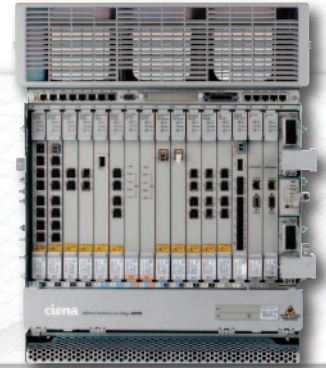# Optical Multiservice Edge 6500

Adaptive intelligent optical transport — simplifying your network

The network is connecting an ever increasing number of devices. People want more—faster Internet speeds, higher bandwidth applications and better quality video. As the world becomes increasingly interlinked and traffic demands surge at an unpredictable growth rate, there is a compelling business case to continue to evolve the metro towards a scalable, adaptive packet-based infrastructure that moves through an agile all-optical long-haul network.

In this volatile and very competitive environment, what if there was one platform that could meet all functionality requirements for both the metro and long haul sections of the network, simplifying the design to drive down costs in both the capital and operating infrastructure?

The Optical Multiservice Edge (OME) 6500 family of products consolidates layers of networking functions and platforms, addressing a wide variety of applications with a reduced number of nodes. The same platform can be employed for wireless backhaul, Ethernet aggregation or business services delivery, can act as an optical transit node with multi-way branching and is leading the market with 40G/100G wavelength transport.

Metro and long-haul DWDM infrastructure

With its integrated photonic capabilities, the OME 6500 offers an architecture with fewer network element types and simplified operations for faster deployment in metro, regional and long haul areas alike. Service providers and enterprises are able to reduce

recurring operating expenses through an overall reduction in managed network elements and a reduction in the cost of network management, equipment sparing, technician training, and document control.

Wavelength-Selective Switch (WSS)-based Reconfigurable Optical Add-Drop Multiplexers (ROADMs) are integrated into the shelf for flexible per-wavelength add/drop/passthrough and per-wavelength switching. Advanced software capabilities applied to ROADMs create the fully agile, end-to-end transport network. Direction-independent and coherent-enabled colorless ROADMs provide benefits such as optical restoration, increasing network availability at little added cost, and wavelength pre-planning simplification, where transceivers can be pre-deployed, and wavelengths can later be added on at the direction of interest with little or no pre-planning.

Figure 1. Scalable platform with integrated 40G and 100G optical interfaces

Features & Benefits

→ Adjusts to site-specific requirements with three OME 6500 shelf variants, all operating on the same software load with interchangeable circuit packs

→ Supports coherent 40G and 100G interfaces to maximize return on investment by delivering up to 10 times more traffic capacity on the existing network

→ Electronically compensates for dispersion, eliminating the need for fixed compensators and associated amplifiers, while also simplifying engineering of the network

→ Delivers a complete suite of integrated Wavelength-Selective Switch (WSS)-based ROADMs for flexible per-wavelength add/drop/passthrough and per-wavelength switching

→ Supports OTN mapping, multiplexing, and transport for standards-based OTN management and networking

→ Provides aggregation/statistical multiplexing on MEF-certified packet interfaces allowing the efficient delivery of packet services with stringent service-level agreements

→ Provides full OAM capabilities and the same carrier-grade capabilities across Layers 0, 1 and 2, while preserving the operational values of circuit-based networks and paradigm operators are familiar with

Data Sheet

Multi-port, multi-protocol transponders with per-port service selectivity offer increased versatility and flexibility. Service providers and enterprises, for example, can deploy the OME 6500 to support their business continuity and data center connectivity needs with Fibre Channel transport, while continuing to offer a varying mix of TDM/WDM/Ethernet/OTN services over a single converged network.

Ciena offers unique network simplification benefits with its high-performance DWDM capabilities on the OME 6500, solving optical transmission complexity using advanced electronics and modem technology integrated into its equipment.

10Gbps and 10GbE transponders employ electronic dispersion compensation (eDCO) that support per-wavelength dispersion compensation directly on the transmitting optical interfaces. Significant CAPEX and OPEX reduction is realized from extending wavelengths without any dispersion compensation equipment or the associated amplifiers and engineering that would otherwise be involved. Each individual wavelength may be routed through the network independent of distance, fiber type or number of intermediate add/drop nodes.

Simplest Upgrades to 40G and 100G

As bandwidth demands continue to increase, operators can easily upgrade their 10G-engineered networks to both 40G and 100G. Ciena's 40G/100G Adaptive Optical Engine solutions deliver both 40G and 100G network capacity, enabling four or ten times the existing network throughput and equipping operators to keep pace with dramatically increasing demand from bandwidth-sapping applications like high-speed Internet, IPTV, HD programming and mobile video phones.

Ciena's 40G and 100G solutions are based on technologies such as coherent detection, Dual Polarization Quadrature

Figure 2. Service diversity and flexibility with Optical Multiservice Edge 6500

Phase Shift Keying modulation, and advanced electronic digital signal processing techniques—all of which Ciena is the first vendor to successfully commercialize.

Coherent technology allows 40Gbps and 100Gbps operation over 10G-engineered networks and advanced digital signal processing automatically corrects for signal degradations caused by fiber impairments.

OME 6500's 40G/100G have the ability to ride over numerous 50GHz-spaced ROADMs, providing operators the ability to gracefully integrate these next-generation solutions into a hybrid network with an incredible level of photonic layer scaling. With their integrated compensation capabilities for both chromatic and polarization mode dispersion, Ciena's 40G/100G deliver both economic and operational benefits both through the reduction and elimination of equipment (regenerators, RAMAN, compensators) as well as the ability to use existing fiber.
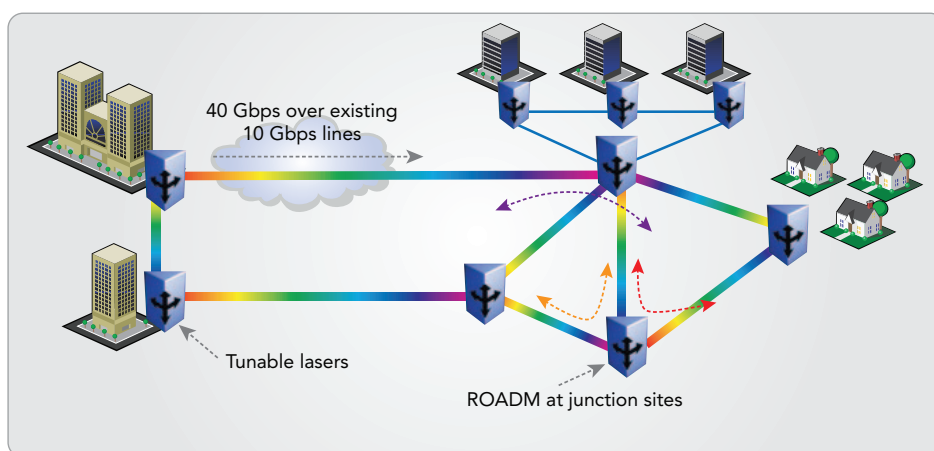
40G Ultra Long-Haul interfaces are also available with the ability to span trans-oceanic distances (9,000km nominal) in submarine applications, allowing operators to upgrade their 2.5G/10G subsea links 16-fold and four-fold respectively.

Ethernet Aggregation services

A key aspect of enabling the transition to a packet-based transport infrastructure is the ability to achieve aggregation/statistical muxing on packet interfaces. Ciena's OME

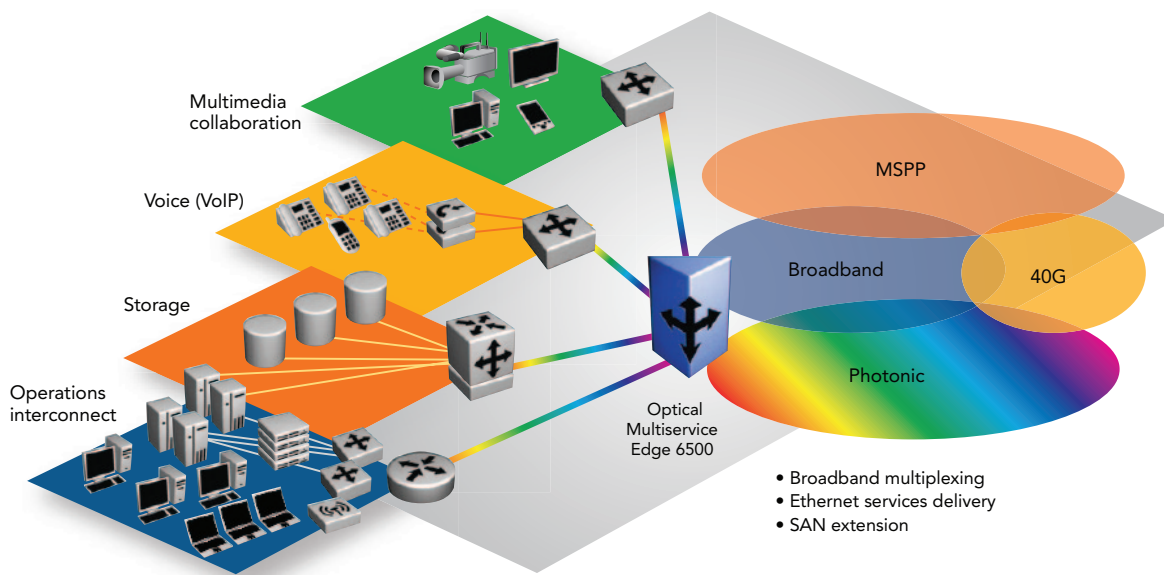Figure 3. 40G Transport over existing 10G network designs and fiber

Figure 4. Delivering multiservice business solutions with a single platform

6500 offers various MEF-certified interfaces with Layer 2 switching capabilities. First, the Layer 2 service switch (L2SS) and L2 MOTR provide excellent Ethernet QoS and traffic management functionality on a per-customer flow basis and allow the delivery of services with stringent SLAs. Very granular customer flows of as low as 64 kbps can be supported. Cost effective and deterministic Ethernet protection is provided with G.8032 Ethernet Protection Ring technology support.

IEEE 802.17b-compliant Resilient Packet Ring (RPR) interfaces allow Ethernet switching over a packet-based ring, and have the same basic traffic management capabilities as the L2SS.

Ethernet Virtual Private LAN or multicast/broadcast video distribution applications

Because they support any-to-any connectivity, the L2 interfaces on the OME 6500 can also be used for Ethernet Virtual Private LAN or multicast/broadcast video distribution applications, bringing the same values of statistical muxing, Ethernet QoS and traffic management to these applications.

For video broadcast applications, the OME 6500 affords carrier-grade resiliency with Ethernet Private Line drop-and-continue capability that includes differentiating equipment and facility protection. Alternatively, operators can cost effectively architect their video broadcasting networks using G.8032 Ethernet Protection Rings, with the OME 6500 interworking across other G.8032 compliant equipment in the access.

Ethernet Private Line (EPL) for business services delivery, Ethernet wholesale, and more

Bridging the TDM transport network and Ethernet world, a variety of Ethernet interfaces encapsulate Ethernet in standard Generic Framing Procedure (GFP) over the SONET/DWDM carrier infrastructure. Given the prevalence of these interfaces in the business services delivery area, the IEEE 802.3ah EFM (Ethernet in the First Mile) standard is supported, allowing customer-located demarc devices to be remotely managed and monitored without having to manage these devices as distinct network elements. In addition, Ethernet and TDM performance measurements are available to provide clear customer demarcation and proof of Service Level Agreement (SLA) compliance, enabling first-class customer guarantees in managed services situations.

Cost optimized, ultra-low latency GbE transport, available on the L2 MOTR, provides benefits for delay-sensitive applications such as financial trading applications.

For high-bandwidth consumer service applications, such as Video on Demand (VoD), efficient transport is provided through native 10GE LAN PHY interfaces, with 40GbE and 100GbE becoming available as the standards are ratified.

Ethernet services over existing copper network

Employing the OME 6500's PDH Gateway function, service providers can cost-effectively start delivering Ethernet services over their existing PDH-based (T1/E1/T3/E3) private

line copper access infrastructures, without requiring any upgrades to the already-deployed access network. The PDH Gateway is based upon industry standard GFP, Virtual Concatenation (VCAT) and Link Capacity Adjustment Scheme (LCAS) technologies that can interoperate with any standards-compliant Customer Located Equipment (CLE). The OME 6500 can terminate hundreds of CLE Ethernet devices on a single shelf, resulting in a highly scalable and cost-effective solution for extending metro Ethernet service footprint and delivering Ethernet bandwidth in the range of 1Mbps to 50Mbps using bundled T1/E1 or T3/E3 links. The fact that the Ethernet service is going over the existing leased line access network is completely transparent to the end customer—he is simply enjoying native Ethernet connectivity with the quality of service he needs and demands.

Full support of TDM, wireless backhaul and next-generation cross-connect replacement

The OME 6500 supports established TDM services with excellent densities and flexibility. High-density copper services (DS1/E1, DS3/E3, EC-1/STS-1), modular and per port selectable optical services (OC-3/STM-1, STM-1e, OC-12/STM-4, OC-48/STM-16, OC-192/STM-64 and 40G OC-768/STM-256 DWDM interfaces provide carriers with a robust service offering and the peace of mind that comes with service forecast tolerance.

Unrestricted bandwidth management capabilities on the cross connect result in a more efficient use of the optical network and prevent premature overlays of equipment that result from limited grooming capabilities.

With unprecedented 80Gbps unconstrained single-stage (non-blocking) VT1.5/VC12 grooming and switching—along with its high optical (with short reach options) DS1/E1 and DS3/E3 densities in a compact frame—the OME 6500 offers

maximum CAPEX and OPEX savings in DCS replacement and wireless backhaul applications. A 48-channel portless transmux interface provides conversion between DS3-channelized and E1/DS1 traffic, processing up to 5G of traffic in one slot, further reducing requirements for external digital cross connect equipment in the network. Full remote troubleshooting capabilities such as optical and electrical loopback, test access and test signal generation capabilities are integrated into the platform, ensuring it meets all operational requirements.

Managing the Optical Multiservice Edge

Underpinning its capabilities, the OME 6500 enhances the manageability of Ethernet networks by delivering a comprehensive management solution that provides full OAM capabilities and the same carrier-grade options across Layers 0, 1 and 2, while preserving the operational values of circuit-based networks and paradigm operators are familiar with.

Capabilities of the OME 6500 management system include:

→ Centralized fault, event and performance monitoring

→ Historical query and reports

→ End-to-end provisioning, visualization and troubleshooting across Layer 0 through Layer 2

→ Embedded IBM Tivoli product line to provide a Web-based client architecture as well as high-rate fault management

→ Industry-standard XML and Corba northbound interfaces adhering to the TMF 814/854 (MTOSI 2.0) standards

→ Optional and customizable service fault correlation and service management
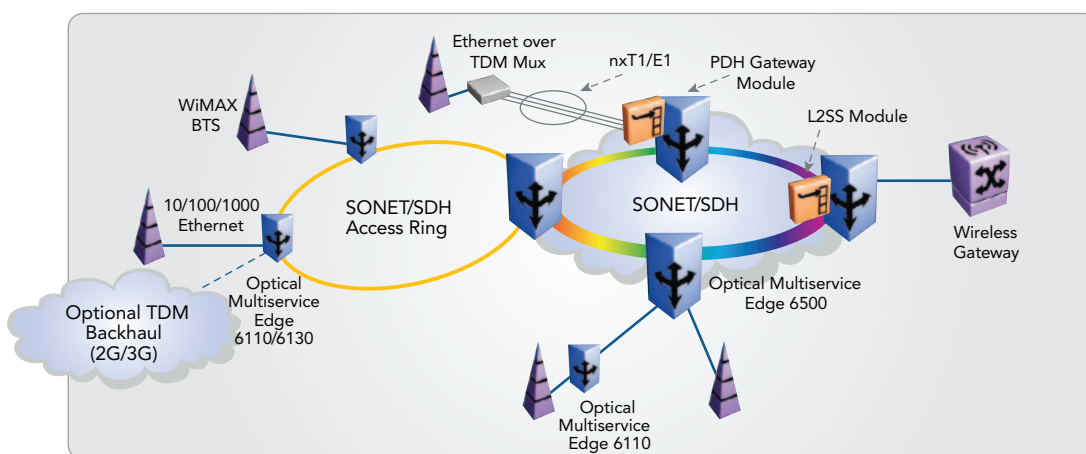

Figure 5. Adding flexibility and scalability to Wireless Backhaul

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In addition, a full suite of sophisticated design tools such as Optical Planner and Optical Modeler are available to customers to evaluate various deployment scenarios over multiple periods, comparing network cost, availability and utilization to decide on the best network architecture to evolve toward. Network resilience to single, dual and multiple failures can be simulated, providing the user with additional data points to compare network deployment scenarios. A powerful GUI interface allows the visualization of a large number of network parameters, such as bandwidth usage per segment, services routing before and after failure, system utilization using color schemes, etc. These graphical outputs are complemented by detailed reports that can be exported for further analysis.

Optical Modeler allows the user to simplify and accelerate photonic network design and expansion to provide an end-to-end photonic solution from planning to modeling to implementation. With Optical Modeler, the user can perform detailed photonic simulation, creating ready-to-deploy designs and guaranteed end-of-life designs. These tools provide an invaluable aid in the planning of customer moves, changes and migration to the latest optical and data networking technologies.

Many network applications. One platform.

Ciena's OME 6500 uses technology innovation to simplify networking for service providers and enterprises. With full integration of TDM, WDM and Ethernet capabilities into the platform, the OME 6500 provides the business model tolerance and service flexibility operators need to seamlessly evolve their networks toward resilient and optimized Ethernet-based infrastructures.

Technical Information

Capacity
Chassis: 640Gbps
System: 8.8Tbps
WDM: 2.5G/10G/40G/100G DWDM, 2.5G CWDM
Wavelength support: 88 wavelengths in C-band, full C-band tunable optics
Channel spacing: 50GHz and 100GHz spacing options
Cross Connects: 20G - 80G low order, 160G – 640G high order

Interfaces
Coherent 100G: 112Gbps line card, 10x10GE client
Coherent 40G: Metro, Regional, Long Haul, Ultra long haul, enhanced PMD 4x10-11.1G client, 40G (OC-768/STM-256/OTU-3) client, 40G XCIF
Photonics: full suite of WSS ROADM, amplifier, and Channel Mux/Demux options
Ethernet: L2 service switch, RPR, PDH Gateway, L2 MOTR, EPL
Electrical: E1, DS1, DS3, EC-1, E3
Optical: OC-3/STM-1 through OC-768/STM-256, OTU-2 and OTU-3

LO Capabilities
Network Topology Autodiscovery
Per channel power monitoring at photonic amplifier output
Per channel power control
Dynamic power equalization per wavelength
Integrated CD compensation - 10G
Integrated CD/PMD compensation for 40G and 100G

Ethernet Capabilities
Rate limiting increments of 64K, 1Mb, 10Mb, and 100Mb
Policing per VLAN, each with COS level having its own CIR, EIR, and Burst rate limiting

Shelf Configuration
Converged optical, photonic, electrical, Ethernet switching shelf
Each slot can be tributary, line, transponder, photonic interface

System Configurations
Unprotected
1+1/MSP linear ASP
1+1 OTN line-side protection
1+1 Transponder Protection Tray
2-Fiber BLSR/MS-SPRing
UPSR/SNCP
Ethernet point-point, Ethernet multipoint-multipoint, G.8032 Ethernet Protection Ring
Resilient Packet Ring
PDH Gateway
International Gateway

Bandwidth Management
VT1.5, VC12, STS1/LO VC3, STS-1/VC4
VC11, VT2, HO VC3
Contiguous Concatenation
Virtual Concatenation (VCAT): High Order (STS1-nv/VC3-nv) and Low Order (VT1.5-nv/VC11-nv, VT2-nv/VC12-nv)
Link Capacity Adjustment Scheme (LCAS), both high and low order

Environmental Characteristics
Normal Operating Temperature: +5° C to +40° C (+41° F to +104° F)
Short Term Operating Temperature (7/14-slot): -5° C to +55° C (+23° F to +131° F)
Short Term Operating Temperature (32-slot): -5° C to +50° C (+23° F to +122° F)
Normal operating humidity: 5% to 85% RH
Earthquake/seismic: Zone 4

Physical Characteristics - Dimensions
6500 7-slot: 10.5" (6U) (H) x 17.3" (W) x 11.1" (D), 267 mm (H) x 440 mm (W) x 281 mm (D)
6500 14-slot: 22.7" (13U) (H) x 17.3" (W) x 11" (D), 577 mm (H) x 440 mm (W) x 280 mm (D)
6500 32-slot: 38.5" (22U) (H) x 19.6" (W) x 10.9" (D), 977 mm (H) x 498 mm (W) x 277 mm (D)

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Specialists in practical network transition ... from complicated to automated.