Intelligent IP Optical Solutions Portfolio

ribbon

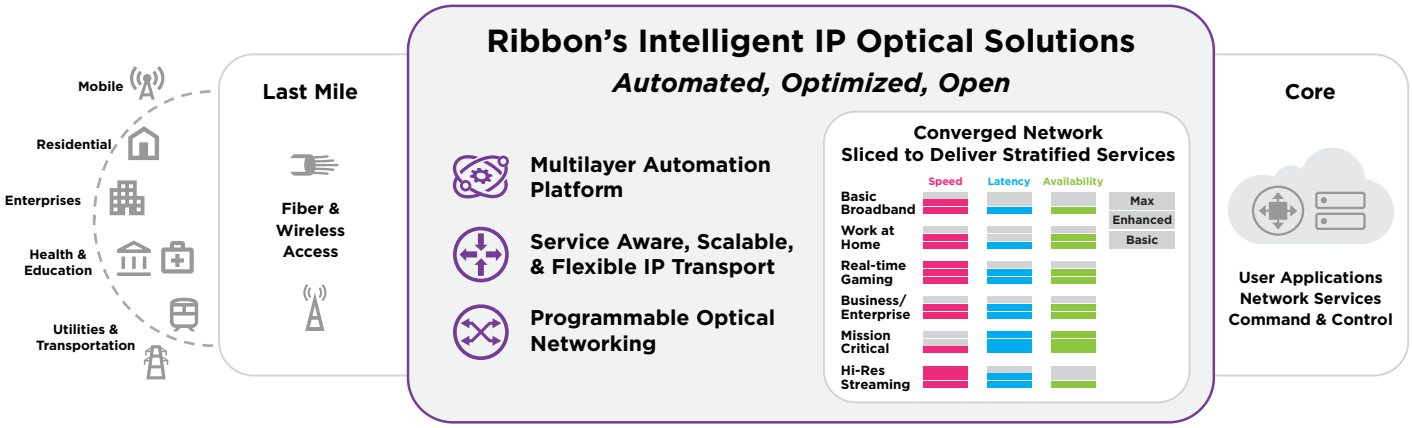
Automated, Optimized, Open IP Optical Network Solutions

State of the Art IP and Optical Networking

Automated, Optimized, Open IP Optical Network Solutions

Ribbon's Intelligent IP Optical solutions connect last mile access networks with core network services and applications. These solutions enable rapid and profitable service delivery by being:

- **Automated:** Ranging from human-assisted to closed loop, covering the entire operations lifecycle.
- **Optimized:** Tailored to meet feature and performance requirements without over-engineering, while being scalable for future traffic growth.
- **Open:** Capable of integrating best-of-breed innovations within a competitive multi-vendor environment.



The IP Wave portfolio consists of three interoperable product families:

RIBBON PRODUCT	Value
Muse Multilayer Automation Platform	Intuitive multilayer IP Optical network lifecycle management, with low code tools for "citizen developer" workflow automation, services design, analytics reporting, and multi-vendor integration.
NPT Service Aware Routing	Multiservice aggregation with Ribbon's advanced IP Wave rNOS, proven to deliver services to meet their service performance needs. Provided on a rich range of platforms to meet varied architectural, capacity, and operational requirements.
Apollo Programmable Optical Networking	Choice of capacity-reach and power-cost optimized wavelengths tunable from 400G to 1.2T, with transport over software reconfigurable DWDM open optical line systems and OTN switching systems.

Ribbon's IP Optical portfolio offers flexible, industry-leading solutions for service provider networks, as well as mission critical, data center, and enterprise private networks.

Service Providers

- Telcos
- Broadband
- Cellular
- Internet
- MSO/Cable
- Rural
- Altnets
- Carrier of Carriers

Private Networks

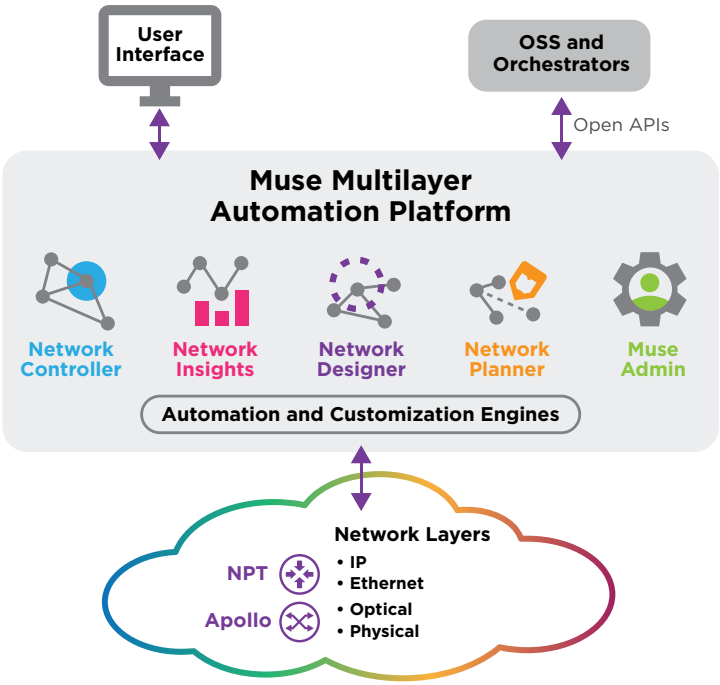
- Enterprises
- Utilities
- Transportation
- Data Centers
- Cloud
- Research and education
- Defense
- Government

Muse Multilayer Automation Platform

Maximizing the Value of IP Optical Networks

Muse Multilayer Automation Platform delivers real-time control over Ribbon IP and Optical networks, providing people and systems with the capabilities they need to maximize the value of network investments. It also integrates with OSS/BSS or higher level orchestrators via northbound interfaces, and can integrate 3rd-party network equipment for multi-layer end-to-end inventory, topology, fault management, and service provisioning.

Muse speeds up services creation and provisioning, assures that services meet commitments, and reconfigures the network on failures. Additionally, Muse streamlines network operations, optimizing capital outlays and reducing costs. To this end, Muse integrates network planning with equipment commissioning, continually analyzes and optimizes the use of network resources, and prevents failures before they happen or sectionalizes them quickly when they do occur.



Muse is deployed on a cloud native infrastructure that can be right-sized for each network operator, and is equipped with low-code toolsets that facilitate adding automation, customization, and multivendor integration to its solutions.

Challenge	Muse Multilayer Automation Platform Solution
Seamless planning to implementation	Iterative planning for greenfield and brownfield networks allows balancing between performance and investment. Plug-and-play commissioning ensures rapid and error-free installation and turn up.
Flexible service creation and rapid provisioning	Template driven service creation processes rapidly define and provision services; includes tools to design new templates from scratch for services differentiation.
Service and network assurance	Continuous network and services monitoring plus analytics identifies issues before they become service affecting. Dynamic restoration recovers from outages using shared resources.
Streamlining operations and reducing costs	Low-code tools enable practical automation at your own pace from human-assisted to closed loop. Operates on an integrated multilayer IP Optical network view.
Multivendor OSS and NE environment	Standard and open NBIs and SBIs enable integration with higher level orchestration as well as other vendors' network equipment.
Evolvable deployment and customization	Deployed on a scalable and secure cloud native infrastructure, with containerized microservices based applications that permit continuous development, customization and delivery.

NPT

Service Aware Aggregation Routing

Ribbon's NPT portfolio combines a proven Network Operating System (NOS) with a rich set of hardware platforms to provide network operators with a family of switching and routing platforms optimized for IP aggregation and transport.

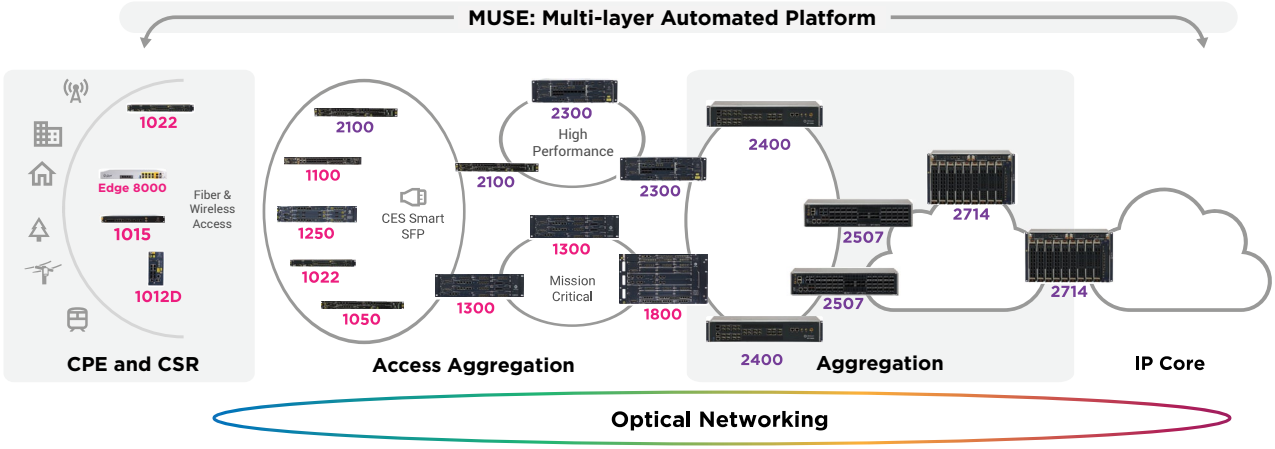
The Ribbon IP Wave rNOS provides features and capabilities across the entire NPT routing portfolio. This allows operators to choose routers with form factors which precisely meet their operational needs in terms of capacity, hardware redundancy, environmental hardening, services supported, interface mix and fan out.

Industry Proven NOS
Single NOS across the entire portfolio

Multi-Service Aggregation
Supports all service types, Legacy, Current, Future

Rich-Set of Form Factors
Right-fit performance, availability, capacity

Flexibility, Agility and Scalability
Pay-as- you grow architecture



	NPT XDR 2000 Series Routers High Performance, High Capacity Routers					NPT AR 1000 Series Routers High Availability, Access Aggregation Routers							
	Access Aggregation		Aggregation			Compact CPE			Access Aggregation				
	NPT 2100	**NPT 2300**	**NPT 2400**	**NPT 2507**	**NPT 2714**	**NPT 1015**	**NPT 1012D**	**NPT 1022**	**NPT 1050**	**NPT 1100**	**NPT 1250**	**NPT 1300**	**NPT 1800**
Application	Multiservice Access Aggregation & DCSG	Multiservice Access Aggregation	High Density Aggregation	High Density Aggregation	High Availability, High Density Aggregation	Fanless Demarc, MPLS-TP	Highly compact CPE for critical industries	High capacity CPE & access aggregation	High availability access aggregation	Cost optimized access aggregation	High availability access aggregation	High availability access aggregation	High availability access aggregation
Form Factor	Fixed	Modular	Fixed	Fixed	Modular, Fully Redundant	Fixed	Fixed	Modular & fixed variants	Modular, Fully Redundant	Modular & fixed variants	Modular, Fully Redundant	Modular, Fully Redundant	Modular, Fully Redundant
Capacity	800Gbps	2.4Tbps	4.8Tbps	7.2Tbps	14.4Tbps	8 Gbps	32 Gbps	Modular: 64 Gbps Fixed: 96Gbps	300 Gbps	300 Gbps	300 Gbps	1 Tbps	1 Tbps
Silicon	Qumran 2A	Jericho 2C	Jericho 2	Qumran 2C+	Jericho 2C+	n/a	Qumran UX	Qumran UX	Qumran UX	Qumran AX	Qumran AX	Qumran MX	Jericho+
Height	1RU	3RU	2RU	2RU	6RU	DIN Rail	1RU	1RU	1RU	1RU	2RU	3RU	8RU

NPT Benefits

Feature Rich

Right-fit IP for every network architecture:

- Deterministic and dynamic MPLS
- Full Layer 3, Layer 2, CES capabilities
- Ring, Mesh, dual-homed, spine-leaf

Choice

Rich set of form factors:

- High availability
- High performance
- Access aggregation, aggregation
- DCSG

Coherent Routing

Architected for seamless IP Optical integration:

- DCO pluggables
- Amplifiers
- Multilayer optimization with Muse

Optimized

Cost efficient by design:

- Fixed architectures for maximum capacity in smallest footprint
- Modular, centralized architectures for cost efficient pay-as-you grow

Apollo

Powerful, Programmable and Open Optical Networks

Apollo combines programmability with advanced optical transmission and wavelength management, providing flexible networking solutions that adapt to traffic changes.

Designed for flexibility and choice, Apollo provides capacity-reach optimized wavelengths up to 1.2T that maximize spectrum efficiency, as well as 400G/800G ZR+ power-cost optimized wavelengths for scalable networks. A modular set of ROADMs and OTN modules route wavelengths and services across all network topologies.

Apollo is easy to deploy and manage, with open control interfaces for multivendor environments.

Programmable Line Rates
100G to 1.2T for the lowest cost per bit

Programmable Wavelengths Routing
for fluid network reconfigurability

Programmable Spectral Grid
for optimum transmission and fiber use

Programmable OTN Switching
for rapid delivery of broadband services

9400 Series
High Density OTN/DWDM

- Compact modular OT and OLS platforms
- Data center optimized with telco NEBS

9408 **9458**

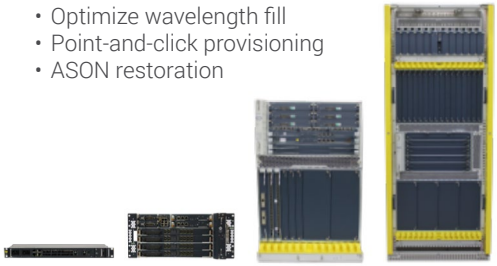
9600 Series
Modular OTN/DWDM

- Rich set of transmission and OLS cards, usable across all platforms without engineering rules
- Telco and data center

9603 **9608/D** **9624**

9900 Series
Scalable OTN Switching

- Optimize wavelength fill
- Point-and-click provisioning
- ASON restoration



9901X 400G
9904X 2.8T
9914 5.6T
9932 16T

Apollo Benefits

Choice
- Capacity-reach optimized to 1.2T for maximal spectral efficiency
- Cost-power optimized 400G/800G ZR+ for metro/regional

Performance
- Multi-service clients GbE/SAN/TDM/OTN
- Layer 1 optical encryption
- CDC-F ROADMs
- Power efficient, as low as 0.07W/G

Intelligence
- Programmable configurations
- Integrated optical performance and fiber health monitoring
- Dynamic network restoration

Open
- Alien wavelengths
- Shared spectrum
- Standards-based interoperability
- Disaggregated control

Contact Us Contact us to learn more about Ribbon solutions

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 rbbn.com.