DATA SHEET

XTM SERIES

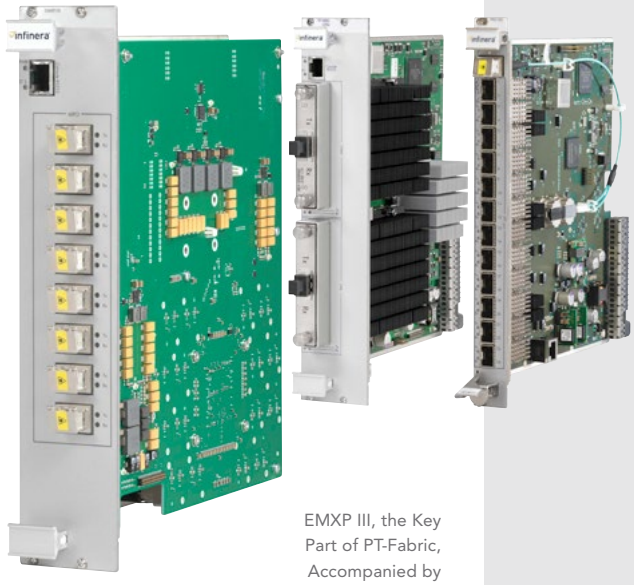
PT-FABRIC

Packet Transport-optimized 100G Networking and Ethernet Services in Packet-optical Networks

The PT-Fabric (Packet Transport Fabric) is part of the Infinera XTM Series that provides seamless integration of Layer 1 and Layer 2 metro Ethernet functionality in a single platform.

PT-Fabric is a powerful terabit-class packet-optical transport switch consisting of a system of cards. It is powered by the EMXP III as central switching unit and utilizes different types of interface modules connected via an optical frontplane for various line and client formats.

The use of pluggable 10G and 100G optics, in combination with support for forward error correction (FEC), enables cost-efficient metro and regional transport with links to other PT-Fabric nodes or to EMXP IIe without requiring the use of additional external transponders.



EMXP III, the Key Part of PT-Fabric, Accompanied by the 100G OTN Transponder and PTIO-10G for 100G and 10G Services.

Key benefits:

- Flexible modular design with support for a mix of 100G and 10G interfaces
- High switching capacity, supporting 920G of Ethernet on up to 8x100G interfaces and 72x10G interfaces
- Flexible frontplane architecture allowing any card in any slot minimizes stranded assets in the nodes
- Integrated 100G-SR10 client interfaces lowers the cost by eliminating the need for separate optical client modules
- Support for C form-factor pluggable (CFP) modules for coherent metro 100G with up to 1200 kilometer (km) reach
- 10G interfaces with selectable mode: OTU2e with FEC for enhanced 1500-2000 km reach or 10G LAN
- Provides CE2.0-compliant E-Line, E-LAN, E-Access or E-Tree services
- Flexible network resiliency options through Ethernet ring protection and link aggregation
- Synchronous Ethernet and IEEE 1588 for efficient frequency and time synchronization essential for mobile backhaul and networks for TDM-over-packet services
- Ultra low latency and almost zero jitter
- Low power design ensures low total cost of ownership

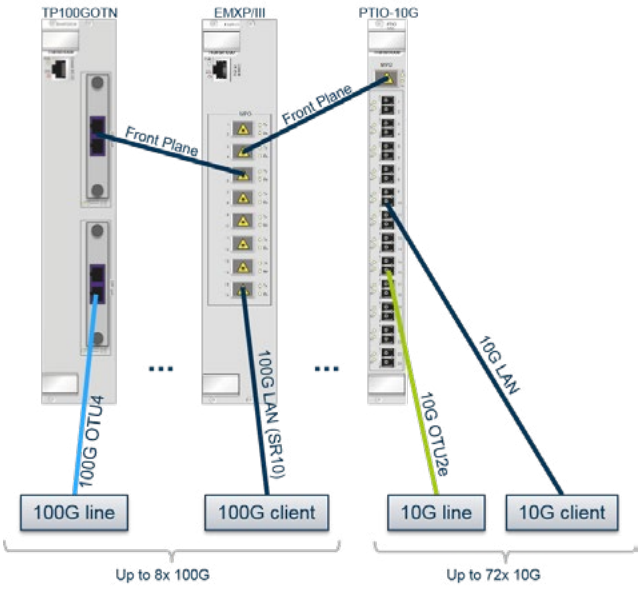


Fig 1. PT-Fabric Consists of the EMXP III Accompanied by the 100G Transponder and PTIO-10G Interface Modules.

Frontplane Design

The use of an optical frontplane between the central 920G-capable switching module and 10G/100G line interface modules allows scaling the system capacity without the need to introduce a costly high-speed backplane to connect to all slots in a chassis. The frontplane uses vertical cavity surface emitting laser (VCSEL) technology and fiber ribbon cords between cards in the PT-Fabric, which allows cards to be freely placed within a chassis or to build up functionality over multiple chassis.

Frontplane technology ensures that existing XTM Series chassis can be used with PT-Fabric and gain switching capabilities for 100G networking applications. There is no need for forklift upgrades of chassis in the field.

Six of the EXMP's eight frontplane connectors can individually connect to either a PTIO-10G card to provide up to a total of 72x 10G, or to the client side of a 100G OTN Transponder for 100G metro coherent connectivity. The other two frontplane connectors are for 2x100G only.

Furthermore, it is possible to connect 100G local area network (LAN) clients using SR10 optics directly to the EMXP III card, which lowers the cost of client optics and saves valuable rack space. If only 100G client optics are needed, the EMXP III can handle a full 800G in only two slots without need for other transport cards.

Ethernet Service Transport

The PT-Fabric creates a Layer 2-optimized transport architecture using selective integration of Layer 2 and multi-protocol label switching (MPLS) functions.

Ethernet services can be port-based or fully service-multiplexed based on flexible combinations of customer or service virtual local area networks (VLANs), traffic type and priority on any interface in the system. A full range of E-Line, E-LAN E-Access or E-Tree services, compliant with the Metro Ethernet Forum's CE2.0, are supported.

A strong classification and policy engine can be used to define flexible Ethernet services based on service-specific requirements and to use quality of service (QoS) classifications for traffic differentiation in the network. Bandwidth profiles allow service providers to offer services with bandwidth regulated to any speed.

The PT-Fabric has the capability to perform sub-50 ms protection for Ethernet services over a range of different topologies thanks to its built-in support for hardware-based operations administration and maintenance (OAM) used together with protection.

The EMXP III provides a flexible toolkit of traffic management features. The toolkit includes features such as strict and weighted scheduling, bandwidth profiles and shaping of bandwidth.

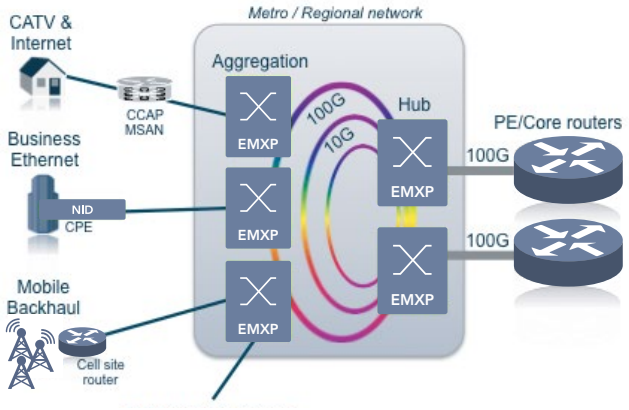


Fig 2. PT-Fabric in a Network Scenario with other EMXP Packet-Optical Transport Switches.

Resiliency

The PT-Fabric offers various methods to provide resiliency through the capabilities of the EMXP III unit. The simplest method is to utilize IEEE 802.3ad link aggregation group (LAG). Normal LAG as well as N+1 and N+N protection LAG are supported.

Furthermore, LAG can be distributed over two separate PT-Fabric systems units using multi-chassis LAG that coordinates information to present a single LAG to the connected system.

If PT-Fabric and/or the units in the EMXP range are deployed in a ring topology, then ITU-T G.8032v2 Ethernet ring protection switching also becomes an option. V2 supports multiple logical rings for the flexibility to use different VLANS in different rings, and allows dual interconnect points between rings to eliminate single points of failure. Rings can also be used in combination with LAG so that the capacity of the rings can be easily scaled. It is even possible to add/remove links without service interruption.

Protection switching is performed with carrier-class sub-50 ms protection using any of these protection schemes.

Synchronization and Timing

Mobile networks need reliable and accurate frequency synchronization from the mobile backhaul network, and some recent standards such as LTE-A also require phase and time synchronization. Support for distributing both frequency through SyncE and phase and time through precision time protocol (PTP) is built into the PT-Fabric.

The implemented SyncE in the EMXP III supports clock selection logic and on-board holdover that exceeds synchronous digital hierarchy (SDH) requirements. Synchronization signaling is used to provide traceability of the synchronization source and to do automatic sync source selection, providing high reliability of the sync.

The EMXP III supports IEEE 1588 transparent clock for phase and time synchronization. This function adjusts the timestamps automatically for timing packets that are carried over native Ethernet or encapsulated in service VLANs or inside MPLS pseudo wires. Adjusting these timestamps to compensate for the internal delay improves the accuracy of the PTP protocol and allows the protocol to have more switch hops between grandmaster and slave without the need for expensive external references (e.g. from GPS).

Ultra-low Latency in Time-critical Applications

The EMXP III has ultra-low (microseconds) latency and virtually zero jitter for all packet sizes, regardless of traffic load. This makes it ideally suited to Ethernet applications where latency and jitter are important, such as services for financial institutions, video distribution and LTE backhaul.

Low Power Design

A fully equipped PT-Fabric system with eight 100 gigabit Ethernet ports, where four are OTU4 with coherent optics using four 100G OTN transponders and the other four are SR-10 100G client ports directly connected to the EMXP III, consumes about 0.5 watt per gigabit. Low power consumption in combination with a small footprint reduces operational costs and enables more capacity to be handled at sites with restrictions on power consumption, cooling and space.

Specifications

Interfaces	EMXP III has eight MPO connectors for fiber ribbon cable. The MPO connectors can be used in the following modes: • 100G LAN client (SR10, 100m) • Frontplane connection to PTIO-10G • Frontplane connection to TP100GOTN
	Via PTIO-10G support for • 10G-LAN mode or OTU2e framing with GFEC, I.4 or I.7 FEC • Uncolored multi mode and single mode • CWDM up to 8 channels, DWDM up to 80 channels
	Via TP100GOTN support for • OTU4 coherent PM-QPSK ~1200 km reach tunable over 80 DWDM wavelengths with SD-FEC • 100G LAN on LR4
Resilience	IEEE 802.3ad Link Aggregation with LACP. Loadsharing, N+1 and N+N protection LAG, Multi-chassis LAG ITU-T G.8032 Ethernet Ring Protection v2 Supports Ethernet ring over LAG and in-service adding/removing links (future release will also support MPLS-TP with 1+1 linear protection)
Ethernet Services	E-Line (EPL and EVPL), E-LAN (EP-LAN and EVP-LAN), E-Tree (EP-Tree), E-Access CE2.0-compliant, MEF 9+14
Quality of Service	Policing using bandwidth profiles Flexible traffic classification, e.g. based on DSCP, CoS, port and inner/outer VLAN Eight strict priority queues / WRR queues, min and max shaping. WRED
OAM	IEEE 802.1ag Continuity Check and Loopback, Port Mirroring Management VLAN for in-band management Port isolation using private VLAN technique Link Layer Discovery Protocol (LLDP)
Synchronous Ethernet and Timing	ITU-T G.8262 Synchronous Ethernet Equipment Clocks (EEC) ITU-T G.8264 Ethernet Synchronization Messaging Channel (ESMC) ITU-T G.781 Synchronization Status Messages (SSM) IEEE 1588v2 Transparent Clock
L2 Switching	Up to 920 Gb/s Ethernet switching on EMXP III depending on units connected via frontplane Selectable learning enabled per VLAN, 4,094 VLAN IDs, 224K MAC-addresses Storm control IEEE 802.1ad Q-in-Q SVLAN Flexible VLAN tag handling: push, pop, swap, pop-swap, including double tag operations Super jumbo frames up to 9216 Bytes
Power Consumption (Including Optics)	EMXP III 140 W TP100GOTN 70 W PTIO-10G 42 W

Specifications and Features Are Subject to Change

Infinera