Optical Transport Network (OTN)

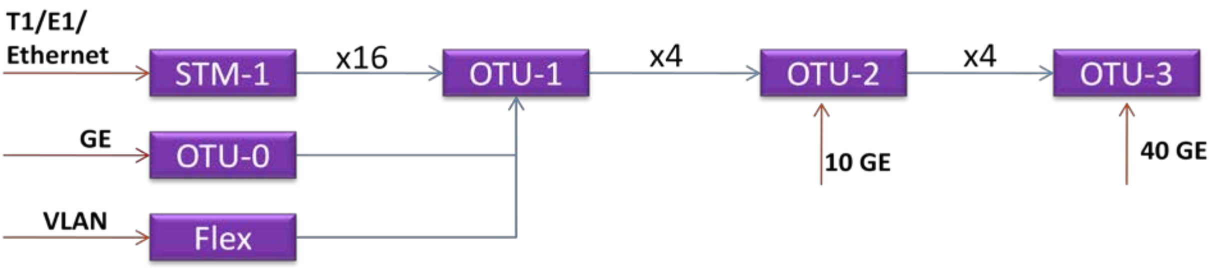
TEJAS® NETWORKS

Future Ready. Today

What is OTN?

As the amount of traffic increases in today's networks, there is a need to handle traffic at more wholesale granularities. Besides, as the ratio of voice to data is constantly moving towards the data side, there was a need to handle data traffic more efficiently in transport networks. As the transport networks become large, they have to be partitioned into several regions or subnets. Since many operators synergize their networks to provide end-to-end services, an easy management of operator-to-operator handoffs is needed. To solve these problems ITU-T laid down the specifications of the Optical Transport Network (OTN). ITU-T provides the general requirements in the G.872 standard and the interface definitions in the G.709 standard.

OTN supports line side interfaces at 2.6 Gbps (OTU1), 10.7 Gbps (OTU2) and 43 Gbps (OTU3) and defines the multiplexing hierarchy between them. OTN dedicates a lot more bytes for forward error correction and thus offers enhanced forward error correction (EFEC)



OTN supports transparent transport of client signals and accepts STM16, STM64 and STM256 as clients. OTN also offers 6 levels of TCM for better management of multi-vendor networks and for clean operator-to-operator handoffs. OTN offers ODUFlex, which is a flexible container primarily for transport of data traffic.

Benefits of OTN

OTN is a significant evolution of transport networks and offers several new benefits to the network operator.

Better Bandwidth Management

OTN handles traffic at a 1Gbps granularity (ODU0). This is perfectly the right granularity for today's aggregation and core networks. With the current increases in network traffic, grooming it at 2Mbps (as provided by SDH) is too inefficient, since with today's 3G/4G networks and DSLAMs generate few hundreds of Mbps of traffic and pipes as large as 1Gbps get easily filled. On the other hand, grooming at wavelength level through ROADMs is not cost effective for aggregation networks which have links typically running at 10Gbps to 40Gbps. OTN with 1Gbps provides the optimum grooming size for these networks.

Longer Reach, Better BER

With support of EFEC more bit errors in links can be corrected. Since bit error ratio is inherently linked to the strength of the signal received at the receiving station. BER performance required limits the span length of a link. Now that more of the bit errors can be corrected, this provides the ability to run the spans longer without having to sacrifice the BER performance. Enhanced FEC in OTN provides a coding gain of up to 6.2dB.

Better Network Management

OTN supports six levels of Tandem Connection Monitoring. This is a significant improvement over the one level provided by SDH. With six levels of TCM, the network can be partitioned into six level of hierarchy from a management perspective. Some of these levels might be defined by a single OTN supports six levels of Tandem Connection Monitoring. This is a significant improvement over the one level provided by SDH. With six levels of TCM, the network can be partitioned into six level of hierarchy from a management perspective. Some of these levels might be defined by a single operator to manage his large network, or for managing multi-vendor subnets within his own networks or for hand-offs between multiple operators. TCM levels might also be used to defined for protection supervision, where, for if one segment of an end-to-end link is protected, then the work and protect links for that sub-connection can be monitored independently of the end-to-end link. The OAM at each TCM level allows network operators to troubleshoot problems quickly in their networks based on hierarchy and can improve the availability of the network.

Efficient Switching of Packet Traffic

It is a known fact that a majority of network traffic arriving at a node is transit traffic. This traffic does not need to be dropped locally and would simply be forwarded on another network interface. In traditional IP/MPLS architecture, all of this traffic will need to be brought to Layer 3 and routed. This bloats up the capacity requirement for the routers since most of the routing capacity is being used for transit traffic. With OTN, the transit traffic does not need to be brought to Layer 3 at all, and can be groomed at Layer 1 itself. This provides several benefits:

1. Reduced Latency: Bypass at OTN layer significantly reduces the latency for the end-to-end link. Low Latency is very crucial for banking and financial services, and one of the main criteria on which they evaluate a service provider performance. Thus, OTN helps to keep these services competitive for the service provider.
2. Reduced Capex & Opex: On a cost per Gbps of switching capacity, routers tend to be much more expensive than OTN fabrics. By substituting OTN for a significant part of the switching capacity (the transit traffic), we're reducing the overall capex significantly. Also, since OTN provides better reliability and OAM compared to IP/MPLS, we also reduce significantly on the number of skilled personnel needed to manage the network.
3. Reduced Power Consumption: OTN fabrics consume less power compared to routing fabrics. They also consume less power than SDH fabrics since they groom traffic at 1Gbps granularity instead of 2Mbps. This leads to significant reduction in service provider's power bill, which these days tend to be a large percentage of the operational expenditure. It also helps to make the network more green and environment friendly.

Better DWDM Utilization

DWDM layer is capable of handling traffic at a wavelength layer. That gives us either a 10 Gbps or a 40Gbps granularity in the DWDM network depending on what interfaces we're using. Since

DWDM by itself does not offer any way to consolidate partially filled wavelengths, this leads to a lot of bandwidth wastage. OTN solves this problem by providing sub lambda grooming through the ODU crossconnect. Thus, an operator is able to optimize his DWDM links by packing the traffic more efficiently in each of his lambdas, while keeping each link totally separate from each other. This allows multiple overlay networks to be run on the same DWDM plant and using the same wavelengths, but which remain completely separate from each other. A service provider can not only run multiple service aggregation networks on the same DWDM plant but can also support wholesales bandwidth services as well, without running the risk of leaking traffic between different networks.

Conclusion

With the telecom networks growing bigger and bigger by the day, carrying more and more traffic and having to support multiple services and applications, OTN provides a cost effective and efficient way to scale these networks. OTN optimizes the layers above (Packet Switching) and below (DWDM) to provide lower cape and opex compared to other technologies. It enables multiple service providers to synergize in order to leverage each other's network to improve coverage and provide seamless end-to-end services.

Tejas Networks Ltd
595, Summer Street, Suite 2,
Stamford, CT 06901
USA

Tejas Networks Ltd,
#58, 1st Main Road,
J.P. Nagar, 3rd Phase,
Bangalore – 560078,
India

Tejas Communcation Pte Ltd,
6, Shenton Way,
#28-09, DBS Building
Tower Two
Singapore 068809

TEJAS® NETWORKS
Future Ready. Today.