Nokia 7750 SR-s Service Router
Release 19

The Nokia 7750 SR-s series of IP routers takes router performance to new heights, with very high scalability, a comprehensive feature set, deterministic performance and an innovative chassis design. Designed to stay ahead of evolving demands driven by the cloud, 5G and the Internet of Things, the Nokia 7750 SR product family consists of the Nokia 7750 SR-s series, the Nokia 7750 SR series, the Nokia 7750 SR-a series and the Nokia 7750 SR-e series.

For webscale companies, the 7750 SR-s enables data center aggregation, gateway and interconnect, point of presence (PoP) edge, internet peering and backbone router functions. As an edge router for service providers, the 7750 SR-s enables the delivery of advanced residential, enterprise and mobile services. For enterprises, the 7750 SR-s provides high-performance IP routing for cloud, data center and wide area networking applications.

The 7750 SR-s is available in four chassis variants (shown with power shelves): the 7750 SR-14s, the 7750 SR-7s, the 7750 SR-2s and the 7750 SR-1s. At the heart of the 7750 SR-s is the highly programmable Nokia 2.4 Tb/s FP4 network processing silicon. It is an essential element in the quest for high performance, industry-leading density and intelligent capabilities—without compromise and adaptable to evolving customer requirements.

Massive scale and density
The 7750 SR-s scales in system capacity from 2.4 Tb/s half duplex (HD) up to 288 Tb/s HD with intelligent fan-in/fan-out to fit a variety of locations and deployment models. The 7750 SR-s is optimized to deliver 100GE and 400GE at scale, providing up to 1,440 100GE or 288 400GE interfaces.
Deterministic performance

The 7750 SR-s leverages the latest generation of Nokia IP routing silicon, FP4, which combines a multichip architecture and intelligent memory design to provide deterministic packet forwarding performance even when complex processing-intensive operations are required. With the FP4 traffic manager, buffering is always deterministic and does not degrade or cause control plane discards if buffer rate increases.

Intelligent fan-in/fan-out

To cost effectively meet the most stringent high-density aggregation scenarios and maximize asset utilization, the 7750 SR-s delivers unprecedented intelligent fan-in/fan-out capabilities.

The pre-classification and pre-buffering capabilities of FP4 allow for the SR-s to support up to 2.5 times intelligent aggregation per eXpandable Media Adapter-s (XMA-s). This enables a single 4.8 Tb/s XMA-s to support up to 12 Tb/s of intelligent fan-in/fan-out. With pre-buffering per MAC ASIC of up to 1 million packets and strict priority pre-classification and scheduling, aggregation is always intelligent and fully scheduled.

This differentiated approach to aggregation allows multiple network layers to be collapsed into a single layer, enables superior peering capabilities, and provides industry-leading support for a high degree of fractional flows. Where competing solutions do not support native aggregation or will drop traffic indiscriminately when oversubscribed, all generations of FP are always deterministic and fully scheduled based on strict QoS priorities.

Full array of IP routing features

The 7750 SR-s supports a full array of IP routing features and network functions.

For webscale companies, the 7750 SR-s delivers massive scalability along with leading features for data center aggregation, gateway and interconnect along with PoP edge, internet peering and backbone router functions, all without compromising performance.

Service providers can use the 7750 SR-s in deployments of all sizes with deterministic performance, supporting multiple network functions, including: Broadband Network Gateway (BNG) for residential subscriber management;
provider edge (PE) router for enterprise VPN, internet access, and cloud and data center interconnect services; and mobile aggregation router for IP mobile anyhaul applications.

For enterprises, the 7750 SR-s provides high-performance IP routing, including connectivity to the data center, internet and wide area networking applications.

**High availability**

For always-on service delivery, the 7750 SR-s sets the benchmark for high availability. Moving beyond full system redundancy, the robust SR OS supports numerous features to maximize network stability, ensuring that IP/MPLS protocols run without interruption. These features include innovative nonstop routing, nonstop services, in-service software upgrade (ISSU) and multichassis resiliency mechanisms.

**SDN integration and automation**

The 7750 SR-s and SR OS enable multivendor software-defined networking (SDN). Control integration is enabled through OpenFlow, Path Computation Element Protocol (PCEP), and model-driven network element management through CLI, NETCONF and gRPC/gNMI using YANG models.

In combination with the Nokia Network Services Platform (NSP), the 7750 SR-s can be deployed to introduce scalable and integrated SDN control across IP, MPLS, Ethernet and optical transport layers.

**Network management**

The 7750 SR-s is fully managed by the Nokia NSP, resulting in integrated network management across the network infrastructure of the service provider, webscale company and enterprise.

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**Hardware overview**

The 7750 SR-s supports a wide range of common system modules and interfaces that are optimized to address various network and application requirements.

**Switch Fabric Module-s (SFM-s)**

The SFM-s and the XMA-s Control Module-s (XCM-s) leverage orthogonal direct cross-connect technology to create a system design that does away with a backplane/midplane, providing upgradeability well beyond traditional system designs with the 7750 SR-14s and SR-7s chassis. Fabrics are fully redundant, supporting graceful capacity degradation in case multiple SFM-s modules fail.

**Control Processor Module-s (CPM-s)**

The CPM-s is a pluggable, hot-swappable module housed in a Control Management Adapter-s (CMA-s) on the 7750 SR-14s and SR-7s. The CPM-s provides the management, security and control plane processing for the 7750 SR-14s and SR-7s. The 7750 SR-2s supports two pluggable, hot swappable CPMs and is installed directly on the front of the SR-2s chassis. The CPM-2s provides the management and control plane processing while the XCM-2s performs security functions.

Redundant CPM-s and CPM-2s modules operate in a hitless, stateful failover mode with full nonstop routing and nonstop services in line with capabilities on all 7750 SR platforms. Central processing and memory are separated from the forwarding function on the interface modules to ensure the utmost system resiliency.

All 7750 SR-s systems support DEC/DTE, Console, Bluetooth, Management, 1588/SyncE, OES, BITS port and a 1PPS port, Compact Flash and Alarm ports on every CPM-s and CPM-2s. For the 7750 SR-1s, these control interfaces are fixed on the integrated chassis.
Expandable Media Adapter-s (XMA-s)
The XMA-s provides flexible interface options for the 7750 SR-14s, SR-7s and SR-2s, including high-density 10GE, 40GE, 100GE and 400GE interfaces. They contain an FP4-based forwarding complex that performs typical functions such as packet lookups, traffic classification, processing and forwarding, service enablement and QoS.

The XMA-s uses front face plate connectors capable of supporting native QSFP-DD and QSFP28 optical modules and includes support for 2 x 100GE and 10 x 10GE optical breakout options. The XMA-s is available in three base adapters: 36 connectors of QSFP-DD at 4.8 Tb/s FD (with four FP4 complexes), 36 connectors of QSFP28 at 2.4 Tb/s FD (with two FP4 complexes) and 18 connectors of QSFP28 at 1.2 Tb/s FD (with one FP4 complex). Smaller licensed versions of these base versions are available to provide flexible entry points and grow capacity, including intelligent fan-in/fan-out options, without hardware replacement.

QSFP-DD optics with flexible breakout options enables any high-density 10GE, 40GE, 100GE and 400GE interfaces. QSFP-DD is backwards compatible to QSFP28, and Nokia takes the additional step of supporting 10 x 10GE breakout per QSFP28. This enables leading 10GE density without the loss of 60 Gb/s of capacity per slot or forcing design shortcuts.

XMA Control Module-s (XCM-s)
The XMA-s is housed in an XCM-s. The XCM-s contains a slot-level control plane subsystem and fabric interface. The 7750 SR-14s XCM-s delivers 9.6 Tb/s FD slot capacity, supporting a pair of XMA-s adapters. The 7750 SR-7s and 7750 SR-2s XCM-s delivers 4.8 Tb/s FD slot capacity supporting a single XMA-s. The 7750 SR-2s supports two XCM-s modules, each supporting a single XMA-s of up to 4.8 Tb/s FD.

The 7750 SR-1s has a fixed XCM-s/XMA-s in a fixed form factor system with a non-redundant control plane. The control plane function and CPU are housed on the integrated XCM-s/XMA-s. The 7750 SR-1s comes in base variants of 36 connectors of QSFP-DD at 4.8 Tb/s FD and 36 connectors of QSFP28 at 2.4 Tb/s FD, and includes support for 2 x 100GE and 10 x 10GE optical breakout options. It is also available in a number of licensable configurations to provide flexible entry points and grow capabilities and scale services through in-place software licensing options, including intelligent fan-in/fan-out options, without hardware replacement.

Power shelf
The 7750 SR-s implements a building-block approach with a decoupled power subsystem design. DC, AC or HVDC power type is available via a clip-on power shelf that can be flexibly changed and spared independent of the main 7750 SR-s system. This decoupled power design provides a very high degree of flexibility along with better cooling efficiencies. The two separate power shelves can be of the same power type or different power types. The 7750 SR-14s and SR-7s share a common power shelf. The 7750 SR-1s and SR-2s have an integrated power shelf that is either AC/HVDC or LVDC. All 7750 SR-s systems share common power supply units (PSUs) which insert into the power shelf.

Decoupling power from the 7750 SR-14s and SR-7s ensures that the system is never handicapped by changing power requirements or power standards in the future. The 7750 SR-s also never relies on rear-mounted power supply fans for the cooling of next-generation ASICs or 400G and greater optics.
## Technical specifications

Table 1. Hardware specifications for the 7750 SR-s

<table>
<thead>
<tr>
<th></th>
<th>7750 SR-1s</th>
<th>7750 SR-2s</th>
<th>7750 SR-7s</th>
<th>7750 SR-14s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System capacity</strong></td>
<td>9.6 Tb/s</td>
<td>19.2 Tb/s</td>
<td>57.6 Tb/s</td>
<td>115.2 Tb/s</td>
</tr>
<tr>
<td>(HD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Per-slot capacity</strong></td>
<td>4.8 Tb/s</td>
<td>4.8 Tb/s</td>
<td>4.8 Tb/s</td>
<td>4.8 Tb/s</td>
</tr>
<tr>
<td>(FD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Per-slot Intelligent fan-in/fan-out capacity (FD)</strong></td>
<td>12 Tb/s</td>
<td>12 Tb/s</td>
<td>12 Tb/s</td>
<td>12 Tb/s</td>
</tr>
<tr>
<td><strong>System design</strong></td>
<td>Centralized</td>
<td>Centralized; control redundant</td>
<td>Orthogonal direct cross-connect; control and fabric redundant</td>
<td>Orthogonal direct cross-connect; control and fabric redundant</td>
</tr>
<tr>
<td><strong>Number of XMA-s</strong></td>
<td>1; integrated</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td><strong>Common equipment redundancy</strong></td>
<td>PSU, fan</td>
<td>XMA-s, XCM-2s, CPM-2s, PSU, fan</td>
<td>XMA-s, XCM-7s, SFM-s, CPM-s, PSU, fan</td>
<td>XMA-s, XCM-14s, SFM-s, CPM-s, PSU, fan</td>
</tr>
<tr>
<td><strong>Hot-swappable modules</strong></td>
<td>PSU, fan</td>
<td>XMA-s, XCM-2s, CPM-2s, PSU, fan</td>
<td>XMA-s, XCM-7s, SFM-s, CPM-s, PSU, fan</td>
<td>XMA-s, XCM-14s, SFM-s, CPM-s, PSU, fan</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>3RU, includes integrated power shelf</td>
<td>5RU, includes integrated power shelf</td>
<td>13RU + 3RU (LVDC) or 4RU (AC/HVDC) power shelf</td>
<td>24RU + 3RU (LVDC) or 4RU (AC/HVDC) power shelf</td>
</tr>
<tr>
<td></td>
<td>Height: 13.3 cm (5.25 in)</td>
<td>Height: 22.2 cm (8.75 in)</td>
<td>Height: 71.1 cm (28 in); (16RU)</td>
<td>Height: 120.0 cm (47.2 in); (27RU)</td>
</tr>
<tr>
<td></td>
<td>Width: 44.5 cm (17.5 in)</td>
<td>Width: 44.5 cm (17.5 in)</td>
<td>Width: 75.6 cm (29.75 in); (17RU)</td>
<td>Width: 124.5 cm (49 in); (28RU)</td>
</tr>
<tr>
<td></td>
<td>Depth: 67.8 cm (26.69 in)</td>
<td>Depth: 81.38 cm (32.04 in)</td>
<td>Depth: 87.9 cm (34.6 in)</td>
<td>Depth: 87.9 cm (34.6 in)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>1.2 Tb/s and 2.4 Tb/s variants:</td>
<td>Empty: 27.21 kg (60.0 lb)</td>
<td>Empty: 45.36 kg (100.0 lb)</td>
<td>Empty: 62.4 kg (137.5 lb)</td>
</tr>
<tr>
<td></td>
<td>– Empty: 23.8 kg (52.5 lb)</td>
<td>– Empty: 23.8 kg (52.5 lb)</td>
<td>– Empty: 23.8 kg (52.5 lb)</td>
<td>– Empty: 23.8 kg (52.5 lb)</td>
</tr>
<tr>
<td></td>
<td>– Loaded: 48.8 kg (107.5 lb); excludes optics</td>
<td>– Loaded: 48.8 kg (107.5 lb); excludes optics</td>
<td>– Loaded: 48.8 kg (107.5 lb); excludes optics</td>
<td>– Loaded: 48.8 kg (107.5 lb); excludes optics</td>
</tr>
<tr>
<td></td>
<td>3.6 Tb/s, 4.8 Tb/s, and 12 Tb/s variants:</td>
<td>Empty: 27.21 kg (60.0 lb)</td>
<td>Empty: 45.36 kg (100.0 lb)</td>
<td>Empty: 62.4 kg (137.5 lb)</td>
</tr>
<tr>
<td></td>
<td>– Empty: 25.4 kg (56 lb)</td>
<td>– Empty: 25.4 kg (56 lb)</td>
<td>– Empty: 25.4 kg (56 lb)</td>
<td>– Empty: 25.4 kg (56 lb)</td>
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<tr>
<td></td>
<td>– Loaded: 50.3 kg (111 lb); excludes optics</td>
<td>– Loaded: 50.3 kg (111 lb); excludes optics</td>
<td>– Loaded: 50.3 kg (111 lb); excludes optics</td>
<td>– Loaded: 50.3 kg (111 lb); excludes optics</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>LVDC: -48 V/-60 V, 80 A max per feed</td>
<td>LVDC: -48 V/-60 V, 80 A max per feed</td>
<td>LVDC: -48 V/-60 V, 80 A max per feed</td>
<td>LVDC: -48 V/-60 V, 80 A max per feed</td>
</tr>
<tr>
<td></td>
<td>HVDC: 260-400 V DC, 12 A max per source</td>
<td>HVDC: 260-400 V DC, 12 A max per source</td>
<td>HVDC: 260-400 V DC, 12 A max per source</td>
<td>HVDC: 260-400 V DC, 12 A max per source</td>
</tr>
<tr>
<td></td>
<td>AC: 200 V–240 V AC, 50 Hz/60 Hz, 16 A per feed</td>
<td>AC: 200 V–240 V AC, 50 Hz/60 Hz, 16 A per feed</td>
<td>AC: 200 V–240 V AC, 50 Hz/60 Hz, 16 A per feed</td>
<td>AC: 200 V–240 V AC, 50 Hz/60 Hz, 16 A per feed</td>
</tr>
<tr>
<td></td>
<td>N+N redundancy</td>
<td>N+N redundancy</td>
<td>N+N redundancy</td>
<td>N+N redundancy</td>
</tr>
<tr>
<td></td>
<td>Integrated 1RU power shelf</td>
<td>Integrated 1RU power shelf</td>
<td>Integrated 1RU power shelf</td>
<td>Integrated 1RU power shelf</td>
</tr>
<tr>
<td></td>
<td>Common PSUs across all 7750 SR-s variants</td>
<td>Common PSUs across all 7750 SR-s variants</td>
<td>Common PSUs across all 7750 SR-s variants</td>
<td>Common PSUs across all 7750 SR-s variants</td>
</tr>
<tr>
<td><strong>Cooling</strong></td>
<td>Front to back</td>
<td>Front to back</td>
<td>Front to back</td>
<td>Front to back</td>
</tr>
</tbody>
</table>

* Dimensions and weights are approximate and subject to change. Refer to the appropriate installation guide for the current dimensions and weights.
### Table 2. 7750 SR-14s/SR-7s/SR-2s XMA-s variants

<table>
<thead>
<tr>
<th>XMA-s and optics pluggable type</th>
<th>Connectors</th>
<th>Packet buffering</th>
<th>Maximum density</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6 Tb/s QSFP28 Universal XMA-s</td>
<td>6</td>
<td>16 GB, plus micro buffering consisting of a 3 million packet pre-buffer</td>
<td>60  6  6  —</td>
</tr>
<tr>
<td>1.2 Tb/s QSFP28 Universal XMA-s</td>
<td>12</td>
<td>16 GB, plus micro buffering consisting of a 3 million packet pre-buffer</td>
<td>120 12 12  —</td>
</tr>
<tr>
<td>1.2 Tb/s QSF28 Universal XMA-s with intelligent fan-in/fan-out of 1.8 Tb/s (base adapter)</td>
<td>18</td>
<td>16 GB, plus micro buffering consisting of a 3 million packet pre-buffer</td>
<td>180 18 18  —</td>
</tr>
<tr>
<td>1.6 Tb/s QSFP28 Universal XMA-s</td>
<td>16</td>
<td>32 GB, plus micro buffering consisting of a 4 million packet pre-buffer</td>
<td>160 16 16  —</td>
</tr>
<tr>
<td>2.4 Tb/s QSFP28 Universal XMA-s</td>
<td>24</td>
<td>32 GB, plus micro buffering consisting of a 4 million packet pre-buffer</td>
<td>240 24 24  —</td>
</tr>
<tr>
<td>2.4 Tb/s QSFP28 Universal XMA-s with intelligent fan-in/fan-out of 3.6 Tb/s (base adapter)</td>
<td>36</td>
<td>64 GB, plus micro buffering consisting of a 12 million packet pre-buffer</td>
<td>360 36 36  —</td>
</tr>
<tr>
<td>3.6 Tb/s QSFP28 Universal XMA-s</td>
<td>36</td>
<td>64 GB, plus micro buffering consisting of a 12 million packet pre-buffer</td>
<td>360 36 36  —</td>
</tr>
<tr>
<td>3.6 Tb/s QSFP-DD Universal XMA-s</td>
<td>36</td>
<td>64 GB, plus micro buffering consisting of a 12 million packet pre-buffer</td>
<td>360 36 36  —</td>
</tr>
<tr>
<td>4.8 Tb/s QSFP-DD Universal XMA-s</td>
<td>36</td>
<td>64 GB, plus micro buffering consisting of a 12 million packet pre-buffer</td>
<td>360 36 48* 12</td>
</tr>
<tr>
<td>4.8 Tb/s QSFP-DD Universal XMA-s with intelligent fan-in/fan-out of 12 Tb/s (base adapter)</td>
<td>36</td>
<td>64 GB, plus micro buffering consisting of a 12 million packet pre-buffer</td>
<td>360 36 120** 24**</td>
</tr>
</tbody>
</table>

* Requires future 4 x 100G QSFP56-DD breakout to get to 48 connector density
** Intelligent fan-in/fan-out

### Table 3. Nokia 7750 SR-s maximum density

<table>
<thead>
<tr>
<th>Ethernet speed</th>
<th>7750 SR-1s</th>
<th>7750 SR-2s</th>
<th>7750 SR-7s</th>
<th>7750 SR-14s</th>
</tr>
</thead>
<tbody>
<tr>
<td>400BASE</td>
<td>12/24*</td>
<td>24/48*</td>
<td>72/144*</td>
<td>144/288*</td>
</tr>
<tr>
<td>100BASE</td>
<td>48/120*</td>
<td>96/240*</td>
<td>288/720*</td>
<td>576/1,440*</td>
</tr>
<tr>
<td>40BASE</td>
<td>36</td>
<td>72</td>
<td>216</td>
<td>432</td>
</tr>
<tr>
<td>10BASE</td>
<td>360</td>
<td>720</td>
<td>2,160</td>
<td>4,320</td>
</tr>
</tbody>
</table>

* Intelligent fan-in/fan-out
Feature and protocol support highlights
Feature and protocol support in the 7750 SR-s includes (but is not limited to) the following.

IP and MPLS routing features
- IP unicast routing: Routing Information Protocol (RIP), Intermediate System-to-Intermediate System (IS-IS), Open Shortest Path First (OSPF), Multiprotocol Border Gateway Protocol (MBGP), Unicast Reverse Path Forwarding (uRPF), comprehensive control plane protection features for security, and IPv4 and IPv6 feature parity
- IP multicast routing: Internet Group Management Protocol (IGMP), Multicast Listener Discovery (MLD), Protocol Independent Multicast (PIM), Multicast Source Discovery Protocol (MSDP), and IPv4 and IPv6 feature parity
- MPLS: Label edge router (LER) and label switch router (LSR) functions with support for seamless MPLS designs, MPLS-Transport Profile (MPLS-TP), Label Distribution Protocol (LDP) and Resource Reservation Protocol (RSVP) for MPLS signaling and traffic engineering and includes GMPLS UNI, Point-to-Point (P2P) and Point-to-Multipoint (P2MP) label switched paths (LSPs) with Multicast LDP (MLDP), P2MP RSVP and weighted Equal-Cost Multi-Path (ECMP)

Segment routing and SDN features
- Multiple instance IS-IS and OSPF Segment Routing support with shortest path tunnel, Segment Routing - Traffic Engineering (SR-TE) LSP, and static and BGP SR policy. The implementation provides LFA, remote LFA and Topology- Independent LFA (TI-LFA) protection for all types of tunnels. PCEP allows the delegation of the SR-TE LSP to the Nokia NSP or a third-party PCE function.
- Programmable forwarding tables via gRPC-based RIB API feature and MPLS forwarding policy
- Extensive set of capabilities using ACL logic to steer routes/flows towards various target types, such as IP next-hop, SR-TE/RSV-TE/MPLS-TP LSP and VRF, and in a wide range of routing and service contexts such as Global Routing table, VPRN, VPLS and EPIPE service; supports control interfaces such as OpenFlow, FlowSpec, CLI and NETCONF
- Multivendor SDN control integration through OpenFlow, PCEP, BGP-LS and BGP SR Policy support

Layer 2 features
- Ethernet LAN (E-LAN): BGP-VPLS (Virtual Private LAN Service), Provider Backbone Bridging for VPLS (PBB-VPLS), Ethernet VPN (EVPN) and PBB-EVPN
- E-Line: BGP-VPWS (Virtual Private Wire Service), EVPNI-VPWS and PBB-EVPN
- E-Tree: EVPN and PBB-EVPN
- EVPN: EVPNI-VXLAN (Virtual eXtensible LAN) to VPLS/EVPN-MPLS gateway functions

Layer 3 features
- IP-VVPN, enhanced internet services, EVPN for Layer 3 services with integrated routing and bridging (EVPN-IRB), and Multicast VPN (MVVPN), which includes Inter-AS MVPN and Next Generation MVVPN (NG-MVPN)

System features
- Ethernet satellites: Port expansion through local or remote Nokia 7210 SAS-S series GE, 10GE and 100GE satellite variants, offering 24/48 x GE ports or 64 x GE/10GE ports over 10GE and 100GE uplinks
- OAM: Extensive fault and performance Operations, Administration and Maintenance (OAM) includes Ethernet Connectivity Fault Management (CFM) (IEEE 802.1ag, ITU-T Y.1731), Ethernet in the First Mile (EFM) (IEEE 802.3ah), Bidirectional Forwarding Detection (BFD), Cflowd, Two-Way Active Measurement Protocol (TWAMP), and a full suite of MPLS OAM tools
- Timing: ITU-T Synchronous Ethernet (SyncE), IEEE 1588v2 (PTP), Network Time Protocol (NTP), BITS ports (T1, E1, 2M), and 1PPS
- QoS: Flexible intelligent packet classification; ingress and egress hierarchical QoS with multitiered shaping and two-tiered, class fair hierarchical policing; advanced, scalable network and service QoS, and end-to-end consistent QoS regardless of oversubscription or congestion
• High availability: Nonstop routing\(^1\), nonstop services\(^1\), in-service software upgrade (ISSU)\(^1\), fast reroute for IP, RSVP, LDP and segment routing, pseudowire redundancy, ITU-T G.8031 and G.8032, weighted ECMP, and weighted, mixed-speed link aggregation

Management features
• Model-driven network element management through CLI, NETCONF and gRPC/gNMI using YANG models
• Full SNMP management support, including configuration
• Comprehensive network and node management through the Nokia NSP

Standards support\(^2\)

Environmental specifications
• Operating temperature: 5C to +40C
• Operating relative humidity: 5% to 85% non-condensing
• Operating altitude: Safety certified up to 5,000 m (16,400 ft); operating temperature range de-rated above 1,829 m (6,000 ft)

Safety
• AS/NZS 60950.1
• IEC/EN 60825-1
• IEC/EN 60825-2
• AS/NZS 62368.1 (SR-1s and SR-2s)
• IEC/EN/UL/CSA 60950-1 Ed2 Am2
• IEC/EN/UL/CSA 62368-1 Ed2

EMC emission
• AS/NZS CISPR 32 Class A
• EN 55032 Class A
• FCC Part 15 Class A
• ICES-003 Class A
• IEC CISPR 32 Class A
• IEC/EN 61000-6-4

• KN 32 Class A
• VCCI Class A
• BSMI CNS13438 Class A

EMC immunity
• ATIS-0600315.01.2015 HVDC Power Supply Interface
• BT GS7
• EN 55024
• EN 55035 (SR-1s and SR-2s)
• ETSI EN 300 132-2 DC Power Supply Interface
• ETSI EN 300 132-3 AC Power Supply Interface
• ETSI EN 300 132-3-1 HVDC Power Supply Interface
• ETSI EN 300 386
• ETSI 201 468 (SR-1s and SR-2s)
• IEC CISPR 24
• IEC CISPR 35 (SR-1s and SR-2s)
• IEC/EN 61000-3-2 Power Line Harmonics
• IEC/EN 61000-3-3 Voltage Fluctuations and Flicker
• IEC/EN 61000-4-2 Electric Static Discharge
• IEC/EN 61000-4-3 Radiated, RF, EM field immunity
• IEC/EN 61000-4-4 Electrical Fast Transients
• IEC/EN 61000-4-5 Surge Immunity
• IEC/EN 61000-4-6 Immunity to conducted disturbances
• IEC/EN 61000-4-11 Voltage Interruptions
• IEC/EN 61000-6-2 Immunity for industrial environments
• ITU-T L.1200
• KN 35

Environmental
• ETSI EN 300 019-2-1 Storage Tests, Class 1.2
• ETSI EN 300 019-2-2 Transportation Tests, Class 2.3

\(^1\) Requires redundant CPM-s modules
\(^2\) System design intent is according to the listed standards. Refer to product documentation for detailed compliance status.
- ETSI EN 300 019-2-3 Operational Tests, Class 3.2
- ETSI EN 300 019-2-3 Earthquake
- ETSI 300 753 Acoustic Noise, Class 3.2 (SR-1s only)

Wireless
- ETSI EN 301 489-1
- ETSI EN 301 489-17 (Bluetooth)
- KN 301 489-1
- KN 301 489-17 (Bluetooth)

NEBS/RBOC requirements
- ATIS 0600010
- ATIS-0600015
- ATIS-0600015.03
- ATT-TP-76200
- GR-63-CORE, Level 3
- GR-1089-CORE, Level 3
- VZ.TPR.9205
- VZ.TPR.9305

Directives, regional approvals and certifications
- EU Directive 2011/65/EU Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment (Recast) Directive (RoHS2)
- EU Directive 2012/19/EU Waste Electrical and Electronic Equipment (WEEE)
- EU Directive 2014/30/EU Electromagnetic Compatibility (EMC)
- KC Mark - South Korea
- NEBS Level 3
- RCM Mark - Australia
- VCCI Mark - Japan
- CE Mark - Common Europe
- CRoHS - China RoHS
- BSMI Mark - Taiwan

MEF certifications
- CE 1.0 (MEF 9 and MEF 14)
- CE 2.0
  - Certified (on E-LAN, E-Line, E-Tree and E-Access MEF service types)
  - 100G certified (on E-Line and E-Access MEF service types)

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