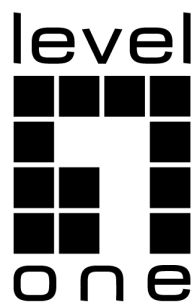# EAPS Configuration

# Table of Contents

# Chapter 1   Introduction of Fast Ethernet Ring Protection

## 1.1  Overview

LEVELONE 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.

Remark:
EAPS supports to set a switch to be a node of multiple physical ring to construct complicated topology.

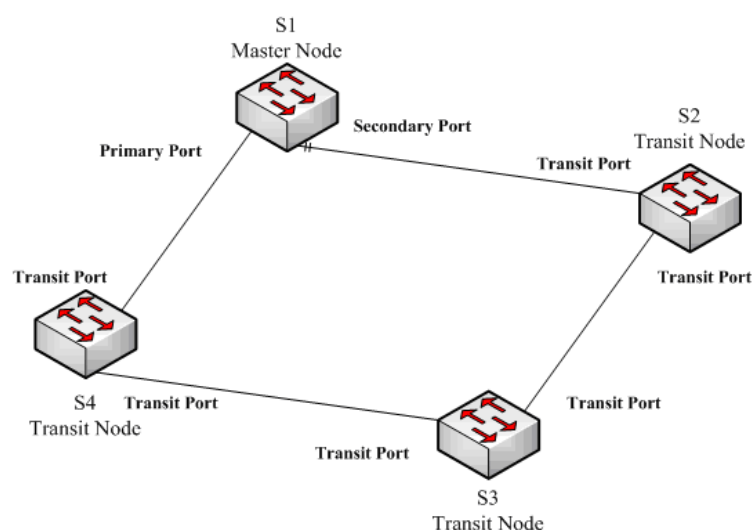## 1.2  Related Concepts of Fast Ether-Ring Protection



Figure 1.1 EAPS Ethernet ring

### 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

EAPS 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 will open the secondary port to forwarding the data packets.

Transit port: the transmit 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.

Remark:
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.

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 Aging of the MAC Address Table

The Ethernet ring protection protocol can transmit data packets to the correct link by controlling the aging of the switch's MAC address table when the topology changes. In general, the time for a MAC address to age in the MAC address table is 300 seconds. The ring protection protocol can control the aging of the MAC address table in a short 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 Types of EAPS Packets

The EAPS packets can be classified into the following types, as shown in table 1.1.

Table 1.1 Types of EAPS packets

| Type of the packet | Remarks |
| --- | --- |
| Loopback detection (HEALTH) | It is transmitted by the master node to detect whether the topology of the ring network is complete. |
| LINK-DOWN | Indicates that link interruption happens in the ring. This kinds of packets are transmitted by the transit node. |
| 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.

# Chapter 2   Fast Ethernet Ring Protection Configuration

## 2.1  Default EAPS Settings

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Note:
The fast Ethernet protection protocol cannot be set together with STP.
After STP is disabled, you are recommended to run **spanning-tree bpdu-terminal** to keep the ring node from forwarding BPDU, which leads to the storm.

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See the following table:

Table 2.1 Default settings of the Ethernet ring protection protocol and STP.

| Spanning tree protocol | **spanning-tree mode rstp** |
|---|---|
| Fast Ethernet Ring Protection | There is no configuration. |

## 2.2  Requisites before Configuration

Before configuring MEAPS, please read the following items carefully:

- One of important functions of the ring protection protocol is to stop the broadcast storm, so please make sure that before the ring link is reconnected all ring nodes are configured. If the ring network is connected in the case that the configuration is not finished, the broadcast storm may easily occur.

- EAPS is well compatible with STP, but the port under the control of EAPS is not subject to STP.

- The ring protection protocol supports a switch to configure multiple ring networks.

- Configuring ring control VLAN will lead to the automatic establishment of corresponding system VLAN.

- The port of each ring can forward the packets from the control VLAN of the ring, while other ports, even in the Trunk mode, cannot forward the packets from 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 Fre-Forward-Time of the transit node, loopback is easily generated and broadcast storm is then triggered.

- The physical interface, the gigabit-Ethernet interface and the aggregation interface can all be set to be the ring's interfaces. If link aggregation, 802.1X or port security has been already configured on a physical interface, the physical interface cannot be set to be a ring's interface any more. Note: The versions of LEVELONE switch software prior to version 2.0.1L and the versions of hi-end switch software prior to version 4.0.0M do not support the configuration of the converged port.

## 2.3 MEAPS Configuration Tasks

- Configuring the Master Node

- Configuring the Transit Node

- Configuring the Ring Port

- Browsing the State of the Ring Protection Protocol

## 2.4 Fast Ethernet Ring Protection Configuration

### 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#**config** | Enters the switch configuration mode. |
| Switch(config)#**ether-ring** *id* | Sets a node and enters the node configuration mode. id: Instance ID |
| Switch(config_ring)#**control-vlan** *vlan-id* | Configures the control VLAN. Vlan-id: ID of the control VLAN |
| Switch(config_ring)#**master-node** | Configures the node type to be a master node. |
| Switch(config_ring)#**hello-time** *value* | This step is optional. Configures the cycle for the master node to transmit the HEALTH packets. Value: It is a time value ranging from 1 to 10 seconds and the default value is 1 second. |
| Switch(config_ring)#**fail-time** *value* | This step is optional. Configures the time for the secondary port to wait for the HEALTH packets. Value: It is a time value ranging from 3 to 30 seconds and the default value is 3 second. |
| Switch(config_ring)#**exit** | Saves the current settings and exits the node configuration mode. |

**Remark:**

The **no ether-ring *id*** command is used 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** | Enters the switch configuration mode. |
| Switch(config)#**ether-ring** *id* | Sets a node and enters the node configuration mode.<br><br>id: Instance ID |
| Switch(config_ring)#**control-vlan** *vlan-id* | Configures the control VLAN.<br><br>Vlan-id: ID of the control VLAN |
| Switch(config_ring)#**transit-node** | Configures the node type to be a transit node. |
| Switch(config_ring)#**pre-forward-time** *value* | This step is optional. Configures the time of maintaining the pre-forward state on the transit port.<br><br>Value: It is a time value ranging from 3 to 30 seconds and the default value is 3 second. |
| Switch(config_ring)#**exit** | Saves the current settings and exits the node configuration mode. |

## 2.4.3 Configuring the Ring Port

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

| Command | Purpose |
|---|---|
| Switch#**config** | Enters the switch configuration mode. |
| Switch(config)#**interface** *intf-name* | Enters the interface configuration mode.<br><br>intf-name: Stands for the name of an interface. |
| Switch(config)_intf#**ether-ring** *id* **{primary-port | secondary-port | transit-port }** | Configures the type of the port of Ethernet ring.<br><br>ID of the node of Ethernet ring |
| Switch(config)_intf#**exit** | Exits from interface configuration mode. |

Remark:

The **no ether-ring** *id* {**primary-port** | **secondary-port** | **transit-port** } command can be used 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** *id* | Browses the summary information about the ring protection protocol and the port of Ethernet ring. id: ID of Ethernet ring |
| **show ether-ring** *id* **detail** | Browses the detailed information about the ring protection protocol and the port of Ethernet ring. |
| **show ether-ring** *id* **interface** *intf-name* | Browses the state of the Ether-ring port or that of the common port. |

# 2.5  MEAPS configuration

## 2.5.1  Configuration Example
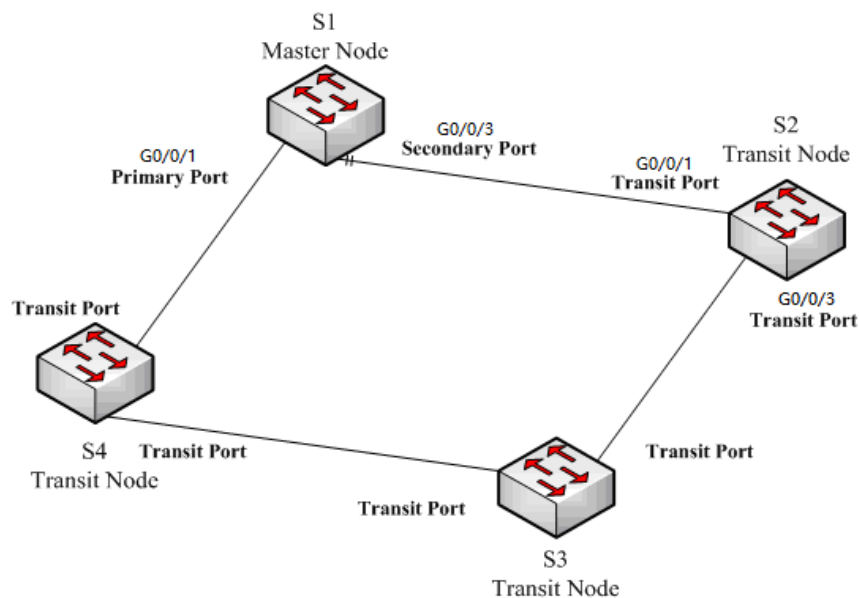


MEAPS configuration

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

The following commands are used to set 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 0/0/1
S1(config-g0/0/1)#ether-ring 1 primary-port
S1(config-g0/0/1)#exit
S1(config)#interface gigaEthernet 0/0/3
S1(config-g0/0/3)#ether-ring 1 secondary-port
S1(config-g0/0/3)#exit

Establishes the control VLAN:

S1(config)#vlan 2
S1(config)#interface range g0/0/1,3
S1(config-g0/0/1,3)#switchport mode trunk
S1(config-g0/0/1,3)#exit


**Configuring switch S2:**

S2(config)#no spanning-tree
S2(config)#ether-ring 1
S2(config_ring1)#control-vlan 2
S2(config_ring1)#transit-node
S2(config_ring1)#pre-forward-time 8
S2(config_ring1)#exit
S2(config)#interface gigaEthernet 0/0/1
S2(config-g0/0/1)#ether-ring 1 transit-port
S2(config-g0/0/1)#exit
S2(config)#interface gigaEthernet 0/0/3
S2(config-g0/0/3)#ether-ring 1 transit-port
S2(config-g0/0/3)#exit
S2(config)#vlan 2
S2(config)#interface range gigaEthernet 0/0/1,3
S2(config-g0/0/1,3)#switchport mode trunk
S2(config-g0/0/1,3)#exit