APPLICATION NOTE

XTM Series in MPLS-TP Networks

MPLS-TP Enables Network Operators to Implement Cost-effective Ethernet-based Optical Transport Networks

XTM Series Benefits in MPLS-TP Networks

- **Transport-optimized MPLS-TP** provides connection-oriented service provisioning and management in metro/regional packet optical transport networks
- **Highly flexible networking options** with MPLS-TP and MEF Carrier Ethernet on the same network, platform, and even physical resources such as ports and wavelengths
- **MEF-compliant Carrier Ethernet and MPLS-TP capabilities**, prioritization, classification, and bandwidth profiling
- **High-performance platform** optimized for demanding transport applications such as video distribution networks and 5G mobile xHaul
- **SDN and automation capabilities** providing highly resilient MPLS-TP 1+1+R protection

Driven by ever-increasing levels of mobile, residential, and business traffic, network operators worldwide are reevaluating their transport network and mobile network architectures. Infinera's high-performance optical networking solutions support Multi-Protocol Label Switching – Transport Profile (MPLS-TP) to deliver highly scalable, reliable, and cost-effective metro and regional packet optical networks.

Limitations on CapEx and OpEx cause operators to demand more cost-effective technologies to meet the challenges brought on by scaling service deployment and delivery. One way to accommodate this is the transition of the transport network from circuit-based to packet-based technologies using Carrier Ethernet or MPLS-TP.

The Metro Ethernet Forum's Carrier Ethernet has standardized services and service management to make Ethernet a viable choice for delivery of cost-efficient residential, business, and backhaul services. The network used to deliver these services has included different technologies in different parts of the network. For smaller networks and metro aggregation networks, Ethernet over Service VLAN has been widely deployed for many years. In the metro core, where meshed network topologies are more common, there is a need for a solution that can cater for a higher number of services and network changes.

MPLS-TP leverages the advantages of MPLS technology to provide connection-oriented service transport. It uses a subset of IP/MPLS features needed for transport networks, and has been extended with operations, administration, and maintenance (OAM) and resiliency features. These extensions provide capabilities needed for carrier-grade transport networks, including scalable operations, high availability, and performance monitoring.

By providing the same OAM, quality of service (QoS), protection, and restoration features as circuit-based networks, MPLS-TP has a familiar look and feel for network operators, who already have management processes and work procedures based on these principles.

In addition to increased scalability, MPLS-TP has other benefits for service providers. It enables a more flexible way to build and provision capacity in the network and can take advantage of the statistical multiplexing gains associated with packet networks. MPLS-TP also ensures service level agreements (SLAs) through the combination of QOS handling and service OAM.

Infinera provides MPLS-TP support with the XTM Series' range of EMXP packet optical transport switches, delivering these essential capabilities to network operators for a broad range of network applications. Infinera's 7100 Series and mTera Series platforms also support MPLS-TP and can be combined with the XTM Series to build larger MPLS-TP domains.

The Infinera XTM Series MPLS-TP Solution

Infinera's packet optical offering is designed to provide scalability, efficiency, flexibility, and manageability while optimizing costs. It does so by integrating key Ethernet Layer 2 and MPLS functionality with the optical transport network. Packet optical offerings are ideal for metro networks as they support extremely high-performance characteristics, as well as multiple service types, such as Ethernet, SONET/SDH, and Fibre Channel (FC), in one cost-efficient solution. In this way, new Ethernet-based services as well as OTN and other time-division multiplexed (TDM) services can be supported, creating an economically efficient transport network for packet-based services while enabling smooth transition to an all-packet world.

Infinera's packet optical solutions bring flexibility by supporting CWDM and DWDM, single fiber and fiber pair, Ethernet-only and multi-service wavelengths, and finally a selection of line rates to choose from. Pluggable optics enable an affordable optical transport solution for service providers large or small. Easy to install, turn up, and commission, Infinera's range of products meets a variety of network needs.

Infinera's approach also provides greatly simplified operation and management, as one management system can be used for all services. This provides end-to-end services provisioning and monitoring of MEF services over Carrier Ethernet and MPLS-TP-based infrastructure. Compliant with well-known MEF standard services, the GUI- or CLI-based management service uses familiar concepts and terms. Recent additions include MEF-based APIs to ease automation and integration to service provider OSS infrastructure.

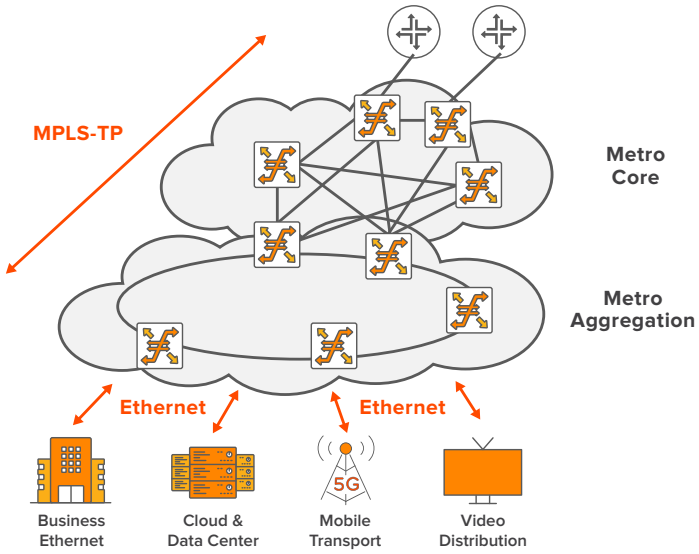

Figure 1: Typical network using MPLS-TP with Infinera EMXP packet optical transport switches

XTM Series Integrates Ethernet and MPLS-TP Switching

The XTM Series combines integrated Ethernet and MPLS-TP switching and transport functionality to create a converged packet optical platform for metro and regional networks. This allows the design of simplified transport networks to provide more flexibility and reduce the number of physical elements in the network. It provides capacity increases based on Ethernet, MPLS-TP, and WDM technologies, known for their scalability and flexibility characteristics. This results in a transport solution that offers a cost-efficient way to support MEF-standardized Carrier Ethernet services delivered over a single converged platform for Ethernet, MPLS-TP, and optical transport.

Expensive network routing elements can be used more efficiently by using the XTM Series' packet optical pre-aggregation capabilities to collapse many interfaces to a single high-speed hand-off. In many instances, aggregation routers can be bypassed and services can connect directly to the PE router edge. Together with the ability to directly provide MEF Ethernet services over the XTM Series platform, this gives a lower total cost of ownership for the complete network.

Infinera's XTM Series MPLS-TP Implementation

The Infinera packet optical platform, delivered on the XTM Series EMXP range of packet optical transport switches, supports all network topologies: mesh, ring, hierarchical, and hub-spoke. EMXP hardware acceleration of OAM for MPLS-TP enables even higher scalability in larger networks.

Infinera's IETF-compliant MPLS-TP implementation brings a common look and feel to optical and Ethernet service provisioning. Both layers of the network are built around a flexible optical and MPLS-TP tunnel architecture, which allows the operator to plan and deploy the best network architecture for their specific deployment challenges. Services are then applied at the edge of this optical or Ethernet cloud independently of how the traffic is routed through the network.

By providing a simple and well-understood common workflow to either layer, network operations are simplified and easy to deploy. Supporting the MPLS-TP capabilities, the Infinera suite of network management software delivers end-to-end service provisioning. More flexible resilience options are supported with MPLS linear protection.

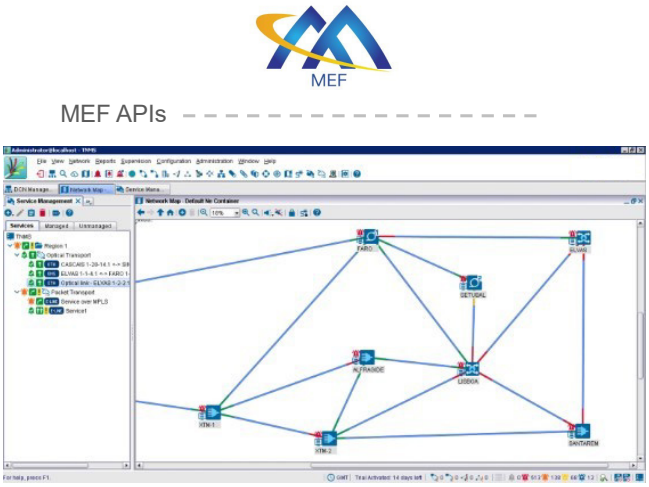

Figure 2: Infinera's network management software provides a simplified view of multi-layer networks

Using the EMXP range, the same Ethernet interfaces can do Ethernet and MPLS-TP switching for smooth network migration. It is thus possible to have different VLANs on the same port; some for Ethernet and some for MPLS-TP. Also, the EMXP range delivers best-in-class synchronization and latency performance for both Ethernet and MPLS-TP interfaces.

SDN and Automation

Infinera's SDN software supports the automation of MPLS-TP infrastructure. One example is 1+1+R protection switching, where the node elements implement 1+1 protection in the data path with sub-50 ms protection time. In the event of a link or node failure, a new protection path is automatically calculated and configured to the node element, restoring the 1+1 protection.

Summary

MPLS-TP leverages the well-known IP/MPLS standard to meet the critical needs of network operators. MPLS-TP enables a broad range of capabilities, particularly OAM and resiliency features, and will continue to evolve to meet emerging requirements. Infinera has gained recognition from customers and independent analysts for its optical networking knowledge, product reliability, and technical innovations. The MPLS-TP features of the Infinera XTM Series EMXP range offer a high-performance solution to meet the evolving needs of Infinera customers.

Infinera