PTN10G/PTNext Interface Card
For HX9400R/HX9500R CHPA Chassis with CCPA Controller

PTNext   **PTN10G**

Description

The PTN10G interface card supports MPLS-TP and Carrier Ethernet for Packet Transport Network (PTN) services, as well as transportation over IP Network. It is an Ethernet switch, an IP router, and an MPLS-TP router all at once. In addition to packet switching and routing, the renowned feature of PTN10G is to act as the Circuit Emulation gateway between PDH/SDH/SONET and Packet Switched Networks (PSNs).

For TDM encapsulation technologies, PTN10G supports TDMoE, TDMoIP, and TDMoMPLS. For Circuit Emulation, PTN10G supports CESoPSN (Nx64K), SAToP (Unframed E1/T1), and CEP (SDH/SONET paths). The capacity of a PTN10G module reaches up to a STM-16/OC-48 worth of TDM traffic groomed from the TDM interfaces mounted on the same HX9500R device.

On-board connectivity of each PTN10G module includes three 10GbE SFP+ interfaces, eight 1GbE SFP interfaces, and one STM-16/OC-48 backplane interface. Ethernet and TDM ports from other modules on the same HX9500R/HX9400R can be cross-connected by the Controller card and mapped to the PTN10G via the STM-16/OC-48 backplane interfaces. Each of the interfaces can be individually configured as an NNI or a UNI port.

In delivering PTN services, two PTN10G cards, coupled with two PTNext cards, equip a HX9400R/HX9500 unit with a channel capacity of up to 96G.

The computational capacity of a PTN10G module reaches up to 100G. The switch/router residing in a PTN10G module works in isolation from any port. With two PTN10G modules simultaneously mounted, traffic from all ports on both PTN10G modules can be merged onto the primary PTN10G card, yielding a total connection of sixteen GbE, six 10GbE, and one STM-16/OC-48 bandwidth. While one PTN10G switch/router is at work, the other may serve as redundancy for protection.

PTN10G provides high availability and reliability of communication systems required in network hauling, power utilities, military and governmental network deployments, and transportation applications. Service continuity and performance can also be monitored via QoS, OAM, and multiple protection schemes.

Topology, cross-connection, and management of a large scale PSN can also be achieved remotely via CXR-iNMS and CXR-iNET.

Features

System capacity

- Up to 3 x 10GE/1GE SFP+ ports
- Up to 8 x GE SFP
- 100G Packet Switching capacity per card
- L2 switching, MPLS switching, and L3 routing (Per port setting)
- 1008 x VC12/1344 x VC11 termination to E1/T1
- 1008 x E1/1344 x DS1 SAToP/CES PWE3
- 1008/1344 x PWs for VC12/VC11 CEP (1 x STM-16 worth)
- 2.5G SDH/SONET Bus (backplane)

MPLS-TP

- MPLS Transport Profile per RFC-5921
- Any Ethernet port can be configured as NNI (MPLS port) or UNI (Ethernet service port)
- Static MPLS LSP label provisioning via NMS
- Pseudo Wire (PW) services
  - Ethernet Pseudo Wire(VPWS, VPLS, H-VPLS)
  - PDH PWE3 (SAToMPLS, CESoMPLS)
  - SDH PWE3 (CEP)
  - Supports up to 1008 TDM PWs
- MPLS-TP OAM
  - Section/LSP/PW monitoring using BFD (Per IEEE 8113.2)
- MPLS-TP QoS
  - 64K Granularity Rate Limit Per Flow
  - Ingress/Egress TC/EXP Class Mapping
  - TC/EXP Priority-based Queuing (8 Queues)
  - Tunnel Traffic Engineering CIR/PIR and CBS/PBS Policing/Shaping
  - PW Traffic Engineering CIR/PIR and CBS/PBS Policing/Shaping
  - WRED
  - Strictly Priority / WRR

Carrier Ethernet (CE)

- L2 Switching/Bridging
- RSTP/MSTP (IEEE 802.1w/1s)
- VLAN 1Q 802.1q/ Q in Q8 802.1ad
- VLAN Operation: Stack/Switch/Strip
- Link Aggregation (802.3ad): Static/LACP
- CE OAM
  - CFM: Ethernet Service OAM (802.1ag/Y1731)
  - EFM: Ethernet Link OAM (802.3ah)

Ethernet Services

- E-Line, E-LAN, E-Tree services as defined by MEF 9 and 14 using VPWS/VPLS*
- Native Ethernet packets supported
- Encapsulation: PW/LSP (MPLS-TP), VLAN tagging (1Q), VLAN double tagging (Q-in-Q)

L3 Routing

- Static Route
- RIPv1 and RIPv2
- OSPFv2 and OSPFv3

VPLS

- VPLS bridging
- H-VPLS bridging
- 32K MAC addresses
- 2K VPLS instances per device
- Split horizon to prevent forwarding loops

Network Protections

- MPLS-TP
  - MPLS LSP 1+1/1:1
  - Dual-homing PW Protection*
  - LSP E2E protection switching within sub 50ms
- CE
  - ERPS Ring (G.8032) Protection
  - ELPS (G.8031) Linear Protection
- SDH/SONET
  - STM-n/OC-n MSP 1+1 Protection

Clock Synchronization

- IEEE 1588 v2 PTP
  - Clock modes: Ordinary/Boundary/Transparent clock
  - ToD (Time of Day)
  - PPS (Pulse per Second) output interface
- SyncE
  - Synchronous Ethernet from all GE ports
  - Ethernet SMC per ITU-T (Ethernet Synchronous Message Channel, ESMC)
- TDM Clocks from other modules
  - External Clock input and output (2Mbps/2MHz)
  - SDH/SONET/PDH Line Clocks
  - Stratum 3 Timing

PWE3 Services

- Ethernet over CE*
  - Port-based and VLAN-based services
  - EPL, EVPL, EPLAN, EVPLAN, E-Tree services as defined by the MEF 9&14
  - Encapsulation: VLAN 802.1Q/802.1ad Q in Q
- Ethernet over MPLS
  - Port-based and VLAN-based services
  - VPWS, VPLS, H-VPLS services as defined by the MEF 9 and 14

- CE QoS
  - 64K Granularity Rate Limit Per Flow
  - Ingress/Egress CoS Class Mapping
  - CoS Priority-based Queuing (8 Queues)
  - CIR/PIR and CBS/PBS Policing/Shaping (2R/3C)
  - Hierarchical QoS
  - WRED
  - Strictly Priority/WRR

CoS/QoS
- 8 Priority Queues
- Scheduling: Strict Priority, WRR with Hierarchy
- Ingress Policing & Egress Shaping per service
- CIR / PIR (EIR) 2-rate-3-color
- MPLS: TC/EXP-Inferred-PSC (Per Hop Behavior Scheduling Class) LSP

- Encapsulation: PW over MPLS-TP
- PDH/SDH/SONET over MPLS/CE/IP
  - Fractional E1/T1 (64K timeslots): CES PW
  - Unframed E1/T1: SAToP PW
  - VCn/TU-n/VT-n/STS-n: CEP
  - PDH Clock Recovery : ACR/DCR/System Clock per PW configurable
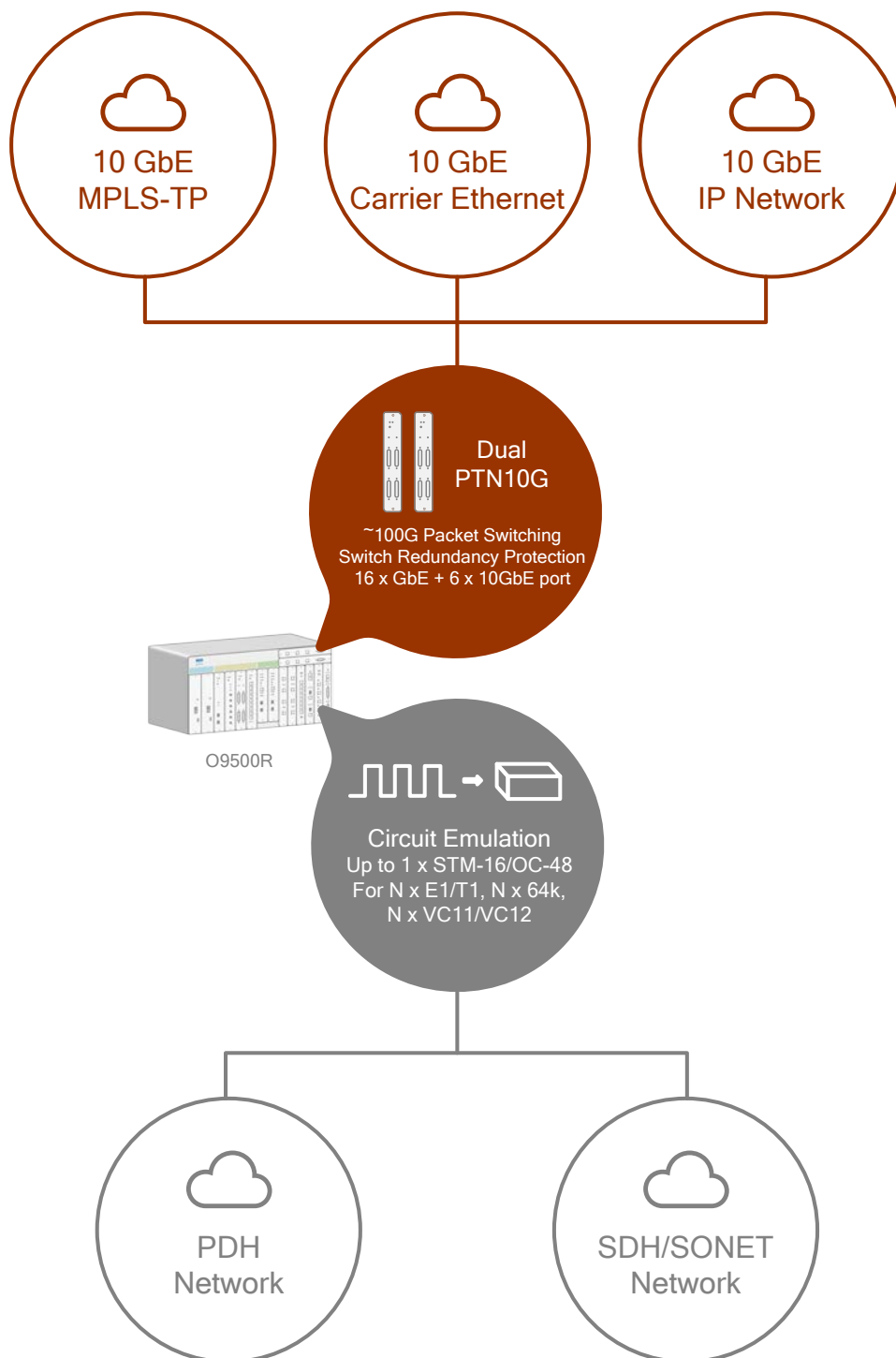 - Supports up to 1008 ACR completions

* Future Option

Application Illustrations
Transcend from PDH and SDH/SONET to 10G

10 GbE
MPLS-TP

10 GbE
Carrier Ethernet

10 GbE
IP Network

Dual
PTN10G

~100G Packet Switching
Switch Redundancy Protection
16 x GbE + 6 x 10GbE port

O9500R

Circuit Emulation
Up to 1 x STM-16/OC-48
For N x E1/T1, N x 64k,
N x VC11/VC12

PDH
Network

SDH/SONET
Network

Connectivity and capacity

PTN Side	XCU	Other Modules
Ethernet: 76G (2 x PTN10G) + 20G (2 x PTN Ext) SDH/SONET: STM-16/OC-48/2.5G (XCU)	Cross-connect Mapping	N x DS0/E1/T1 N x STM-n/OC-n Ethernet

O9500R

*PTN Ext card in development
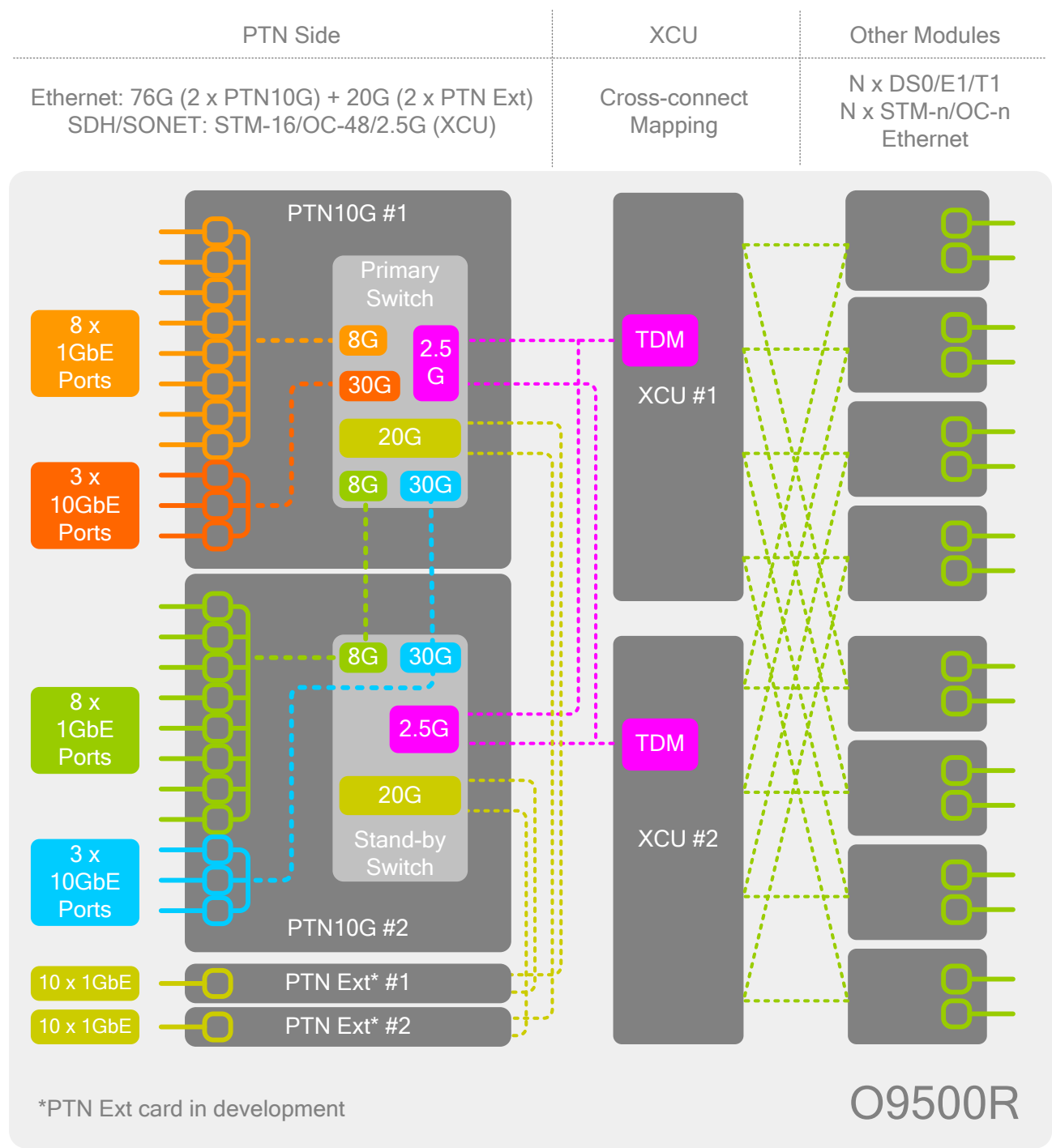
One PTN10G card per Chassis

PTN10G in TRIB 3

eth-3-1
eth-3-2
eth-3-3
eth-3-4
eth-3-5
eth-3-6
eth-3-7
eth-3-8
eth-3-9
eth-3-10
eth-3-11

1GbE ports

Primary Switch

10 GbE ports

STM-16/OC-48 (2.5G) backplane channel

XCU #1

STM-4/OC-12 (622M) backplane channel

HS (622 Mbps) modules in TRIB 4

7FOM
8GESW
B155/622
E1/T1
.
.

XCU #2
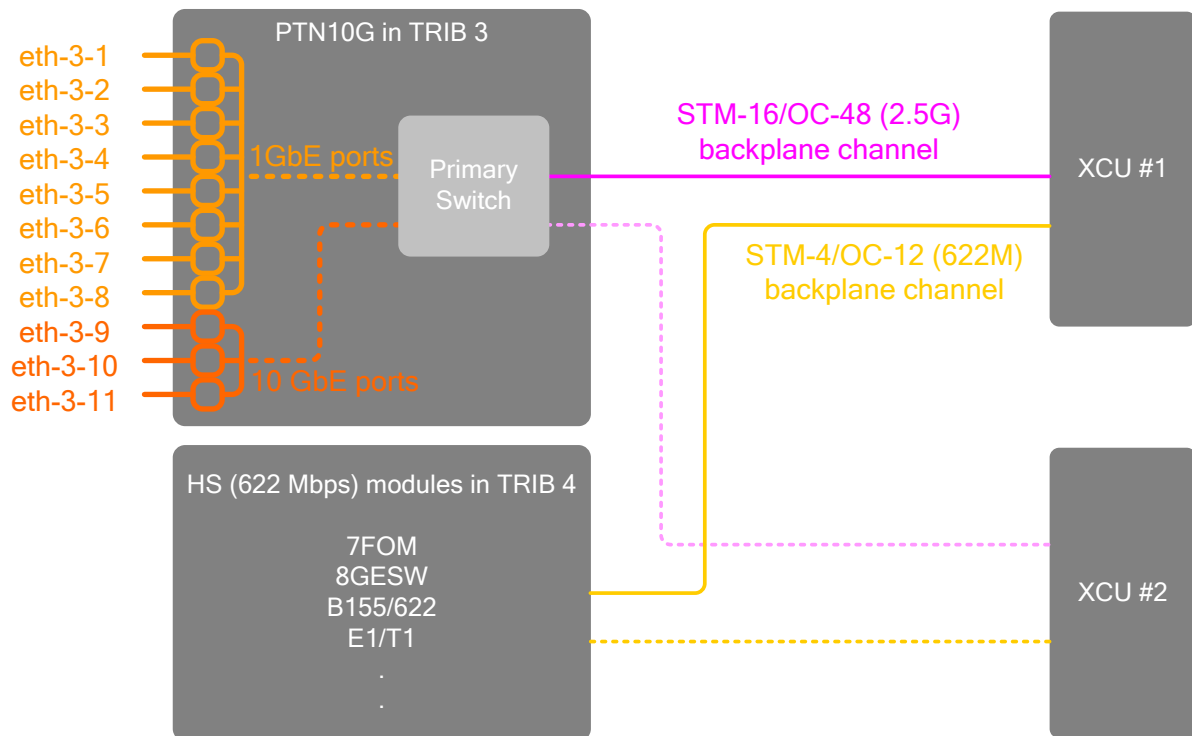
Two PTN10G cards per Chassis
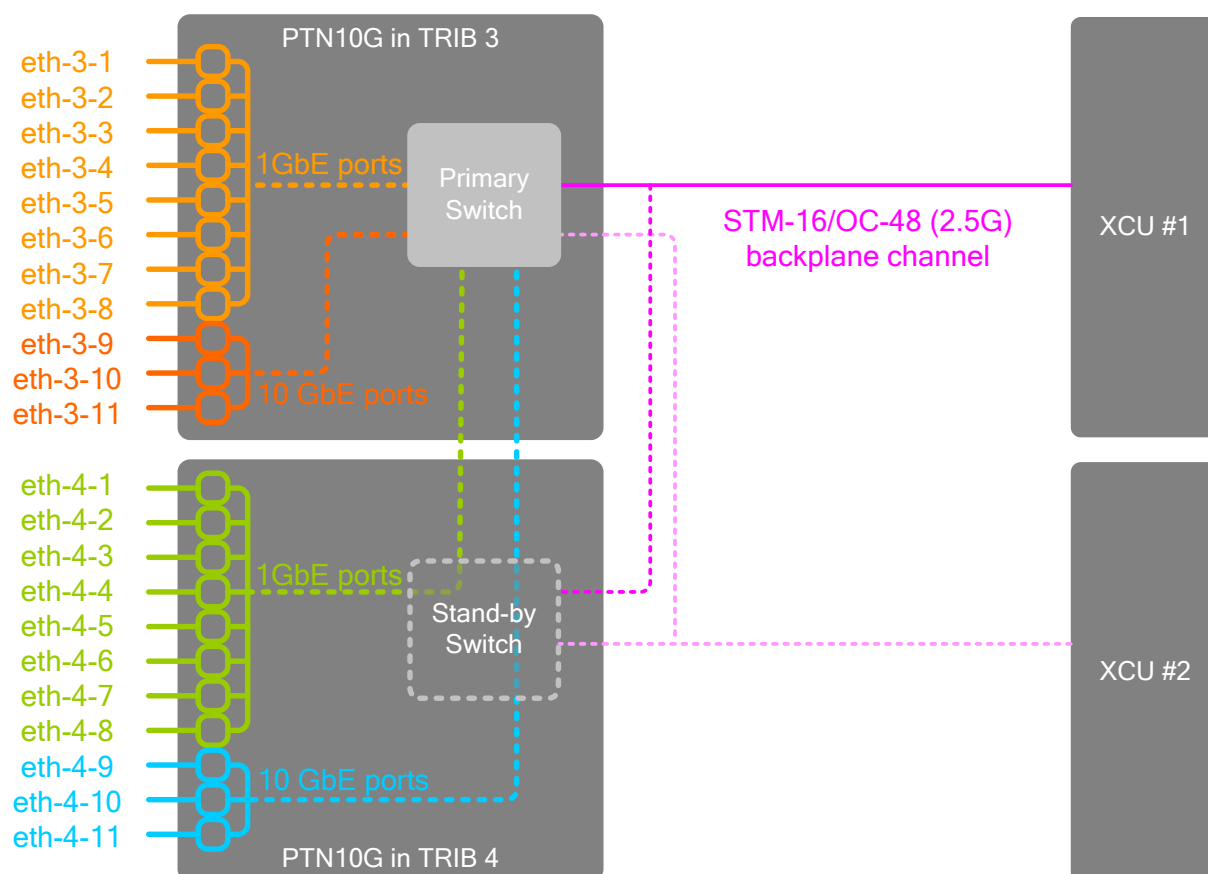
PTN10G Card Specifications

Compatibility

HX9500R Series		HX9400R Series	
XCU	CCPA	XCU	CCPA
Chassis	CHPA	Chassis	CHPA
Max	2 PTN10G cards per chassis	Max	2 PTN10G cards per chassis

Interface

1 GbE		10 GbE	
Number of Ports	PTN10G: 8	Number of Ports	PTN10G: 3
	PTNext (Operable with PTN10G only): 10		PTNext (Operable with PTN10G only): 1
		Connector	SFP+
Connector	SFP		

SDH/SONET	
Number of Ports	1 STM-16/OC-48
Connector	Backplane to XCU

Circuit Emulation

SAToP	Unframed E1/T1 packets
CESoPSN	Fractional E1/T1 (N x DS0) packets
CEP	SDH/SONET path packets

Encapsulation

TDM	over MPLS, over Carrier Ethernet, over IP (using pseudowire)
IP	over MPLS (using pseudowire)
Ethernet	VPWS, VPLS (using pseudowire)

QoS

Eight priority queues per port
Scheduling – Strict Priority, Weighted Round Robin with hierarchy
Ingress policing per service
Egress shaping per service
CIR / PIR (EIR) Two-rate, three-color. (Committed Information Rate, Peak or Expected Information Rate)
E-LSP: EXP-Inferred PSC (Per Hop Behavior Scheduling Class) LSP. (Label Switching Path)
WRED for congestion management. (Weighted Random Early Detection)

Standard Compliance

IEEE

802.1d	STP	
802.1w	RSTP	
802.1s	MSTP	
802.1q	VLAN	
802.1ad	VLAN Tag Stacking (Q-in-Q)	
802.1ag	Ethernet OAM (CFM)	
802.3ah	Ethernet in the First Mile (EFM)	
1588 v2	Precision Time Protocol (PTP)	

RFC (IETF)

2131 & 2132	DHCP
6378	MPLS-TP Linear Protection
1058	RIPv1
1389	RIPv2
2328	OSPFv2
5340	OSPFv3
4842	Circuit Emulation over Packet (CEP)
3985	Pseudowire End-to-end Emulation (PWE3)

ITU-T

G.8031	ELPS
G.8032	ERPS
G.8113.2	MPLS-TP OAM
Y.1731	Ethernet OAM

EMC/EMI

FCC15 Class A
EN55022 Class A
EN55024

Safety

EN60950-1

Physical and Environmental

Temperature   -20°C to +65 °C, chassis fan must be present at rugged temperatures

Ordering Information

Note: RoHS compliant units are identified by the letter **G** at the end of the ordering code.

Models

Ordering Code	Description	Notes
HX9500-R-PTN10G	MPLS-TP plug-in module with 3 x 10G/1G SFP+ ports and 8 x GE SFP ports, without SFP (mini-GBIC) optical modules	Please order SFP optical modules separately from SFP optical modules brochure
HX9500-R-PTNEXT	MPLS-TP plug-in module with 1 x 10GbE or 9 x GbE SFP ports, without SFP (mini-GBIC) optical modules	Compatible with HX9500-R-CCPA controller module and HX9500-R-CHPA chassis only

Accessories

User's Manual	
HX9500-R-PTN10G-UM	User's Manual (paper copy). **Note:** A CD version of the manual is already included as standard package.

SFP Optical Modules
Please place your order using the 5-digit alphanumeric codes listed in the separate SFP Optical Module Brochure. **Note:** Non-CXR SFP modules are not guaranteed to work with our equipment. It is strongly recommended that CXR branded SFP modules be concurrently used.