DATA SHEET

8112

Ciena's 8112 Coherent Aggregation Router is purpose-built for 25GbE services and aggregation. With dense 1/10/25GbE to 100/200/400GbE aggregation and with the option of WaveLogic™ 5 Nano (WL5n), the 8112 addresses the increasing need for medium-capacity routing and switching applications.

Edge dynamics, 25GbE service delivery, and 400 Gb/s transport

Edge dynamics are driving bandwidth demand at unprecedented rates. These dynamics include annual growth by 5G Radio Access Network (RAN), even higher-speed broadband, and enterprise requirements for cloud service growing at twice the rate of the others. As network operators get closer to their customers, the mix of connections and services—from 1GbE to 25GbE and 1/10/25GbE to 400GbE—are creating the need for 25GbE service delivery and aggregation to 400GbE.

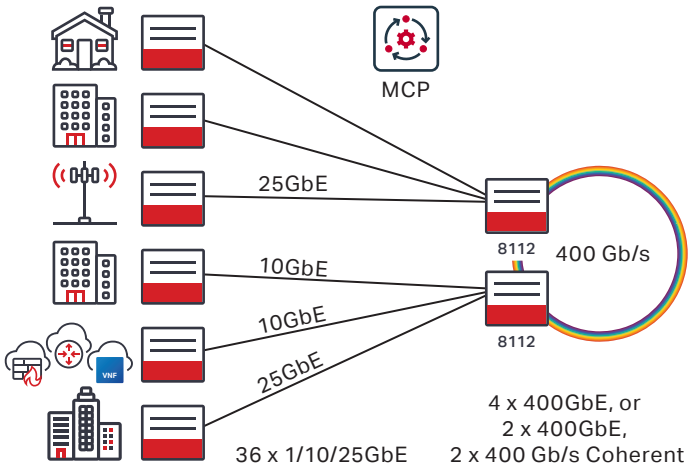

Figure 1. 8112 multi-edge aggregation

The 8112's high-density, 400G ports can provide significant savings in power, cooling, and transport costs. Video content and streaming giants have pushed cloud content closer to the customer, increasing the need for peering at the edge. With Adaptive IP™,

Features and Benefits

- Temperature-hardened (-40°C to +65°C) for temperature-challenged or space-constrained locations
- 36 x 1/10/25GbE, 4 x 100/200/400GbE fixed ports
- IP routing, SR-MPLS, Carrier Ethernet, and SRv6 ready
- Routing and switching OAM scaled to deliver 100GbE services with guaranteed SLA differentiation
- SZTP for rapid, secure, and error-free turn-up of services
- Advanced synchronization, including built-in GNSS receiver
- Built-in RFC 2544 and ITU-T Y.1564 SAT with 25 Gb/s traffic generation and analysis
- SDN-ready next-generation management, including support for protocols such as NETCONF/YANG and gNMI/gRPC
- Ciena's MCP multi-layer support for end-to-end network management control and planning
- Redundant AC or DC power

network operators can easily terminate Provider Edge (PE) or route peer Provider (P) traffic for Internet Exchange Points (IXPs)and cloud providers on the 8112.

Dense, compact form-factor platform

Efficient use of real estate assets is a growing concern for network operators who either host their own network equipment or lease power and space in collocation facilities. As services multiply, operators have been forced to stack 10G-capable equipment, incurring additional collocation rental and power costs.

The 8112's sleek, shallow depth and 2.4 Tb/s of routing and switching enable and facilitate cabinet and controlled environmental vault deployment. Extended temperature range support allows for installations in uncontrolled environments for outdoor aggregation of 25GbE, enabling high capacity at the outdoor edge.

Space is increasingly limited and expensive. Network operators face substantial capital expenditures to activate new locations or must retire active equipment to free space for new service delivery. Addressing bandwidth demand growth by deploying more and larger equipment is simply not a sustainable business model—economically or environmentally.

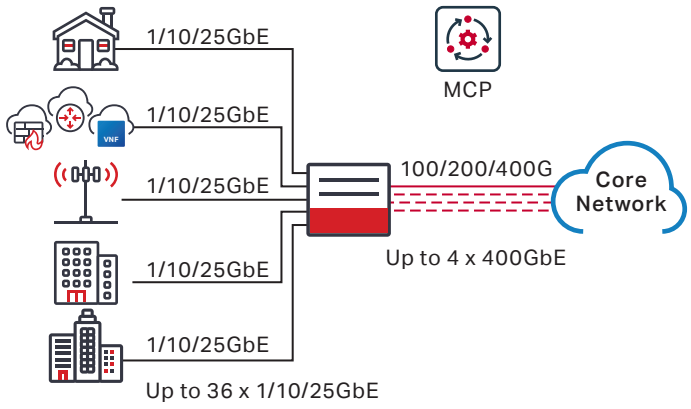

Figure 2. 8112 Router service and aggregation

Ciena's 8112 cost-effectively offers dense 25GbE service delivery in a 1RU fixed form-factor with dual power supplies to minimize network downtime and a variety of pluggable optics offering greater flexibility, including WL5n 400Gb/s.

The evolution of network and cloud peering

Over the years, network operators have provided peering, or have provided an equal relationship between two customers, like Internet Service Providers (ISPs). Peering traffic arrangements were agreed upon or compensated for, based on each customer's portion of traffic.

While this model continues today, cloud peering is growing at an alarming rate as public and private Cloud Service Providers (CSPs) push and deliver services closer to the customer. Cloud peering uses a different interconnect model than the existing ISP or IXP peering model. This is where the 8112 helps operators maintain low latency while keeping traffic local and secure to deliver easy, fast, and resilient customer access to their services.

Using Segment Routing (SR), Topology-Independent Loop-Free Alternate (TI-LFA) link protection can be used for resiliency, which also considers link, node, and Shared Risk Link Groups (SRLG) where Fast Reroute (FRR) and other techniques cannot.

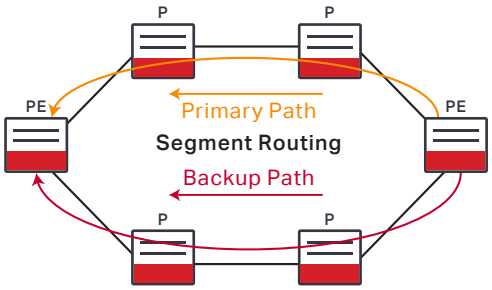

Figure 3. TI-LFA link/node protection using SR

Access to the cloud

As more and more enterprise, mobility, and residential applications are generated and consumed in regional and local edge Data Centers (DCs), there is a growing need to connect to the cloud locally. Ciena's 8112 is the perfect fit, with four ports of 400GbE—of which two can be 400GbE integrated coherent optics—to help maximize fiber capacity and Data Center Interconnect (DCI) to a local or regional DC.

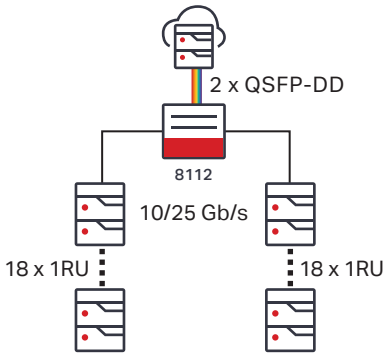

Figure 4. Edge compute with integrated DCI

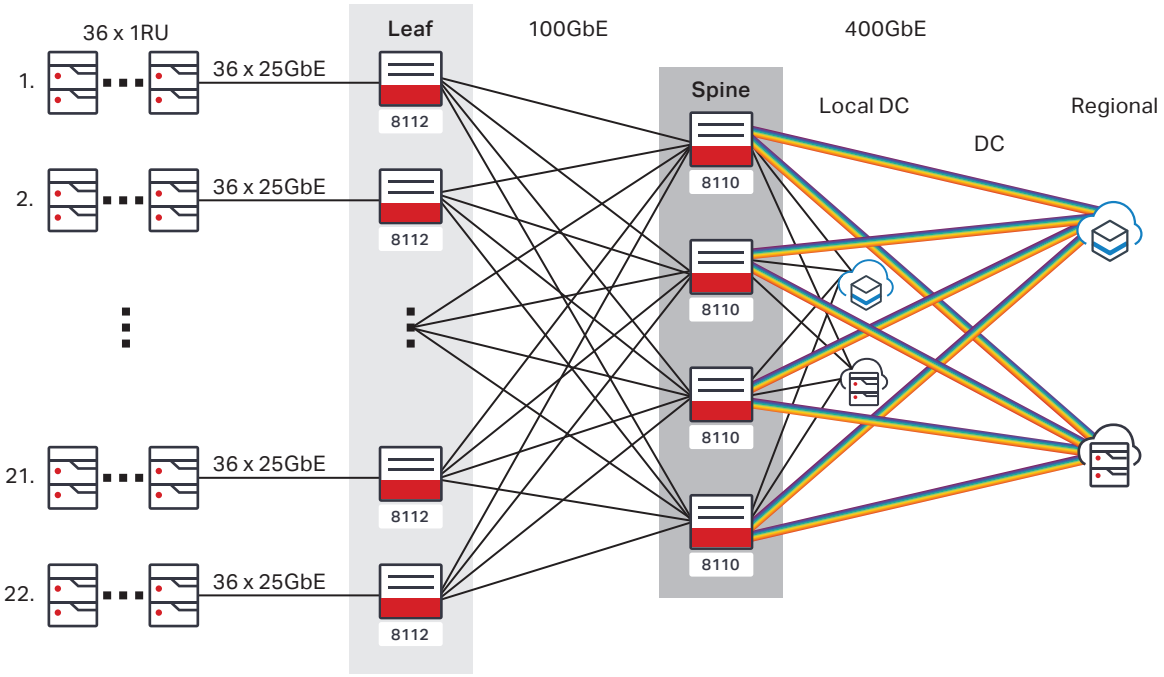

Figure 5. Leaf and spine

Up to 0.9 Tb/s of edge compute, using 36 x 25 Gb/s servers in two relay-racks, can be connected to the 8112 with cost-effective 25GbE SFP28+ cables while being over-subscribed to 800 Gb/s 2 x QSFP-DD coherent NNI ports. This is a 1.125:1 (900:800 Gb/s) oversubscription model.

Two-layer leaf-spine architecture is becoming increasingly popular over traditional three-layer access-distribution/aggregation-core architectures. The use of leaf-spine architecture can improve latency and cloud traffic speed for applications, including Content Delivery Networks (CDN), cloud gaming, Industrial IoT (IIoT), auto, augmented reality/virtual reality, and many more.

Acting as a leaf switch, Ciena's 8112 Router can replace access/aggregation layer to improve latency and connect servers at 25GbE for enterprise, mobility, and residential data traffic. And, up to 4 x 100GbE connections can be used to connect the leaf switch (8112) to (8110) spine switches. Each leaf switch is meshed into every spine switch, which is very useful for east-west network traffic versus north-south traffic.

In the example above, using 22 of Ciena's 8112 leaf switches, a massive 19.8 Tb/s (east-west) traffic is by connecting 36 x 25GbE (800 Gb/s) servers to each of the 8112 Routers. Each leaf is connected using 100GbE to each of the 8110 spine switches to local/edge or regional cloud DCs using their 4 x 400GbE interfaces (grey and coherent). This is a 12.375:1 (19.8/1.6 Tb/s) oversubscription model.

Fine-grained SLA monitoring and enforcement

The 8112 includes performance benchmark testing based on ITU-T Y.1564 and RFC 2544, enabling end-to-end 1/10/25GbE line-rate traffic measurements across virtual circuits. This approach improves end-customer satisfaction by enabling operations personnel to proactively respond to network events via increased performance visibility for differentiated Service Level Agreement (SLA) reporting.

Advanced multi-layer protocol support

The 8112 supports a flexible selection of service offerings, including Layer 2 (L2) and Layer 3 (L3) services over a carrier-class, connection-oriented infrastructure using Multi-Protocol Label Switching (MPLS) and SR. The platform supports a rich suite of L2/L3 features with TDM, Ethernet, MPLS, MPLS LDP, Seamless MPLS, OAM, Sync, ACL, QoS, Network Slicing, IGP (IS-IS, OSPFv2), ISIS-SR, BGP/MP-BGP, LAG, FRR, SR, TI-LFA, and SR functionality.

The 8112 operates as a full-featured IP router supporting NETCONF/YANG to easily integrate into an open Software-Defined Networking (SDN) environment with full visibility via streaming telemetry, and automated provisioning using open APIs.

Synchronization and timing

To realize the full benefit of Ethernet, MPLS, and IP, highly accurate time/phase synchronization, frequency synchronization, and even more stringent timing precision will be required.

New technologies, such as Time Sensitive Networking (TSN), have emerged as tools to provide these latency and jitter guarantees.

The 8112's rich timing and synchronization options—including support for IEEE 1588v2 and Global Navigation Satellite System (GNSS) receiver—enable new capabilities. These include Sync-as-a-Service with SLA for wholesale operators, soft network slicing, and additional applications like massive Machine-Type Communications (mMTC), URLLC, and native Ethernet services.

The cost-effectiveness and versatility of the 8112 Router provides synchronization and timing for many architectures with support for high-density 100GbE to 400GbE aggregation.

Differentiation through accelerated service velocity

Service velocity has become a critical competitive advantage for network, mobile, and wholesaler operators. In many cases, service velocity is the determining factor in winning new

service opportunities. The 8112 implements Ciena's unique Secure Zero-Touch Provisioning (SZTP) capabilities, allowing operators to deploy new packet-based services rapidly and securely in a fully automated manner. By reducing or eliminating costly and time-consuming manual intervention, provisioning errors are eliminated via SZTP. Most importantly, SZTP improves service deployment velocity and provides a significant competitive advantage.

Rich routing and switching OAM capabilities

As network operators and their customers increasingly rely on new IP/MPLS networks, operator must maintain guaranteed service levels. Networks must support a broad array of routing and switching Operations, Administration, and Maintenance (OAM) capabilities to ensure operators can proactively and reactively maintain and report on the ongoing health of their networks and delivered services. The 8112 also supports a comprehensive set of hardware-assisted routing and switching OAM capabilities, and is architected to provide SLA metrics and OAM at a high scale. This enables operators to take full advantage of the port density and 2.4 Tb/s full-duplex fabric for delivering the maximum number of services at the lowest cost. Additionally, the 8112 has an embedded line-rate Service Activation Test (SAT) engine (RFC 2544, ITU-T Y.1564), with traffic generation to a full 100 Gb/s to guarantee strict, market-differentiating SLAs, without relying on costly external test equipment and the highly trained personnel that requires.

Simplified multi-layer management and control

Ciena's Manage, Control and Plan (MCP) domain controller offers a unique and comprehensive solution for the administration of mission-critical networks that span access, metro, and core domains, and provides unprecedented multi-layer visibility from the photonic to the data layers. With this innovative management approach, MCP supports a programmable and automatable solution that provides a fully open approach to installing, manipulating, and monitoring service behaviors in an SDN environment.

Technical Information

Interfaces

Fixed Ethernet Ports

- 36 x 1/10/25GbE SFP28+ ports
- 2 x 100/200/400GbE QSFP-DD (grey)
- 2 x 100/200/400GbE QSFP-DD (grey or coherent)

Other

- 1 x USB-C Off-switch memory
- 1 x USB-C Console
- 1 x RJ45 Time-of-Day (ToD + 1PPS in/out)
- 1 x SMB Phase input (1 pps or 10MHz in/out)
- 1 x SMB GNSS antenna
- 1 x RJ45 Management (MGMT)

Ethernet

- IEEE 802.1D MAC Bridges
- IEEE 802.1p Class of Service (CoS) prioritization
- IEEE 802.1Q VLANs
- IEEE 802.1ad Provider Bridging (Q-in-Q) VLAN full S-VLAN range
- VLAN tunneling (Q-in-Q) for Transparent LAN Services (TLS)
- Layer 2 Control Frame Tunneling
- IEEE 802.1ax Link Aggregation (LAG): Active/Active; Active/ Standby
- IEEE 802.3ad Link Aggregation Control Protocol (LACP)
- Jumbo frames up to 9216 bytes
- IEEE 802.3-2018 IEEE Standard for Ethernet and supporting following rates
  - IEEE 802.3z-1998 Gigabit Ethernet
  - IEEE 802.3ab-1999 1000Base-T via copper SFP
  - IEEE 802.3ae-2002 10Gb/s
  - IEEE 802.3ba-2010 100Gb/s
  - IEEE 802.3by-2016 25Gb/s
  - IEEE 802.3bs-2017 200Gb/s

Carrier Ethernet OAM

- EVC Ping (IPv4)
- IEEE 802.1ab-2006 Link Layer Discovery Protocol (LLDP)
- IEEE 802.1ag-2007 Connectivity Fault Management (CFM)
- IEEE 802.3ah-2004 EFM Link-fault OAM ITU-T Y.1564 Ethernet Service Activation Test Methodology
- ITU-T Y.1731 Performance Monitoring
- RFC 2544 Benchmarking Methodology for Network Interconnect Devices Generation and Reflection at 25GbE

Synchronization

- External Timing Interfaces
- ITU-T G.703 Frequency in or out (10MHz)
- ITU-T G.703 1pps and ToD in or out
- Integrated GNSS receiver
- ITU-T G.8262/G.8264 EEC option1 and option2
- ITU-T G.8275.1 full timing support T-BC, T-GM, and T-TSC
- G.8273.2 clock, Class C
- G.8275.2 T-BC, T-GM, and T-TSC
- Stratum 3E oscillator

Networking Protocols

- ISO10598 IS-IS intra-domain routing protocol
- OSFP Segment Routing extension
- OSFP TI-LFA Topology Independent Fast
- Reroute using Segment Routing
- RFC 1195 Use of OSI Is-Is for Routing in TCP/ IP and Dual Environments
- RFC 1997 BGP Community Attribute
- RFC 2328 OSPF Version 2
- RFC 3630 Traffic Engineering (TE) extensions to OSPF Version 2
- RFC 4577 OSPF as the Provider/Customer Edge Protocol for BGP/MPLS IP Virtual Private Networks
- BGP Prefix Independent Convergence
- EVPN FXC draft-ietf-bess-evpn-vpwsfxc-03.txt
- RFC 2698 A Two Rate Three Color Marker
- RFC 2865 Remote Authentication Dial in User Service (RADIUS)
- RFC 3031 Multiprotocol Label Switching Architecture
- RFC 3032 MPLS label stack encoding
- RFC 6478 Pseudowire Status for Static Pseudowires
- RFC 7769 Media Access Control (MAC) Address Withdrawal over Static Pseudowire
- RFC 4762 Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling
- Hierarchical VPLS (H-VPLS)
- RFC 6073 Segmented Pseudowire
- RFC 4664 Framework of L2VPN (VPLS/VPWS)
- RFC 5654 MPLS-Transport Profile (TP)
- RFC 3107 Support BGP carry Label for MPLS
- RFC 4271 A Border Gateway Protocol 4 (BGP-4)
- RFC 4360 BGP Extended Communities Attribute
- RFC 4364 BGP/MPLS IP Virtual Private Networks (VPNs)
- RFC 4456 BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP)
- RFC 4632 Classless Inter-domain Routing (CIDR): The Internet Address Assignment and Aggregation Plan
- RFC 4760 Multiprotocol Extensions for BGP-4
- RFC 4762 Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling (HVPLS)
- RFC 5004 Avoid BGP Best Path Transitions from One External to Another
- RFC 5036 LDP Specification
- RFC 5037 Experience with the LDP protocol
- RFC 5301 Dynamic Hostname Exchange Mechanism for IS-IS
- RFC 5302 Domain-Wide Prefix Distribution with Two-Level IS-IS
- RFC 5303 Three-Way Handshake for IS-IS Point-to-Point Adjacencies
- RFC 5309 Point-to-Point Operation over LAN in Link State Routing Protocols
- RFC 5396 Textual Representation of Autonomous System (AS) Numbers
- RFC 5398 Autonomous System (AS) Number Reservation for Documentation Use
- RFC 5492 Capabilities Advertise with BGP-4
- RFC 5561 LDP Capabilities
- RFC 5668 4-Octet AS Specific BGP Extended Community
- RFC 6241 Network Configuration Protocol (NETCONF)
- RFC 6310 Pseudowire (PW) Operations, Administration, and Maintenance (OAM) Message Mapping
- RFC 6793 BGP Support for Four-Octet Autonomous System (AS) Number Space
- RFC 7432 EVPN VPWS/VPLS
- RFC 7737 Label Switched Route (LSP) Ping and Traceroute Reply Mode Simplification
- RFC 4448 Encapsulation Methods for Transport of Ethernet over MPLS Networks (PW over MPLS)
- RFC 4665 Service Requirement of L2 VPN
- RFC 4762 VPLS (Virtual Private LAN Service) and Hierarchical VPLS (H-VPLS)
- RFC 6391 Flow-Aware Transport of Pseudowires over an MPLS Packet Switched Network
- RFC 8469 Ethernet Control Word
- RFC 8029: Detecting Multiprotocol Label Switched (MPLS) Data-Plane Failures
- RFC 8287: Label Switched Path (LSP) Ping/ Traceroute for Segment Routing (SR)
- RFC 6426: MPLS On-Demand Connectivity Verification and Route Tracing
- RFC 7911 Advertisement of Multiple Paths in BGP
- RFC 8214 Virtual Private Wire Service Support in Ethernet VPN
- SR-MPLS TI-LFA Topology Independent Fast Reroute using Segment Routing draft-ietf-rtgwg-segment-routing-ti-lfa-03

Technical Information continued

- RFC 5880 Bidirectional Forwarding Detection (BFD)
- RFC 5881 Bidirectional Forwarding Detection (BFD) for IPv4 and IPv6 (Single Hop)
- RFC 5883 Bidirectional Forwarding Detection (BFD) for Multihop Paths
- RFC 5654 MPLS-Transport Profile (TP)
- RFC 5884 Bidirectional Forwarding Detection (BFD) for MPLS Label Switched Paths (LSPs)

Network Management

- Alarm Management and Monitoring Configuration
- Event and Alarm Notification/Generation Comprehensive Management
- Via CLI Management
- Via Netconf/YANG Models
- gRPC-based Streaming telemetry
- IPv4 and IPv6 Management Support
- IPv4 Management ACL (in-band)
- IPv6 Management ACL (in-band)
- RADIUS, AAA
- RFC 2131 DHCP Client
- RFC 3315 DHCPv6 Client
- RFC 6614 RadSec Client
- RFC 5425 Syslog over TLS
- SNMPv2 Trap
- SNMPv2 GET
- RFC 3046 DHCP Relay
- RFC 5905 NTP Client
- Secure File Transfer Protocol (SFTP)
- Secure Shell (SSHv2)
- RFC 8572 Secure Zero-Touch Provisioning (SZTP)
- Software upgrade via FTP, SFTP
- Syslog Accounting
- TACACS + AAA
- Web GUI

Physical Characteristics

Dimensions
- 17.36" (W) x 11.8" (D) x 1.73" (H)
- 441mm (W) x 300mm (D) x 43.9mm (H)

Weight
- AC variant: 22.1 lbs; 10.02 kg
- DC variant: 21.8 lbs; 9.89 kg

Power
- AC input: 100Vac, 240 Vac (nominal)
- DC input: -48 Vdc (nominal)
- ETSI EN 300 132-2 V1.1.1 (2002-1) AC
- ETSI EN 300 132-3 V2.1.1 (2003-01) DC

Standards Compliance

Emissions and Immunity (EMC)
- CISPR 24
- CISPR 32 Class A
- CISPR 35
- ETSI EN 300 386
- ETSI EN 55032
- FCC Part 15 Subpart B, Class A
- GR-1089 Issue 6
- Industry Canada ICES-003 Class A
- VCCI Class A

NEBS (Network Equipment-Building System)
- LEVEL 3 compliant
- GR-63 Issue 5

Safety
- ANSI/UL 60950-1 2nd edition / ETSI EN 60950-1, AI:2011 and A2:2014
- CAN/CSA-C22.2 No. 60950-2, Amd 1:2011, Amd 2:2014
- ETSI EN 62368-1:2014+A11:2017 and CSA/UL 62368-1:2014
- IEC 60825-1
- IEC 60825-2

Environmental
- ETSI EN 300-019-2-1
- ETSI EN 300-019-2-2
- ETIS EN 300-119-3
- GR-3108 Class 2 / ETSI EN 300-019-3-3 Class 3.2
- NEBS Level 3 CO (GR-63 Core)
- RoHS2 Directive (2011/65/EU)
- WEEE 2002/96/EU

Operating Temperature

- -40°F to +149°F (-40°C to +65°C)

Storage Temperature

- -40°F to +158°F (-40°C to +70°C)

Humidity

- Non-condensing 5% to 90%

Altitude

- 1800m (operating temperature range)
- 4000m (12,000 ft) at reduced temperature (40°C)

Service Security

- Broadcast Containment Egress Port Restriction
- Hardware-based DOS Attack Prevention Layer 2, 3, 4 Protocol Filtering
- User Access Rights Local user authorization

Ordering information (SAOS 10.x) - Router Configuration

Part Number	Description
170-8112-900	8112, (36)25/10/1G SFP, (4)400/200/100G QSFP-DD, EXT. TEMP, DUAL DC POWER
170-8112-901	8112, (36)25/10/1G SFP, (4)400/200/100G QSFP-DD, EXT. TEMP, DUAL AC POWER
Required OS Base System Perpetual Software Licenses	
S75-LIC-8112EO-P	SAOS BASE OS, ETHERNET & OAM SOFTWARE LICENSE FOR 8112, PERPETUAL
Optional OS Applications	
S75-LIC-8112MPLS-P	SAOS ROUTING/MPLS SOFTWARE LICENSE FOR 8112, PERPETUAL
S75-LIC-8112SEC-P	SAOS SECURITY SOFTWARE LICENSE FOR 8112, PERPETUAL
S75-LIC-8112SYNC-P	SAOS SYNCHRONIZATION SOFTWARE LICENSE FOR 8112, PERPETUAL
S75-LIC-8112400GS-P	SAOS 400G SOFTWARE LICENSE FOR 8112, PERPETUAL
S75-LIC-8112EVPN-P	SAOS EVPN SOFTWARE LICENSE FOR 8112, PERPETUAL