Neptune 2100

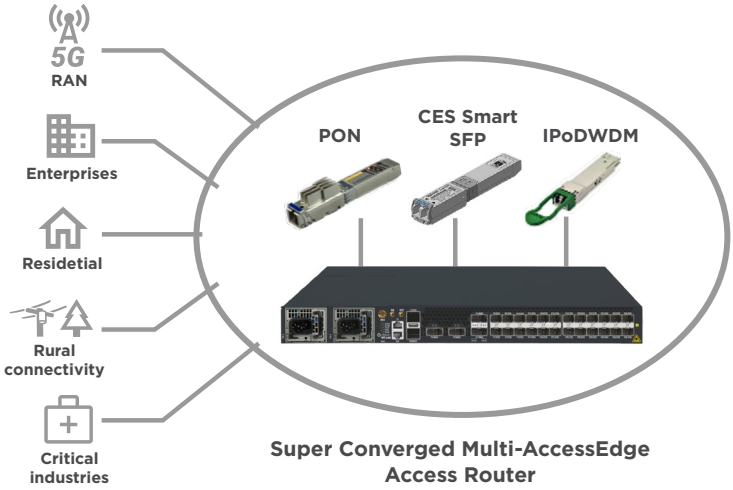
Access Router Optimized for the Multi-Access Edge

Neptune 2100 is an access router designed for next generation services and applications. With support for multiple access technologies , it is optimized for the access edge. It is temperature hardened, with high throughput, a small form factor, and is suitable for both outdoor and indoor deployment.

Neptune 2100 provides 800G non-blocking switching capacity and 1G/10G/25G/50F/100G/200G and 400G interfaces in a 1RU form factor. It provides an extensive set of interfaces for multiple access technologies such as Ethernet, MPLS, PON and legacy TDM, making it the ideal solution for deployment at the access edge. With a full set IP/MPLS transport capabilities, the Neptune 2100 can efficiently aggregate and route the services over the network, meeting their service performance needs (SLAs) on a service by service basis.

Neptune 2100 supports a full set of optical interfaces including 400G ZR/ZR+ coherent optical pluggables, this allows it to support both single layer, hop-by-hop IPoDWDM and multilayer IP and Optical transport. The operator can choose which approach best meets their needs, or they can run both in a hybrid approach.
With such a rich and robust feature-set, Neptune 2100 is well suited for a wide variety of applications and networking scenarios, these include;

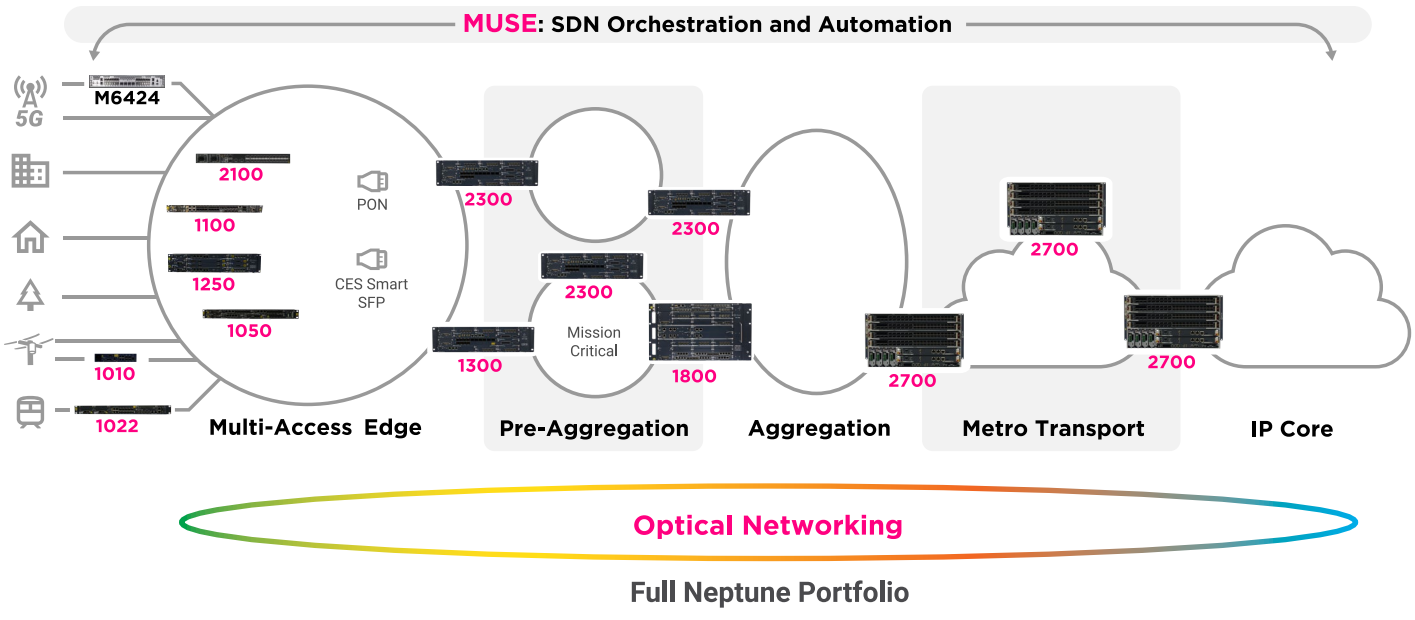
- 5G Cell site router: with 5G specific functionality including, Class C timing, Segment Routing, Flex-Algo, EVPN, and 5G interfaces
- Access Edge for Broadband backhaul: providing a full set of IP/MPLS capabilities providing optimized service-aware support for voice, video, and data services
- Access Edge for Business services: a full range of Ethernet interfaces and full set of IP protocols such as EVPN and segment routing ensure services are transported to meet the SLA's on a per service basis
- PON infill: with a 10GSFP+ OLT Optics pluggable module providing XGS-PON/EPON connectivity supporting up to 128 ONUs per OLT



- TDM migration: supporting voice trunk and legacy service migration with circuit emulation services (CES) mapping a full range of legacy TDM interface speeds onto the packet switched network (PSN)
- Converged Multi-access Edge: Supporting 5G, broadband backhaul, business services, PON and TDM migration all from a single converged access edge platform

Neptune 2100 Key Product Highlights

- Multi-access Edge supporting Ethernet, XGS-PON, EPON, TDM with CES
- 1RU small form factor with a 300mm depth
- Environmentally hardened, suitable for deployments in indoor or outdoor sealed cabinets
- Versatile Ethernet interface options: 1G/10G/25G/50F/100G/200G and 400G
- Low-latency forwarding, Class C compliant
- 400G/100G ZR/ZR+ optics support
- Precise frequency and phase/time synchronization using the latest industry standards
- Rich quality-of-service capabilities for different SLAs
- Security-Trust Anchor module infrastructure, secure boot, image signing, run-time defense
- MEF 3.0 Compliant
- Open NE for 3rd Party Management
- Advanced Management Capabilities provided by Muse Software



Key Neptune 2100 Product Specifications

Platform

Description	Specification
CPU	Intel x86 8-Core/1.7GHz Core
Memory	• 2 x 8GB DDR4 SO-DIMM with ECC • 2 x 16MB boot flash
Storage	1 x 128GB M.2 SSD
Traffic Ports	• 2 x QSFP-DD (400G/200G/100G) • 2 x QSFP28 (1 x 100G/50G, 4 x 25G /10G) • 24 x SFP28 (1/10/25G)
Control Interfaces	• 10/100/1000Base-T (RJ45) • RS232 console (RJ45) • USB 3.0 Type A
Timing Interfaces	• GNSS input SMA • 10MHz input/output SMB • 1PPS input/output SMB • BITS input RJ48 • ToD input RJ45
Performanc	Switch capacity: 800Gb/s @600Mpps
Power Supplies	• 1 + 1 Redundant and hot-swappable • DC Power supply - 400W @ -48VDC • AC Power supply - 400W @ 100-240VAC
Cooling	• 4 + 1 reundant fan FRU • Front to back Air flow
Timing	• Stratum 3E OCXO • ITU-T G.8262 Sync-E • IEEE 1588v2 - T-GM, T-BC, APTS • G.8275.1, G.8275.2 • G.8275.2 Class C/D
Physical Specification	• 1RU • Dimension: 440 mm (W) x 302 mm (D) x 44mm (H)

Multi-access Edge Capabilities

Description	Specification

L2/L3 VPN Sevices	• L2VPN - MEF 3.0 (IP-MPLS and MPLS-TP)
	  • E-Line
	  • E-LAN
	  • E-Tree
	  • E-Access
	• Ethernet Virtual Private Network (EVPN)
	  • Virtual Private Wire Service (EVPN-VPWS, EVPN-ELINE)
	  • Virtual Private LAN Services (EVPN-VPLS, EVPN-ELAN)
	  • Anycast IRB with IPv4 and IPv6 support
	  • Multihoming - Active-Active, Single-Flow-Active, Port-Active
	  • PW Virtual Ethernet Segment
	• L3VPN
	  • IPv4 VRF
	  • 6VPE
	  • IRB, PHT

IP over DWDM	• CWDM • DWDM • Amplifiers • 100G, 200G, 400G coherent interfaces • ZR and OPENZ+ application • CFP2 DCO for 100G/200G • QSFP_DD for 100/200/400G

TDM Services	• Circuit Emulation Services (CES)
	  • SAToP
	  • CESoPSN
	  • CEP

TDM Pluggables	• E1/T1 • E3/DS3 • STM-1/OC-4 • SYM-16/OC-48

TDM Interfaces	• Max. Interfaces:
	  • 224 x E1/T1
	  • 168 x DS3
	  • 28 x STM-1/OC-3
	  • 7 x STM-4/OC-12
	  • 64 x STM-16/OC-48

PON Pluggables	Smart SFP 10G XGS-PON - 10G SFP+ OLT Optics modules

Software features provided by the Neptune's IP-Wave rNOS

Description	Specification
Layer 2	• Layer 2 forwarding and bridging • Bridge Domains (BD) • Flexible VLAN-Tagging • IEEE 802.1Q VLANs and Q-in-Q • Ethernet Link Aggregation Group (LAG) • Link Aggregation Control Protocol (LACP) 802.3ad • G.8032 • Spanning Tree Protocol • Jumbo frames on all ports
Layer 3	• IPv4 and IPv6 unicast routing • Layer 3 interfaces: physical interfaces and logical interfaces (Units) • Virtual Routing and Forwarding (VRF) • Open Shortest Path First (OSPFv2, OSPFv3) • Intermediate System to Intermediate System (ISIS) • Multiprotocol Border Gateway Protocol (MP-BGP) • Equal-Cost Multipath (ECMP) • Bidirectional Forwarding Detection (BFD), MH-BFD • Virtual Router Redundancy Protocol (VRRP) • Integrated Routing Bridging (IRB), Anycast IRB • Pseudowire Headend Termination (PHT)
MPLS	• Label switching (LER, LSR) • Label Distribution Protocol (LDP) • BGP labeled Unicast (BGP-LU) • MPLS-TP • MPLS Traffic Engineering with RSVP-TE, SR-TE • Point-to-point L2VPN - Static, T-LDP, EVPN-VPWS • Multipoint L2VPN - VPLS, EVPN • EVPN with Anycast IRB • 6VPE • IP Loop-Free Alternate (LFA) Fast Reroute (FRR) • RSVP-TE Fast Reroute (FRR) and Path-protection

Segment Routing (SR)	• SR-MPLS
	• ISIS, OSPF, BGP extensions to segment routing
	• TI-LFA
	• Segment Routing Traffic Engineering (SR-TE, SR Policies)
	  • PCE, PCC initiated SR Policies
	  • Path Protection
	  • TI-LFA Local Repair Protection
	  • Anycast SID
	  • Binding SID
	• SR, SR-TE OAM
	• Flexible Algorithm
	• BGP Color Extended Community

Software features provided by the Neptune's IP-Wave rNOS (continued)

Description	Specification
Multicast	• IPv4 and IPv6 Multicast Routing • PIM-SM, PIM-SSM, PIM-ASM • IGPv3, MLDv2 • MSDP • Anycast RP • BGP IPv4 Multicast
Quality of Service (QoS)	• Class-based 3-level Hierarchical QoS • Virtual Output Queueing (VOQ) • Policing, Shaping • Multi-level priority queuing • Classification based on L2/L3/L4 fields • Remarking • Weighted Random Early Detection (WRED) • Deep packet buffer
Timing and Synchronization	• Stratum 3E OCXO • ITU-T G.8262 Sync-E • IEEE 1588v2 - T-GM, T-BC, APTS • G.8275.1, G.8275.2 • G.8273.2 Class C/D • Integrated GNSS receiver

OAM	• Ethernet OAM
	  • IDDD802.3ah
	  • IEEE802.1ag
	  • ITU-T Y.1731 PM
	• IP OAM
	  • BFD
	  • Ping
	  • Trace-route
	  • TWAMP
	• MPLS-TP OAM - G8113.2, RFC5860, BFD
	• MPLS OAM - Ping/Traceroute MPLS
	• RFC 2544 Generator, Y.1564
	• LLDP
	• DJCP Relay
	• Steaming Telemetry
	• sFlow
	• Link Delay-Measurement

Software features provided by the Neptune's IP-Wave rNOS (continued)

Description	Specification
Security	• Control-plane and management plane protection • Authentication, Authorization, and Accounting (AAA) • RADIUS • Terminal Access Controller Access-Control System Plus (TACACS+) • Secure Shell (SSH) • Layer 2 and Layer 3 ingress Firewall filters (ACL) • Unicast Reverse Path Forwarding (Unicast RPF) • Ieee802.1x
Manageability	• CLI • LCT • SNMP MIB • NETCONF/gRPC - XML, JSON, GPB • YANG models - OpenConfig, IETF • Muse software suite (SDN orchestration and control) • LightSOFT® NMS • Zero-Touch Provisioning (ZTP

Environmental

Description	Specification
Operating Environment and Altitude	-40^{0}C to +65^{0}C (10,000 ft)
Operating Humidity	5% to 93% (noncondensing)
Altitude	0 to 10,000 ft.
Power Input	• Worldwide ranging AC (90-264V; 47-63 Hz) • Worldwide ranging DC (-37V to -75)
Power Dissipation	305W

Standards compliance

Description	Specification
Regulatory Compliance	Products comply with CE markings according to directives 2014/30/CE and 2014/35/CE
NEBS	Designed to meet GR-63, GR-1089 and GR-3160
Safety	• IEC 62368-1 • UL 62368-1 • IEC 60825-1 for lasers • IEC 60825-2 for lasers
EMS Standards	• FCC CFR 47 Part 15 subpart B ANSI C63.4 • IEC 61850-3 • IEEE 1613 • ETSI EN 50121-4 • IEC 62236-4 • FTZ 1TR9
EMC Immunity	• ETSI EN 300 386 • IEC 61000-4 series

ETSI/Environmental	• ETSI EN 300 019
	  • Storage: Class 1.1
	  • Transportation: Class 2.3
	  • In-Use/Operational: Class 3.1
	• QM 333
	• ETSI EN 300 753

RoHS	Compliance per EU RoHS, RoHS 2 directive 2011/65/EU and amendment 2015/863/EU directive

Contact Us We are here to help. Contact us about our IP Wave 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, please visit rbbn.com.