



Parallel Redundancy Protocol (PRP)

This chapter provides details about configuring the Parallel Redundancy Protocol (PRP) on the Cisco Industrial Ethernet 5000 Series switches.

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Information About PRP

PRP allows a data communication network to prevent data transmission failures by providing network nodes two alternate paths for the traffic to reach its destination. Two local area networks (LANs) provide alternate paths for the traffic over independent LAN segments. However, the two LANs must share a similar topology.

Role of the Switch

A switch operating with PRP has a Gigabit Ethernet port connection to each of the two LANs. The switch sends two packets simultaneously to each LAN through the two different ports to the destination node. When the destination node receives the first packet successfully, it discards the second packet if it arrives successfully as well. Each packet sent includes an incremented sequence number that helps the destination node distinguish between duplicate packets.

Key Terms

The following terms are relevant when you configure PRP on the switch:

- **PRP channel**- A logical interface that aggregates PRP groups (access, trunk or routed) into a single link. The PRP channel remains up as long as both of its member ports remain up and send traffic. When both member ports are down, the channel is down. Only the up and down states of the ports can trigger different redundancy behavior or Single Attached Node (SAN) traffic routing decisions.

Each channel contains two Layer 2 or Layer 3 Gigabit Ethernet interfaces.

Prerequisites

Within each channel group, Gigabit Ethernet interfaces (Gi1/17 and Gi1/18) will always be the primary ports; and, Gigabit Ethernet interfaces, (Gi1/18) and (Gi1/20) will be the secondary port. PRP group 1 always contains the Gi1/17 and Gi1/18 interfaces.

- PRP group-A group is composed of two ports, one of which represents LAN A and the other LAN B.
 - PRP group 1 always contains the Gi1/17 and Gi1/18 interfaces.
 - PRP group 2 always contains Gi1/19 and Gi1/20 interfaces.

Prerequisites

Must have FPGA version 0.56 or greater to support PRP.

Guidelines and Limitations

- PRP configuration should always be done in default status mode.
- PRP traffic load cannot exceed 90% bandwidth of the Gigabit Ethernet interface channels.
- PRP does not support third-party systems.
- A PRP channel must have two active ports configured within a channel to remain active and maintain redundancy.
- Both interfaces within a channel group must have the same configuration.
- For Layer 3, you must configure the IP address on the PRP channel interface.
- Precision Time Protocol (PTP), when enabled, traverses PRP within LAN A only.
- Load-balancing is not supported.
- LLDP and CDP must be disabled on a system level.
- Primary link, Gi1/17 and Gi1/18, should not be shut down.
- (Optional configuration) Precision Time Protocol (PTP) traffic only traverses PRP within LAN A only.
- The following message might appear after the switch reloads; it can be ignored (CSCuq52270):
Gi1/18 is not compatible with Gi1/17
- The Protocol status displays incorrectly for the *Layer type = L3* section when you enter the **show prp channel detail** command. Refer to the *Ports in the group* section for the correct Protocol status (CSCur88178).

show prp channel detail

PRP-channel listing:

PRP-channel: PR1

Layer type = L3

Ports: 2 Maxports = 2

Port state = prp-channel is Inuse

Protocol = Disabled

Ports in the group:

1) Port: Gi1/17

Logical slot/port = 1/17 Port state = Inuse

Protocol = Enabled

Default Settings

```
2) Port: Gi1/18
   Logical slot/port = 1/19 Port state = Inuse
   Protocol = Enabled
```

- When a link, LAN A (Gi1/17) or LAN B (Gi1/18) goes down, both links will continue to show a link status of *UP*. Use the **show prp channel** command to confirm the status of the links.

Default Settings

PRP LED is disabled on IE 5000.

Configuring PRP

This section includes the following topics:

- [Creating a PRP Channel and Group, page 379](#)
- [\(Optional\) General Usage Precision Time Protocol \(PTP\) Enable on LAN A Channel, page 385](#)
- [Disabling the PRP Channel and Group, page 386](#)

Creating a PRP Channel and Group

To create and enable a PRP channel and group on the switch, follow the steps in this section.

BEFORE YOU BEGIN

Review the [Prerequisites, page 378](#) and [Guidelines and Limitations, page 378](#) sections.

DETAILED STEPS

	Command	Purpose
1.	configure terminal	Enters global configuration mode.
2.	no spanning-tree etherchannel guard misconfig	Prevents the PRP link from going into an err-disable state.
3.	interface range {GigabitEthernet1/17-18 GigabitEthernet1/19-20}	Assigns two Gigabit Ethernet interfaces to the PRP channel group. Note: You must apply the Gi1/17 interface before the Gi1/18 interface. So, we recommend using the interface range command. Similarly, you must apply the Gi1/19 interface before the Gi1/20 interface. Use the no interface prp-channel 1 2 command to disable PRP on the defined interfaces and shut down the interfaces.
4.	[no] switchport	(Optional) For Layer 2 traffic, enter switchport . (Default). Note: For Layer 3 traffic, enter no switchport .
5.	switchport mode access	(Optional) Sets a non-trunking, non-tagged single VLAN Layer 2 (access) interface.
6.	switchport access vlan <value>	(Optional) Creates a VLAN for the Gi1/17-18 interfaces. Note: Only required for Layer 2 traffic.
7.	no ptp enable	Disables Precision Time Protocol (PTP) on the switch.
8.	no keepalive	Disables loop detection for the redundancy channel.
9.	prp-channel-group prp-channel group	Enters sub-interface mode and creates a PRP channel group. <i>prp-channel group</i> -Value of 1 or 2. You must assign two interfaces to a channel group. The no form of this command is not supported.
10.	no shutdown	Brings up the PRP channel.

EXAMPLE 1

This example shows how to create a PRP channel on an IE 5000 switch, create a PRP channel group, and assign two ports to that group.

```
router# configure terminal
router(config)# no spanning-tree etherchannel guard misconfig
router(config)# interface range GigabitEthernet1/17-18
router(config-if)# no ptp enable
router(config-if)# no keepalive
router(config-if)# prp-channel-group 1
router(config-if)# no shutdown
```

EXAMPLE 2

This example shows how to create a PRP channel on the IE 5000 switch with a VLAN ID of 2.

```
router# configure terminal
router(config)# no spanning-tree etherchannel guard misconfig
```

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```

router(config)# interface range GigabitEthernet1/17-18
router(config-if)# switchport
router(config-if)# switchport mode access
router(config-if)# switchport access vlan 2
router(config-if)# no ptp enable
router(config-if)# no keepalive
router(config-if)# prp-channel-group 1
router(config-if)# no shutdown

```

EXAMPLE 3

This example shows how to create a PRP channel on a switch configured with Layer 3.

```

router# configure terminal
router(config)# no spanning-tree etherchannel guard misconfig
router(config)# interface range GigabitEthernet1/17-18
router(config-if)# no switchport
router(config-if)# no ptp enable
router(config-if)# no keepalive
router(config-if)# prp-channel-group 1
router(config-if)# no shutdown
router(config-if)# exit
router(config)# interface prp-channel 1
router(config)# ip address 192.0.0.2 255.255.255.0

```

EXAMPLE 4

In this example, the configuration establishes two VLANs, 80 and 81 and the Spanning Tree Protocol is configured for each PRP channel on the VLANs, MST-PRP1 and MST-PRP2, respectively.

There are two IE 5000 switches within the topology, identified as switch 1 (SW1) and switch 2 (SW2).

The steps below show how to configure the Spanning Tree Protocol, VLANs and PRP channels and groups on SW1:

```

spanning-tree mode mst
spanning-tree portfast bpduguard default
spanning-tree portfast bpdufilter default
no spanning-tree etherchannel guard misconfig
spanning-tree extend system-id
!
spanning-tree mst configuration
instance 1 vlan 80
instance 2 vlan 81

vlan 80
name MST-PRP2
!
vlan 81
name MST-PRP1
!
interface PRP-channel1
switchport access vlan 81
switchport mode access
spanning-tree bpdufilter enable
!
interface PRP-channel2
switchport access vlan 80
switchport mode access
spanning-tree bpdufilter enable
!
interface GigabitEthernet1/17

```

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```
switchport access vlan 81
switchport mode access
media-type rj45
speed 100
prp-channel-group 1
!
interface GigabitEthernet1/18
switchport access vlan 81
switchport mode access
media-type rj45
speed 100
prp-channel-group 1
!
interface GigabitEthernet1/19
switchport access vlan 80
switchport mode access
media-type rj45
speed 100
prp-channel-group 2
!
interface GigabitEthernet1/20
switchport access vlan 80
switchport mode access
media-type rj45
speed 100
prp-channel-group 2

interface GigabitEthernet1/9
switchport access vlan 81
switchport mode access
!
interface GigabitEthernet1/10
no switchport
ip address 192.168.100.222 255.255.255.0
shutdown
!
interface GigabitEthernet1/11
switchport access vlan 80
switchport mode access
!
interface GigabitEthernet1/12
switchport access vlan 80
switchport mode access
!
interface GigabitEthernet1/13
switchport access vlan 81
switchport mode access
!
interface Vlan80
ip address 10.208.80.111 255.255.255.0
!
interface Vlan81
ip address 10.208.81.111 255.255.255.0
```

The steps below show how to configure the Spanning Tree Protocol, VLANs, and PRP channels and groups on SW2:

```
spanning-tree mode mst
spanning-tree portfast bpduguard default
spanning-tree portfast bpdufilter default
no spanning-tree etherchannel guard misconfig
spanning-tree extend system-id
!
spanning-tree mst configuration
instance 1 vlan 80
instance 2 vlan 81
```

Configuring PRP

```
!  
!  
interface PRP-channel1  
switchport access vlan 81  
switchport mode access  
spanning-tree bpdudfilter enable  
!  
interface PRP-channel2  
switchport access vlan 80  
switchport mode access  
spanning-tree bpdudfilter enable  
!  
interface GigabitEthernet1/17  
switchport access vlan 81  
switchport mode access  
media-type rj45  
speed 100  
prp-channel-group 1  
!  
interface GigabitEthernet1/18  
switchport access vlan 81  
switchport mode access  
media-type rj45  
speed 100  
prp-channel-group 1  
  
interface GigabitEthernet1/19  
switchport access vlan 80  
switchport mode access  
media-type rj45  
speed 100  
prp-channel-group 2  
  
interface GigabitEthernet1/20  
switchport access vlan 80  
switchport mode access  
media-type rj45  
speed 100  
prp-channel-group 2  
  
interface GigabitEthernet1/9  
switchport access vlan 81  
switchport mode access  
  
interface GigabitEthernet1/10  
no switchport  
ip address 192.168.100.223 255.255.255.0  
shutdown  
!  
interface GigabitEthernet1/11  
switchport access vlan 80  
switchport mode access  
!  
interface GigabitEthernet1/12  
switchport access vlan 80  
switchport mode access  
  
interface GigabitEthernet1/13  
switchport access vlan 81  
switchport mode access  
interface Vlan80  
ip address 10.208.80.222 255.255.255.0  
!
```

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```
interface Vlan81
ip address 10.208.81.222 255.255.255.0
```

The steps below show how to configure the Spanning Tree Protocol and VLANs on SW3:

```
spanning-tree mode mst
spanning-tree extend system-id

spanning-tree mst configuration
instance 1 vlan 80
instance 2 vlan 81

interface GigabitEthernet1/0/1
switchport access vlan 81
switchport mode access
shutdown
no mdix auto
!
interface GigabitEthernet1/0/2
switchport access vlan 81
switchport mode access

interface GigabitEthernet1/0/5
switchport trunk allowed vlan 20,80,81,88
switchport mode trunk

interface GigabitEthernet1/0/8
switchport access vlan 80
switchport mode access
```

The steps below show how to configure the Spanning Tree Protocol and VLANs on SW4:

```
spanning-tree mode mst
spanning-tree extend system-id
!
spanning-tree mst configuration
instance 1 vlan 80
instance 2 vlan 81
vlan 80
name MST-PRP2

vlan 81
name MST-PRP1

interface gigabitethernet0/3
port-type nni
switchport trunk allowed vlan 20,80,81,88
switchport mode trunk

interface gigabitethernet0/7
port-type nni
switchport access vlan 80
!
interface gigabitethernet0/8
port-type nni
switchport access vlan 80

interface GigabitEthernet1/17
port-type nni
switchport access vlan 81

interface GigabitEthernet1/18
port-type nni
```


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```
switchport access vlan 81
```

The steps below show how to configure the Spanning Tree Protocol and VLANs on SW5:

```
spanning-tree mode mst
spanning-tree extend system-id

spanning-tree mst configuration
instance 1 vlan 80
instance 2 vlan 81

vlan 80
name MST-PRP2

vlan 81
name MST-PRP1

interface gigabitethernet1/7
switchport access vlan 80
switchport mode access
ip device tracking maximum 0

interface gigabitethernet1/8
switchport access vlan 80
switchport mode access
ip device tracking maximum 0

interface GigabitEthernet1/17
switchport access vlan 81
switchport mode access
ip device tracking maximum 0
!
interface GigabitEthernet1/18
switchport access vlan 81
switchport mode access
ip device tracking maximum 0
```

(Optional) General Usage Precision Time Protocol (PTP) Enable on LAN A Channel

PTP traffic traverses PRP within LAN A only.

	Command	Purpose
1.	configure terminal	Enters the global configuration mode.
2.	interface range {gi1/17-20}	Specifies the two Gigabit Ethernet interfaces in the PRP channel that you want to modify and enters interface mode.
3.	ptp enable	Enables PTP on the interface.
4.	exit	Exits interface mode

Disabling the PRP Channel and Group

	Command	Purpose
1.	configure terminal	Enters the global configuration mode.
2.	no interface prp-channel <i>prp-channel-number</i>	Disables the PRP channel. ■ <i>prp-channel number</i> : Value of 1 or 2.
3.	exit	Exits the interface mode.

PRP Mode LED

For IE 5000 systems with the HSR/PRP LED on the faceplate, the switch supports the following states.

Verifying Configuration

Label Description	Color and State	Description
HSR/PRP mode LED	Green (solid).	PRP mode enabled.
Port LEDs	Green (solid).	Uplink port configured for PRP channel 1 (Gi1/17,Gi1/18) and/or PRP channel 2 (Gi1/19, Gi1/20)
	Black.	Feature disabled or No uplink port configured for PRP channel 1 (Gi1/17,Gi1/18) and/or PRP channel 2 (Gi1/19, Gi1/20)
	Black.	Downlink ports.

Verifying Configuration

Command	Purpose
show prp statistics {egressPacketStatistics pauseFrameStatistics nodeTableStatistics ingressPacketStatistics ptpPacketStatistics}	Displays statistics for PRP components.
show prp control {prpProfile ptpLanOption supervisionFrameOption supervisionFrameTime supervisionFrameLeifCheckInternal supervisionFrameRedboxMacaddress pauseFrameTime}	Displays PRP control information.
show prp channel {1 2} [detail status summary] detail status summary}}	Displays configuration details for a specified PRP channel.
show control	Displays PRP control information VDAN table and supervision frame information.
show statistics	Displays ingress, egress, node table, and pause frame statistics.

Related Documents

Release Notes for the Cisco IE 5000 Series Switches for Cisco IOS Release 15.2(2)EB

Refer to IEC 62439-3 on Parallel Redundancy Protocol.

[Cisco CGS 2520 Switch Software Configuration Guide for IOS Release 15.0\(2\)SE](#) for configuration details for the Precision Time Protocol.

Feature History

Feature Name	Release	Feature Information
Parallel Redundancy Protocol including PRP mode LED.	Cisco IOS Release 15.2(2)EB	Initial support on IE 5000.

