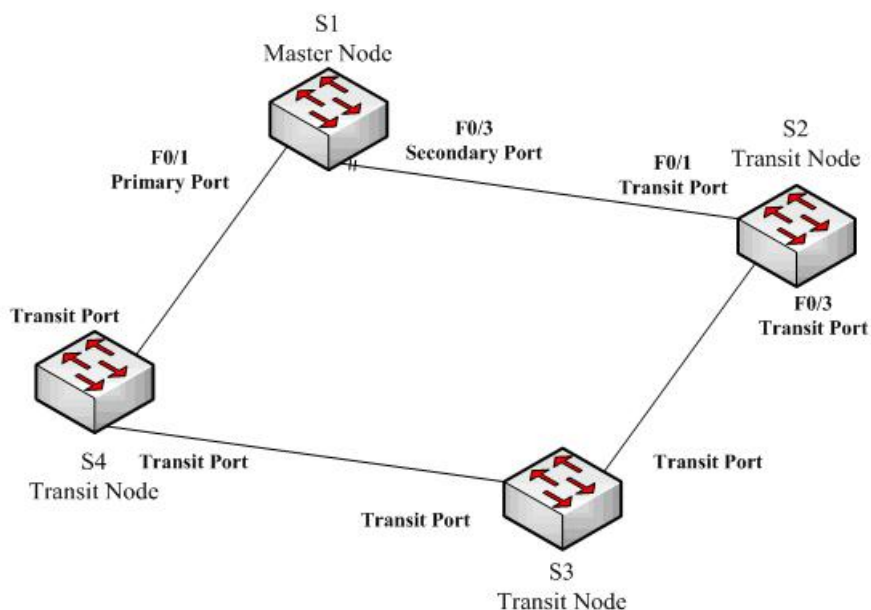


Figure2- 1 Security settings of Fast Ethernet Ring Protection Ethernet ring

As shown in figure 2.1, master node S1 and transit node S2 are configured as follows. As to the settings of other nodes, they are same to S2's settings.

Configuring switch S1:

Shuts down STP and configures the Ether-ring node:

```
S1_config# no spanning-tree
```

```
S1_config# ether-ring 1
```

```
S1_config_ring1# control-vlan 2
```

```
S1_config_ring1# master-node
```

Configures the time related parameters:

```
S1_config_ring1# hello-time 2
```

```
S1_config_ring1# fail-time 6
```

Exits from the node configuration mode:

```
S1_config_ring1# exit
```

Configures the primary port and the secondary port:

```
S1_config# interface gigaEthernet 0/1
S1_config_f0/1# ether-ring 1 primary-port
S1_config_f0/1# exit
S1_config# interface gigaEthernet 0/3
S1_config_f0/3# ether-ring 1 secondary-port
S1_config_f0/3# exit
Establishes the control VLAN:
S1_config# vlan 2
S1_config_vlan2# exit
S1_config# interface range f0/1 , 3
S1_config_if_range# switchport mode trunk
S1_config_if_range# exit
```

Configuring switch S2:

```
S1_config# no spanning-tree
S1_config# ether-ring 1
S1_config_ring1# control-vlan 2
S1_config_ring1# transit-node
S1_config_ring1# pre-forward-time 8
S1_config_ring1# exit
S1_config# interface fastEthernet 0/1
S1_config_f0/1# ether-ring 1 transit-port
S1_config_f0/1# exit
S1_config# interface fastEthernet 0/3
S1_config_f0/3# ether-ring 1 transit-port
S1_config_f0/3# exit
S1_config# vlan 2
```

S1_config_vlan2# exit

S1_config# interface range gigaEthernet 0/1 , 3

S1_config_if_range# switchport mode trunk

S1_config_if_range# exit