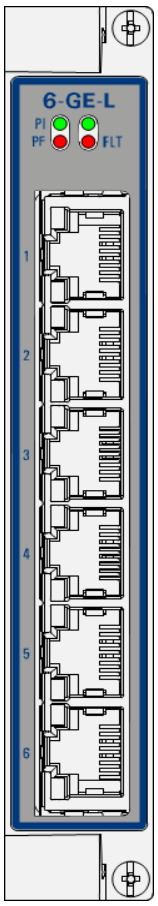
User Manual

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



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1. INTRODUCTION

1.1 General

This document is valid as of Dragon PTN Release 4.3DR.

This document describes the 6-GE-L interface module (=IFM) which provides Layer2 functionality. This IFM is often referred to as the 'L2 IFM'. This IFM 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). 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 IFM slot this IFM can be used. This IFM requires an interface adapter kit in core nodes which is not needed in aggregation nodes (see §2.1, Nodes: see Ref. [3], [3b] in Table 1). 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 ASIC
  - L2 VLAN handling;
  - QoS;
  - MSTP (=Multiple Spanning Tree);
  - LAG (=Link Aggregation);
  - IGMP Snooping (IGMP=Internet Group Management Protocol)
- Port Mirroring;
- Storm Control;
- BPDU Guard via MSTP;
- RGERP (=Redundant Gigabit Ethernet Ring Protocol) Support;
- MRP (=Media Redundancy Protocol) Support.

1.2 Manual References

Table 1 is an overview of the manuals referred to in this manual. '&' refers to the language code, '*' refers to the manual issue. All these manuals can be found in the HiProvision Help.

Table 1 Manual References

Ref.	Number	Title
[1]	DRA-DRM801-&-*	Dragon PTN Installation and Operation
[2Mgt]	DRA-DRM830-&-*	HiProvision Management Operation
[2Eth]	DRA-DRM831-&-*	Dragon PTN Ethernet Services
[2Leg]	DRA-DRM832-&-*	Dragon PTN Legacy Services
[2Net]	DRA-DRM833-&-*	Dragon PTN Network Operation
[3]	DRB-DRM802-&-*	Dragon PTN Aggregation Nodes: PTN2210, PTN2206, PTN1104, PTN2209
[3b]	DRB-DRM840-&-*	Dragon PTN Core Nodes: PTN2215
[4]	DRB-DRM803-&-*	Dragon PTN Switching Module: PTN-CSM310-A/PTN-CSM540-A
[7]	DRE-DRM823-&-*	Dragon PTN Interface Module: PTN-9-L3A-L (Main)/PTN-9-L3EA-L (Extension)
[8]	DRA-DRM810-&-*	Dragon PTN General Specifications
[100]	DRA-DRM828-&-*	Dragon PTN Bandwidth Overview

2. MODULE DESCRIPTION

2.1 Front Panel

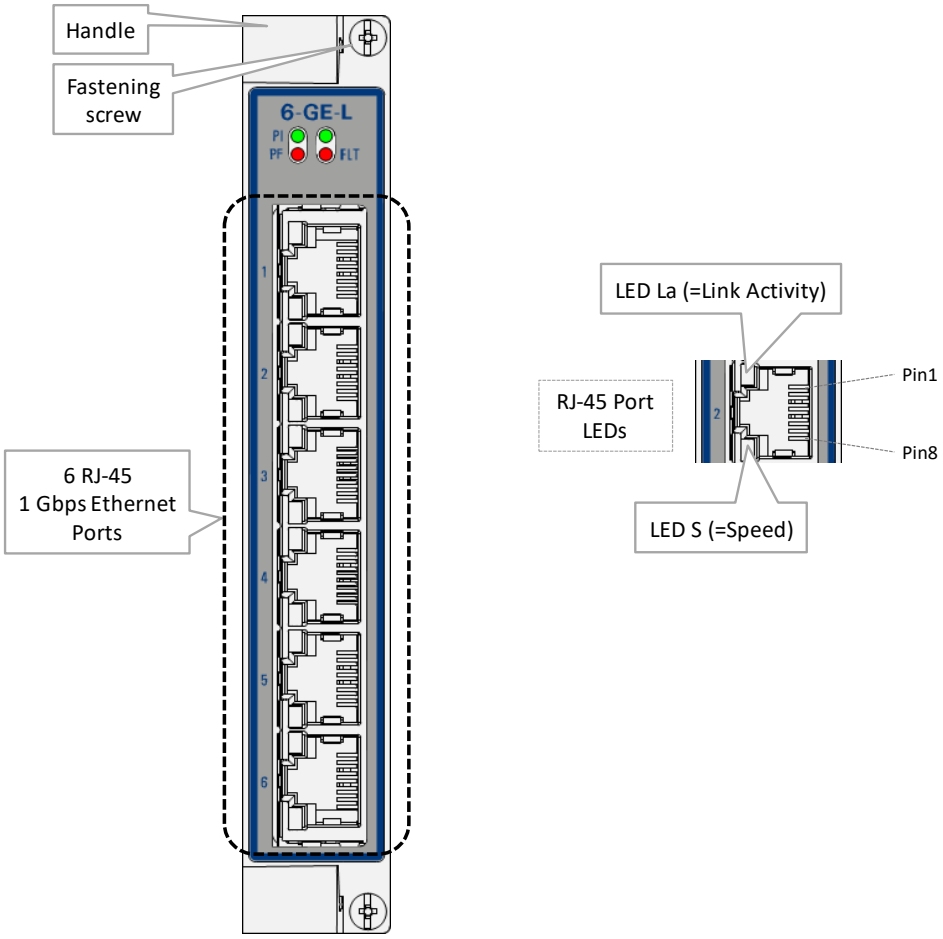

Figure 1 Front Panel In Aggregation Node

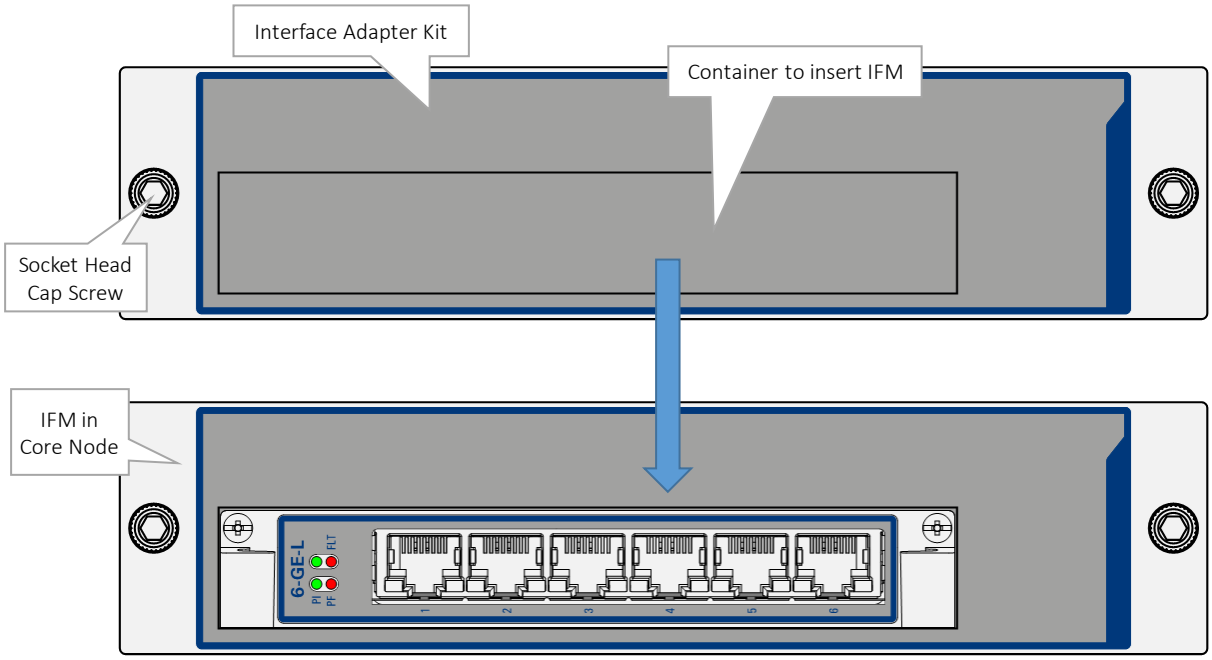

Figure 2 Front Panel In Core Node: Interface Adapter Kit Required

2.1.1 Insert/Remove Module from Node

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

2.1.2 LEDs

a. IFM LEDs

The meaning of the LEDs depends on the mode of operation (= boot or normal) in which the L2 IFM 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	✓	---	---	---
2	✓	---	✓	✓
3	✓	---	---	---
✓ : 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.

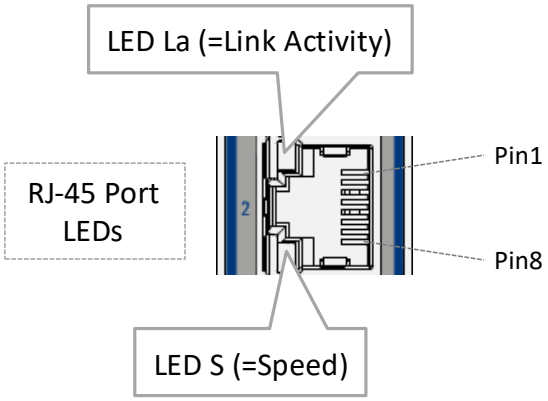

Figure 3 RJ45 Ethernet port

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 L2 IFM 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 L2 IFM 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 IFMs (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;

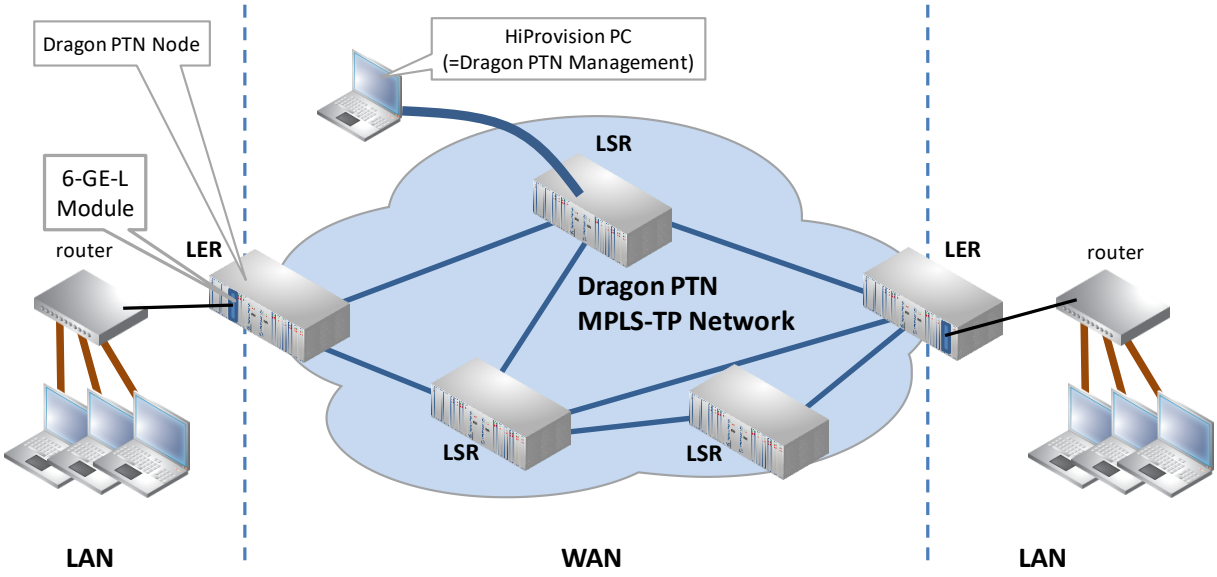

Figure 4 General Example

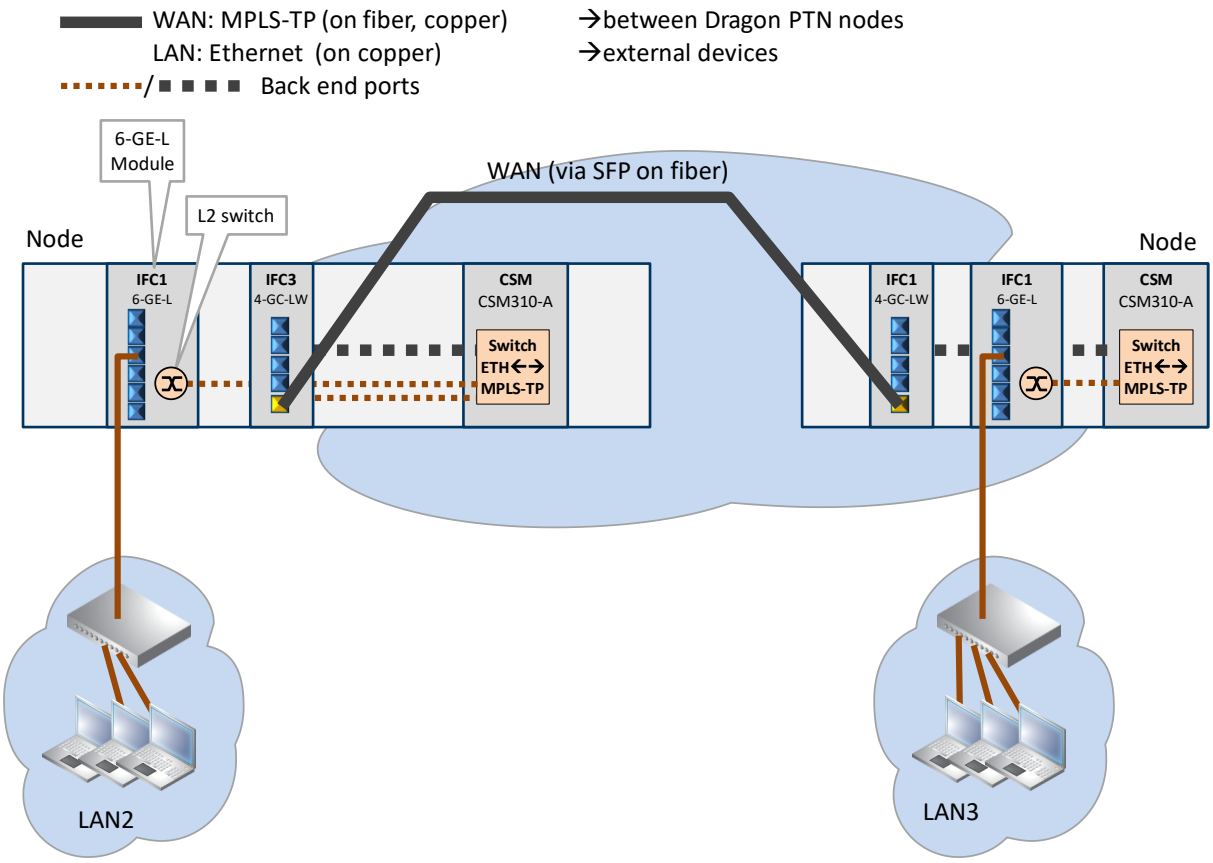

Figure 5 Detailed Example

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

The L2 IFM receives Ethernet traffic via its front panel ports and forwards this to the CSM via the L2 IFM 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 IFMs in the node.

2.2.3 Ethernet Service

a. General

The access or end-points of the L2 IFM communicates over the Dragon PTN network via an Ethernet service. This service must be configured via HiProvision. This service can operate port or VLAN based. An Overview can be found in the figure below. For the L3 IFM, see Ref.[7] in Table 1.

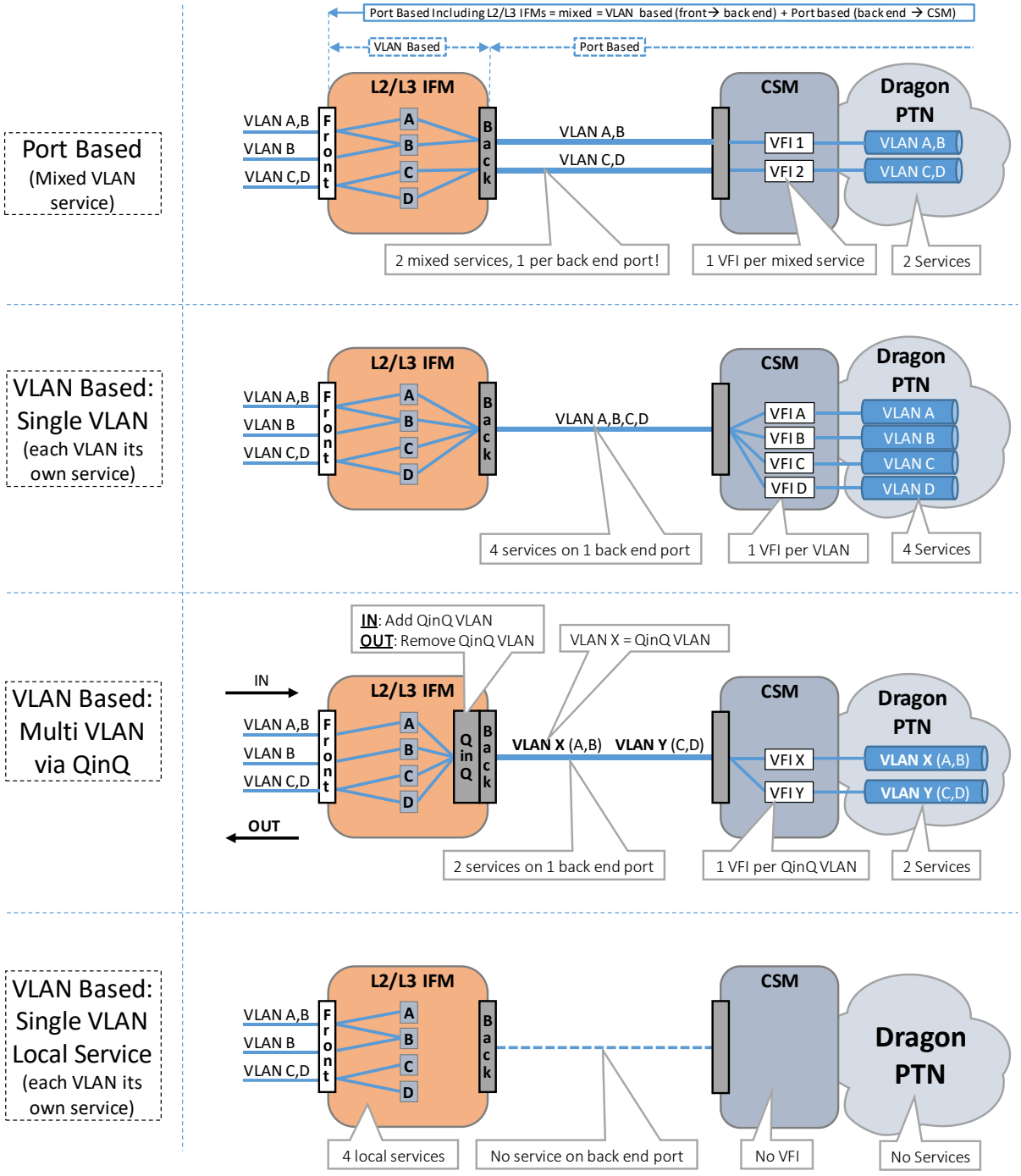

Figure 6 Ethernet Service Overview on L2/L3 IFM

b. Port Based (=Mixed Service)

Use this mode if all the traffic on a port must be transported transparently in one and the same service. Each port based service will consume an entire backend port on the L2 IFM. This means that no other service, either port based or VLAN based, can be configured on the used backend port. Each port based service consumes one VFI in the CSM. This service is a hybrid or mixed service that partially acts as a pure Port based on the WAN side (VLAN unaware) and partially as a VLAN based (single VLAN) service on the LAN side. The single VLAN services will be embedded (= child) in the port based service (=parent).

c. VLAN Based: Single VLAN

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'. Each backend port on the L2 IFM can carry multiple VLAN based services. Each Single VLAN based service consumes one VFI in the CSM. If you have many single VLAN based services originating in one node, it's better to consider Multi VLAN services for a more efficient usage of VFIs in the CSM.

d. VLAN Based: Multi VLAN / QinQ

With QinQ, a VLAN based service can carry multiple VLANs instead of just one. QinQ is a feature that operates at the back end ports of the L2 IFM. For incoming traffic (LAN or WAN), this feature adds an outer VLAN (=QinQ VLAN with EtherType 0x8100) around the existing VLANs resulting in double VLAN tagged Ethernet packets. For outgoing traffic (WAN or LAN), the QinQ VLAN is removed. Each backend port on the L2 IFM can carry multiple VLAN based services. Each Multi VLAN based service consumes one VFI in the CSM.

e. VLAN Based: Single VLAN Local Service

A Single VLAN Local service:

- Is a VLAN based service between only the front ports on L2 IFMs;
- Does not use back end ports, tunnels, WAN ports or the Dragon PTN network. As a result, this service does not consume network bandwidth;
- Requires an external cable if IFMs of different nodes participate in the service.

f. Configuration

See Ref. [2Eth] in Table 1 for more configuration information in HiProvision.

2.2.4 Voice Service

The L2 IFM ports can be used in a Voice service. This service must be configured via HiProvision. See Ref. [2Leg] 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. [2Eth] 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. [2Eth] 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 L2 IFM back end ports). CAUTION: using a VLAN based service with MSTP over the back end ports could cause loops!

MSTP is fully supported on L2 IFMs. On L2 IFMs, there is always a default MSTP running even if no MSTP is configured in HiProvision. See Ref. [2Eth] in Table 1 for more configuration information in HiProvision.

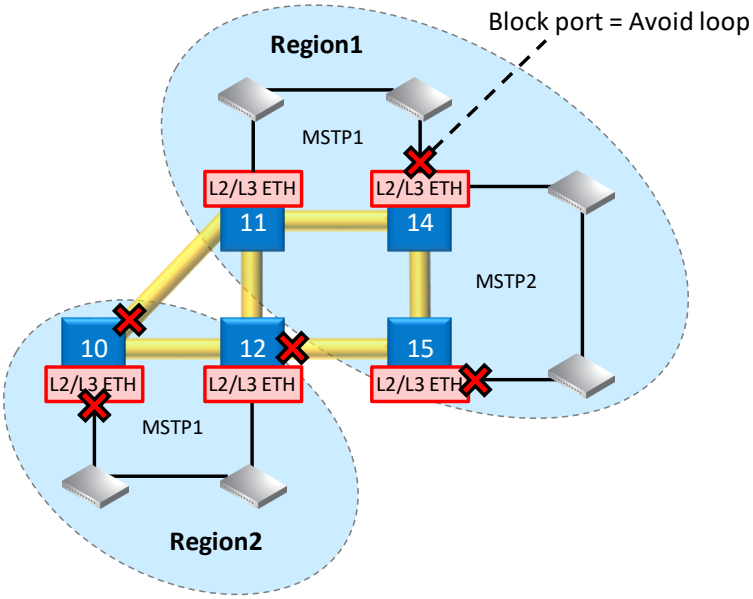

Figure 7 MST Example

2.2.8 Layer2: Link Aggregation/LAG (=Link Aggregation Group)

Link Aggregation is the bundling (=aggregation) of multiple physical Ethernet links between a source and destination side into one combined logical Ethernet link. A LAG is a combination of multiple Ethernet LAN ports within one logical port group, maximum 8 ports per LAG and 8 LAGs per node. The Link Aggregation is the communication between two LAGs. E.g. one LAG in one Dragon PTN node and the second LAG in a third party switch/application. For 1G ports, all the ports of the source and destination LAG must be in autonegotiation. On the Dragon PTN side, ports with the same speed and linked to the same switch ASIC (CSM, L2 or L3) can be added to the same LAG. Each bullet shows the possible LAG ports per switch ASIC:

- CSM: all Ethernet IFM ports (4-GC-LW, …) of the same speed in the same node;
- L2: all 6-GE-L IFM ports;
- L3: all 9-L3A-L / 9-L3EA-L IFM ports of the same speed;

NOTE: Example: Ports in different nodes can not be added to the same LAG because they are linked to different switch ASICs. CSM (4-GC-LW, …), L2 and L3 ports in a same node can not be added to the same LAG because they are linked to different switch ASICs.LAG on WAN ports and L2/L3 back end ports is not supported.

The resulting combined logical link:

- has at least the bandwidth of one individual link (1 Gbps bandwidth for a 1G port, 10 Gbps for a 10G port), 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 loadshares these streams over different links within the LAG;
- offers loadsharing based on the source and destination MAC addresses;
- offers redundancy in case one of the individual links should fail.

LAG is configured in HiProvision. See Ref. [2Eth] in Table 1 for more configuration information in HiProvision.

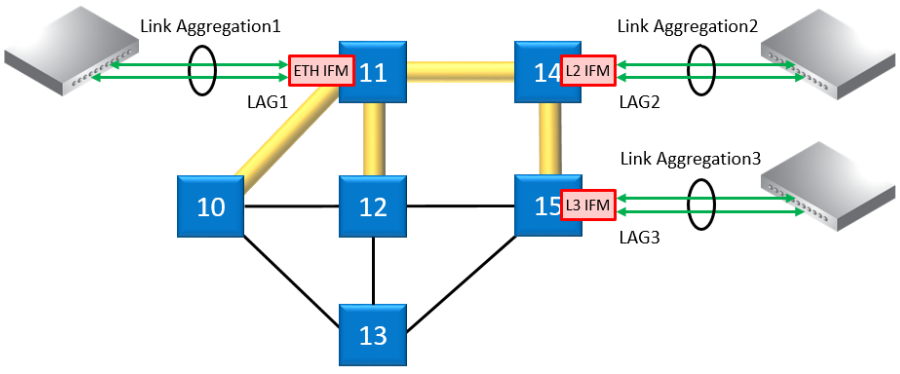

Figure 8 Link Aggregation and LAGs

2.2.9 Layer2: IGMP Snooping (IGMP = Internet Group Management Protocol)

IGMP snooping is designed to prevent hosts on a local network from receiving traffic for a multicast group they have not explicitly joined. Via IFMs that support IGMP snooping (see support matrix in Ref. [2Net] in Table 1), it provides the Dragon PTN nodes with a mechanism to diminish multicast traffic from links that do not contain a multicast listener (an IGMP client). The Dragon PTN node will, by default, flood multicast traffic to all the ports

in a broadcast domain (or the VLAN equivalent). Multicast can cause unnecessary load on host devices by requiring them to process packets they have not solicited.

CAUTION: IGMP Snooping is MAC based on L2 IFMs.

IGMP snooping allows the Dragon PTN node to only forward multicast traffic to the ports that have solicited them. IGMP snooping is not a protocol but a layer 2 optimization for the layer 3 IGMP protocol. IGMP Snooping takes place internally on IFMs that support it.

Snooping is therefore especially useful for bandwidth-intensive IP multicast applications such as IPTV. IGMP Snooping is configured in HiProvision. See Ref. [2Eth] in Table 1 for more configuration information in HiProvision.

NOTE: The mentionned PIM (=Protocol-Independent Multicast) and IGMP protocol in the figure below is only supported on the 9-L3A-L IFM, see Ref. [7] in Table 1.

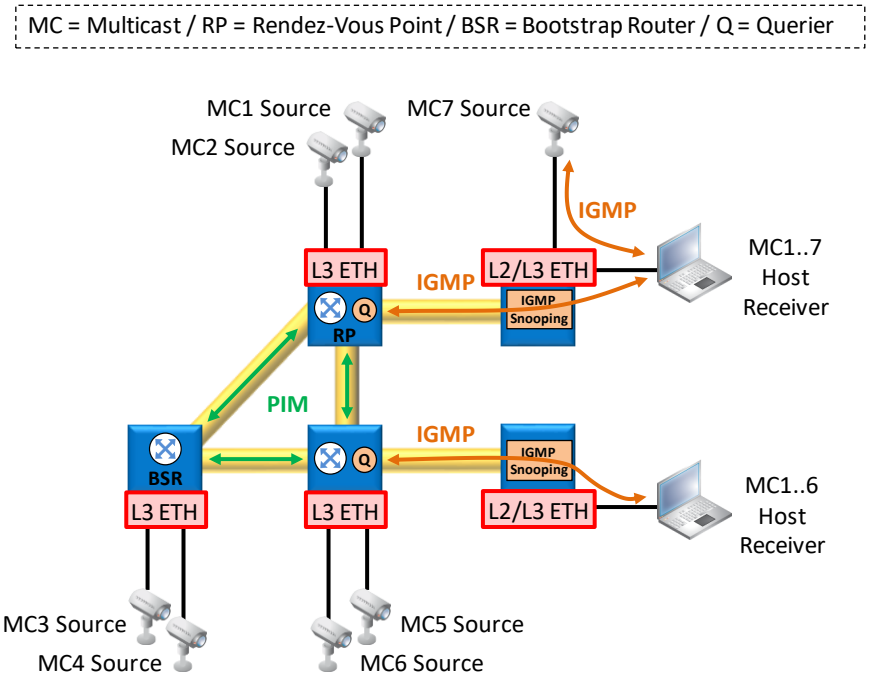

Figure 9 PIM/IGMP/IMGP Snooping Overview

2.2.10 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 IFM 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. [2Eth] in Table 1 for more configuration information in HiProvision.

2.2.11 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 L2 IFM. See Ref. [2Net] in Table 1 for more configuration information in HiProvision.

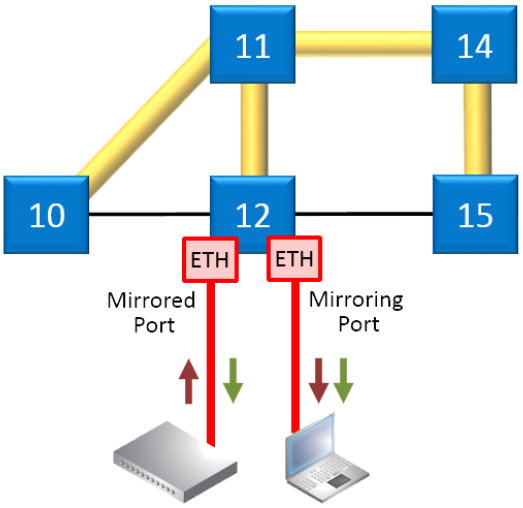

Figure 10 Port Mirroring Example

2.2.12 BPDU Guard via MSTP

BPDU Guard on L2 IFMs 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 IFM:

- protects the network against possible loops created via this IFM;
- 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. [2Eth] in Table 1 for more configuration information in HiProvision.

2.2.13 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. [2Eth] in Table 1 for more configuration information in HiProvision.

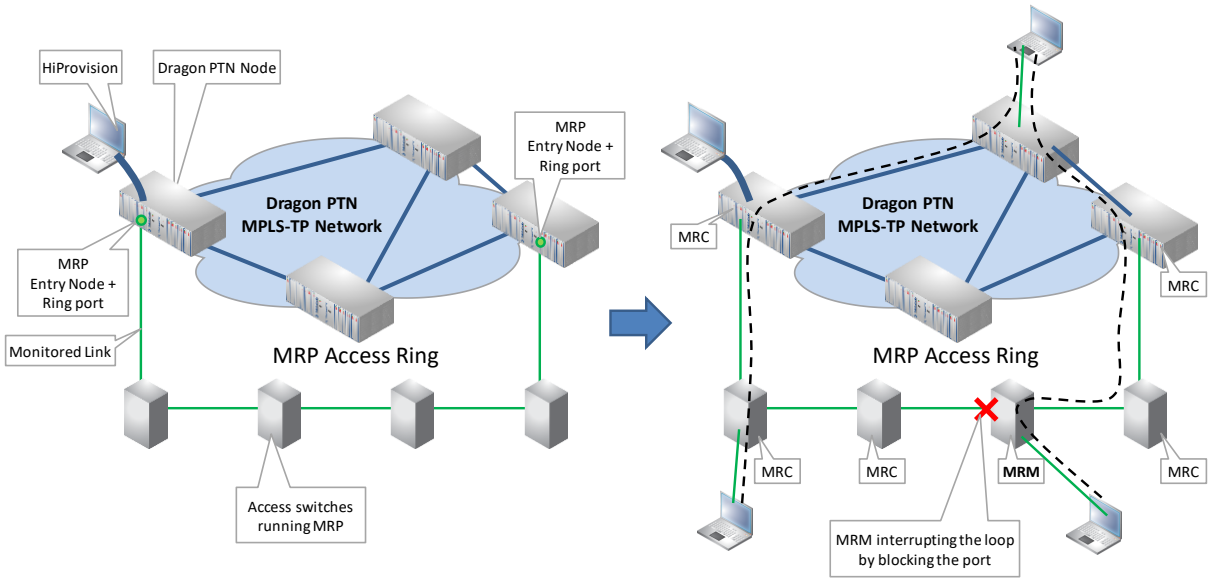

Figure 11 MRP: General Example

2.2.14 Hardware Edition

The hardware edition of this IFM has been factory set and can not be changed! It can be read out via HiProvision, see Ref. [2Mgt] in Table 1.

2.3 Onboard Interfaces

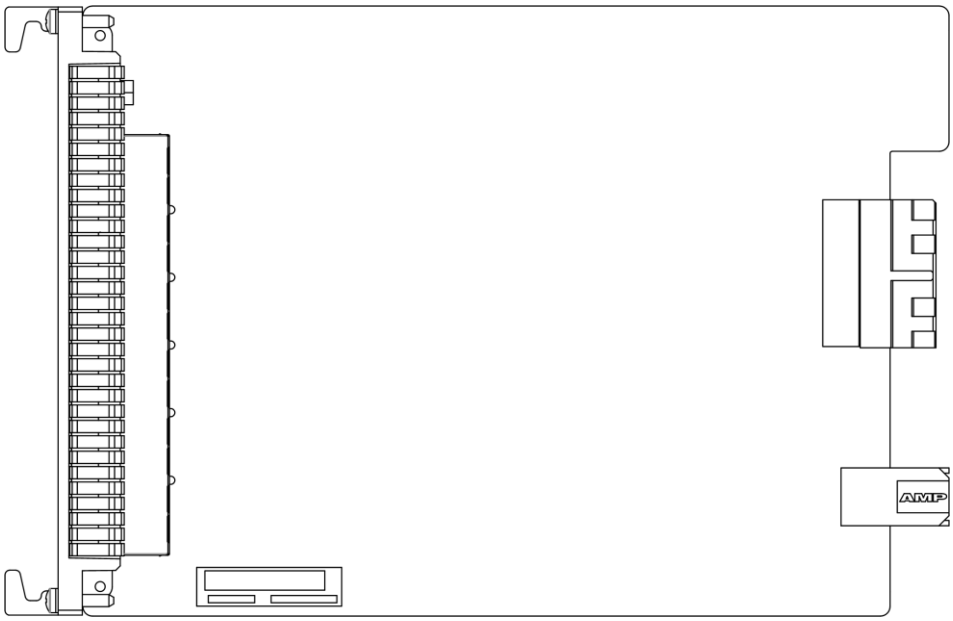

Figure 12 6-GE-L: Side View

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

- 6-GE-L: 942 236-003
- Interface Adapter Kit for Core Nodes: 942 237-007

4. ABBREVIATIONS

ASIC	Application-Specific Integrated Circuit
BE	Back End Port
BPDU	Bridge Protocol Data Unit
CE	Conformité Européenne
CSM	Central Switching Module
EMI	Electromagnetic Interference
FLT	Fault
FP	Front Port
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IFM	InterFace Module
IGMP	Internet Group Management Protocol
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
PIM	Protocol-Independent Multicast
PTN	Packet Transport Network
Qos	Quality of Service
RGERP	Redundant Gigabit Ethernet Ring Protocol
HiProvision	Dragon PTN Management System
VFI	Virtual Forwarding Interface
VID	VLAN ID
VLAN	Virtual LAN
WAN	Wide Area Network