IP Wave Portfolio

Optimized, Automated, Open
IP Optical Network Solutions

State of the Art IP and
Optical Networking
Optimized, Automated, Open IP Optical Network Solutions

Ribbon’s IP Wave portfolio builds IP Optical network solutions that deliver innovative services rapidly with better overall economics. Its solutions are:

- **Optimized** – tailored to meet feature and performance requirements without costly over-engineering, while being scalable to handle future traffic growth
- **Automated** – from human-assisted to closed loop, covering the entire operations lifecycle
- **Open** – able to incorporate best-of-breed innovations in a competitive multi-vendor environment

The IP Wave portfolio consists of three interoperable product families:

<table>
<thead>
<tr>
<th>NPT IP Networking</th>
<th>Delivers multiservice aggregation and transport using a state-of-the-art IP stack with common NOS, while providing the right fit with a range of form factors and capabilities</th>
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</thead>
<tbody>
<tr>
<td>Apollo Optical Networking</td>
<td>Delivers industry leading performance for 1.2T/800G/400G wavelengths over software reconfigurable DWDM/OTN solutions with smooth capacity growth</td>
</tr>
<tr>
<td>Muse SDN Orchestration</td>
<td>Delivers multilayer IP Optical operations lifecycle management, with practical automation to speed up services delivery, streamline operations, and integrate into multi-vendor ecosystems</td>
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IP Wave solutions are agile enough to support multiple network topologies and geographies for a broad range of Service Provider, Private Network and regulated industry customers.

### Service Providers
- Telcos
- Broadband Service Providers
- Internet Service Providers
- Mobile Network Operators (Cellular)
- Multi-System Operators (Cable)
- Rural carriers and altnets
- Carrier of Carriers

### Private Networks
- Enterprises
- Regulated industries such as electric power, oil, gas and water utilities.
- Transportation communications for rail, highways and ports
- Research and education networks
- Defense networks
- Cloud service providers
Apollo
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.

### Performance Benefits

<table>
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<tr>
<th><strong>Performance choice</strong></th>
<th><strong>Feature rich</strong></th>
<th><strong>Intelligent</strong></th>
<th><strong>Open</strong></th>
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</thead>
<tbody>
<tr>
<td>Capacity-reach optimized for 1.2T DCI, 800G regional, 400G ultra long haul</td>
<td>Multi-service clients GbE/SAN/TDM/OTN</td>
<td>Programmable for SDN control</td>
<td>Optical line systems with for alien wavelengths and shared spectrum</td>
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<tr>
<td>Cost-power optimized 400G for most metro applications</td>
<td>Per service L1 optical encryption</td>
<td>Integrated optical performance and fiber health monitoring</td>
<td>Disaggregated OpenConfig control</td>
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<td></td>
<td>Up to 32 degree CDC ROADMs</td>
<td>Dynamic network restoration</td>
<td>OpenROADM interoperable</td>
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<td>Power efficient, as low as 0.11W/Gigabit</td>
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NPT
Converged, Optimized, Open and Automated IP Networking

NPT is optimized for access edge, aggregation, and IP transport. It provides operators with the automated, programmable platform they need to collapse all their services onto a single converged IP network, and the agility to evolve the network as services and customer needs evolve.

NPT is made up of the XDR and AR router families. NPT XDR routers with their state-of-the-art merchant silicon, 400G interfaces and disaggregated or fully integrated deployment options are optimized for transporting high-performance, high-capacity services. NPT AR routers provide the hardware redundancy and modular architecture required to support mission and business critical services. The IP Wave rNOS provides a common set of industry proven features and capabilities across both the NPT XDR and NPT AR router families.

### NPT Benefits

**Converged Multiaccess, Multiservice**
- EVPN-MPLS, MEF 3.0 Services, L3 VPN, L2 VPN
- Provide right-fit IP backbone/backhaul functionality for xHaul, broadband backhaul, CIN
- Industry leading TDM to IP migration
- Provide interfaces and mission critical performance required by regulated industries.

**Advanced Service Assurance and Availability**
- Network telemetry
- Real-time, right-first-time, OAM, and analytics
- Transport and service restoration
- AR family provides modular redundant hardware

**Automated and Programmable**
- Programmable IP transport with multiple traffic engineering options: IP/MPLS, SR-TE, RSVP-TE, MPLS-TP, FlexE, FlexAlgo
- Open ecosystem integration with standards-based, field-proven, interfaces such as PCEP, BGP-LS, NETCONF/YANG, sFlow, Telemetry

**Open**
- Proven IP Wave rNOS supporting fully integrated and disaggregated router deployment options.
- Pluggable 400G ZR and OpenZR+ provide support for IPoDWDM
Muse
SDN Orchestrator

Muse delivers real-time control over IP and optical networks, providing people and systems with the capabilities they need to maximize the value of network investments.

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 achieves service-centric streamlined network operations through five central elements of design and functionality: complete IP optical network control, practical automation, multi-vendor adaptation, low code customization, and secure cloud-native deployment.

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<th>Challenge</th>
<th>Muse SDN Orchestrator Solution</th>
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<tr>
<td>Seamless planning to implementation</td>
<td>Iterative planning for greenfield and brownfield networks allows balancing between performance and investment. Plug-and-play features ensure rapid and error-free installation and turn up.</td>
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<td>Fast time to market and service differentiation</td>
<td>Template driven service creation processes rapidly define and provision services; includes tools to design new templates from scratch for service differentiation.</td>
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<td>Service assurance</td>
<td>Continuous network and services monitoring plus analytics identifies issues before they become service affecting. Dynamic restoration recovers from outages using shared resources.</td>
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<td>Streamlining operations and reducing costs</td>
<td>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.</td>
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<tr>
<td>Multivendor environment</td>
<td>Standard and open NBIs and SBIs enable integration with higher level orchestration as well as other vendors’ network equipment.</td>
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Contact Us Contact us to find out how to Transform your Network with IP Wave
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.