

Meeting the challenge of the service providers with combined WDM and OTN layer Metro Edge MSPP

Service providers in today's telecommunication market are faced with a challenge of providing high capacity services cost effectively with the shortest lead times. As a result, access network infrastructure must be flexible in design and support delivery of high-capacity services of Carrier Ethernet, MPLS, SONET/SDH, Storage Area Network (SAN), video and other demanding services while maintaining the most efficient manageable transport solution.

This white paper provides an overview of the next generation optical access platform features and capabilities in conjunction with DWDM and OTN layer. The main emphasis will be made on benefits of the OTN layer as the consolidation layer for existing and next generation access networks such as the packet optical network, carrier Ethernet and the traditional SONET/SDH networks which remain relevant today for many service providers and their customers.

Evolving trends

Metro access networks are becoming more fiber oriented towards the end user requiring different types and capacity of traffic mixes with increasing popularity of Ethernet/data services. As the data traffic continues to grow, traditional SONET/SDH networks that were primarily designed for TDM traffic and low granularity E1/T1 rates are insufficient to support the new demands of Ethernet networks.

The fiber capacity utilization has also become a major consideration for providers to reduce their overhead costs. This lead to an increasing use of wavelength division multiplexing (WDM) enabling 88+ channels of traffic to pass on different spectrally separated wavelengths over the same fiber infrastructure. The WDM layer enables most effective utilization of the existing fibers rather than investment in new construction of a new physical layer.

As a result of the growth trends, a new Optical Transport Network (OTN) layer evolved over WDM network enabling more efficient convergence of traditional SONET/SDH and new data services. The OTN layer is designed to for highly effective mapping of different protocols and rates into the same 10G uplink pipe providing high bandwidth capabilities, low heat dissipation, compact rack space requirements, and comparatively low cost. Furthermore, OTN infrastructure enables transport over longer distances with less regeneration sites by utilizing forward error correction (FEC) mechanism embedded within the OTN layer. Thus, the OTN layer forms the most efficient and cost effective Multi Service Provisioning Platform (MSPP) over WDM infrastructure.

The Next Generation networks - MSPP

MSPP enables service providers to offer customers new bundled services at the transport, switching and routing layers of the network, while also dramatically decreasing the time it takes to provision new services and improving the flexibility of adding, migrating or removing customers.

These provisioning platforms allow service providers to simplify their edge networks by consolidating the number of separate boxes needed to provide intelligent optical access. Thus drastically improve the efficiency of networks for transporting multiservice traffic.

The MSPP platforms also reduce the number of network management systems needed, and decrease the resources needed to install, provision and maintain the network (Network World).

The next generation MSPP platforms are composed of two aggregation levels:

Level -1: Using the OTN layer to encapsulate all the services over the same high bandwidth pipe converging layer of OTU2, 10G or above forming high capacity aggregated pipe

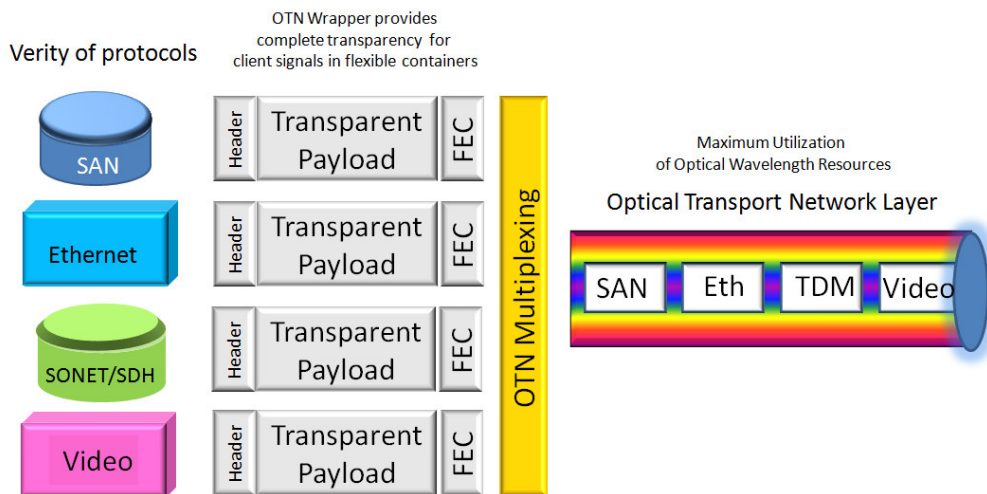


Figure 1.0

Level -2: Using the CWDM or DWDM layer to provide different wavelength for each of the OTU2 10G aggregated uplink pipes and enable them to share the same fiber infrastructure and maximize the fiber bandwidth capacity

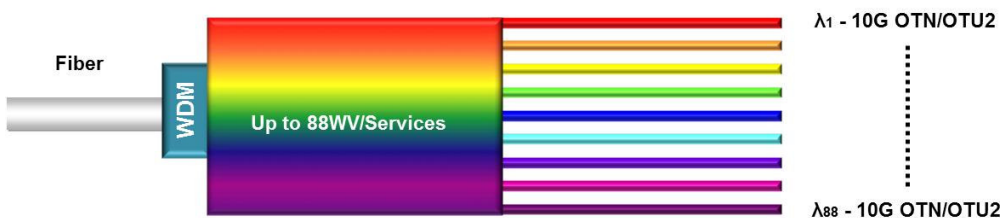


Figure 2.0

According to a recent research, the backbone network of more than 80% of carriers worldwide is based on a combination of OTN and DWDM infrastructure. Such a combination is most effective for efficiently delivering end-to-end services to the customer’s premises and between any sites across the entire OTN backbone network.

PacketLight's PL-2000 multi-service and multi-protocol OTN access solution not only enables the service providers to take advantage of OTN and DWDM mix, but does so in a most compact 1U size efficient for CPE location.

The following paragraphs explore several application scenarios using PL-2000 MSPP.

Connecting two remote access networks over OTN backbone network

By integrating the rich feature set of PL-2000 MSPP, service providers can provide a flexible service mix to any user with full demarcation and SLA at the lowest possible cost. They can reduce the number of network layers and can map multiple different protocols directly to the OTN layer starting at the very edge of the network.

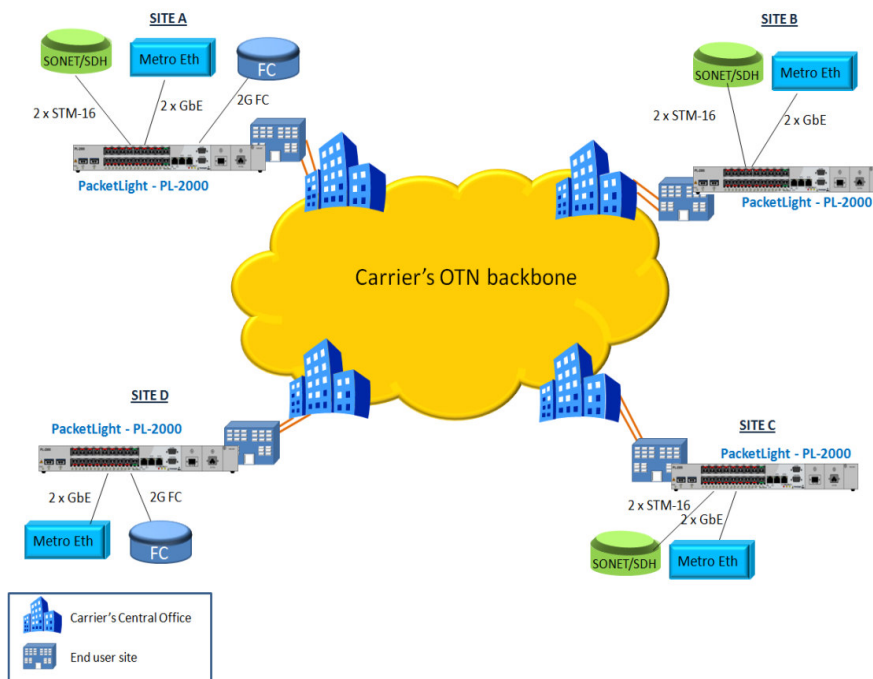


Figure 3

As the solution diagram in Figure-3 shows, PL-2000 MSPP is installed at 4 edge sites (A through D) of the backbone OTN network and converges the OC48/STM16, 2xGbE and 2G FC into a single OTU2 uplink. The solution is forming 3 node SONET/SDH ring, 3 node Metro Eth/MPLS ring and P2P 2G protected FC link over the OTN backbone network by combining different services into two OUT2 10G uplinks connected directly to the existing core OTN network. This type of aggregation enables delivery of the multiple different services over a single protected 10G wavelength across the DWDM infrastructure and is extremely spectral efficient saving optical filters and colored

optics. The service provider can leverage its existing network infrastructure resources of the OTN/DWDM network easily to deliver additional services.

The PL-2000 MSPP is not limited to the configuration provided in the example above. PL-2000 MSPP can support up to 16 flexible multi-rate services such as data (100M/GbE), SONET/SDH(OC3/12/48, STM1/4/16) and SAN (1/2/4G Fibre Channel) rates and aggregate them into a single 10G OTU2 or dual 10G for a total of 20G pipe with dual OTU2 standard based uplinks. The 10G OTU2 uplinks are split into 4x ODU1 pipes each 2.5G in size to which different services are mapped flexibly according to network manager requirements. This configuration positions the PL-2000 as the true multi-service provisioning platform (MSPP) over OTN and DWDM infrastructures.

PL-2000 MSPP provides several options for remote management, configuration, and monitoring. Remote management can be done through a dedicated out of band optical supervisory channel (OSC) pipe or by utilizing dedicated 100Mbps in-band management channel within the 10G OTU2 uplink . Both options allow full access to the local and remote devices for a full spectrum of management and monitoring activities: configuration, performance monitoring, and maintenance functionality.

The PL-2000 edge OTN MSPP enables service providers to extend the OTN network to the very edge of their fiber network. Using the OTN layer for converging different types of networks such as Metro Ethernet, MPLS, SONET/SDH, SAN and Video, they can form unified service optical transport layer in the most efficient way.

MSPP solution for building Multi Service Access Ring network

The PL-2000 is an efficient MSPP platform for building highly transparent 10G access/metro networks for service providers and large enterprises. The PL-2000's multi-rate, multiprotocol capability reduces the number of wavelengths needed to build a CWDM/DWDM infrastructure by a factor of 16. This capability translates into significant cost savings in optical infrastructure while at the same time increasing fiber capacity for future growth.

Using the WDM infrastructure in combination with OTN layer enables the service providers to map any of the service offerings to end customer with easy upgrade path over existing fiber network. Since the OTN and WDM layers make up generic Layer-1 Transport network, different service types can coexist and share the same infrastructure transparently without influencing each other's performance. As an example, the service provider can offer any combination of the SONET/SDH services, MPLS, Metro Ethernet and storage services all on the same fiber network.

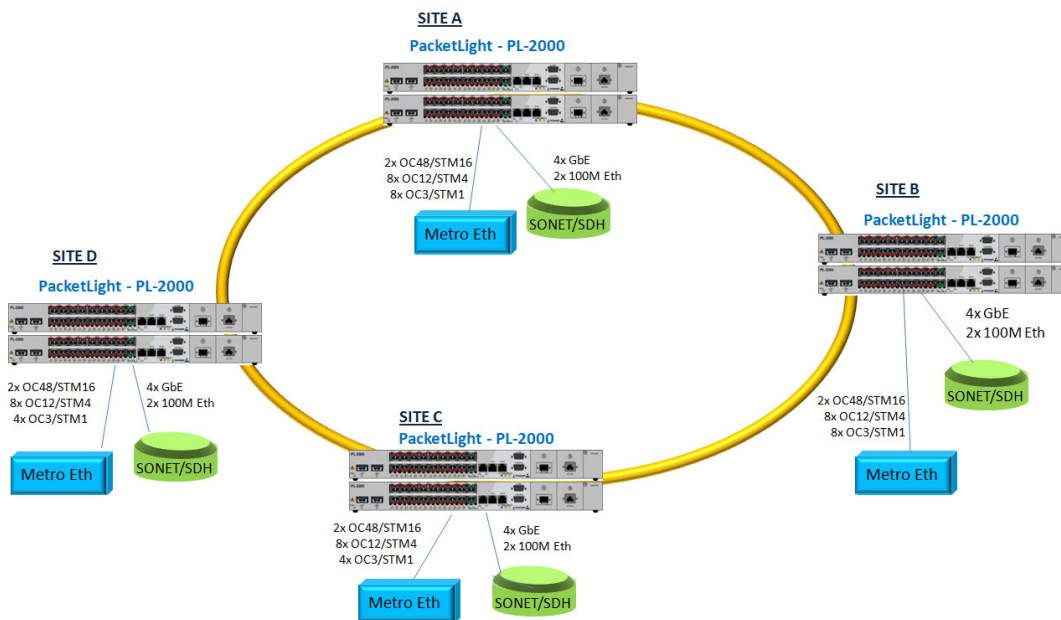


Figure 4

Figure-4 demonstrates a 4 node network over WDM and OTN infrastructure which handles multiple SONET/SDH ADMs and Multiple Metro Eth/MPLS L2/L3 access platforms. The solution provides full hardware and fiber protected infrastructure and uses only 2 wavelengths for transporting 20 different services. The capacity of the solution can be easily increased by adding additional wavelengths and PL-2000 units to the existing infrastructure without affecting the operational traffic.

The OTN and WDM form a generic backbone network that is used by providers to transport and connect over a variety of vendor agnostic 3rd party platforms and protocols according to the service mix required at each location as illustrated in Figure-5. Therefore, the service provider can evolve the type and mix of services over time without the need to change the generic optical transport layer infrastructure.

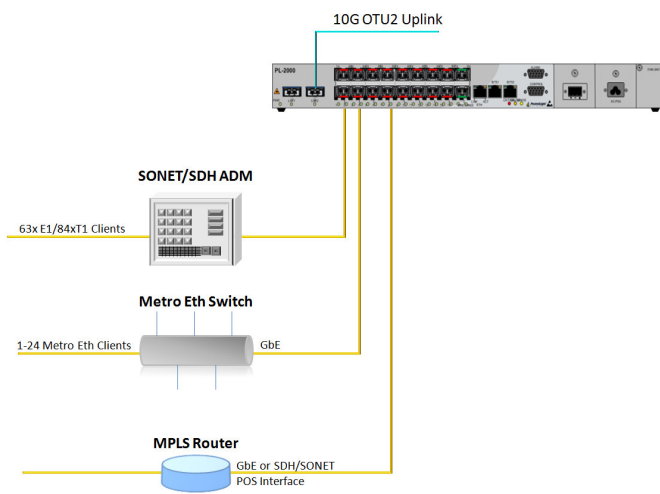


Figure 5

Advantages of OTN layer

The reasons carriers are moving toward OTN include the following:

- 1) Desire to eliminate network layers in order to reduce OPEX. OTN convergence layer is a much less complex technology for transport applications than SONET/SDH. Each network layer that a carrier must manage creates a substantial amount of operating expense. In some carriers, an entire organizational units exist are dedicated to managing each network layer. Since operations constitute 30-40% of carriers' annual expenses, they must minimize the number of different layers in their networks whenever possible.
- 2) The OTN signal incorporates overhead optimized for efficient direct mapping for LAN and SAN signals and other lower rate client signals over carrier WDM networks.
- 3) One of the primary benefits of the G.709 OTN is that it provides a stronger FEC code than the one available with SONET/SDH, thus improving the optical network OSNR (Optical Signal Noise Ratio). This is especially important to allow improved bit error rate and link reliability in long distance amplified links with ROADM systems.
- 4) The key to saving network operational costs is having effective Operation, administration, maintenance, and provisioning (OAM&P) capability built into the signal format. The OTN OAM&P overhead is built to providing remote manageability and all monitoring/transparency needed for reliable service provisioning.

Summary

A big shift is being observed to take place between now and year 2014 in the area of optical networking, with the number of carriers who plan to deploy OTN interfaces on electrical switching equipment rising from 37% to 84%. As expressed by a recent research conducted by Infonetics Research group, majority if not all of the carriers in a conducted survey of world carriers are deploying OTN infrastructure in transport applications, and based on conversations aside from the survey, very few major carriers will 'skip' OTN.

PacketLight's PL-2000 MSPP solution is designed to provide both the WDM optical layer and OTN layer in the same small form factor 1U device, making it the highest capacity per rack space and smallest power consumption solution in the market.

By utilizing the PL-2000 capabilities together with the enhanced functionality of CWDM and DWDM network components such as EDFAs (optical amplifiers) for extended link budget, Tunable XFPs, and optical filters (Mux/DeMux), service providers can build an extremely efficient convergences layer for the different protocols and services needed.

It opens up an opportunity to extend the reach of the back bone OTN infrastructure to reach the very end access point of the fiber network and map the services directly over their existing optical network infrastructure at minimal investment and fast turnaround time.

About PacketLight Networks, Ltd.

PacketLight Networks offers a suite of Leading 1U Metro CWDM/ DWDM and OTN solutions, for transport of data, voice and video applications, over dark fiber and WDM networks, featuring high quality, reliability and performance at affordable prices. Our products are distinguished with low power consumption ideal for CLE (Customer Located Equipment) allowing maximum flexibility as well as ease of maintenance and operation and providing real Pay-as-you-grow architecture. PacketLight customers are carriers, service providers, IT integrators and enterprises who are active in meeting the demands for metro Ethernet, business continuity, Triple Play solutions and enterprise data sharing applications. For product and reseller information, Please contact info@packetlight.com