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Apollo Family

Optical Networking System

Powerful, Programmable and Open Optical Networks

Apollo programmable and open optical networks satisfy the economy's insatiable appetite for bandwidth while providing network operators with fit-for-purpose and future-proof solutions.
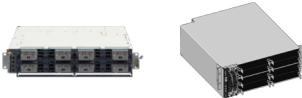
Built around flexibility and choice, Apollo provides industry-leading 140Gbaud-powered high-performance links to 1.2T, filling up fiber channels to their theoretical limits, as well as 400G ZR+ power-cost optimized links for pay-as-you-grow networks. An erector set of SDN-controlled ROADM and OTN switching modules provide unlimited configurations to route links and the services they carry dynamically from the access to the core. Above all Apollo is easy to deploy and to manage, and open control interfaces enable Apollo to participate in disaggregated, multivendor environments.

140Gbaud-powered real-regional 800G and 1.2T DCI	**Modular** fit to application	**Programmable** for automation	**Open** for multivendor deployments
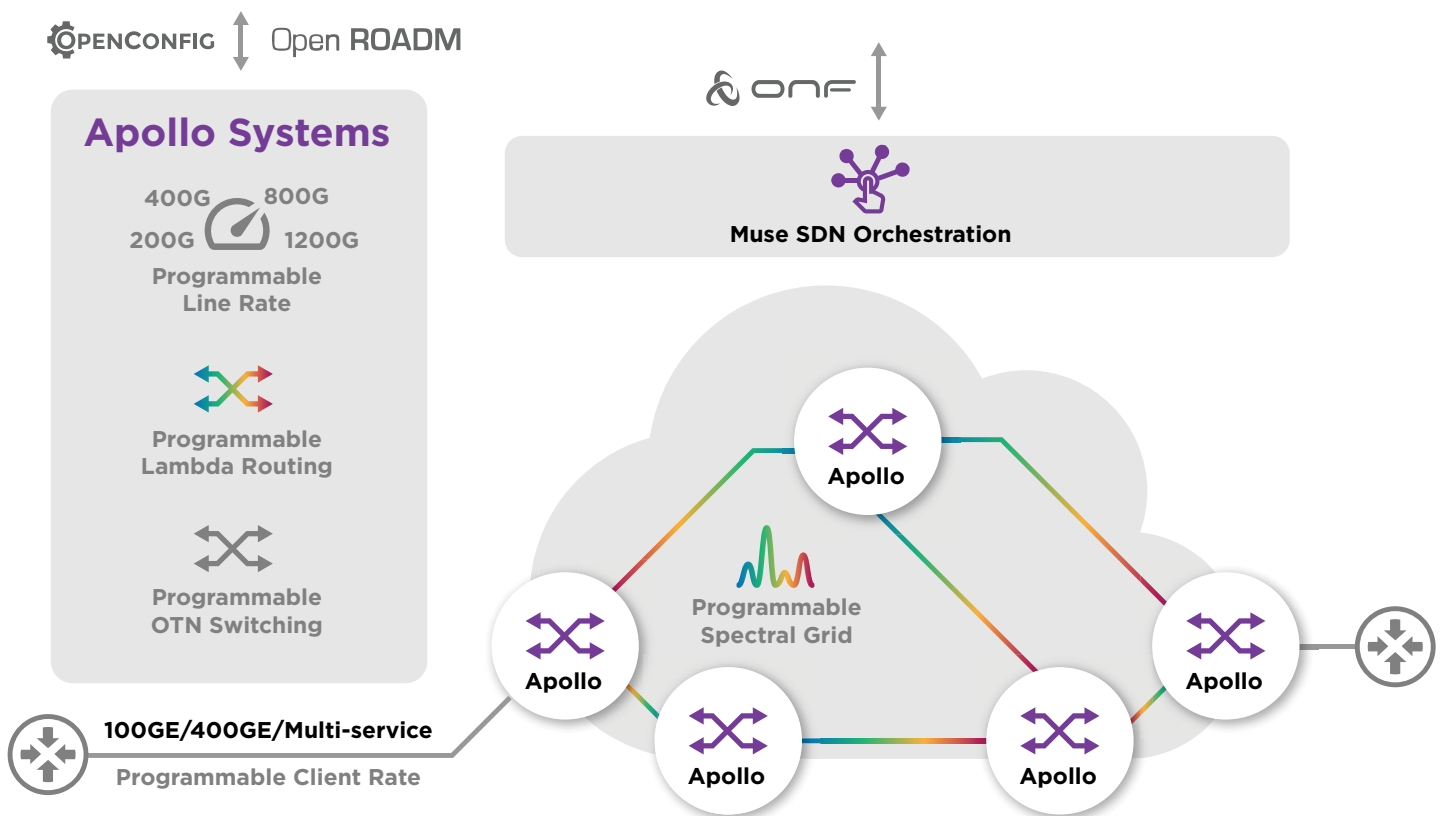
Family and Capabilities Overview

The Apollo family of OTN/DWDM transport and OTN switching platforms work together seamlessly to provide powerful, fit-for-purpose and future-proof optical networks, from the access to core, covering all performance requirements and network topologies.

OTN/DWDM Transport		OTN Switching

9400 Series High Capacity Applications	**9600 Series** Tailored Applications	**9900 Series** Scalable OTN Switching
• Compact modular • Data center optimized with telco NEBS	• Rich set of transmission and OLS cards, usable across all platforms without engineering rules • Telco and data center	• Optimize wavelength fill • Point-and-click provisioning • Dynamic ASON restoration

OT9408	**OLS9408**	**9603**	**9608/D**	**9624**	**9901X** 400G	**9904X** 2.8T	**9914** 5.6T	**9932** 16T

Capabilities	OTN/DWDM Transport		OTN Switching 9900 Scalable
	9400 High Capacity	**9600 Tailorable**	
Client transport	100/400GbE, OTU4	1/10/25/40/100/400GbE, SAN, TDM, OTN	1/10/40/100GbE, SAN, TDM, OTN
Capacity-reach (performance) optimized line interfaces	140Gbaud 400G-1200G	70Gbaud 100G-600G 140Gbaud 400G-1200G	
Power-cost optimized line interfaces	QSFP-DD DCO 100/200/300/400G ZR+	CFP2 DCO 100/200/300/400G ZR+	CFP2 DCO 100/200/300/400G ZR+
L1 optical encryption	Wavelength level	Service selectable	Wavelength level
ROADMs and Open Optical Line Systems	32 degree CDC-F; Alien wavelengths; Shared spectrum	20 degree CDC-F; Alien wavelengths; Shared spectrum	4-degree
OTN Switching		10G ADM	Scalable 400G to 16T
GMPLS control plane	WSON wavelength restoration	WSON wavelength restoration	ASON service restoration
Performance monitoring	Wavelengths; Physical fiber (OTDR)	Wavelengths; Physical fiber (OTDR)	Wavelengths
Disaggregated open control	OpenConfig, OpenROADM	OpenConfig, OpenROADM	OpenROADM
Air flow environment	Data center	Telco, data center	Telco

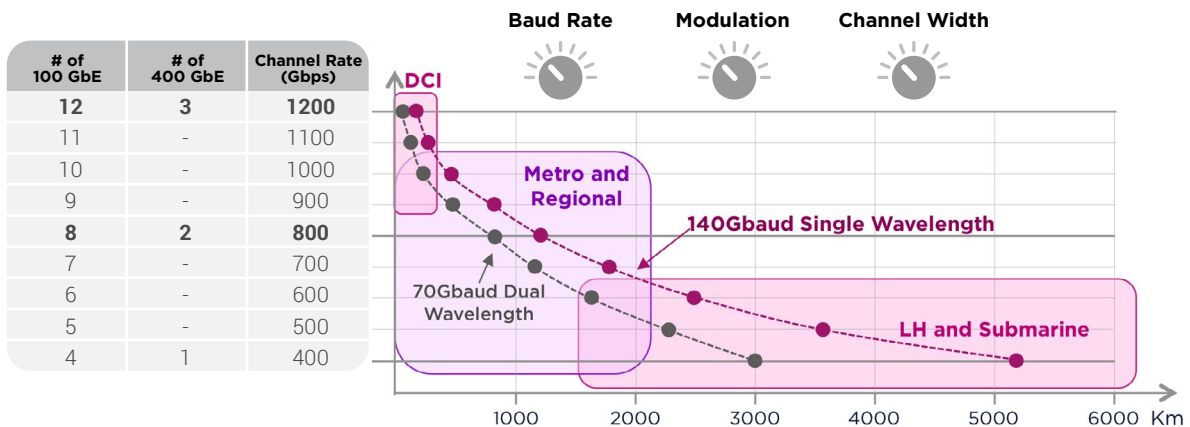**Access to core, covering all network topologies**

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Capacity-Reach or Power-Cost Optimized 400G+Transport

Optical networks are moving to transmission lanes operating at speeds of 400G and higher to transport predominant 100GbE and growing 400GbE client traffic. Apollo offers two types of 400G+ transport to provide a best fit for any application.
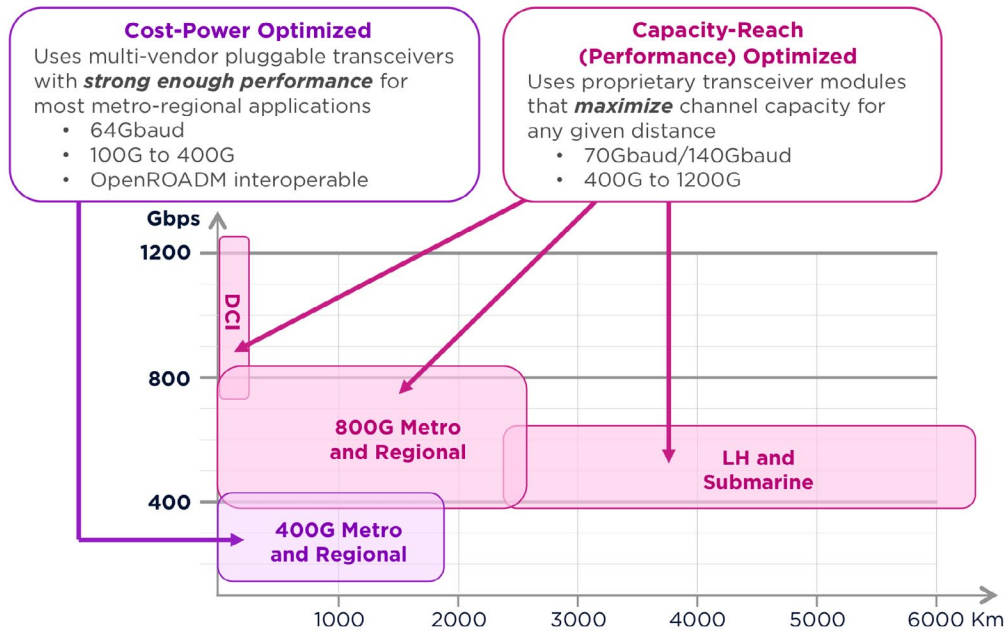
Apollo *capacity-reach (performance) optimized* transport provides software controllable "knobs" that tune the baud rate, modulation scheme, and flexible grid channel width, to maximize the line rate for any distance and fiber condition, including for brownfield fixed grid networks. It is ideal for long haul transport where there is a need to squeeze every bit of spectral capacity from a channel right to the edge of the nonlinear Shannon Limit, and for applications like high density metro transport among data centers where it provides up to 1.2T lanes.

Within 2023, Apollo is migrating to industry-leading 5nm-140Gbaud transceiver technology, that provides unprecedented single wavelength reach including 1200G DCI, regional-coverage 800G, and unlimited 400G.

# of 100 GbE	# of 400 GbE	Channel Rate (Gbps)
12	3	1200
11	-	1100
10	-	1000
9	-	900
8	2	800
7	-	700
6	-	600
5	-	500
4	1	400

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Apollo **cost-power optimized** transport delivers strong 400G performance suitable for the majority of metro and regional networking applications. Apollo's solution is first to market using cost-efficient and open 400G ZR+ technology designed for multi-hop ROADM networks. Our unique design incorporates an internal switch that uses two pluggables in either independent or combined wavelength modes, providing exceptional advantages.


In independent mode, it targets metro applications. Here it delivers two 400G lanes in two 400G wavelengths, at the same cost but for twice the distance of competitors' 800G wavelengths also supporting two lanes. Moreover, it permits network operators to add one pluggable or 400G lane at a time, enabling "pay as you grow" to scale networks. In combined mode, it targets long haul applications. Here it combines two 200G wavelengths to deliver a single 400 lane, which can transmit about 20% further than the competitors' 400G wavelength, also at the same cost.

Multiservice Encryptable L1 Transport and Integrated L2 Services

Besides solutions for predominant 100GbE and growing 400GbE client traffic, Apollo also transports a wide variety of other clients for Enterprise and low speed aggregation applications, including 1GbE, 10GbE, Fibre Channel up to FC32, OTN, SDH/SONET, and various video interfaces.

To protect against information interception by fiber tapping, Apollo provides the highest level of AES-256 layer 1 optical encryption without adding any latency to connections. Entire channels are encryptable or individual services selectively. Enterprise customers can exercise encryption key management (EKM) directly. As a future proof capability, Apollo supports both conventional and post quantum cryptography (PQC) key exchange algorithms.

To accommodate popular data services without having to add specialized equipment, Apollo also integrates L2 statistical multiplexing and packet switching alongside L1 transport. This includes all MEF Carrier Ethernet 2.0 services, including E-Line, E-Lan, and E-Tree.
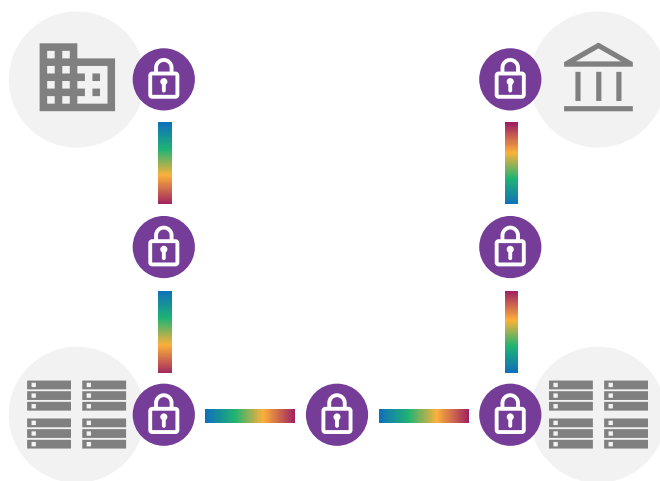
Open Optical Line System

Apollo's optical line system (OLS), combines ROADMs (reconfigurable optical add/drop multiplexers) with amplifiers, to route wavelengths across a DWDM network under software control. Apollo's OLS speeds up service provisioning, reduces costs by eliminating unneeded optical-electronic-optical conversions, and maintains availability by rerouting wavelengths dynamically when failures occur. Moreover, it is a superlative "open" OLS in that it provides equal support for alien wavelengths alongside native Apollo wavelengths, and supports a new "shared spectrum" capability.
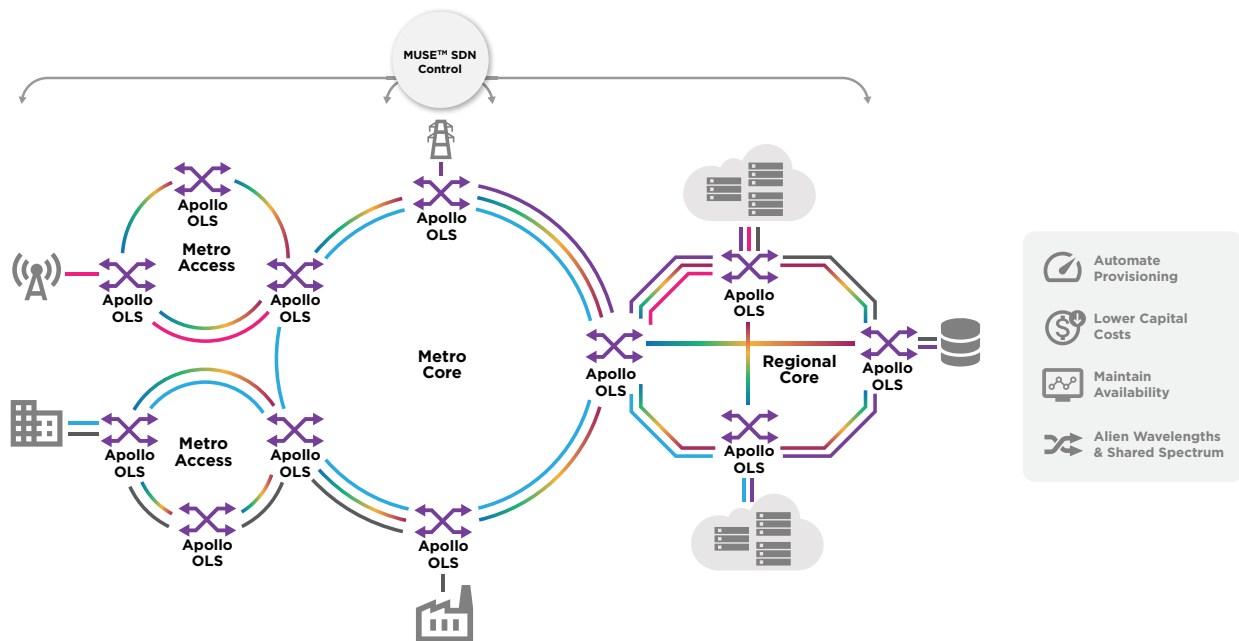

Featuring among the richest set of ROADM and amplification building blocks in the industry, Apollo can satisfy any open OLS configuration, including:

- 2-degree to 32 degree nodes.
- Economical broadcast-and-select and low insertion loss route-and-select architectures.
- Any mix of colorless, directionless, and contentionless (CDC) wavelength add/drop.
- Fixed-grid and flexible-grid channel spacing.

Unsurpassed end-to-end optical performance and fiber health visibility

Apollo's open OLS provides unprecedented insight into the network's optical health at all times. Proven algorithms convert integrated power measurements (no need for separate OCM cards) into OSNR and other parameters. OTDR modules report on the status of the multiple connections and splices along the fiber path, and pinpoints failures to within meters. Historical measurement analysis detects problems before they affect services. These unique capabilities allow operators to maintain their optical network proactively, eliminating the need for costly external test equipment, and reduce field maintenance costs.

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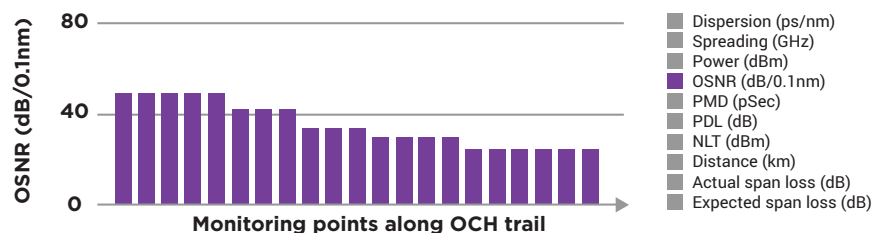
Dynamic Restoration

In the event of a fiber failure, Apollo OLS uses Wavelength Switched Optical Network (WSON) signaling to reroute wavelengths dynamically to restore services. This can be applied agnostically to both native and alien wavelengths, and can also be exercised under centralized SDN control.

Alien wavelengths and shared spectrum

All Apollo OLS optical routing and monitoring capabilities apply equally to Apollo native wavelengths and alien 3rd-party wavelengths. Apollo can even transport bands of alien or shared spectrum – configured as point-to-point spectral pipes, or sliced spectrum controllable over a ROADM domain – providing ultimate flexibility for opening up the optical network to partnerships and innovative services.
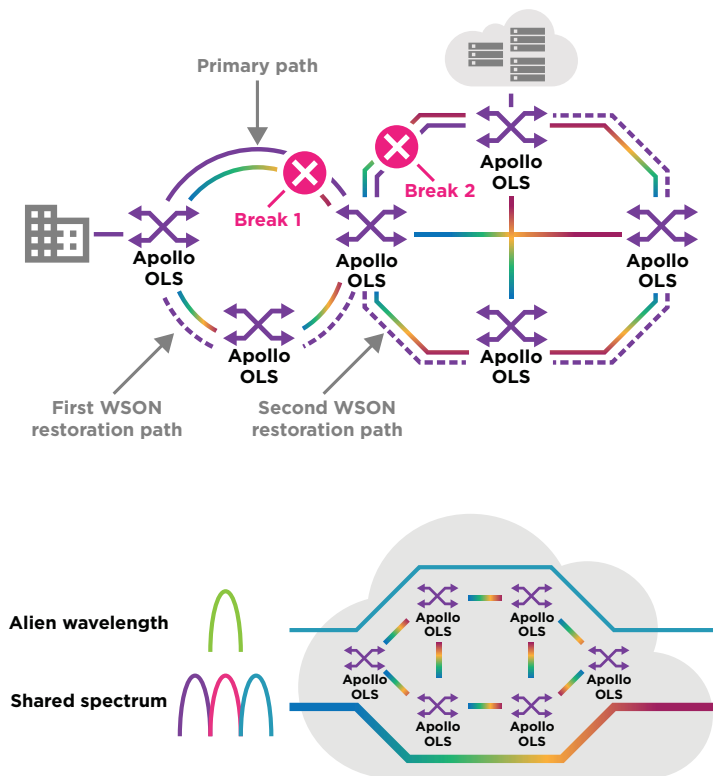
Access to Core OTN Switching

OTN switching packs and unpacks multiple lower speed services onto and off higher speed wavelengths under software control. It optimizes optical network solutions by providing benefits that include:

- Grooming multiple lower speed services onto a reduced set of wavelengths.
- Provisioning services rapidly and end-to-end under software control.
- Employing ASON (automatic switched optical network) signaling to dynamically reroute and restore individual services in the event of link failures.

Apollo provides a complete set of access to core OTN switching platforms, with capacity scaling from 400G to 16T, enabling operators to obtain the benefits of OTN switching economically throughout their network. In particular, Apollo features a 1RU Access OTN Switch aimed at streamlined delivery of L1 business services to Enterprises, and a Metro OTN Switch with a unique design that adds capacity in a pay as you grow fashion.
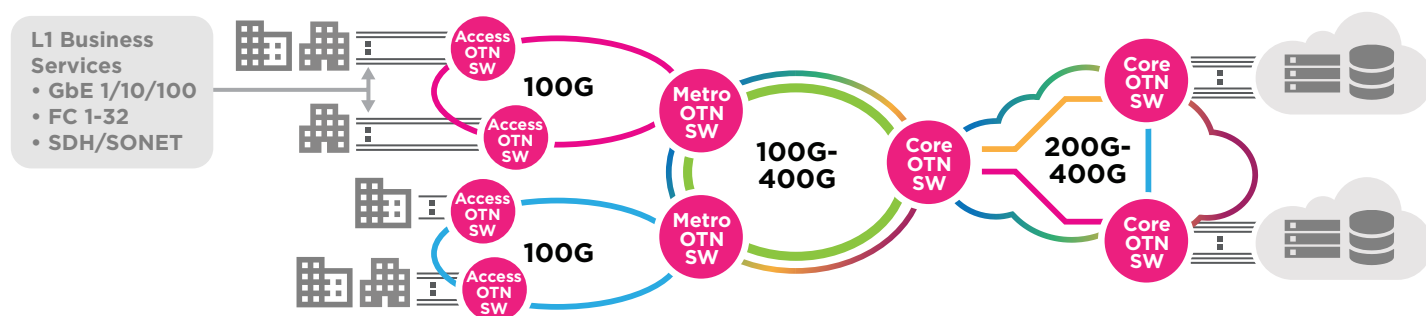
Disaggregated Open Control

Apollo supports both partially and fully disaggregated optical networks based on OpenConfig, OpenROADM, and ONF open and standard APIs, for a variety of configurations. This unleashes Apollo's ability to deliver its unique benefits in multi-vendor networks, including high performance transport that transmits 400GbE clients further than any competitor approach, an optical line system that elevates alien wavelengths to alien spectrum and spectrum slicing, and OTN switching that revolutionizes delivery of L1 business services.
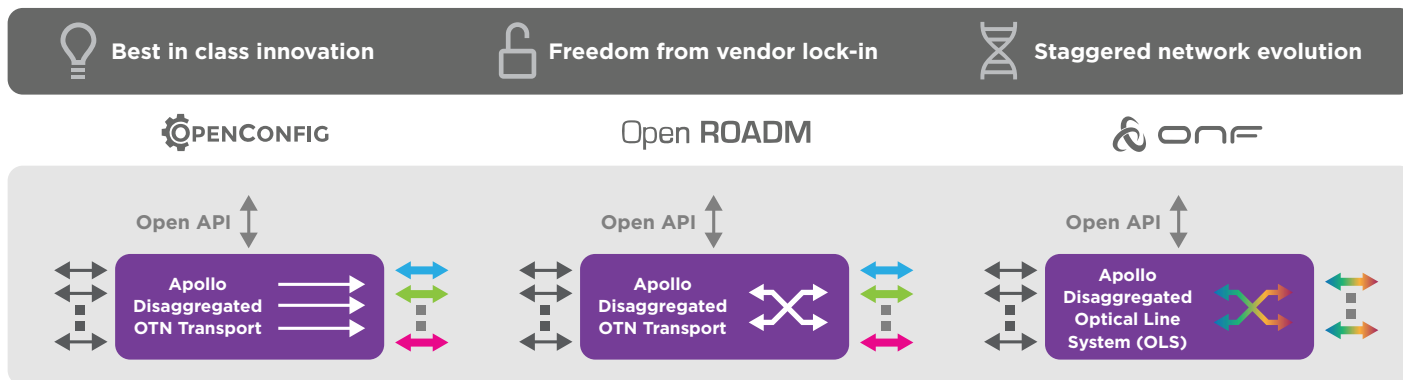
SDN Lifecycle Management and Automation

Apollo expresses it full value when coupled with Muse SDN domain control. Advanced planning algorithms optimize architectures for Capex, and automated download of configuration files guarantee an error-free network turn-up. A library of services templates simplify provisioning, and links are verified before they go live. Data is continuously streamed from the network to monitor health, and analytics anticipates problems before they become service affecting. When hard problems do occur, dynamic rerouting restores links and services temporarily, while diagnostic tools pinpoint the failure source quickly enabling speedy dispatch and repair.

Muse integrates with OSS/BSS and higher-level domain controllers through open transport APIs, and permits migrating smoothly from human control, to partial automation with human oversight, to fully automated lifecycle control.
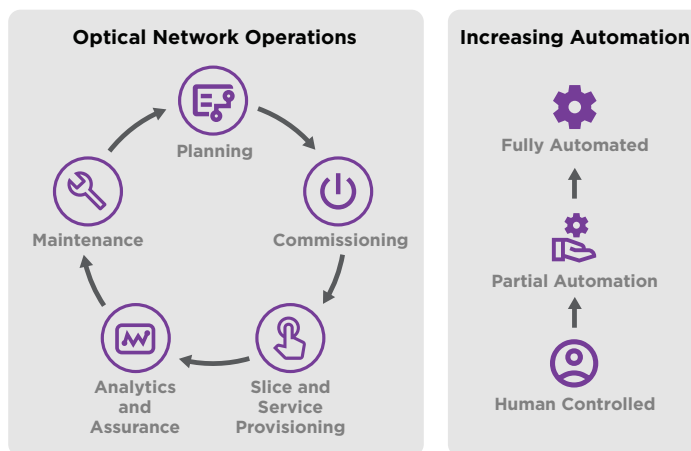
Contact Us Find Out How Apollo Can Energize Your Optical Network

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.