

**DATA SHEET**

# eMOTR MODULES

For the 6500 Packet-Optical Platform

Full Integration of Packet Switching and Transport. The Ethernet-enabled Muxponder (eMOTR) modules integrate Ethernet service aggregation and switching with optical transport functions in one high-density, compact package.

Leveraging Ciena's field-proven, full-featured Service-Aware OS (SAOS) packet software, eMOTR helps operators scale to swiftly and cost-effectively manage the surging demand for Ethernet service connectivity from the network access to the metro core, using a cohesive converged packet-optical approach that yields substantial savings in equipment and operating costs.

## Product Description

The eMOTR modules specialize in packet switching within the market-leading 6500 Packet-Optical Platform. The eMOTR modules leverage Ciena's SAOS, which is available across the company's Packet Networking portfolio and deployed on more than 710,000 platforms worldwide. The common technology implementation shared across different devices allows for rich functionality implementation and maximum operational efficiencies through equipment interoperability. Additionally, the eMOTR modules offer MEF (Metro Ethernet Forum) Carrier Ethernet (CE) 2.0-certified services.

The eMOTR modules are high-density, packet-enabled muxponders (up to 152 Gb/s per module) and complement the 6500's central packet and Optical Transport Network (OTN) fabric capability to address lower-density bandwidth requirements. Deployment does not require a central fabric and the modules operate flexibly in all 6500 D-Series and S-Series shelf configurations (6500-D2, -D7, -D14, -S8, -S14, -S32) to meet site-specific capacity, footprint, and power requirements.



## Features and Benefits

- Features integrated packet switching and transport in one cost-optimized, highly integrated package
- Leverages 10G and 40G/100G coherent infrastructure with OTN port mapping for enhanced performance and fault detection
- Provides scalable 2-slot to 32-slot chassis-based solution with full redundancy of all components, including card protection
- Offers wire-rate switching on all ports irrespective of packet size and presence of multicast traffic
- Supports MEF CE 2.0 certified services
- Provides broad service stratification and robust bandwidth allocation for guaranteed SLAs via MEF CE 2.0 hierarchical Quality of Service (QoS) capabilities
- Expands the reach of the access network with a compact extended temperature solution optimized for GE and sub-GE services

An eMOTR module can be mated via the backplane with another collocated eMOTR to provide additional switching capacity, service ports, and/or equipment redundancy without the use of inter-card faceplate cabling or a central fabric. eMOTR(s) can also be mated with a 40G coherent line interface for efficient aggregation and grooming of Ethernet services directly onto a 40G wavelength. This modularity allows unparalleled flexibility with the ability to adjust to different networking requirements. An operator can easily scale up to 300 Gb/s to support more services simply by inserting a second eMOTR module.

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The eMOTR is available in three form factors, allowing operators to tailor the solution to their service requirements:

- The eMOTR Edge is a single-slot module designed to cost-effectively deliver GbE and sub-10GE services closer to the edge with support for deployments in extended temperature environments. It provides 2 FE/1GbE/10GbE SFP/SFP+ ports, 8 FE/1GbE/10GbE SFP ports, and 4 10GbE/ODU-2 XFP ports for a total of 68G of faceplate capacity.
- The single-slot eMOTR is optimized around 10G, providing 8 FE/GbE/10GbE ports and 4 10GbE/ODU-2 XFP ports for a total of 120G of faceplate capacity.
- The dual-slot eMOTR offers the same port configuration as the single-slot version, but also adds 32 x GbE SFP ports. The dual-slot eMOTR can therefore support a total of 40 GbE ports with simultaneous line rate packet switching using its 4x10GbE/ODU-2 XFP line ports.

Leveraging its card-mating capabilities, the eMOTR offers a variety of equipment grouping capabilities with both packet-enabled and optical transport clients. It can peer with transport as well as Ethernet switching equipment to operate seamlessly over a service provider's existing infrastructure. The flexible path and equipment protection options deliver a complete suite of differentiated service offerings.

The eMOTR module offers sophisticated traffic management capabilities supporting a rich set of Quality of Service (QoS) mechanisms and congestion control. Ethernet OAM features offer improved service monitoring and troubleshooting, including:

- IEEE 802.1ag Connectivity Fault Management (CFM) for Continuity Check Messages (CCM), Link Trace, Loopback and delay/loss measurements
- ITU-T Y.1731 Performance Monitoring

In addition to its comprehensive packet capabilities, the eMOTR realizes all the integrated optical advantages inherent with the widely deployed 6500 platform. The purpose-built packet capabilities of the eMOTR combine with the 6500's industry-leading WaveLogic Photonics for 10G to 100G transport over any distance, the full range of integrated ROADMs solutions for dynamic service delivery, and integrated link planning tools for operational efficiencies. The combined capabilities offer a tailored and cohesive Ethernet service offering that can handle growth demands for years to come.

Operationally, because of the SAOS integration, the eMOTR modules offer packet software and user interface commonality with Ciena's successful Packet Networking Portfolio for all Ethernet service functions. Therefore, operators trained on

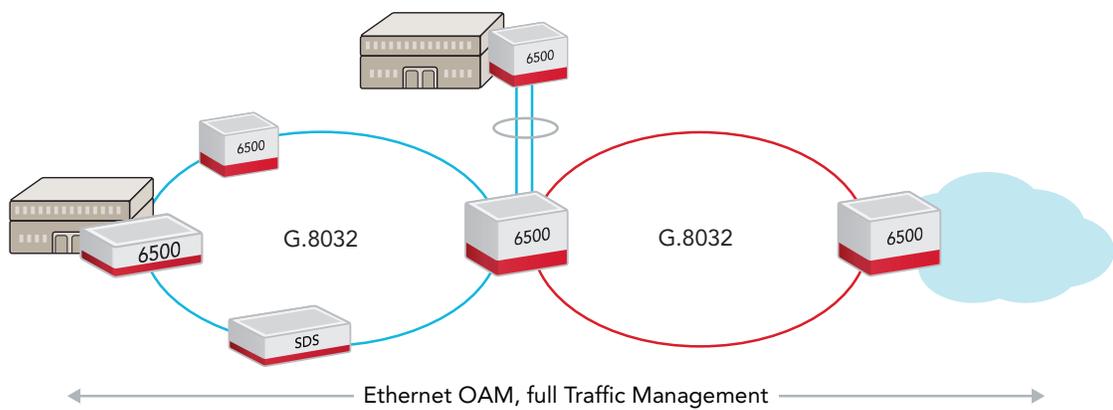


Figure 1. Business service delivery and edge aggregation

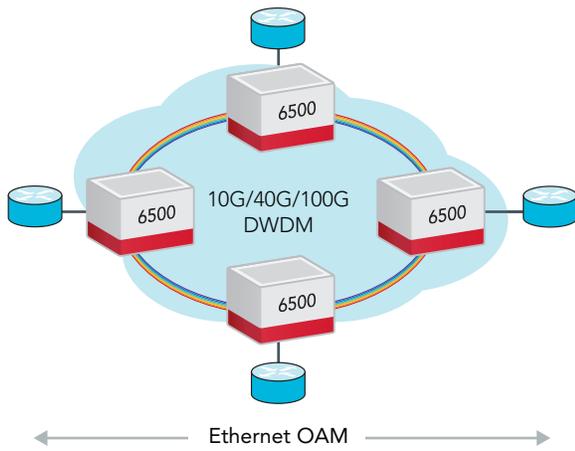


Figure 2. Metro/regional router interconnect application

Ciena's packet products will find the configuration of the packet layer easy and familiar. The eMOTR also retains the 6500 management model for the module, port, and OTN layers to achieve a consistent approach toward the operation of a transport network. In summary, the module maintains the ubiquitous transport mode of operation for transport functions and aligns with the packet portfolio operation for the packet layer.

Single end-to-end Ethernet service management is provided with Ciena's multi-layer, cross-portfolio OneControl Unified Management System. OneControl provides end-to-end, point-and-click service provisioning for faster service turn-up, as well as end-to-end service visibility to meet Service Level Agreements (SLAs) and achieve quick troubleshooting in the event of a network outage or alarm.

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### Applications

The eMOTR modules support a wide variety of applications, both at the network edge and as an infrastructure aggregation device. In all applications, differentiation is provided by the ability to:

- Consolidate functions in one platform to reduce network equipment
- Offer better reach/performance and simpler connectivity to transport systems
- Provide full equipment and path redundancy in a chassis-based offering

**Business service delivery and edge aggregation.** By offering business service connectivity flexibility, providers can offer both E-LINE (Ethernet Private Line [EPL], Ethernet Virtual Private Line [EVPL]) and E-LAN services using the eMOTR. The eMOTR also supports Virtual Link Loss Indication (VLLI) for EPL services to ensure proper detection and indication of network faults. For differentiated SLA options, the eMOTR offers high-end traffic management capabilities and packet manipulation options.

Additionally, the eMOTR Edge is purpose-built to cost-effectively deliver GE and sub-GE business services closer to the edge of

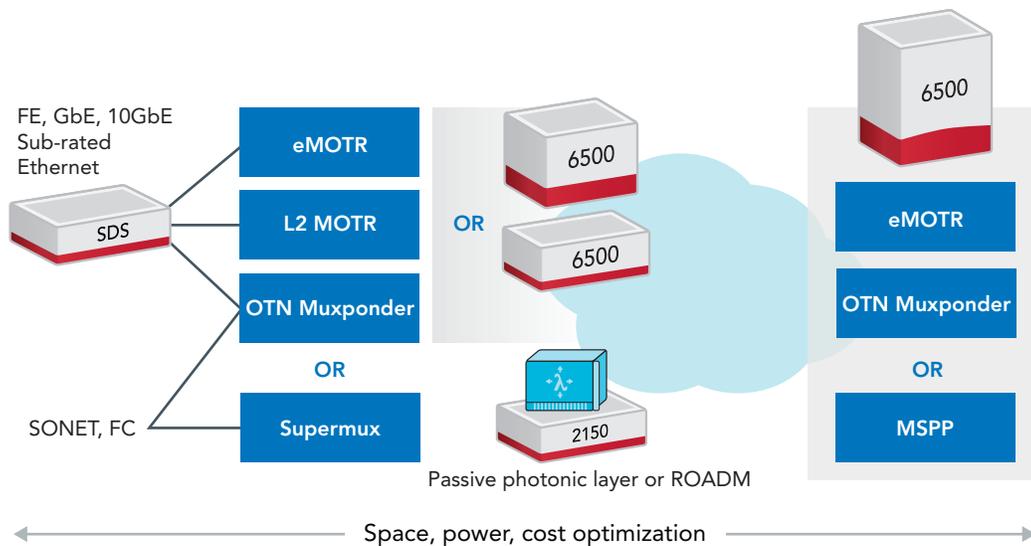


Figure 3. Multiservice transport application

the network. When deployed on the 6500-D2 shelf configuration it can support a compact extended temperature solution ideal for applications such as mobile backhaul packet transport.

Scalability is another advantage. The dual-slot version can support 40 GbE ports, and by cascading two eMOTR modules interconnected via backplane links, operators can terminate 80 GbE-based access services using only four 6500 shelf slots. The single-slot version can be mated with a coherent 40G line module to maximize 10G services with the additional benefits of improved spectral efficiency and operation over any fiber, including older fiber. The eMOTR can be used to groom partially filled GbE/10GbE ports to optimize bandwidth efficiencies, extending the life of both the optical and router networks. Inter-card Link Aggregation (LAG) can be used to increase capacity for higher throughput and provide facility and equipment protection. In addition, efficient 50 ms Ethernet path protection is available using the ITU-T G.8032 Ethernet Ring Protection (ERP) protocol, ensuring continuous availability of business-critical traffic.

With the flexibility afforded by the eMOTR in this application, the operator can offer a mix of protected and unprotected EPL/EVPL services efficiently over a shared infrastructure that can offer protected and unprotected paths simultaneously.

**Metro/regional router interconnect.** The eMOTR offers a very scalable GbE/10G muxing capability for metro/regional infrastructure, including efficient grooming of sub-rated ports to maximize bandwidth and network efficiencies. With add-drop

multiplexing and ITU-T G.8032 packet rings, operators can add or drop GbE/10GbE ports at intermediate sites with multi-site traffic sharing a common wavelength. G.8032 over LAG provides scalability, allowing for increased capacity on a per span basis as needed. With eMOTR, operators are able to leverage the inherent best-in-class photonic capabilities of the 6500 to achieve service flexibility with right-sized ROADMs and maximum scale, with seamless transport over 10G/40G/100G DWDM optics.

**Multiservice transport.** Operators can deploy the eMOTR in any of the existing 6500 D-Series or S-Series shelf configurations to deliver efficient high-density Ethernet connectivity in any captive office or Enterprise building environment. OTN muxponders complement eMOTR for efficient delivery of SONET/SDH, WDM, Fibre Channel or OTN services. Using the 6500, operators can thus support any service mix using a handful of interfaces over a single shared optical network for substantial savings in equipment and operational costs.

## Conclusion

The 6500 platform with eMOTR offers unparalleled integrated packet-optical capabilities to deliver a simpler, more scalable metro architecture. Operators can use eMOTR to adapt to different service requirements while benefiting from best-in-class, feature-rich packet and optical technologies and economies of scale resulting from equipment, bandwidth, and operational efficiencies.

## Technical Specifications

### Physical Interfaces

eMOTR Edge:

2 SFP/SFP+ ports, FE/1GbE/10GbE

8 SFP ports, FE/1GbE/10GbE

4 XFP ports, 10GbE, OTU2/2e

Single Slot eMOTR:

8 SFP+ ports, FE/1GbE/10GbE

4 XFP ports, 10GbE, OTU2/2e

Dual Slot eMOTR:

32 SFP ports, FE/1GbE

8 SFP+ ports, FE/1GbE/10GbE

4 XFP ports, 10GbE, OTU2/2e

### Ethernet

IEEE 802.3 Ethernet

IEEE 802.3u Fast Ethernet

IEEE 802.3z Gigabit Ethernet

IEEE 802.3-2008 10-Gigabit Ethernet

IEEE 802.1D MAC Bridges

IEEE 802.1Q VLANs

IEEE 802.1ab Link Layer Discovery Protocol (LLDP)

IEEE 802.1ad Provider Bridging- full S-VLAN range

EPL, EVPL, EVP-LAN, EPL-Access, and

EVPL-Access MEF CE 2.0 Certified services\*

VLAN tunneling (Q-in-Q) for Transparent LAN Services (TLS)

IEEE 802.3ad Link Aggregation Control Protocol (LACP)

Virtual Loss Link Indication (VLLI) for EPL services

Protected and Unprotected Service (EPL/VLLI) coexistence over G.8032

Jumbo Frames to 9600 bytes

Layer 2 Control Frame Tunneling

DHCP Option 82

Ingress/Egress Port Mirroring

L2 traffic reflector

Wire rate switching for all packet sizes

### Quality of Service (QoS)

8 Hardware Queues per Port

Committed and Excess Information Rate (CIR and EIR)

Classification based on IEEE 802.1D priority

Classification based on VLAN

Layer 2 Quality of Service

Ingress metering per-port

Ingress metering per-port per-CoS

Ingress metering per-port per-VLAN

C-VLAN Priority to S-VLAN Priority Mapping

S-VLAN Priority based on C-VLAN ID Statistics

Congestion avoidance - WRED

Configurable bandwidth profiles

Egress bandwidth shaping

Storm Control

### Ethernet OAM

IEEE 802.1ag Connectivity Fault Management (CFM)

ITU-T Y.1731 Performance Monitoring

### Protection

Link Aggregation (LAG)

Inter-card LAG

ITU-T G.8032 Ethernet Ring Protection

### Synchronization

IEEE 1588v2 Precision Time Protocol (hardware ready)

ITU-T G.8262 Synchronous Ethernet

### Network Management

Command Line Interface for packet layer management functions

Operational commonality with 6500 for card, port and OTN layers

Dual Stack IPv4/IPv6 management

User management (authentication)

Surveillance

Access Control

Intrusion Detection

Tracking (Security Log)

Encrypted communication

Secure Shell (SSH)

Secure Shell File Transfer Protocol (SFTP)

Secure Hyper Text Transfer Protocol (HTTPS)

SNMP version 3

Syslog

Comprehensive Management via OneControl Unified Management System

### Environmental Characteristics

6500-D2 extended temperature solution:

-40°C to 65°C (-40°F to 149°F)

Normal Operating Temperature:

+5°C to +40°C (+41°F to +104°F)

Normal operating humidity: 5% to 85% RH

Earthquake/seismic: Zone 4

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