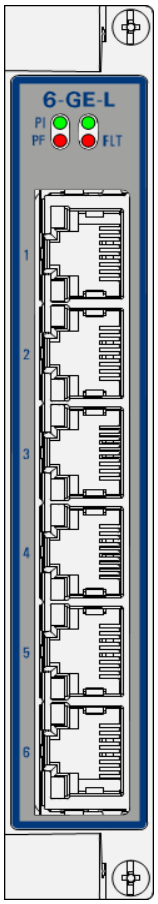
User Manual

Installation
Dragon PTN
Interface Module PTN-6-GE-L



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Contents

List of figures

List of Tables

1. INTRODUCTION

1.1 General

This document is valid as of Dragon PTN Release 4.0DR.

This document describes the PTN-6-GE-L interface module which provides Layer2 functionality. This Interface Module has 6 electrical LAN (LAN = Local Area Network) ports on the front panel: 6*1Gbps RJ45 ports. Each individual port can be configured via HiProvision (=Dragon PTN Management System). PTN-6-GE-L refers to '6 ports – Gigabit Ethernet – LAN'.

Verify the 'Dragon PTN Bandwidth Overview' manual (Ref. [100] in Table 1) to see in which node and Interface Module slot this Interface Module can be used.

Main supported features:

- Gigabit Ethernet LAN Ports: 6 x RJ45: 10/100/1000BASE-T copper;
- 4 back end ports, each 1Gbps, to the CSM;
- Layer2 Switch
  - L2 VLAN handling;
  - QoS;
  - MSTP (=Multiple Spanning Tree);
  - LAG (=Link Aggregation);
- Port Mirroring;
- Storm Control;
- BPDU Guard via MSTP;
- MRP (=Media Redundancy Protocol) Support.

1.2 Manual References

Table 1 is an overview of the manuals referred to in this manual. All these manuals can be found in the HiProvision (=Dragon PTN Management System) Help function.

Table 1 Manual References

Ref.	Manual	Title
[1]	UM_BasicConfig_Dragon-PTN_and_HiProvision-Operation_Rel_4-0DR_1019_en.pdf	Dragon PTN and HiProvision Operation
[2]	IG_Dragon-PTN_Installation-and-Operation_02_1019_en.pdf	Dragon PTN Installation and Operation
[4]	IG_Dragon-PTN_PTN-CSM310-A_02_1019_en.pdf	Dragon PTN Switching Module: PTN-CSM310-A
[5]	IG_Dragon-PTN_PTN-1-10G-LW_02_1019_en.pdf	Dragon PTN Interface Module: PTN-1-10G-LW
[6]	IG_Dragon-PTN_PTN-4-GC-LW_PTN-4-GCB-LW_02_1019_en.pdf	Dragon PTN Interface Module: PTN-4-GC-LW/ PTN-4-GCB-LW
[7]	IG_Dragon-PTN_TRMs_SFP_XFP_02_1019_en.pdf	Dragon PTN TRMs (Transmit Receive Modules: SFP, XFP)
[8]	IG_Dragon-PTN_General-Specifications_01_1019_en.pdf	Dragon PTN General Specifications
[9]	IG_Dragon-PTN_PTN-4-GO-LW_01_1019_en.pdf	Dragon PTN Interface Module: PTN-4-GO-LW
[100]	UM_Dragon-PTN_Bandwidth-Overview_01_1019_en.pdf	Dragon PTN Bandwidth Overview

2. MODULE DESCRIPTION

2.1 Front Panel

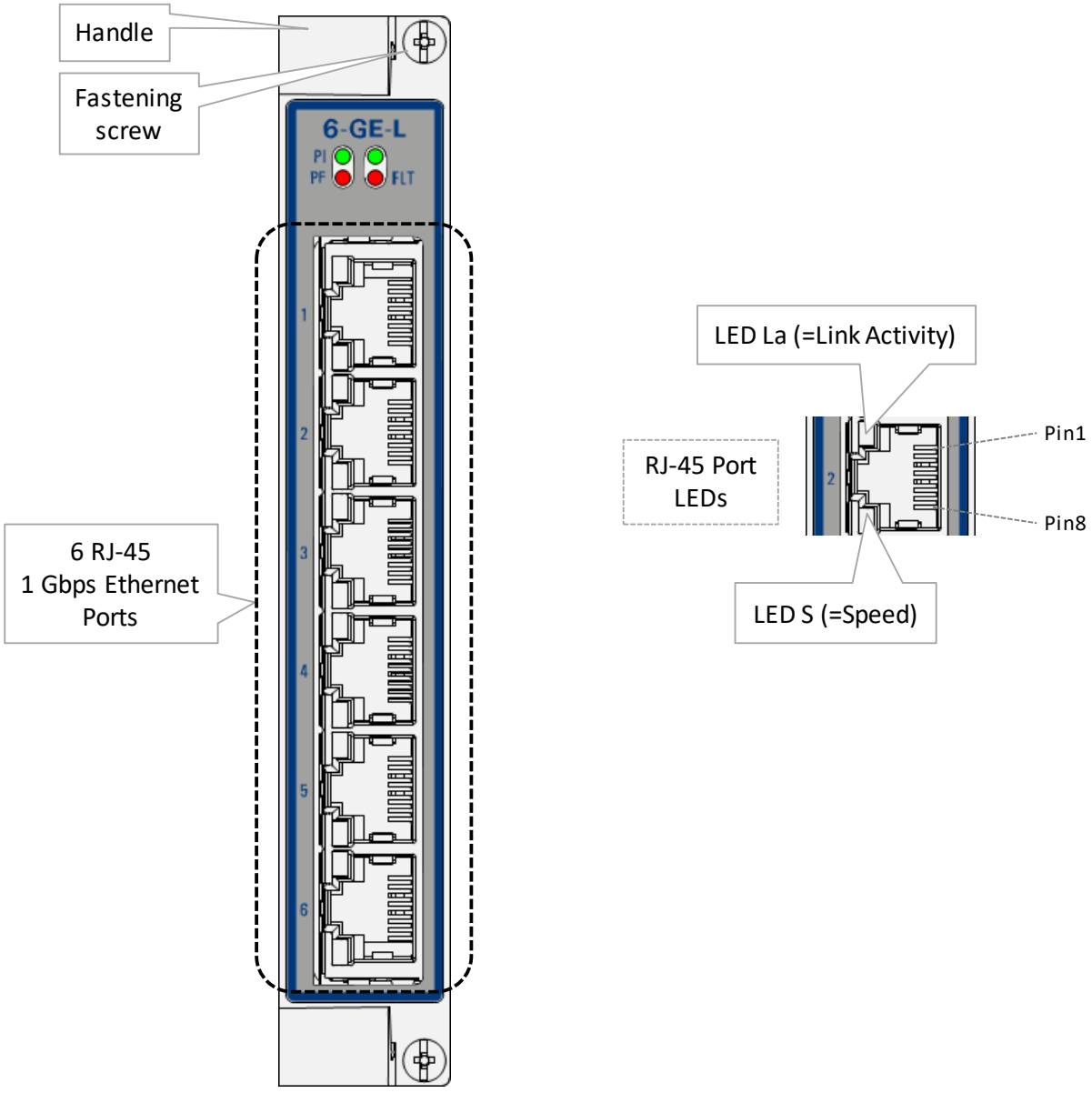

Figure 1 Front Panel

2.1.1 Insert/Remove Module from Node

See 'Dragon PTN Installation and Operation Manual' Ref.[2] in Table 1.

2.1.2 LEDs

a. Interface Module LEDs

The meaning of the LEDs depends on the mode of operation (= boot or normal) in which the PTN-6-GE-L module currently is running. After plugging in the module or rebooting it, the module turns into the boot operation, see Table 2. After the module has gone through all the cycles in the table below (=rebooted successfully), the module turns into the normal operation, see LEDs in Table 3.

Table 2 LED Indications In Boot Operation

Cycle	PI	PF	FLT	Spare LED
1	x	---	---	---
2	x	---	x	x
3	x	---	---	---
x : LED is lit / --- : LED is not lit. The sub cycle times may vary. The entire boot cycle time [1→3] takes less than 1 minute.				

Table 3 LED Indications in Normal Operation

LED	Color	Status
PI (=Power Input)	Not lit, dark	+12V power input to the board not OK
	Green	+12V power input to the board OK
PF (=Power Failure)	Not lit, dark	power generation on the board itself is OK
	Red	power generation on the board itself is erroneous
FLT (=FauLT)	Not lit, dark	no other fault or error situation, different from PF, is active on the module
	Red	a fault or error situation, different from PF, is active on the module
1G Port (Port 1..6) LA<port n°> (=Link Activity)	Not lit, dark	The link on port<port n°> is down
	Yellow lit	The link on port<port n°> is up, no activity
	Yellow blinking	The link on port<port n°> is up, with activity
1G Port (Port 1..6) S<port n°> (=Speed)	Dark	10 Mbps
	Orange,lit	1000 Mbps
	Green, lit	100 Mbps

2.1.3 Connectors

This module has following ports:

- **Port1…6 = RJ45 Ethernet port:** 10/100/1000Base-T Gigabit Ethernet copper port. Use CAT5E shielded cables for 10/100Base-T and CAT6 shielded cables for 1000Base-T to connect these ports.

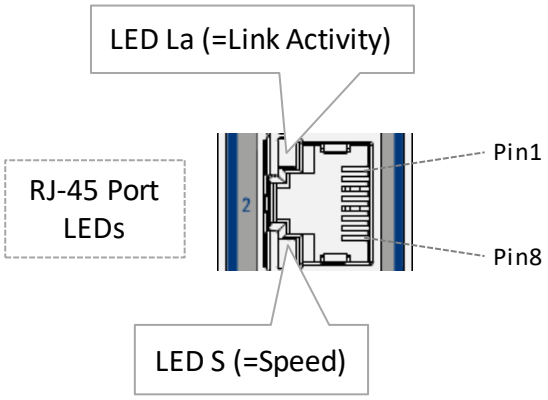

Figure 2 RJ45 Ethernet port

Table 4 RJ45 Ethernet port: Pin Assignments

Pin No.	Signal 100/100Base-T	Signal 1000Base-T
1	Transmit output (+)	DA+
2	Transmit output (-)	DA-
3	Receive input (+)	DB+
4	---	DC+
5	---	DC-
6	Receive input (-)	DB-
7	---	DD+
8	---	DD-

2.2 Functional Operation

The PTN-6-GE-L performs following major tasks:

2.2.1 Media Module for Ethernet: Interfacing to a LAN Network

WAN ports interconnect nodes within the Dragon PTN network (MPLS-TP) whereas LAN ports interconnect the nodes with their applications. The PTN-6-GE-L Interface Module has LAN ports and as a result can not be used to interconnect nodes. Interconnecting nodes on the WAN side must be done via LAN/WAN Ethernet Interface Modules (PTN-4-GC-LW, ...).

A LAN port talks Ethernet and a WAN port talks MPLS-TP. As a result, the node can serve as an edge node (or LER = Label Edge Router) where traffic is received on a LAN port, mapped into pseudowire and forwarded to the correct label switched path on a WAN port.

For a configured application service, the node can operate as a:

- LER = Label Edge Router or access node: The node is located on the edge between the LAN and WAN. The node converts Ethernet into MPLS-TP and vice versa;
- LSR = Label Switching Router: The node is fully located in the WAN. The node has no end-points for the configured application service, it only forwards MPLS-TP traffic via label switched paths;

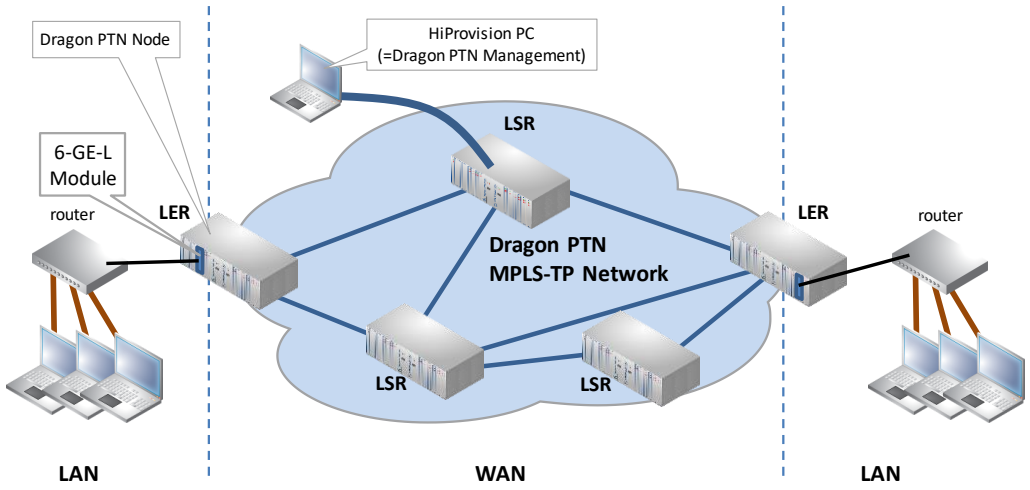

Figure 3 General Example

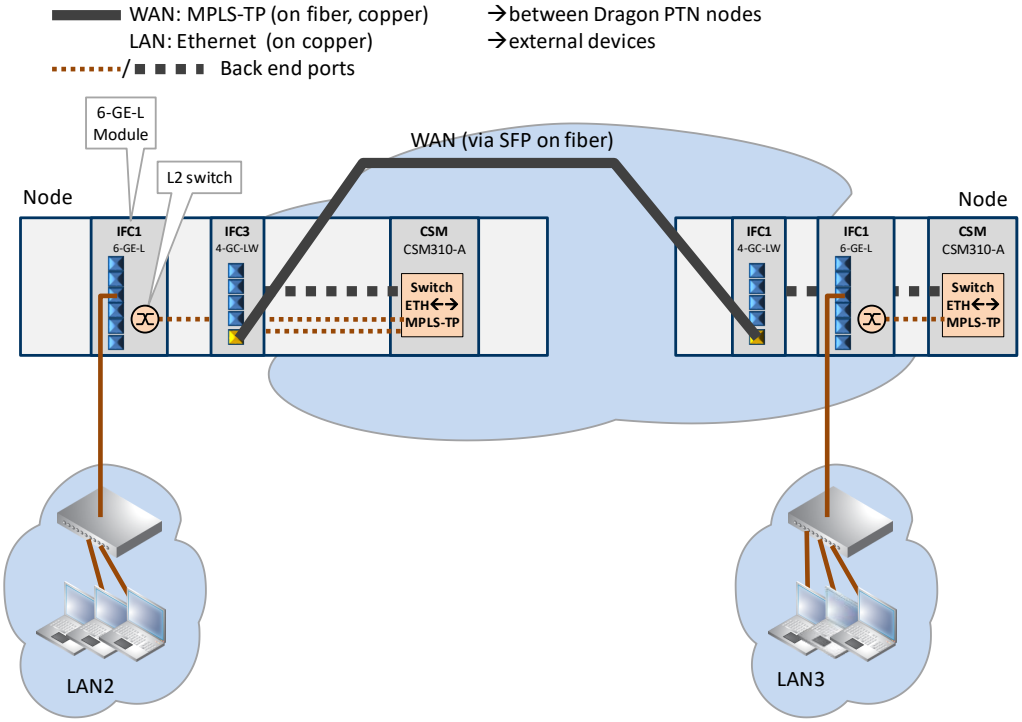

Figure 4 Detailed Example

2.2.2 I/O with the Central Switching Module (=CSM)

The PTN-6-GE-L module receives Ethernet traffic via its front panel ports and forwards this to the CSM via the L2 switch back end ports on the CSM. The CSM does all the processing on this data (synchronization, CRC checks, conversions, switching…). The resulting data will be forwarded via the backplane to one of the Interface Modules in the node.

2.2.3 Ethernet Service

a. General

The PTN-6-GE-L Interface Module access or end-points communicate over the Dragon PTN network via an Ethernet service. This service must be configured via HiProvision. This service can operate port or VLAN based.

b. Port Based / VLAN Based

- Port based: Use this mode if all the traffic on a port must be transported transparently in one and the same service;
- VLAN based/VLAN ID: Use this mode if each VLAN (ID) on a port must have its own service. Ethernet packets with the configured VLAN ID will be forwarded in this service, other VLAN IDs and untagged packets will be dropped. This behavior can be overruled by a more advanced VLAN processing in the 'VLAN Tagging/Untagging' feature in HiProvision. This feature also supports VLAN translation which replaces VLAN ID 'x' into VLAN ID 'y'.

c. VLAN Based Local Service

A VLAN Based Local service is a VLAN based service between only the LAN front ports on PTN-6-GE-L Interface Modules. This service does not use back end ports, tunnels, WAN ports, the Dragon PTN network and as a result, this service does not consume network bandwidth.

d. Configuration

See Ref. [1] in Table 1 for more configuration information in HiProvision.

2.2.4 Voice Service

The PTN-6-GE-L Interface Module ports can be used in a Voice service. This service must be configured via HiProvision. See Ref. [1] in Table 1 for more configuration information on a Voice service in HiProvision.

2.2.5 Layer2: VLAN handling

Both port based and VLAN based Ethernet services are supported in which VLANs can be handled (tagging/untagging behavior, Qos, ...). See Ref. [1] in Table 1 for more configuration information in HiProvision.

2.2.6 Layer2: QoS (=Quality of Service)

Each Ethernet service can be assigned its own quality of service (bandwidth, priority, burstsize). See Ref. [1] in Table 1 for more configuration information in HiProvision.

2.2.7 Layer2: MSTP (=Multiple Spanning Tree)

MSTP originally defined in IEEE 802.1s and later merged into IEEE 802.1Q-2003, defines an extension to RSTP to further develop the usefulness of VLANs. This MSTP instance configures a separate Spanning Tree for all VLANs included in this instance and blocks all but one of the possible alternate paths within each Spanning Tree.

If there is only one VLAN in the network, single (traditional) STP works appropriately. If the network contains more than one VLAN, the logical network configured by single STP would work, but it is possible to make better use of the alternate paths available by using an alternate spanning tree for different VLANs or groups of VLANs. More than one VLAN can be assigned to one MST instance. Multiple MST regions can be operational, each having its own MSTP instances. The IST (MSTP) instance monitors the entire Region, the CST (MSTP) instance monitors the links between the regions.

MSTP in a port based service is supported network wide whereas MSTP in a VLAN based service is supported only locally (not over the PTN-6-GE-L back end ports). CAUTION: using a VLAN based service with MSTP over the back end ports could cause loops!

MSTP is fully supported on PTN-6-GE-L Interface Modules. On PTN-6-GE-L Interface Modules, there is always a default MSTP running even if no MSTP is configured in HiProvision. See Ref. [1] in Table 1 for more configuration information in HiProvision.

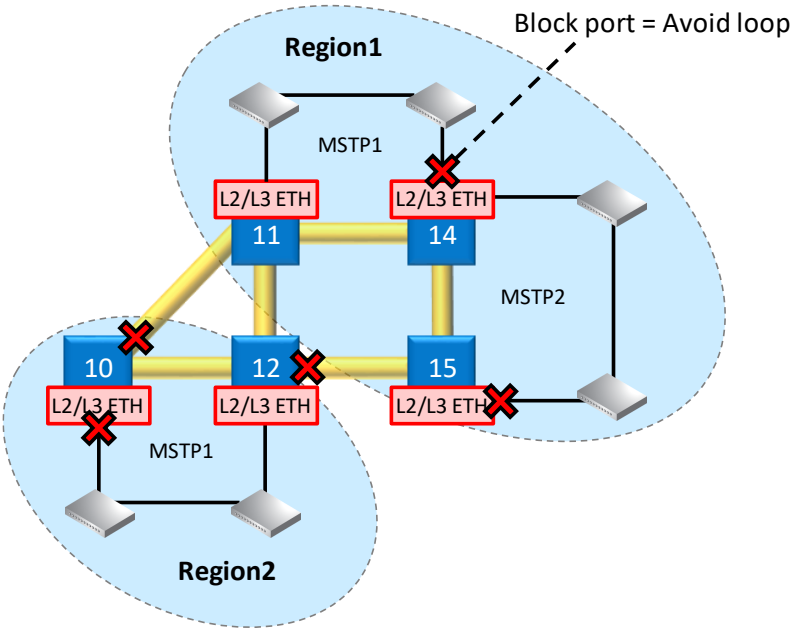

Figure 5 MST Example

2.2.8 Layer2: LAG (=Link Aggregation Group)

Link Aggregation is the bundling (=aggregation) of multiple parallel 1 Gbps links between a source and destination into one logical link. The resulting combined logical link:

- has at least one 1 Gbps bandwidth, but can have more bandwidth if both conditions below are met:
  - multiple streams from different MAC addresses are streamed over the LAG;
  - the LAG algorithm results in loadsharing these streams over different links within the LAG;
- offers loadsharing;
- offers redundancy in case one of the individual links should fail.

LAG is configured in HiProvision. See Ref. [1] in Table 1 for more configuration information in HiProvision.

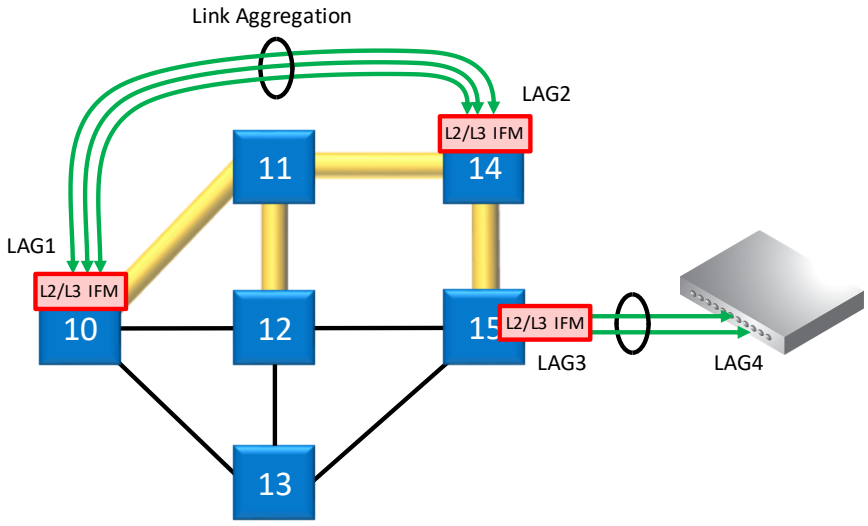

Figure 6 LAG Example

2.2.9 Storm Control on Ethernet LAN Port

A traffic storm is the growing of excessive network traffic due to Ethernet packets flooding the LAN. Such a storm can for example occur because of a data loop in the network due to no or misconfiguration of MSTP. These storms degrade the network performance and must be avoided whenever possible. The storm control feature:

- is an extra protection against these traffic storms;
- can be configured on the Interface Module ports;
- limits the amount of unlearned received data (Unicast, Broadcast, Multicast) on the LAN port ingress or input side;
- limits the amount of transmitted data (all data) on the LAN port egress or output side;
- Data that exceeds the configured limitations will be dropped. As a result, a possible data storm cannot overload the node processor or the node will limit outgoing data.

See Ref. [1] in Table 1 for more configuration information in HiProvision.

2.2.10 Port Mirroring

Port Mirroring is a network debugging or monitoring feature. It is used in the Dragon PTN node to send a copy of network packets seen on a source port (=mirrored port) to a destination port (=mirroring port). This feature can be used for network appliances that require monitoring of network traffic, such as an intrusion-detection system etc... Port mirroring is supported when source and destination ports are located in the same PTN-6-GE-L Interface Module. See Ref. [1] in Table 1 for more configuration information in HiProvision.

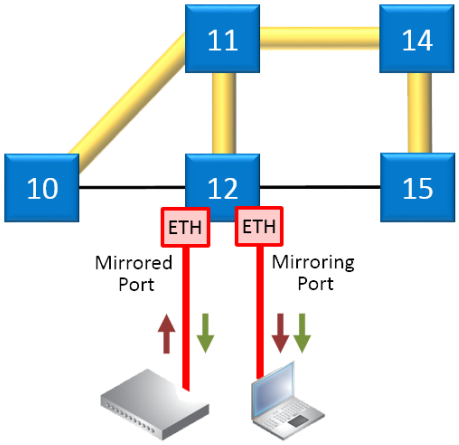

Figure 7 Port Mirroring Example

2.2.11 BPDU Guard via MSTP

BPDU Guard on PTN-6-GE-L Interface Modules is supported via the MSTP protocol wizard which can be configured in HiProvision. BPDU Guard (=Bridge Protocol Data Unit) is a LAN port property or feature that shuts down the LAN port when a BPDU packet enters this port. As a result, this feature or Interface Module:

- protects the network against possible loops created via this Interface Module;
- protects a running MSTP protocol somewhere else in the Dragon PTN network from external MSTP influences via this LAN port, e.g. root bridge protection etc....

See Ref. [1] in Table 1 for more configuration information in HiProvision.

2.2.12 MRP (=Media Redundancy Protocol) Support

The MRP is a protocol (IEC 62439-2) especially designed for industrial applications which need a predictable fail-over time. This protocol can only be used in a ring-topology network and makes sure that the ring network stays loop-free. MRP does in ring networks what spanning tree does in meshed networks but with much faster convergence times. The ring has one selected MR Manager (MRM) and a number of MR Clients (MRC). The two Dragon PTN nodes act as MRC. See Ref. [1] in Table 1 for more configuration information in HiProvision.

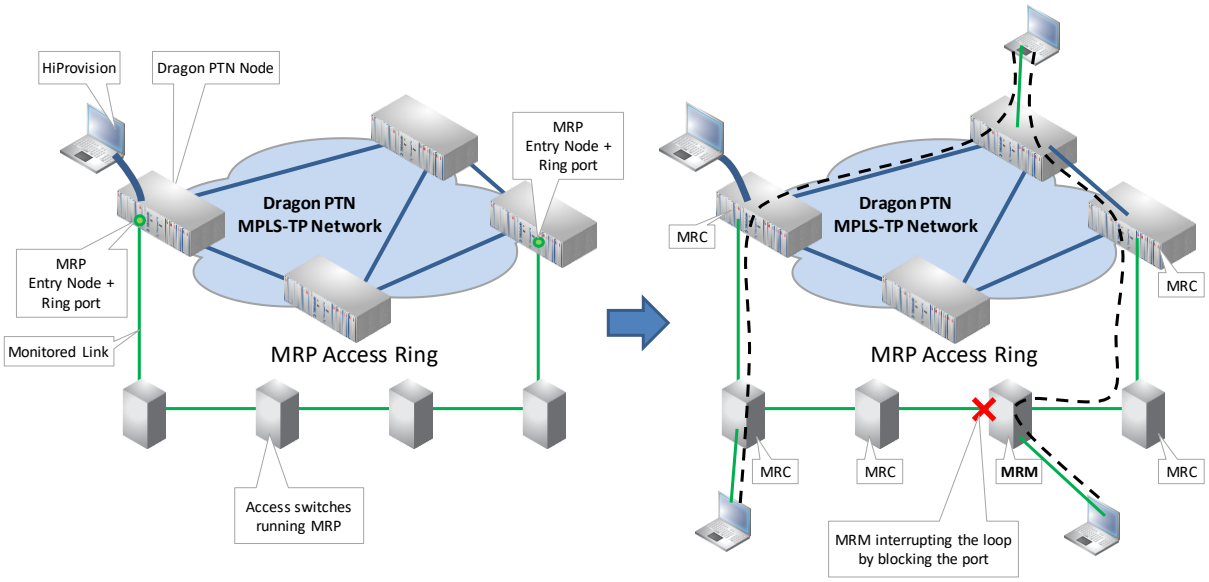

Figure 8 MRP: General Example

2.2.13 Protocol Scalability Parameters

An overview can be found in Ref. [1] in Table 1 in the Protocols chapter.

2.2.14 Hardware Edition

The hardware edition of this Interface Module has been factory set and can not be changed! It can be read out via HiProvision, see Ref. [1] in Table 1.

2.3 Onboard Interfaces

2.3.1 Straps

No straps on the board.

2.3.2 Rotary DIP Switches

No rotary DIP switches on board.

3. MODULE SPECIFICATIONS

3.1 General Specifications

For general specifications like temperature, humidity, EMI... see Ref.[8] in Table 1.

3.2 Other Specifications

Table 5 Other Specifications

Description	Value
Weight	0.220 kg / 0.49 lb
MTBF	128 years at 25°C/77°F
Power Consumption	7.5 W (measured at 25°C/77°F, with data transport)
Module Size	width: 20.32 mm / 0.8 inches height: 126 mm / 4.96 inches depth: 195 mm / 7.68 inches

3.3 Ordering Information

- PTN-6-GE-L: 942 236-003

4. ABBREVIATIONS

BE	Back End Port
BPDU	Bridge Protocol Data Unit
CE	Conformité Européenne
CSM	Central Switching Module
EMI	Electromagnetic Interference
ETS	Industrial Ethernet Switch
FLT	Fault
FP	Front Port
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
LAG	Link Aggregation
LAN	Local Area Network
LER	Label Edge Router
LSA	Link State Advertisement
LSR	Label Switching Router
MRC	Media Redundancy Clients
MRM	Media Redundancy Manager
MRP	Media Redundancy Protocol
MSTP	Multiple Spanning Tree
MTBF	Mean Time Between Failures
Qos	Quality of Service

PTN	Packet Transport Network
VFI	Virtual Forwarding Interface
VID	VLAN ID
VLAN	Virtual LAN
WAN	Wide Area Network