

# ERPS Configuration

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# 1、 ERPS

## 1.1 ERPS Overview

ERPS (Ethernet Ring Protection Switching) is released by ITU-T with the convergence rate of telecommunication level. If all equipment inside the ring support this agreement, it can achieve intercommunication.

## 1.2 ERPS Basic Conception

ERPS mainly includes ERPS ring, node, port role and port status.

### 1. ERPS Instance

ERPS instance is formed by the same instance ID, control VLAN and interconnected switches.

### 2. Control VLAN

Control VLAN is the transmission VLAN of ERPS protocol, and the protocol packet will carry corresponding VLAN tag.

### 3. RPL

RPL (Ring Protection Link), Link designated by mechanism that is blocked during Idle state to prevent loop on Bridged ring

### 4. ERPS ring

ERPS ring is ERPS basic unit. It composed by a set of the same control VLAN and the interlinked L2 switch equipment.

### 5. Node

The L2 switch equipment added in ERPS ring are called nodes. Each node cannot be added to more than two ports in the same ERPS ring. The nodes are divided into RPL Owner, Neighbor, Next Neighbor and Common.

### 6. Port Role

In ERPS, port roles include: RPL Owner, Neighbor, Next Neighbor and Common:

- ① RPL Owner: An ERPS ring has only one RPL Owner port configured by the user and it prevents loops in the ERPS ring via blocking the RPL Owner port. The node that owns the RPL Owner port becomes the RPL Owner node.
- ② RPL Neighbour: An ERPS ring has only one RPL Neighbor port configured by the user and it must be a port connected to the RPL Owner port. If the network is normal, it will

block together with the RPL Owner port to prevent loops in the ERPS ring. The node with the RPL Neighbor port becomes the RPL Neighbor node.

- ③ RPL Next Neighbour : An ERPS ring can have up to two RPL Next Neighbor ports configured by the user. It must be the port connecting the RPL Owner node or the RPL Neighbor node. To become the RPL Next Neighbor node, the RPL Next Neighbor port should own the node of RPL Next Neighbor port.

Note: RPL Next Neighbour nodes are not much different from ordinary nodes. They can be replaced by Common nodes.

- ④ Common: The common port. The ports except RPL owner, Neighbor and Neighbor port are common ports. If the node has only the Common port, this node will become the Common node.

## 7. Port Status

In the ERPS ring, the port status of the ERPS protocol is divided into three types.

- ① Forwarding: In *Forwarding* status, the port forwards user traffic and receives / forwards R-APS packets. Moreover, it forwards R-APS packets from other nodes.
- ② Discarding: In the *Discarding* status, the port can only receive / forward R-APS packets and cannot forward R-APS packets from other nodes.
- ③ Disable: port in *Linkdown* status.

## 8. Wrok Mode: ERPS operating mode

Work mode includes: revertive and non-revertive.

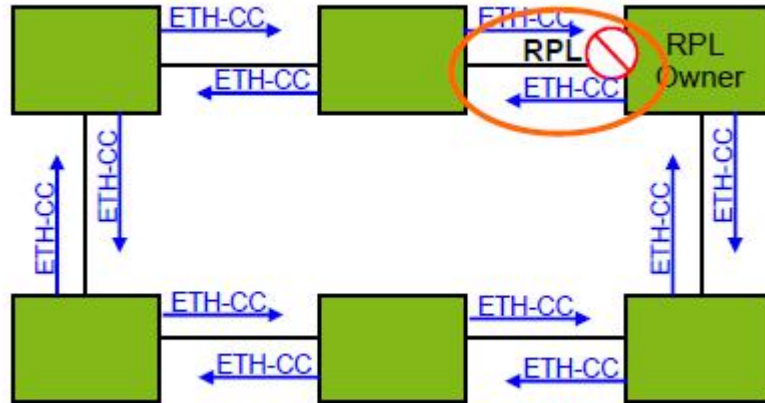
- ① Revertive: When the link fails, the RPL link is in the release protection state and the RPL link is re-protected after the faulty link is restored to prevent loops.
- ② Non-revertive: After the fault is rectified, the faulty node remains faulty (without entering Forwarding) and the RPL link remains in the release protection state.

## 1.3 ERPS Ring Protection Mechanism

ERPS uses ETH CFM for link monitoring. When the network is normal, a blocking link is set on the ring network to prevent the ring network from ringing. If a fault occurs in the network, a blocked backup link is opened to ensure uninterrupted link between each node. The general process is as follows:

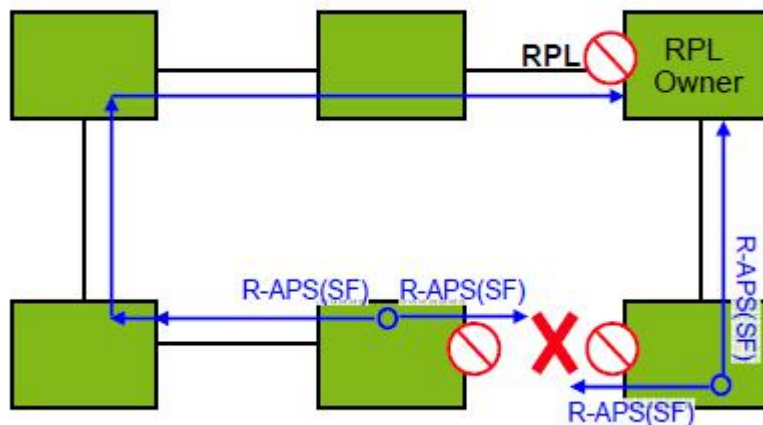
- ① As shown in Figure 1-1, when six devices are connected in a ring and the link is in the IDLE state, the loop is removed via setting the RPL link and BLOCKING port (RPL Owner port).

1-1 loop diagram in IDLE state



- ② When a node on the link detects a fault, it immediately blocks the faulty node and reports the fault message (R-APS (SF)) to all the other devices in the ring. After receiving the message, all other nodes refresh the FDB. The RPL owner port receives the fault message, and the recovery port is in the forwarding state. The ERPS ring enters the protection state. As shown in Figure 1-2:

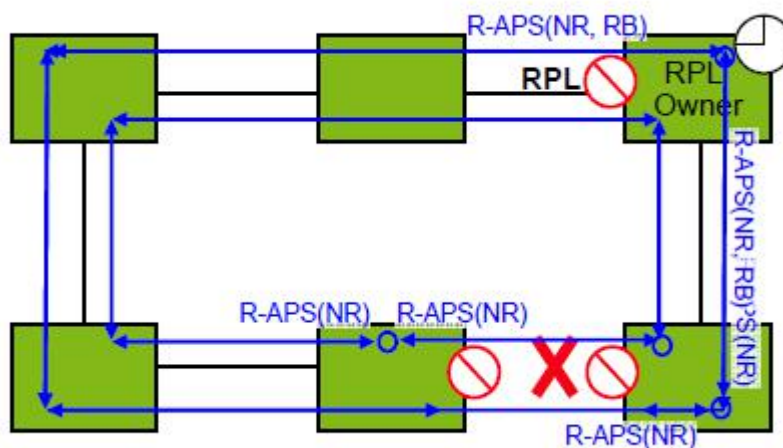
1-2 loop diagram in ring network protection fault (link fault)



- ③ As shown in Figure 1-3, when the link of the faulty device recovers, it sends RAPS (NR)

packets to other devices in the ring to inform them that there is no local request. When the RPL owner receives the packet, it will block the port and send the R-APS (NR, RB) message again after some time. After receiving the packet, the other nodes will refresh the FDB entry. Later, the port of the faulty node will be restored to the forwarding state, and the ring will revert to the IDLE state (Figure 1-1)

1-3 loop diagram in loop protection (link recovery) state



## 2、 ERPS Configuration

### 2.1 Task Overview for ERPS Configuration

Task Overview for ERPS Configuration

configuration task	explanation	detailed configuration
Enable ERPS	required	<a href="#">2.2</a>
Configure ERPS Instance	required	<a href="#">2.3</a>
Configure Connectivity Detection of ERPS Link	required	<a href="#">2.4</a>
Configure the ERPS Related Timers	optional	<a href="#">2.5</a>
ERPS Display and Maintenance	optional	<a href="#">2.6</a>

### 2.2 Enable ERPS

Enable ERPS


operation	command	remark
Enter global configuration mode	<b>configure terminal</b>	-
Enable ERPS	<b>erps</b>	required

Disable ERPS	<b>no erps</b>	
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## 2.3 Configure ERPS Instance

Configure ERPS Instance

operation	command	remark
Enter global configuration mode	<b>configure terminal</b>	-
Configure erps instance	<b>erps instance</b> <i>instance-id</i>	required
Configure control-vlan	<b>control-vlan</b> <i>vlan id</i>	required
Configure work-mode	<b>work-mode</b> { <i>revertive non revertive</i> }	optional
Configure ring id	<b>ring</b> <i>ring id</i>	optional
Configure ring level	<b>ring</b> <i>level</i>	optional, 0 refers to main ring, 1 refers to subring.
Configure ring port	<b>{Port0 port1} ethernet</b> <i>interface-num</i> <i>portrule</i>	required
Enable ring	<b>ring enable</b>	Required. Before enabling Ring, you should configure port and control VLAN.

 note:

About Ring ID: ERPS ring ID, the last byte of the DMAC in the R-APS message is Ring Id. From G.8032 can be learned that the ERPS ring ID can be the same, and the control VLAN needs to be different. The reverse is also true. The ring ID of each instance can be 1 to 239, and the control VLAN does not allow duplication.

## 2.4 Configure Connectivity Detection of ERRP Link

In ERPS, there is no HELLO packet to monitor link connectivity in real time. Instead, it uses the CC function in ETH CFM to detect the link connectivity by sending ETH-CC messages between the two ports. Therefore, you need to configure the CFM CC for the ports in the ERPS. In the ERRP instance, you need to configure the MEL (MEG level, which must be consistent with the CFM configuration).

For more information about CFM, please refer to the CFM User Manual.

### Configure connectivity detection of ERRP link

operation	command	remark
Enter global configuration mode	<b>configure terminal</b>	-
Configure erps instance and then enter instance configuration mode	<b>erps instance</b> <i>instance-id</i>	required
Configure MEL	<b>mel</b> <i>level</i>	Optional; MEG level; It needs to be the same as CFM configuration

 note:

CFM ETH-CC function is to detect non-LINKDOWN link failure, such as single-pass. If you do not use the CFM ETH-CC function, ERPS can also work normally while it cannot detect single-pass failure.

## 2.5 Configure ERPS Related Timers

ERPS has two timers: WTR timer and Guard timer.

- ① WTR timer: When the RPL owner port is restored to the Forwarding state due to another device or link failure, if the fault is restored and some ports may not have been changed from the Down state to the Up state, it starts the WTR timer when the RPL owner port receives the fault-free RAPS packet from a port to prevent the shock of blocking point; If the fault is received before the timer expires, the WTR timer is disabled. If a faulty RAPS packet from another port is received before the timer times out, the WTR timer will be disabled. If the WTR timer does not receive any faulty RAPS packets from other ports, it will block the RPL Owner port and send RPL blocking RAPS packets after timed out. After receiving the packet, the other ports set the forwarding state of its own port as *Forwarding* state.
- ② Guard timer: After the failure recovery, the equipment involved in link failure or node failure will send R-APS packet to the other devices and it will start the Guard Timer at the same time. The device does not process RAPS packets until the timer times out with the purpose to prevent the receipt of outdated faulty R-APS packets. If the device receives the faulty RAPS packet from another port after the timer times out, the port forwarding state will turn to *Forwarding*.

### Configure ERPS Related Timers

operation	command	remark
Enter global configuration mode	<b>configure terminal</b>	-
Configure erps instance and then	<b>erps instance</b> <i>instance-id</i>	required



enter instance configuration mode		
Configure wtr-timer timer	<b>wtr-timer</b> <i>timer value</i>	Optional, 5min by default, 1~12min
Configure guard-timer timer	<b>guard-timer</b> <i>timer value</i>	Optional, 500ms by default, 0~2s

## 2.6 ERPS Display and Maintenance

After you complete the above configurations, you can use the following commands to view the configurations.

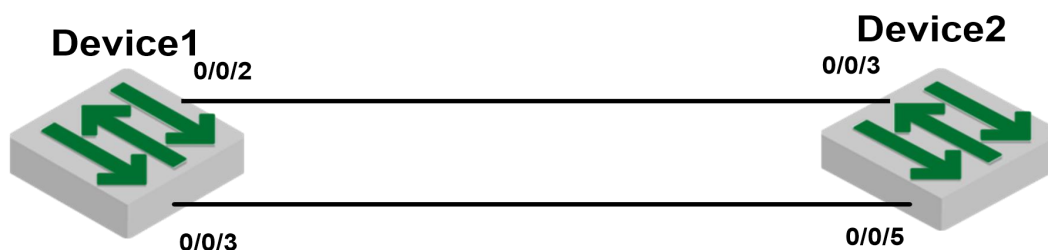
ERPS display and debug

operation	command	remark
display ERPS information	<b>show erps</b> [ <i>instance instance id</i> ]	
display the sending and receiving packets	<b>show erps</b> [ <i>instance instance id</i> ] <b>statistics</b>	
clear the sending and receiving packets	<b>clear erps</b> [ <i>instance instance id</i> ] <b>statistics</b>	

## 3、ERPS Configuration Example

### 3.1 Demand and networking

The two switches form a single ring. The ETH CFM detects the link fault and eliminates the loop through ERPS. The network diagram is as follows:



## 3.2 Configuration on ERPS Ring Network Protection

1) Configure ETH CFM on DEVICE1 and DEVICE2

#DEVICE1 CFM configuration

```
DEVICE1(config)#s run cfm
![CFM]
cfm md 1
cfm md format string name test Erps level 1
cfm ma 1
cfm ma format string name test Erps primary-vlan 100
cfm mep 1 direction down interface ethernet 0/0/3
cfm mep 1 state enable
cfm mep 1 cc enable
cfm rmep 2 mep 1
exit
exit
```

#DEVICE2 CFM configuration

```
DEVICE2(config)#s run cfm
![CFM]
cfm md 1
cfm md format string name test Erps level 1
cfm ma 1
cfm ma format string name test Erps primary-vlan 100
cfm mep 2 direction down interface ethernet 0/0/2
cfm mep 2 state enable
cfm mep 2 cc enable
cfm rmep 1 mep 2
exit
exit
```

2) Configure ERPS on DEVICE1 and DEVICE2


# ERPS configuration of DEVICE1

```
DEVICE1(config)#s running-config erps
![ERPS]
erps
erps instance 1
mel 1
ring level 1
control-vlan 100
port0 ethernet 0/0/2 owner
port1 ethernet 0/0/3
protected-instance 0
ring enable
exit
```

# ERPS configuration of DEVICE2

```
DEVICE2 (config)#s run erps
![ERPS]
```

```
erps
erps instance 1
mel 1
ring 1
ring level 1
control-vlan 100
port0 ethernet 0/0/3 neighbour
port1 ethernet 0/0/5
protected-instance 0
ring enable
exit
```

 note:

- cfm md format string name test Erps level 1

Here, the “level” refers to MEG Level, that is, the MEL in ERPS needs to be configured into the same.

- cfm ma format string name test Erps primary-vlan 100

Here, the primary-vlan 100 needs to be the same as the ERPS control VLAN.

- mep and rmep need one-to-one correspondence

### 3.3 Result Verification

The 0/0/2 port of Device 1 and the 0/0/3 port of Device 2 are blocked and the loop is removed.

```
DEVICE1 (config)#show erps
ERPS state: enable
```

```
Instance Id : 0
Mel          : 1
Work-mode    : revertive
Time value   : WTR 5 min, guard timer 500 ms, holdoff timer 0 s
Ring 1 info:
Control vlan: 100
Status       : enable
Node Role    : owner
Level        : 1
Stm          : Idle
            portId  role    state    nodeId          BPR
port0 e0/0/2  owner  Blocking  00:01:7f:00:00:11  0
port1 e0/0/3  Common Forwarding  10:7b:ef:fd:4b:cd  0
```