Metro Edge Networking

BUILDING OUT THE METRO EDGE FOR NEW GENERATION SERVICES

The demand for high bandwidth Ethernet, video, and storage applications is accelerating, and a new market is developing for technologies that enable service providers to efficiently connect these new services at the metro edge. An architectural approach based on an open photonic layer fits the unique needs of metro edge applications, enabling profitable connectivity of VoD, FTTH, GbE, 10GbE, and wireless services.

METRO EDGE CONNECTIVITY GAP

The fiber build out in the late 90s resulted in overbuilt capacity on long haul and select regional networks. More recently (2000-2002), competition in the metro resulted in increased build at the metro core as service providers in major metro centers constructed core fiber rings connecting the same top tier 1 customers. The long forecast growth in ultra-broadband services is a reality. Numerous new technologies and services are being deployed or planned for access networks delivering VoD, FTTH, GbE, 10GbE, DSL and other services. In order to address this growth and connect these services to existing fiber networks in the core, service providers must solve the connectivity gap at the metro edge. A solution is required to connect new services over fiber from tier 2 customers within the metro, and from customers located in new regional markets in distant vicinities.

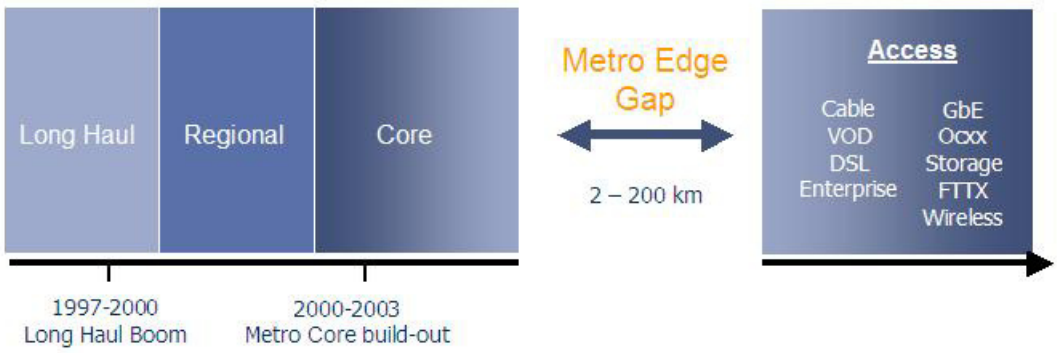

Figure 1: Metro Edge Connectivity Gap

THE NEW METRO EDGE MARKET REQUIREMENTS

The requirements of the metro edge are unique in the network. Whether it is an MSO backhauling new VoD services from a distant hub to a private site or an ILEC requiring new capacity for increased DSL capacity, metro edge transport is driven by the need for simple, cost effective service connectivity. Specific requirements include:

- A traffic profile of straight backhaul to the metro core
- Thin route connectivity - 4-8 channels typically addresses existing services and future service growth needs
- Optical reach of 100km and beyond to reach outlying vicinities
- Management within existing operational umbrella of core transport systems
- Simple deployment - installation is typically by union labor with minimal training working at remote sites
- Multi-vendor operability to seamlessly interwork with wide range of core and access service platforms

SOLVING THE METRO EDGE GAP

Metro edge transport is typically addressed by three alternative vendor solutions: traditional SONET/WDM transport systems, direct optical ports on WAN and CPE service nodes, or stand-alone discrete optical solutions such as amplifiers and stand-alone passives. None of these solutions are optimized to address the needs of the metro edge.

Traditional WDM and SONET transport systems contain additional complexity such as electrical aggregation, transponders, high scalability and wide ranging topology support not typically required for the metro edge. This translates into higher footprint/power and cost with a corresponding reduction in service margins.

Direct optical ports on WAN and CPE service nodes (Ethernet switches, routers, DSLAMs etc) can be connected directly, but typically don't reach the distance required. This solution also lacks the scale and flexibility required to optimize fiber usage for thin routes. Long reach and WDM optical ports can also be highly priced – lacking optical link engineering expertise it is often not a business of interest to service node vendors.

The third current alternative is stand-alone subsystems such as media converters, amplifiers, or passive solutions. These solutions typically lack carrier grade management capability and do not scale well to meet the needs of the metro edge.

PHOTONIC LAYER SYSTEMS: A NEW APPROACH TO THE METRO GAP

A photonic layer approach is built and optimized for the needs of the metro edge. This system architecture is based on the philosophy of an open photonic layer that translates into space/power and cost savings for increased service margins. Characteristics of a photonic layer approach are:

- No packet/protocol specific processing – eliminates additional costs of electrical grooming, expensive transponders, or a centralized grooming matrix for optimal cost/service channel for straight optical backhaul.
- Open ITU interfaces – with the rapid adoption of pluggable optics on CPE and WDM service nodes (Ethernet switches, routers etc), connectivity can now be done directly at ITU wavelengths – 1550, CWDM, or DWDM. This eliminates the cost of transponders on both the service node and transport solution. Why convert twice?
- Architecture cost optimized for 4-8 channels – addresses optimal cost point for metro edge with additional scalability to 32 channels.
- Integration of complete photonic functionality in a single platform including amplification, signal conditioning, management, multiplexing, and wavelength conversion. Avoids the need for expensive external solutions such as stand-alone amplifers.

A photonic layer approach must be optimized for deployability and network fit in a carrier's environment. This includes the following stringent criteria:

- Carrier grade functionality including environmental, safety, and operational requirements
- Service platform node independence – Open ITU interfaces enables connectivity with all service types and platforms – edge routers and switches, SONET MSPPs, wireless edge devices etc. For legacy devices where ITU interfaces are not available, wavelength conversion enables connectivity at any optical interface
- Operational fit – TL-1 and SNMP interfaces for seamless integration into 3rd party EMS and NMS systems. Remote operations through optical supervisory channel
- Ease of deployment – simple installation and commissioning means no complex training is required. Meets the "truck and turn-around" needs of the metro edge.

Key Attributes	Business Benefits	Photonic Layer Approach
All photonic	Cost optimized for new generation services	**No packet/protocol specific processing** • Eliminates additional cost of electrical grooming, expensive transponders, & centralized grooming matrix. • Ensures optimal cost per service channel for straight optical backhaul.
Direct ITU connectivity	Standard interfaces for multi-vendor fit	**Open ITU interfaces – Connectivity directly at ITU wavelength.** • Connecting directly at coloured wavelengths eliminates need for transponders on WDM-lite systems.
Optimized Packaging	Cost optimized for metro edge scale	**Packaging and architecture - Optimized for metro edge networks** • Addresses optimal cost point - 4-8 channels • Additional scalability to 32 channels
Single Platform	One vendor solution	**Complete photonic functionality on a single platform** • Our platform includes amplification, signal conditioning, management, multiplexing, and wavelength conversion. This avoids expensive external solutions such as amplifiers.
Simple Operation	Operational impact minimized	**Integrated Management for simple operational fit** • Simple integration into existing OSS infrastructure • Simple installation • Simple training • Simple remote operation

Figure 2: The Photonic Layer Approach

PHOTONIC LAYER SOLUTIONS AT THE EDGE

As service providers and MSOs are challenged to rollout new data services to grow their revenues and maintain margins in a very competitive market, a photonic layer solution can deliver the required capacity at a price point which guarantees a strong return on investment while leveraging their installed assets. Examples of how carriers have capitalized on the attributes of a photonic layer approach include the following:

SONET/SDH Reach Extension: Existing carriers often need to expand existing SONET core networks to deliver new private line services to customers at the metro edge. Typical distances are 70km and beyond. Metro core SONET/SDH platforms are usually limited to 1310. If 1550 is available the cost is often so prohibitive that direct fiber connectivity is not an option. A photonic layer system deployed with amplifiers and WDM multiplexers at the customer site and the metro core site can extend the reach of multiple SONET links for typically 50% less cost than traditional transport solutions, resulting in ROI improvements for the carrier of up to 100%.

VoD Metro Connectivity: MSOs are widely deploying VoD services to increase their competitive offering against the ILECs. Service connectivity requires backhauling VoD streams contained in GbE links from metro hub sites to a router at the head end. To deliver VoD profitably, MSOs are targeting a cost point of approximately $10 per Video stream or $2400 per GbE. Existing transport solutions based on traditional Metro WDM solutions result in a cost point of approximately $25 per stream. Deploying a photonic layer solution with WDM multiplexing at each end of the network for GbE transport results in a cost point of less than $5 per video stream.

Private Network Ethernet Connectivity: Private enterprises, government and municipalities are widely deploying Ethernet WANs for high bandwidth data connectivity and Internet access. Deployment of these networks results in Ethernet switches dispersed across the metro. Metro edge service connectivity requires connecting these sites and backhauling GbE and 10GbE pipes to a central pop site for Internet hand-off. A photonic layer metro edge system provides a simple solution for Ethernet backhaul, with a system located at each site connected in an 8-channel ring. Ethernet connections are duplicated in each direction around the ring for resilient cost effective backhaul. Resulting costs savings are up to 4x traditional transport solutions.

PHOTONIC LAYER METRO EDGE SYSTEMS: SOLVING THE CHALLENGES AT THE EDGE

With widespread deployment of high bandwidth, new generation services in the access becoming a reality, service providers are facing the practical challenge of connectivity at the metro edge while maintaining service margins. Photonic layer systems optimized for the metro edge address this need, reducing capital and operational expense to unlock the revenue potential of new voice, video, data and storage services.

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