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White Paper

TRANSITION NETWORKS®

Taking Packet Networks to the Edge

Using Network Interface Devices for Cost Efficient Carrier Ethernet or MPLS Edge Networks

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Taking Packet Networks to the Edge

Carrier networks are moving to more flexible packet-based network technologies in order to more efficiently use their network infrastructure. Carrier Ethernet and MPLS are the two leading technologies for this transition and often carriers support both network types or have to make a choice between the two as they roll out new services and upgrade networks from older technologies.

Transition Networks recently expanded its family of managed network interface devices (NIDS) with the debut of the S3290 CE 2.0 NID, the most compact NID on the market and the first one to provide both full Carrier Ethernet 2.0 services and MPLS-TP as well.

The new S3290 managed NIDs are part of Transition Networks' comprehensive Carrier Ethernet 2.0 / MPLS product family that has been designed to help service providers deliver dynamic services through advanced edge and access networks. The product family includes both access switches and NIDs and is complemented by Converge service orchestration software that provides simplified provisioning for dynamic MPLS-TP and Carrier Ethernet 2.0 services along with open REST APIs for interfacing to 3rd party SDN/NFV platforms.

> **"The edge of the network is the most costly for carriers to manage, especially when it comes time to provision services. We designed the S3290 NID with the performance that carriers expect from Transition Networks, and expanded the manageability features to simplify provisioning and flexibility. For the operator that already has MPLS in the core, MPLS-TP allows the same provisioning of label path switching and the same MPLS OAM tools that they are accustomed to using today."**
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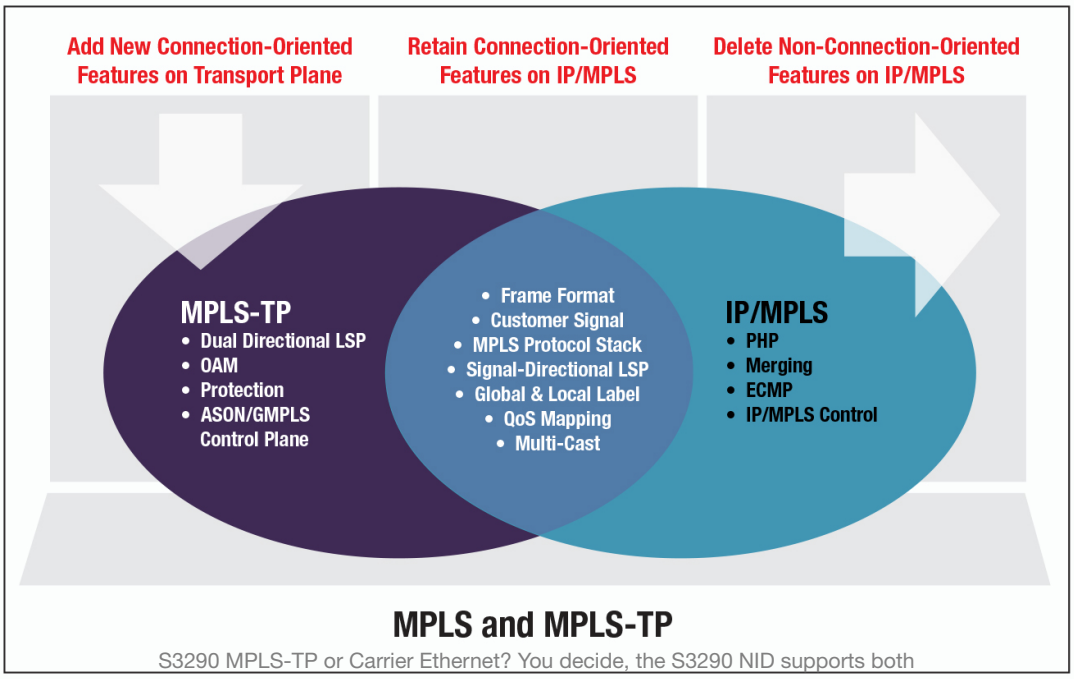
> **"Adding MPLS-TP to our CE 2.0 offers the operator a choice to use one or all of these services from the same device. We believe service providers want a flexible edge device that can extend their MPLS core network all the way to the customer premise using MPLS-TP and/or, if full Carrier Ethernet 2.0 services are needed, the S3290 NID supports any and all services without a costly 'fork-lift' replacement of edge network systems."**
>
> **- Tony LeFebvre, Director of Product Management for Transition Networks**

MPLS and MPLS-TP

MPLS and MPLS-TP are compatible and interoperate together with label switch path (LSP) provisioning, link attachments and, tunneling. MPLS is used mainly in the core, while MPLS-TP is primarily used in the access network. Development of the standards for MPLS-TP has been a joint effort by the Internet Engineering Task Force (IETF) and the International Telecommunications Union (ITU-T).

MPLS-TP is a subset (or profile) of MPLS that was designed for use in packet-based optical transport networks at layer two. MPLS-TP does not implement some layer 3 IP MPLS features that are unnecessary in a layer 2 network, for example native IP line-rate forwarding and Penultimate Hop Popping (PHP). MPLS-TP also requires no MAC learning, which reduces the quantity of MAC addresses traversing the network edge.

Alternatively, MPLS-TP supports bi-directional LSPs, with main and back-up paths similar to SONET and SDH, OAM monitoring, protection switching and PWE3 pseudo wire architectures that enable legacy TDM-based networks to be supported. MPLS-TP enables connection-oriented point-to-point and point-to-multipoint LSPs optical packet transport based on widely deployed MPLS protocols with transport-grade performance and management operation for defect-alarm indications compatible with IP/MPLS.



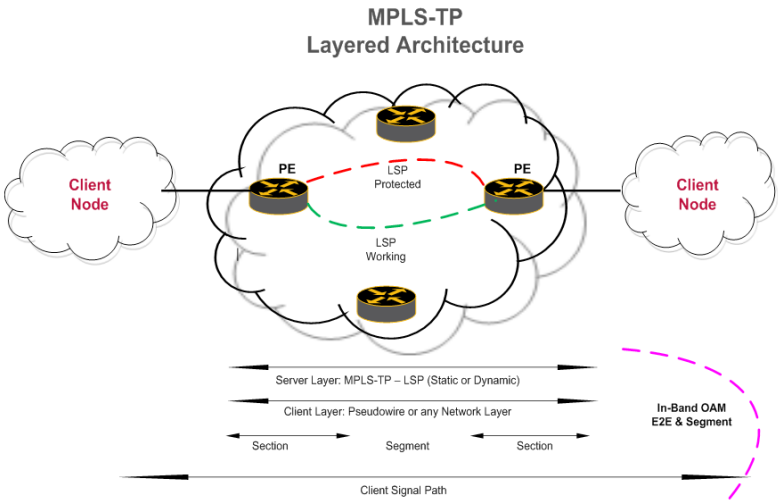
MPLS and MPLS-TP

S3290 MPLS-TP or Carrier Ethernet? You decide, the S3290 NID supports both

When to Use Carrier Ethernet or MPLS-TP

The S3290 NID provides full Carrier Ethernet CE 2.0 services and is one of the first known "edge" NID devices to support MPLS-TP as well. Whether it is best to utilize MPLS-TP or Carrier Ethernet depends on your existing network and the problem you are trying to solve.

Important items to consider when selecting a NID include quality of service, performance management, fault management, timing, protection, existing network technologies deployed, and cost (both CapEx and OpEx). MPLS-TP is ideally suited to transport ATM, TDM, or SONET. It is a deterministic/connection-oriented protocol. It allows label switching with primary and back-up links, and is not dependent on IP source/destination addresses. The sections below discuss the pros and cons of each technology on a variety of capabilities and in terms of cost.



Quality of Service

Ethernet has stronger quality of service (QoS) supporting a PCP field in each packet for prioritization marking as well as S-tagged Ethernet with discard eligibility (DEI) marking. The Metro Ethernet Forum has also defined a token bucket algorithm. MPLS-TP traffic class enables support for Diffserv prioritization but MPLS-TP does not support a token bucketing algorithm.

Performance Monitoring

Both Ethernet and MPLS-TP have performance monitoring functions. Ethernet has comprehensive functionality with Y.1731. MPLS-TP supports RFC 6374, which is a series of procedures for the measurement of packet loss, delay, and throughput in an MPLS network, RFC 6375 applies this to an MPLS-TP network. Y.1731 is the more widely deployed technology.

Fault

Ethernet with a unique source address allows trace back functionality and along with Y.1731 and EFM provide comprehensive fault management functionality. MPLS-TP uses bidirectional forwarding detection for continuity check (BFD for CC) and LSP ping for fault diagnosis. Y.1731 is more full featured and widely deployed.

Timing

Ethernet supports timing protocols (SyncE, IEEE 1588) that are crucial to some applications such as mobile backhaul. IEEE 1588 for MPLS-TP is currently in the works. To date, Ethernet with either SyncE or IEEE 1588 is the most widely deployed for timing dependent applications.

Protection

Both Ethernet and MPLS-TP support protection switching. Ethernet supports linear and ring protection via G.8031 and G.8032. MPLS-TP protection is provided via RFC 6378 for linear protection. MPLS-TP ring protection is still in its infancy and is based on RFC 6372 and applying RFC 6378 for single ring topologies. G.8031 and G.8032 for Ethernet are the most extensively deployed.

Traffic
If you're looking at a multiservice transport, MPLS-TP is optimized for multi-service, multiprotocol (ATM, frame relay, Ethernet, IP) transport. Ethernet does not directly carry ATM or frame relay.

OpEx Considerations include:

- OSS System Integration
- Personnel training
- Network testing and certification operations
- Network Care (FCAPS)
- Network upgrades and patches
- Network elements management equipment and software

CapEx Considerations
Ethernet is more widely deployed and Ethernet-based solutions benefit from economies of scale driving the cost down. MPLS technologies in general are deployed at a much lower rate and therefore typically more expensive.

The Path Forward for MPLS Networks

MPLS-TP provides service providers with a path forward without the cost of full IP control planes and by supporting traditional/required transport network functionalities like OAM, fault management, performance management, automatic protection switching (APS), and ring topologies in next-generation network architecture. The design, based on requirements provided by service providers, ensures that MPLS-TP aligns with the carrier's current processes and procedures allowing them to utilize similar and familiar network configuration tools.

MPLS-TP allows carriers to design and implement predictable, connection-oriented networks utilizing a single packet switching technology resulting in reduced transport network complexity and a more scalable, simpler, and resilient network design allowing carriers to realize the inherent CAPEX and OPEX savings. The S3290 NID provides operators with the familiarity of MPLS and the benefits of carrier Ethernet in a simple to use edge device.

The Path Forward for MPLS Networks

The compact, six-port S3290 NIDs are up to 50 percent smaller than competing devices for use in environments where space is at a premium. The compact devices are fan-less requiring less rack space and power, and they support advanced Carrier Ethernet 2.0 and multiprotocol label switching-transport profile (MPLS-TP). Supporting both Y.1564 and RFC 2544 service activation testing, the S3290 NID can be used as a traffic generator to non-intrusively test EVCs and/or VLAN traffic flows, or as a collector to receive the traffic flows and provide comprehensive reporting/results of each test or, as a reflector to be looped up/down from an external test set.

As part of Transition Networks portfolio of Carrier Ethernet 2.0 certified products, the S3290 NID provides carriers with the flexibility of deploying the NID in either their MPLS-TP or Carrier Ethernet networks. The S3290 NID was designed by Transition Networks as a full featured, temperature hardened, small form factor, edge solution to allow carriers to deploy in a variety of networking scenarios while paying particular attention to cost and simplicity.

Connection Flexibility

There are two S3290 NID models: the S3290-24 with two 10/100/1000 RJ45 copper ports and four 100/1000 SFP ports for fiber-optic connectivity, and the S3290-42, which features four RJ45 ports and two SFP ports. Both models are available to support either AC or DC power. In addition, they both feature a fan-less design and are rated for operation at up to 65 degrees Celsius / 150 degrees Fahrenheit.

Converge Service Orchestration Suite of Apps Allow Provisioning of Services in Minutes

The NID is supported by Converge services orchestration software that also supports representational state transfer (REST) application programming interfaces (API) that make it possible to deliver customized service provisioning and deployment apps that can be used across the entire Transition Networks carrier Ethernet product family to easily deploy new services.

Provisioning and bandwidth allocation is simplified with Converge's tablet computer apps that service providers – or customer – can use to create, provision and protect a new service. For example, the Dynamic Bandwidth Allocation App can be used to change bandwidth on any service "on-the-fly" without service disruption. The apps complement the family of Transition Networks NIDs and access switches to offer a robust portfolio of access and customer premise solutions that deliver improved service creation agility. Creating or changing a service using the apps is as easy as selecting the end devices, checking off specific service parameters and making the service live.

Availability

The S3290 NID with Converge EMS is now available worldwide through Transition Networks and its resellers.

About Transition Networks, Inc.

Transition Networks, Inc. is an industry leader with over 25 years of experience designing fiber integration products that deliver the security and reliability for today's networks while future proofing for tomorrow. Offering support for multiple protocols, any interface, and a multitude of hardware platforms, including Hardened Ethernet, Carrier Ethernet, CWDM, 1G/10G Ethernet, SFPs, PoE and PoE+, Transition Networks gives you the power to deliver and manage traffic reliably over fiber in any data network – in any application – in any environment. Based in Minneapolis, Transition Networks distributes hardware-based connectivity solutions exclusively through a network of resellers in 50 countries. Transition Networks is a wholly owned subsidiary of Communications Systems, Inc., a publicly traded company (NASDAQ-GM: JCS). For more information about Transition Networks, please visit www.transition.com.