



# Flexible Enterprise Optical DCI



Accelerating Network  
Transformation

### Flexible Enterprise Optical Data Center Interconnect

Ribbon makes it easy for enterprises to interconnect their campus and colocation-based data centers for high-speed layer 1 Ethernet and Fibre Channel services, with an ability to selectively encrypt individual services. A flexible optical line system fulfills any amplification and ROADM needs. Management options range from platform APIs to a sophisticated Enterprise DCI controller with operator-definable automation.

Enterprises can implement Ribbon's Enterprise DCI solutions directly as a private optical network. Alternatively, service providers can implement the solutions and extend DCI connectivity to enterprises as a managed service. In a shared network, the DCI controller uses multi-tenancy to enable each enterprise to view their unique DCI network slice.



#### What Ribbon Offers

##### Superior Technology

- Flexible 25/40/100/400 GbE and FC 8/16/32/64 transport
- Per service (client) encryption with conventional or PQC/QKD key exchange
- Open optical line system

##### Easy to Operate

- Network equipment APIs
- Sophisticated DCI controller with
  - Low code automation
  - Multi-tenancy

##### Easy to Work With

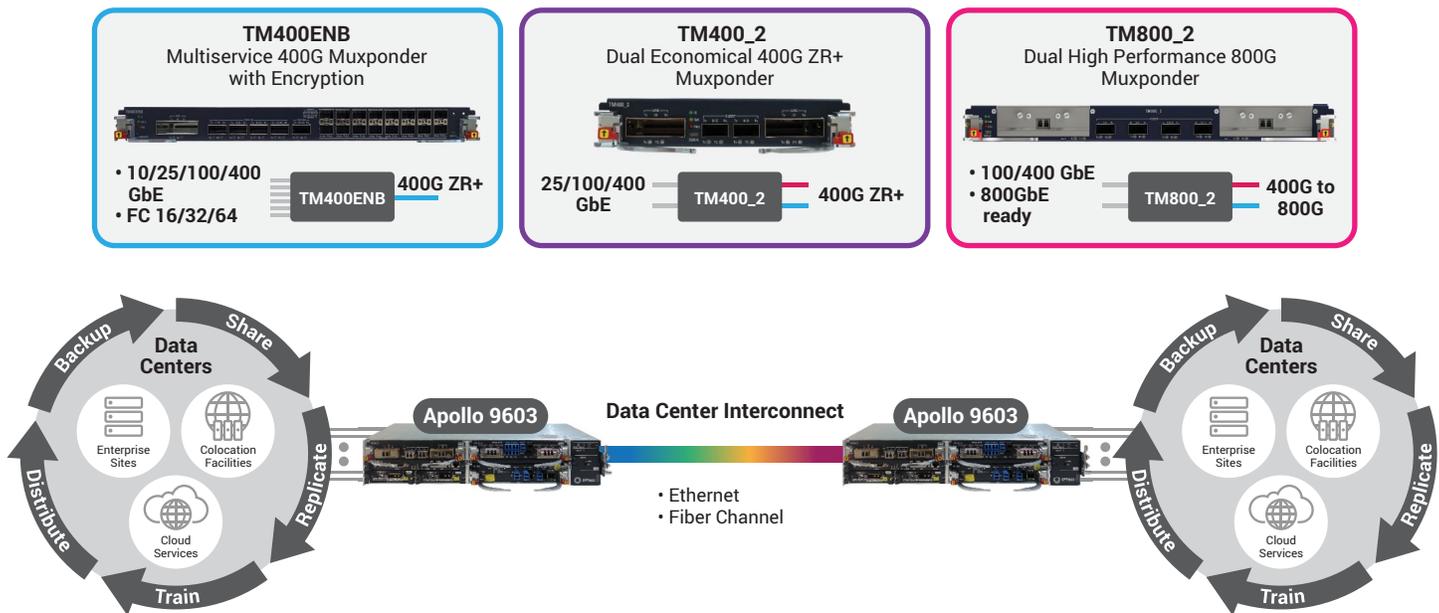
- Tailored configurations
- White glove installation
- Tiered field support

#### Apollo 9600 Family Enterprise DCI Muxponders

Ribbon Enterprise DCI solutions are based on the Apollo 9600 family of optical networking platforms which are available in 2RU, 5RU, and 15RU form factors, among which all line cards are interchangeable. The platforms use right-to-left airflow, and the 5RU platform is also available with front-to-back airflow. Both DC and AC power is available.

The primary muxponder line cards used to implement Enterprise DCI are discussed below, and other trans/mux/switchponder cards are available. Optical Line Protection (OLP) and Optical Multiplexer Section Protection (OMSP) schemes can be applied to all configurations. And while most configurations use fiber pairs, 400G BiDi is also available.

# Flexible Enterprise Optical DCI



## TM400ENB Multiservice 400G Muxponder with Encryption

TM400ENB aggregates multiple 10/25/100/400 GbE and 16/32/64 Fibre Channel clients onto a 400G ZR+ pluggable line interface, capable of 400G-300G-200G-100G line rates for metro to long haul distances.

An earlier TM200EN of this card is also available for 40GbE and FC8 clients over a 200G pluggable line interface.

For both cards, each client interface can selectively be encrypted or not, and both conventional and post-quantum key exchange mechanisms (PQC, QKD) are available.

## TM400\_2 Dual Economical 400G ZR+ Muxponder

TM400\_2 supports two independent transponder-muxponders for low power and versatile transport of 25GbE, 100GbE, and 400GbE clients. Each 400G ZR+ pluggable line interface is capable of 400G-300G-200G-100G line rates for metro to long haul distances.

## TM800\_2 Dual High Performance 800G Muxponder

TM800\_2 uses high-performance 5nm-140Gbaud transceiver technology to meet the most demanding optical transport applications for 100GbE, 400GbE and future 800GbE clients. Two independent transponder-muxponders deliver from 800G wavelengths for metro-regional coverage to 400G for unlimited long haul in 100G increments. Continuous baud rate and continuous modulation controls maximize the line rate for any distance and channel condition right to the edge of the Shannon Limit. The transceivers are pluggable for smooth growth.

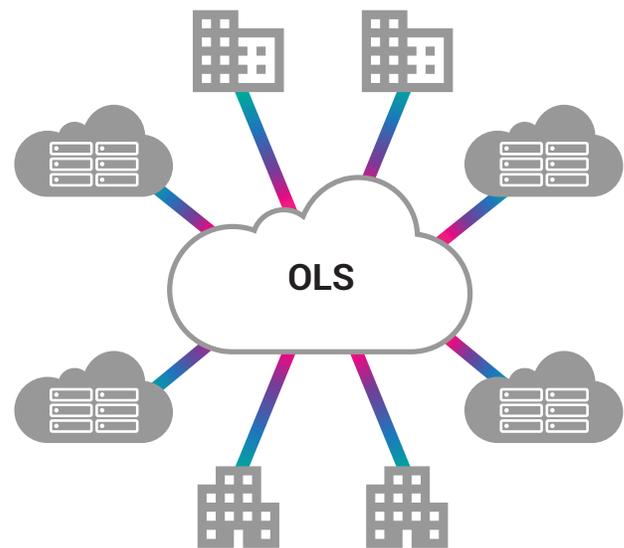
## Flexible Enterprise Optical DCI

### Apollo Flexible Optical Line System

While most DCI applications are less than 100km/60miles and point-to-point, many require in-line amplification for extended distances and ROADMs for networking multiple data center connections.

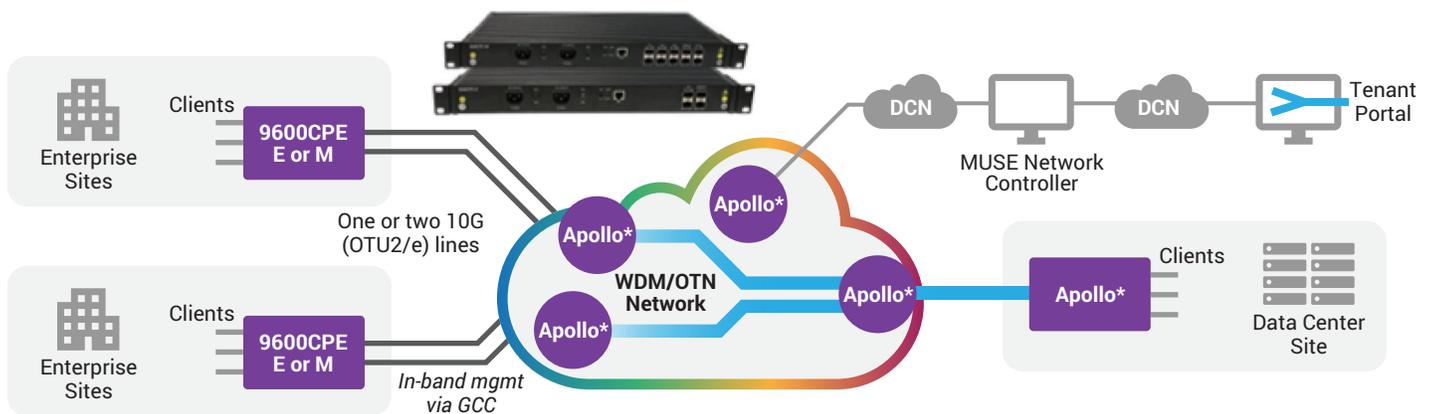
Apollo's OLS covers all needs using:

- A large menu of Erbium Doped Fiber Amplifiers (EDFAs), Raman, and Hybrid EDFA/Raman amplifiers.
- A range of 4-degree to 20-degree flex grid ROADMs, supporting a full set of colorless, directionless, and contentionless add/drop options. Associated Wavelength Switched Optical Networking software delivers automated restoration.



### CPE OTN Demarcation

To support certain Enterprise architectures Apollo 9600CPE provides economical OTN demarcation, extending 10G connections to customer premises to aggregate FE, 1GbE and 10GbE client traffic. This can be implemented in wholly private networks or to support "wavelength services" where DCI connectivity is offered as a managed service by communication service providers.



\* Can be various Apollo 9600 or 9900 platforms, including the 9600CPE at the data center site

# Flexible Enterprise Optical DCI

## Muse DCI Network Controller

Ribbon's Muse cloud-native SDN orchestrator delivers real-time control over Ribbon IP and Optical networks. While DCI operators can manage Apollo NEs directly using APIs, Muse supports a fully featured lightweight version tailored for Apollo DCI solutions, enabling Enterprises and network operators to maximize the value of their investment.

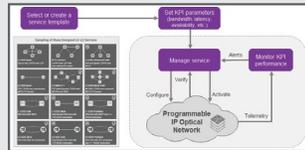
Through powerful Web UI interfaces and automated routines Muse speeds up service creation and provisioning, assures that managed services meet SLA commitments, and reconfigures the network on failures. Powerful analytics monitor optical performance and fiber health and use trend analysis to identify potential problems before they affect services. Muse low-code toolkits enable operators to add workflow automation, ecosystem integration, and other customizations without expensive professional services support.

Service providers can use Muse to manage multiple Enterprise DCI services on a shared network, and using multi-tenant capabilities it can extend to each enterprise via tenant portals an ability to view their unique DCI network slice.

### Network Automation

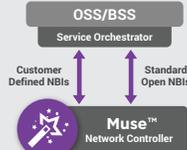


Workflow Engine

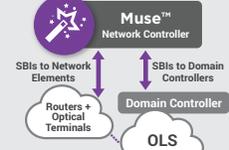


Closed Loop Automation

### Multi-Vendor and OSS Integration



Flexible NBI



Flexible SBI

### Advanced Analytics



Network Insights



Network Health

### Cloud Native Architecture



Microservices Architecture



K8S Infrastructure

## Flexible Enterprise Optical DCI

### Key Specifications

Apollo 9600 Platform Family	<ul style="list-style-type: none"> <li>• Apollo 9603 – 2RU, 3 slots, 300mm deep, right to left cooling</li> <li>• Apollo 9608 – 5RU, 8 slots, 300mm deep, right to left cooling</li> <li>• Apollo 9624 – 15RU, 3 slots, 300mm deep, right to left cooling</li> <li>• Apollo 9608D – 5RU, 8 slots, 620mm deep, front to back cooling</li> <li>• AC and DC power</li> <li>• NEBS GR63, GR1089</li> </ul>
TM400ENB Multiservice 400G Muxponder with Encryption	<ul style="list-style-type: none"> <li>• Double slot</li> <li>• One line using a CFP2-DCO 400GZR+ pluggable transceiver capable of 400G-300G-200G-100G line rates for metro to long haul distances</li> <li>• 21 pluggable client ports support a mix of 10/25/100/400 GbE, FC 16/32/64, OTU2/2e, OTU4</li> <li>• AES256 encryption, Diffie-Hellman key distribution with PQC and QKD options, FIPS 140-3 Level 3</li> </ul>
TM200EN Multiservice 200G Muxponder with Encryption	<ul style="list-style-type: none"> <li>• Earlier version of the above card with a CFP2-DCO 200G line interface, and among other clients additionally supports 40GbE and FC 8 for DCI applications</li> </ul>
TM400_2 Dual Economical 400G ZR+ Muxponder	<ul style="list-style-type: none"> <li>• Single slot</li> <li>• Two independent pluggable 400G muxponders</li> <li>• Line interfaces use CFP2-DCO 400GZR+ pluggable transceivers capable of 400G-300G-200G-100G line rates for metro to long haul distances</li> <li>• For each independent muxponder, a QSFP28/28DD/56DD pluggable supports 1x400GbE or a mix of 100GbE and 25GbE clients using fanout up to the line capacity</li> </ul>
TM800_2 Dual High Performance 800G Muxponder	<ul style="list-style-type: none"> <li>• Double slot</li> <li>• Two independent pluggable 800G muxponders</li> <li>• Line interfaces use pluggable high performance 5nm-140Gbaud transceivers delivering line rates from 400G to 800G using continuous baud rate and modulation</li> <li>• For each independent muxponder, two QSFP-DD pluggables support a mix of 400GbE and 100GbE clients using fanout up to the line capacity; gray or ZR</li> </ul>
Protection	<ul style="list-style-type: none"> <li>• Optical Multiplexer Section Protection (OMSP)</li> <li>• Optical Line Protection (OLP)</li> </ul>
Economical 9600CPE	<ul style="list-style-type: none"> <li>• 1RU for 19"/21"/23" rack, or wall/desktop installation, with fanless design</li> <li>• One or two 10G (OTU2/e) lines, colored and muxed on a single fiber, gray over two fibers</li> <li>• E-version: 2 x 10GbE clients</li> <li>• M-version: 6 clients of FE, 1GbE, STM1/4</li> </ul>
Optical Line System	<ul style="list-style-type: none"> <li>• Full range of EDFA and Raman amplifiers</li> <li>• 4 to 20 degree flex grid ROADMs supporting a full set of colorless, directionless, and contentionless add/drop options</li> <li>• Wavelength Switched Optical Network (WSON)</li> </ul>
Management	<ul style="list-style-type: none"> <li>• Muse SDN Orchestrator</li> <li>• OpenConfig and OpenROADM APIs</li> </ul>

**Contact Us** Contact Ribbon to learn how we can fulfill your Enterprise DCI Needs

## About Ribbon

Ribbon Communications (Nasdaq: RBBN) delivers communications software, IP and optical networking solutions to service providers, enterprises and critical infrastructure sectors globally. We engage deeply with our customers, helping them modernize their networks for improved competitive positioning and business outcomes in today's smart, always-on and data-hungry world. Our innovative, end-to-end solutions portfolio delivers unparalleled scale, performance, and agility, including core to edge software-centric solutions, cloud-native offers, leading-edge security and analytics tools, along with IP and optical networking solutions for 5G. We maintain a keen focus on our commitments to Environmental, Social and Governance (ESG) matters, offering an annual Sustainability Report to our stakeholders. To learn more about Ribbon visit [ribbon.com](https://www.ribbon.com).