

CPwE Parallel Redundancy Protocol Monitoring and Troubleshooting

This chapter describes management tools and diagnostic information available to monitor and troubleshoot PRP status and operation, including DANs, VDANs, and RedBox IES.

PRP Diagnostics Overview

PRP information can be obtained using Stratix IES Device Manager or WebUI, Cisco CLI commands, Studio 5000 Logix Designer Add-On Profiles (AOP), CIP message diagnostic and IACS device webpages.

The main diagnostic information for a PRP topology includes LAN Warning status and traffic statistics for individual DANs and VDANs in the node tables.

The **LAN Warning** flag indicates following conditions for LAN A or LAN B:

- Loss of communication for 3 seconds on one LAN, but not the other. This condition applies to traffic from all nodes (e.g., one of the PRP channel ports is down). The condition is cleared once communication is restored for 3 seconds.
- A DAN or VDAN Node is active on one LAN but not the other. This means that no packets were received from one of the PRP nodes in the switch table (DANs or VDANs) on one of the LANs for 3 seconds. The condition is cleared once packets are received again within 3 seconds.
- Packets from a wrong LAN were received on one of the ports in the last second. The condition is cleared once no wrong packets are received for 1 second.

Typically, a LAN Warning condition comes up after a link fault to a DAN or a RedBox. It can also mean a misconfiguration in the network, for example cables are swapped by mistake between A and B ports, or a 2-port embedded switch device without PRP is connected to both LANs.

In non-resilient linear LAN topologies, a LAN Warning condition may indicate failure of a link or an infrastructure switch in one of the LANs.

**Note**

Resilient LAN topologies, such as DLR or redundant star, may recover quickly after a fault and may not trigger the PRP LAN Warning flag. It is critical to monitor the infrastructure status, in addition to monitoring PRP-specific information, to be able to detect the fault and restore redundancy.

The **Node Table statistics** helps to identify the problem node during the LAN Warning condition. This data shows if packets are being received on each LAN for each known PRP node.

**Note**

The nodes are removed from the table after a certain time if there is no traffic coming on any of the LAN. The PRP LAN Warning flag is not sustained after a complete DAN fault.

RedBox IES

This section provides PRP information available from a RedBox IES via Device Manager or WebUI webpage or CLI commands.

Device Manager or WebUI

Stratix RedBox IES provides information about connected VDANs on the Device Manager (Stratix 5400 and Stratix 5410) or WebUI (Stratix 5800) web-based interface. The following examples are shown using the Stratix 5800 WebUI. The Device Manager information for PRP is similar.

The Monitoring - General - PRP page displays information about VDANs connected to the RedBox, known nodes (SAN, DAN or VDAN) in the PRP VLAN, and PRP channel statistics.

The VDAN MAC addresses are learned automatically from the switch MAC table. The RedBox IES sends PRP supervisory frames for each VDAN via the PRP channel ports.

Figure 4-1 Stratix 5800 VDAN Table

Vdan	Node	Statistics
Channel Group	MAC Count	Static
1	5	1

Channel	MAC Address	TTL	Dynamic
Channel 1	34C0.F9E5.1A0B		
Channel 2	34C0.F9E5.1A01	60	Y
	34C0.F9E5.1A02		

RedBox IES learns about DANs and SANs in the network from the supervisory frames received on the PRP channel ports. These frames are propagated within a VLAN as special Layer 2 multicast frames.

Figure 4-2 Stratix 5800 Node Table

Monitoring > General > PRP

Vdan	Node	Statistics
Channel Group	MAC Count	DAN Count LAN-A Count LAN-B Count
1	19	17 1 1

Channel 1	Channel 2	TTL	Dynamic	Node
	5C88.16F3.5ABB	59	Y	dan
	34C0.F9E5.9884	Packets Received A	Packets Received B	Error Packets A
	34C0.F9E5.9883	41976	41976	0
	F454.33A9.0988			Error Packets B
	34C0.F9E5.988B	Remote Type		0
	0000.0C9F.F004	RedBoxP		

- Time To Live (TTL) value shows the number of seconds since the last received frame. Node entries age out and are removed from the tables after 60 seconds.
- The switch supports a maximum of 512 SAN and DAN entries in the Node table. If the Node table is full, the switch treats new nodes as a DAN by default.
- The switch supports a maximum of 512 VDAN entries in the VDAN table. If the VDAN table is full, the switch cannot send supervisory frames for new VDANs.
- The number of DAN packets received from LAN A and LAN B should be the same or very close in a normally functioning network. The increasing difference may be due to dropping packets in one of the LANs and may require further troubleshooting.
- There should be no Wrong Packets entries. If any exist and are increasing, this indicates incorrect cabling of a DAN or a RedBox.
 - Verify if LAN A and LAN B cables are swapped on any of the modules or RedBoxes
 - Verify if any of the DAN EtherNet/IP modules is incorrectly configured in the DLR mode

**Note**

DANs, SANs, and VDANs can be manually added to and deleted from the corresponding tables on the **Configure - PRP** page. Normally dynamic learning should be sufficient. Static configuration may be needed only if PRP devices do not support supervisory frames.

Command-line Interface

CLI diagnostics commands for PRP provide more detailed information for troubleshooting.

- “**show prp statistics egress**” command shows detailed packet counts and byte counts for transmitted frames over the PRP channel.

```
PRP-IES-RB1#show prp statistics egressPacketStatistics
```

```
PRP channel-group 1 EGRESS STATS:
duplicate packet: 2308893385
supervision frame sent: 7883182
packet sent on lan a: 2308893377
packet sent on lan b: 2308890642
byte sent on lan a: 389844980047
byte sent on lan b: 389924896911
egress packet receive from switch: 2309098088
overrun pkt: 0
overrun pkt drop: 0
```

- “**show prp statistics ingress**” command shows detailed packet counts and byte counts for different types of frames received on the PRP channel.

```
PRP-IES-RB1#show prp statistics ingressPacketStatistics
```

```
PRP channel-group 1 INGRESS STATS:
ingress pkt lan a: 2503748276
ingress pkt lan b: 2503792103
ingress crc lan a: 0
ingress crc lan b: 0
ingress danp pkt acpt: 2449954701
ingress danp pkt dscrd: 2449759968
ingress supfrm rcv a: 53914548
ingress supfrm rcv b: 53914032
ingress over pkt a: 0
ingress over pkt b: 0
ingress pri over pkt a: 0
ingress pri over pkt b: 0
ingress oversize pkt a: 0
ingress oversize pkt b: 0
ingress byte lan a: 530416337651
ingress byte lan b: 530510451733
ingress wrong lan id a: 0
ingress wrong lan id b: 0
ingress warning lan a: 1
ingress warning lan b: 0
ingress warning count lan a: 1
ingress warning count lan b: 0
ingress unique count a: 105123619610672
ingress unique count b: 377957242996
ingress duplicate count a: 2449759973
ingress duplicate count b: 2449759973
ingress multiple count a: 0
ingress multiple count b: 0
```

- **Ingress Warning** status indicates following conditions for LAN A or LAN B:

Warning counts and wrong LAN counts show total number of faults since the last reset of counters.

```
PRP-IES-RB1#show prp statistics ingressPacketStatistics
```

```
<...>
ingress wrong lan id a: 12
ingress wrong lan id b: 2
ingress warning lan a: 0
ingress warning lan b: 0
ingress warning count lan a: 8
ingress warning count lan b: 3
<...>
```

- **“show prp statistics ptp”** command displays PTP traffic counters for the PRP channel. The PTP data is sent and received independently on each port, bypassing PRP duplication mechanism.

```
PRP-IES-RB1#show prp statistics ptpPacketStatistics
PRP channel-group 1 PTP STATS:
  ingress lan a: 13665146
  ingress drop lan a: 0
  ingress lan b: 14556100
  ingress drop_lan b: 0
  egress lan a: 107395
  egress lan b: 996227
```

- **“clear prp statistics”** command resets all PRP counters and could be useful when troubleshooting an ongoing problem with PRP communication.

```
PRP-IES-RB1#clear prp statistics
```

- **“show prp node-table detail”** command provides warning status and received count per LAN for each PRP node learned by the RedBox, including DANs, SANs, remote VDANs, and other RedBoxes. The table also shows the "last time seen" information for nodes on each LAN which helps to see what devices are impacted by the fault.

Figure 4-3 Node Table Statistics

```
PRP-IES-RB1#show prp node-table detail
PRP Channel 1 Node Table
```

Mac Address	Type	Dyn	TTL	Rcvd lan-a	Err lan-a	Rcvd lan-b	Err lan-b	LastTimeSeenA	LastTimeSeenB	RemoteType
F454.339D.A7F7	dan	Y	59	495452645	0	495452645	0	1	1	VDANP
001D.9CD9.4626	dan	Y	60	958488	0	958489	0	28	28	DANP
F454.3311.2447	dan	Y	59	404756	0	408147	0	2	2	VDANP
F454.3311.2448	dan	Y	59	340225	0	340225	0	106	106	VDANP
F454.33AA.3A0F	dan	Y	60	388816997	0	388817283	0	0	0	DANP
F454.3311.2402	dan	Y	59	340089	0	340087	0	105	105	RedBoxP

258344

Studio 5000 Logix Designer

Studio 5000 Logix Designer Add-on Profile provides PRP diagnostics, counters, and node information for PRP-enabled devices in the controller I/O tree.

The AOP for a Stratix RedBox IES displays PRP warning status and total counters for the PRP channel. This information is available in the AOP for Stratix IOS version 15.2(6)E2a or later.

Figure 4-4 Stratix AOP

Module Properties: Y51 (1783-HMS8TG8EG4CGN 7.001)

Channel Group 1

Network Mode: Parallel Redundancy Protocol (PRP)

Diagnostics for this node

	Port A (Gi1/1)	Port B (Gi1/2)
Network Status	OK	OK
Network Fault Count	0	0
Transmit Count	2016426	2016424
Receive Count	2179493	2179483
Wrong LAN Count	0	0
Unique Entry Count	65	59
Duplicate Entry Count	2133517	2133517
Multiple Entry Count	0	0

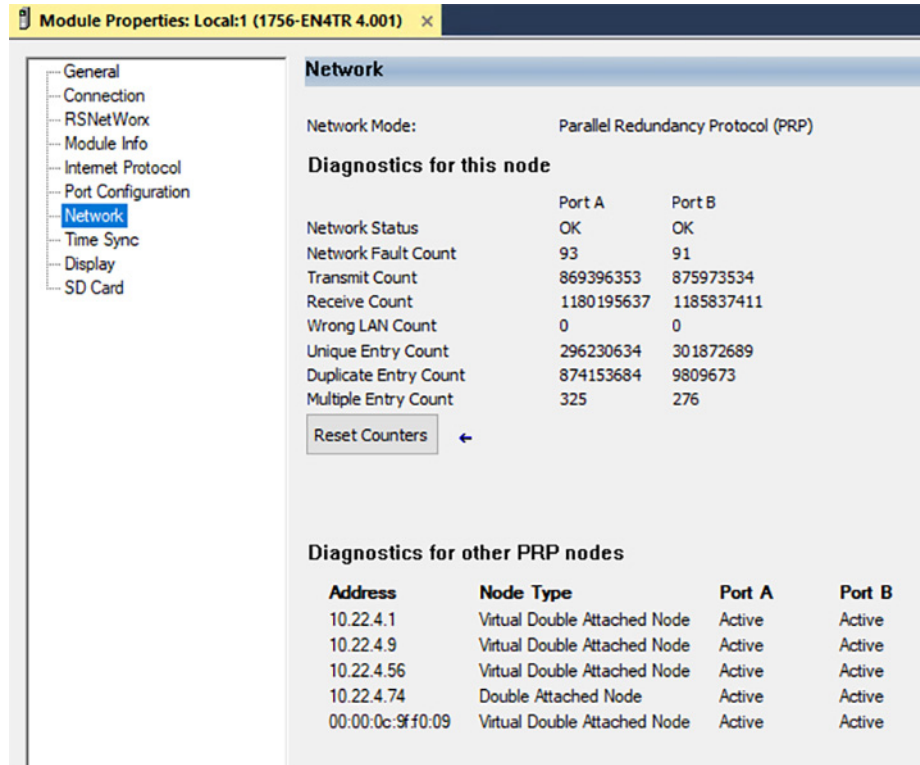
Reset Counters

258345

The AOP for a PRP EtherNet/IP module displays the PRP network status, total counters, and the node table with node status. IP addresses are displayed for PRP nodes in the I/O tree, otherwise only MAC addresses are shown.

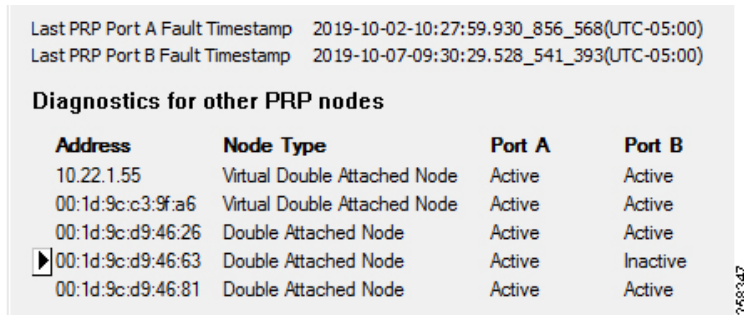
Below is an example of the PRP status page for the 1756-EN4TR module.

Figure 4-5 EtherNet/IP PRP Module AOP



The AOP for the FLEX 5000 EtherNet/IP adapter also includes a last PRP fault time stamp data (connection type “Status with PRP”).

Figure 4-6 FLEX 5000 Module AOP



The PRP warning status for a PRP EtherNet/IP module or a RedBox can be obtained by the controller program by sending a CIP message to the device. Parameters for the message instruction are shown below.

Table 4-1 CIP Message Parameters for PRP Status

Field	Parameter
Message Type	CIP Generic
Service Type	Get Attribute Single
Class	56 (Hex)
Instance	1
Attribute	11 (Hex) for LAN A 12 (Hex) for LAN B
Data Type	DINT

Figure 4-7 CIP Message Configuration

Message Configuration - LANAWarningMSG

Configuration Communication Tag

Message Type: CIP Generic

Service Type: Get Attribute Single

Service Code: e (Hex) Instance: 1

Class: 56 (Hex) Attribute: 11 (Hex)

Source Element: Source Length: 0 (Bytes)

Destination Element: LANAWarningStatus

Enable Enable Waiting Start Done Done Length: 1

Error Code: Extended Error Code: Timed Out

Error Path: PRP

Error Text:

OK Cancel Apply Help

**Note**

PRP-enabled EtherNet/IP modules also provide PRP diagnostics via webpages, similar to data available in the AOP. Depending on the platform and the firmware revision, web access to the module may need to be enabled first using AOP.