NETWORK SWITCHING FEATURES

ERPS

Contents

Supported Models

Model Series	Type
QN-CS-4810GF	Core Switch
QN-CS-2410GF	Core Switch
QN-CS-1610GF	Core Switch

Glossary

The following terms are frequently used in this document.

Term	Definition
ERPS	Ethernet Ring Protection Switching
RPL	Ring Protocol Link
VLAN	Virtual Local Area Network
WTR	Wait To Restore Timer
R-APS	Ring Automatic Protection Switching
PDU	Protocol Data Unit
STP	Spanning Tree Protocol

Functional Description

ERPS is designed to provide protection and fast recovery in ring topologies, which is specified in ITU-T G.8032. ERPS ensure that data traffic can be quickly rerouted in the event of a link or node failure, minimizing downtime and maintaining network reliability.

ERPS (Ethernet Ring Protection Switching) is a protocol that ensures high reliability and network stability in Ethernet ring networks by preventing loops and providing fast recovery from failures. It uses a dedicated ring protection link and logical rings to achieve these goals.

An Ethernet ring is a collection of Ethernet ring nodes which are network elements with (at least) two ring ports, connected to two adjacent Ethernet ring nodes forming a closed physical loop. All Ethernet ring nodes must be able to support the ERP control plane functionality and control the blocking and unblocking of traffic through the ring ports.

RPL (Ring Protection Link)

The basic idea of an Ethernet ring is to use one specific link to protect the whole ring. This special link is called a ring protection link (RPL). If no failure happens in other links of the ring, the RPL blocks the traffic and is not used. The RPL is controlled by a special node called an RPL owner. There is only one RPL owner in a ring. The RPL owner is responsible for blocking traffic over the RPL. Under ring failure conditions, the RPL owner is responsible for unblocking traffic over the RPL. A ring failure results in protection switching of the RPL traffic. Protection switching blocks traffic on the failed link and unblocks the traffic on the RPL. When the failure clears, revertive protection switching blocks traffic over the RPL and unblocks traffic on the link on which the failure is cleared.

Two important management configurable entities in the ERPS are the Root Port and Root Neighbor port. The node which has the Root Port is called as the Root Node. The link adjacent to the Root Port is called the Ring Protection Link and is blocked for data traffic. However, management PDU can be exchanged.
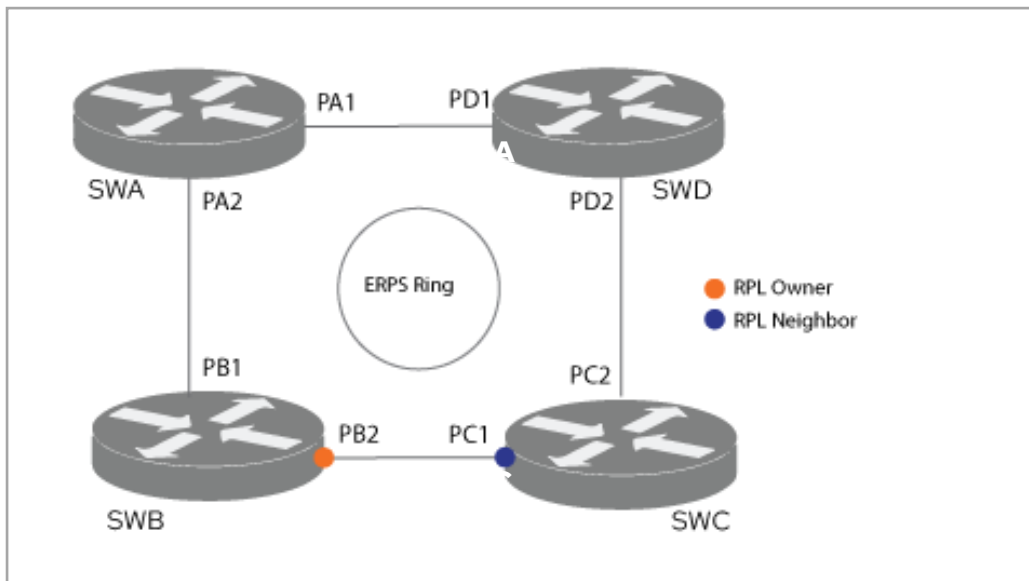
Figure 1

o   There is a Ring protection link node with an RPL owner. The RPL owner blocks the node when traffic normally flows through the network to prevent the looping.

o   When the network fails, the RPL owner node opens the RPL node to let the traffic pass without compromising network traffic flow.

ERPS Operating Mode

There are two types of operating mode

1. Revertive

In ideal case, the link between the Root Node and the Root Neighbor is blocked. In case of Signal Failure or operator command like Forced Switch or Manual Switch occurs, the aforementioned link gets unblocked in order to steer the traffic.

Upon recovery, the same link should get blocked to prevent the formation of loop. In the Revertive mode of operation, upon the recovery of the failed link, the Ring Protection Link gets blocked automatically.

2. Non-Revertive

In non-Revertive mode, upon the recovery of failed link or operator commands, the Ring Protection Link doesn't get blocked automatically.

The failed link or the link upon which the operator command was issued remains in the blocked state, thereby preventing in loop formation.

ERPS Timers

1. Guard Timer:

When Protection state is initiated, the Guard Timer starts. During this period, the nodes in the ring ignore any control packets related to the previous state to avoid confusion and ensure the new state is correctly established. In Quantum switches the default Guard timer is 500 milliseconds, but you can configure it between 10 to 2000 milliseconds.

2. Hold-Off Timer:

When a fault is detected, the Hold-off Timer starts. If the fault persists beyond the timer's duration, the protection switch is executed. If the fault clears before the timer expires, no switching occurs. When any fault will occur, the ring will not move to the protection state immediately, it will wait till hold-off timer expires. If hold-off time expires and fault will not clear, then ring will immediately move to the protection state. In Quantum switches the default Hold-Off timer is 0 milliseconds, but you can configure it between 0 to 10,000 milliseconds.

3. Wait-To-Restore Timer (WTR):

Once the primary path is restored, the Wait-to-Restore Timer starts. Only after this timer expires the network switch back from the backup path to the primary path, ensuring the primary path is stable. In Quantum switches the default WTR timer is 5 minutes, but you can configure it between 1 to 12 minutes.

ERPS in QN Switches

Commands outline

Use this command to create an ERPS profile and enter ERPS Profile

Configuration Mode. ERPS profile is required to set ERPS ring parameters.

switch(config)# erps profile PR1

Use this command to enables non-revertive mode for EPRS ring profile.

switch(config-erps-profile) # enable non-revertive

Use this command to set ERPS ring guard interval in milliseconds.

switch(config-erps-profile) # timer guard 1000

Use this command to set ERPS ring Hold Off timer in milliseconds.

switch(config-erps-profile) # timer hold-off 1000

Use this command to set ERPS ring Wait-To-Restore interval.

switch(config-erps-profile) # timer wtr 3

Use this command to create an ERPS ring and enter ERPS Ring Configuration Mode.

switch(config)# erps ring RING-1

Use this command to add VLANs to ERPS ring.

switch(config-erps-ring) # data-traffic 2,10-99

Use this command to administratively enable ERPS ring.

switch(config-erps-ring) # enable

Use this command to define ERPS ring ports.

switch(config-erps-ring) # physical-ring east-interface te1/0/1

Use this command to apply ERPS profile to ERPS ring.

switch(config-erps-ring) # profile-name PR1

Use this command to set the R-APS PDUs CFM level.

switch(config-erps-ring) # raps-cfm-level 7

Use this command to define port role as owner or neighbor in ERPS ring.

switch(config-erps-ring) # rpl port east-interface role owner

Use this command to define ring ID for ERPS ring.

switch(config-erps-ring) # ring-id 1

Use this command to define the R-APS control VLAN for ERPS ring.

switch(config-erps-ring) # raps-channel 100

Use these commands to manually force the ERPS ring state change or clear from

previously forced change.

console# erps-action forced-switch RING-1 east-interface

console# erps-action clear RING-1

Configuration Steps:

Let's consider that we are applying ERPS on a switch to prevent loops and providing fast recovery from failures.

Switch A is RPL owner blocks traffic on the RPL in case of a failure, allowing traffic to flow through the remaining links.
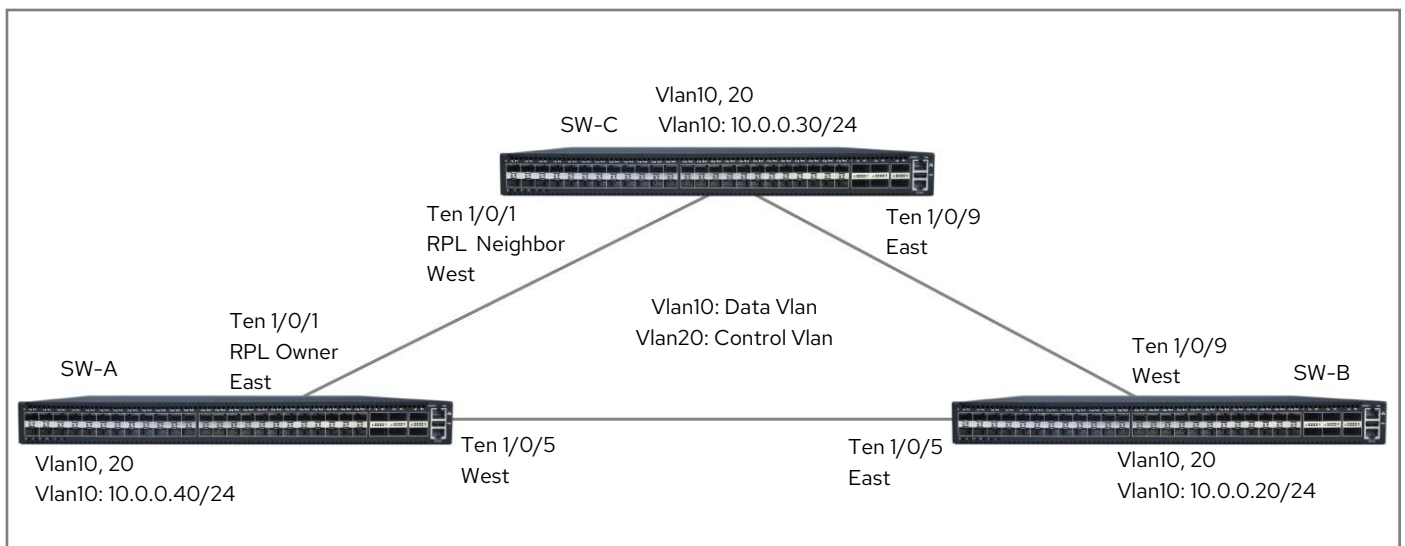

Figure 2

SW-A: (RPL Owner Switch)

To configure a vlan.

SW-A(config)#vlan 10,20

Navigate to interface range.

SW-A(config)#int range ten1/0/1, ten1/0/5

To configure the switchport (or a range of ports) as a trunk port. A trunk port is designed to carry traffic for multiple VLANs (Virtual Local Area Networks) between switches or between a switch and other network devices.

SW-A(config-if-range) #switchport mode trunk

To allow the trunk port to carry traffic only for VLANs 10 and 20.

SW-A(config-if-range) #switchport trunk allowed vlan 10,20

To disable spanning-tree-protocol.

SW-A(config-if-range) #spanning-tree disable

To configure a profile for Ethernet Ring Protection Switching (ERPS), which is a protocol designed to provide protection and recovery in Ethernet ring topologies.

SW-A(config)#erps profile test

To exit the ERPS profile configuration mode and return to the global configuration mode of the switch.

SW-A(config-erps-profile) #exit

To configure ERPS ring globally.

SW-A(config)#erps ring test

To configure VLAN 10 to handle normal data traffic across the ERPS ring. This is necessary to allow data traffic to flow through the ring while maintaining loop protection and fast recovery in case of failure.

SW-A(config-erps-ring) #data-traffic 10

To configure configures the physical interfaces for the ERPS ring, with ten1/0/1 as the east-facing interface and ten1/0/5 as the west-facing interface.

SW-A(config-erps-ring) #physical-ring east-interface ten1/0/1 west-interface ten1/0/5

To associates the current ERPS ring configuration with the ERPS profile named test.

SW-A(config-erps-ring) #profile-name test

To configure VLAN 20 to carry the R-APS control messages for the ERPS ring.

SW-A(config-erps-ring) #raps-channel 20

To assigns the ring ID 1 to the current ERPS ring configuration.

SW-A(config-erps-ring) #ring-id 1

To configure the east interface as the owner of the RPL, allowing it to manage the protection and rerouting responsibilities for the ERPS ring.

SW-A(config-erps-ring) #rpl port east-interface role owner

To activate the ERPS ring that has been configured on the switch.

SW-A(config-erps-ring) #enable

SW-B:

To configure a vlan.

SW-B(config)#vlan 10,20

Navigate to interface range.

SW-B(config)#int range ten1/0/5, ten1/0/9

To configure the switchport (or a range of ports) as a trunk port. A trunk port is designed to carry traffic for multiple VLANs (Virtual Local Area Networks) between switches or between a switch and other network devices.

SW-B(config-if-range) #switchport mode trunk

To allow the trunk port to carry traffic only for VLANs 10 and 20.

SW-B(config-if-range) #switchport trunk allowed vlan 10,20

To disable spanning-tree-protocol.

SW-B(config-if-range) #spanning-tree disable

To configure a profile for Ethernet Ring Protection Switching (ERPS), which is a protocol designed to provide protection and recovery in Ethernet ring topologies.

SW-B(config)#erps profile test

To exit the ERPS profile configuration mode and return to the global configuration mode of the switch.

SW-B(config-erps-profile) #exit

To configure ERPS ring globally.

SW-B(config)#erps ring test

To configure VLAN 10 to handle normal data traffic across the ERPS ring. This is necessary to allow data traffic to flow through the ring while maintaining loop protection and fast recovery in case of failure.

SW-B(config-erps-ring) #data-traffic 10

To configure configures the physical interfaces for the ERPS ring, with ten1/0/5 as the east-facing interface and ten1/0/9 as the west-facing interface.

SW-B(config-erps-ring) #physical-ring east-interface ten1/0/5 west-interface ten1/0/9

To associates the current ERPS ring configuration with the ERPS profile named test.

SW-B(config-erps-ring) #profile-name test

To configure VLAN 20 to carry the R-APS control messages for the ERPS ring

SW-B(config-erps-ring) #raps-channel 20

To assigns the ring ID 1 to the current ERPS ring configuration.

SW-B(config-erps-ring) #ring-id 1

To activate the ERPS ring that has been configured on the switch.

SW-B(config-erps-ring) #enable

SW-C:

To configure a vlan.

SW-C(config)#vlan 10,20

Navigate to interface range.

SW-C(config)#int range ten1/0/1, ten1/0/9

To configure the switchport (or a range of ports) as a trunk port. A trunk port is designed to carry traffic for multiple VLANs (Virtual Local Area Networks) between switches or between a switch and other network devices.

SW-C(config-if-range) #switchport mode trunk

To allow the trunk port to carry traffic only for VLANs 10 and 20.

SW-C(config-if-range) #switchport trunk allowed vlan 10,20

To disable spanning-tree-protocol.

SW-C(config-if-range) #spanning-tree disable

To configure a profile for Ethernet Ring Protection Switching (ERPS), which is a protocol designed to provide protection and recovery in Ethernet ring topologies.

SW-C(config)#erps profile test

To exit the ERPS profile configuration mode and return to the global configuration mode of the switch.

SW-C(config-erps-profile) #exit

To configure ERPS ring globally.

SW-C(config)#erps ring test

To configure VLAN 10 to handle normal data traffic across the ERPS ring. This is necessary to allow data traffic to flow through the ring while maintaining loop protection and fast recovery in case of failure.

SW-C(config-erps-ring) #data-traffic 10

To configure configures the physical interfaces for the ERPS ring, with ten1/0/5 as the east-facing interface and ten1/0/9 as the west-facing interface.

SW-C (config-erps-ring) # physical-ring east-interface ten1/0/9 west-interface ten1/0/1

To associates the current ERPS ring configuration with the ERPS profile named test.

SW-C(config-erps-ring) #profile-name test

To configure VLAN 20 to carry the R-APS control messages for the ERPS ring

SW-C(config-erps-ring) #raps-channel 20

To assigns the ring ID 1 to the current ERPS ring configuration.

SW-C(config-erps-ring) #ring-id 1

To configures the west interface on switch SW-C as the neighbor of the RPL.

SW-C(config-erps-ring) #rpl port west-interface role neighbour

To activate the ERPS ring that has been configured on the switch.

SW-C(config-erps-ring) #enable

Verifying the configuration

SW-A:

SW-A#show erps ring status

ERPS ring name: test

Ring ERP instance enabled: Yes

Ethernet ring ERP instance is RPL Owner node in Idle

Last top priority request is WTR Expires

East Interface: te1/0/1

Status: RPL, Blocked

Remote R-APS node ID: 00:00:00: 00:00:00, BPR: 0

West Interface: te1/0/5

Status: Non-RPL, Unblocked

Remote R-APS node ID: 00:00:00: 00:00:00, BPR: 0

SW-B:

SW-B#show erps ring status

ERPS ring name: test

Ring ERP instance enabled: Yes

Ethernet ring ERP instance is regular node in Idle

Last top priority request is R-APS (NR, RB)

East Interface: te1/0/5

Status: Unblocked

Remote R-APS node ID: 58:61:63: fe:2a:79, BPR: 0

West Interface: te1/0/9

Status: Unblocked

Remote R-APS node ID: 00:00:00: 00:00:00, BPR: 0

SW-C:

SW-C#show erps ring status

ERPS ring name: test

Ring ERP instance enabled: Yes

Ethernet ring ERP instance is RPL Neighbour node in Idle

Last top priority request is R-APS (NR, RB)

East Interface: te1/0/9

Status: Unblocked

Remote R-APS node ID: 58:61:63: fe:2a:79, BPR: 0

West Interface: te1/0/1

Status: Blocked

Remote R-APS node ID: 00:00:00: 00:00:00, BPR: 0

Notes & Limitations

o   There should be a trunk port for east and west ports.
o   Configured a VLAN on all three switches and associated two network interfaces from each of the three switches with the VLAN.
o   While configuring ERPS, STP (Spanning Tree Protocol) should be disabled.