Nokia 7250 IXR-6e, IXR-10e and IXR-18e Interconnect Routers

Release 26

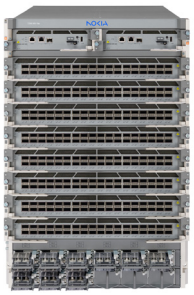
The Nokia 7250 IXR-6e, IXR-10e, and IXR-18e are ultra-high-capacity, modular platforms designed for data center spine, super-spine, aggregation and WAN deployments. These platforms deliver up to 460.8 Tb/s full duplex (FD) capacity and high-density interfaces ranging from 10GE up to 800GE, providing massive scalability, flexibility and operational simplicity for AI and cloud providers, telecommunication providers, and mission-critical enterprise environments.

Overview

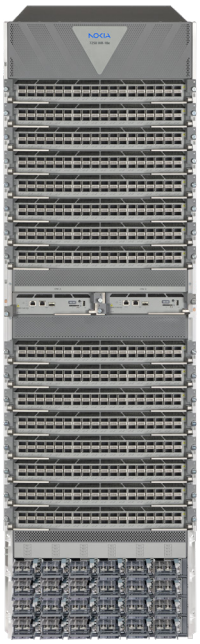
AI, high-performance computing (HPC), cloud and other data-intensive workloads are driving the need for greater speed, capacity and scalability in data center networks. Network operators need reliable, modular, high-performance platforms with high-speed and high-density interfaces and comprehensive networking capabilities to support evolving network architectures and flexible connectivity within and across data centers.



7250 IXR-6e



7250 IXR-10e



7250 IXR-18e

Delivering up to 28.8 Tb/s FD per-slot throughput, the 7250 IXR-6e, IXR-10e and IXR-18e scale capacity up to 115.2 Tb/s FD, 230.4 Tb/s and 460.8 Tb/s respectively. They offer a wide range of connector speeds and optics, including 800G QSFP-DD, 800G OSFP, 400G QSFP-DD and 100G QSFP28, along with flexible optical breakout options. These platforms provide high-density 800GE, 400GE, 100GE, 50GE, 40GE, 25GE and 10GE interfaces, enabling intra-fabric, WAN and server connectivity without compromising on power efficiency. The line cards are based on the latest generation of application-specific integrated circuits (ASICs).

Leveraging the advanced capabilities of Nokia Service Router (SR) Linux, the 7250 IXR-6e, IXR-10e

and IXR-18e deliver a robust and comprehensive set of IP routing, Layer 2 Ethernet, QoS, MPLS, segment routing, router security, scalable telemetry and model-driven programmability capabilities. Flexible traffic management includes deep buffering, per-port queuing and shaping.

Innovative hardware design

The Nokia 7250 IXR-6e, IXR-10e and IXR-18e deliver massive scalability, very high throughput and flexibility, enabling rapid deployment and easy adaptation for evolving data center, cloud and WAN environments and for supporting the demanding needs of AI and HPC workloads.

In addition to supporting high availability control, fabric, fan and power configurations, these platforms support industry-leading and unique hardware design innovations and capabilities, including:

- High-quality, midplane-less, orthogonal direct cross-connect—a critical design element to successfully move to future faster SERDES speeds and beyond
- An architecture without retimers across multiple generations of ASICs driving low power and ultra-high reliability due to a component minimizing design
- Power- and cooling-optimized design
- A seamless integration of a broad range of optics, maximizing configuration options and empowering operators to tailor network designs to their evolving needs.
- Support for 800GE and 400GE coherent optics with support for 400GE ZR+ optics in all pluggable optics positions
- High-capacity 800GE density and efficiency in a 16-slot configuration
- The IXR-6e and 10e platforms share the same control processor module (CPM). All chassis share the same integrated media modules (IMMs). The 10e and 18e platforms share the same power supply units (PSUs) and the same fan tray.
- A generational chassis design that can start with J2C+ IMMs and upgrade to J3 while preserving CPMs, PSUs and fans with full backward compatibility for J2C+ IMMs.

These innovative hardware design attributes combined with a full suite of SR Linux software features and the Nokia Event Driven Automation (EDA) operations and automation toolkit help data center and cloud teams to achieve their high availability design and operations efficiency goals.

IP network security

The 7250 IXR-6e, IXR-10e and IXR-18e provides user plane protection through low-latency, line-rate encryption capabilities based on IEEE 802.1AE MACsec. This guarantees the security of data against unauthorized access or tampering by any intermediate device or network. Furthermore, it supports IPsec[1] without requiring dedicated appliances.

This platform, with Root-of-Trust (RoT) features, offers a multi-core x86e CPU that delivers control plane scalability and performance, crucial for data center leaf-spine designs. The platform's features include an integrated 80G SSD and a discrete trusted platform module. It is designed to meet all demanding performance benchmarks.

The RoT enables Secure Boot to ensure the system executes trusted software. The Trusted Platform Module (TPM 2.0) is pre-provisioned with Nokia Initial Device Identity (IDevID) and Initial Attestation Key (IAK). TPM 2.0 technology supports secure boot and measured boot, using hardware based security keys for enhanced security over software-based keys.

Advanced timing and synchronization

The Nokia 7250 IXR-6e and IXR-10e is equipped with a high-precision clock to meet the strict timing requirements of applications such as 5G transport.

These routers support both ITU-T Sync-E and IEEE1588, offering precise timing synchronization for various applications.

1 IPsec supported in a future software release

Nokia Service Router Linux

Nokia SR Linux is a Linux®-based open, extensible and resilient NOS that enables scalability, flexibility and efficiency in data center and cloud environments. The Nokia 7250 IXR-6e, IXR-10e and IXR-18e implement Nokia SR Linux.

SR Linux is a key component of the Nokia Data Center Fabric solution, which also includes the Nokia Event Driven Automation (EDA) and the Nokia Data Center hardware platforms.

Ground-up, model-driven architecture delivers extensibility

In cloud-scale networks, the primary challenges are scalability and ease of operations. SR Linux is designed from the ground up with a management architecture that meets the demands of a model-driven world where visibility—and the scalability and granularity of that visibility—are paramount.

SR Linux features a completely model-driven architecture for flexible and simplified management and operations. An extensible and open infrastructure allows applications to define and declare their own schemas, enabling the retrieval of fine-grained system state and setting of configuration.

Modular, state-sharing architecture

SR Linux uses an unmodified Linux kernel as the foundation on which applications share state via a publish/subscribe (pub/sub) architecture. The Nokia pub/sub architecture is implemented using generalized Remote Procedure Call (gRPC), protocol buffers (protobufs) and the Nokia Impart Database (IDB).

The Nokia IDB is a lightweight database that is optimized to handle high volumes of messages while protecting against any one application slowing down the whole system.

Field-proven protocol stacks

SR Linux leverages field-proven protocol stacks from the Nokia Service Router Operating System (SR OS), which has a strong pedigree in IP routing.

AI and cloud providers, telecommunication providers, and mission-critical enterprise data center networks are increasingly adopting leaf-spine fabric designs that use enhanced IP routing with Multiprotocol-Border Gateway Protocol (MP-BGP), EVPN, Virtual Extensible LAN (VXLAN), MPLS and segment routing protocols. By leveraging field-proven protocol stacks, data center planning and operations teams can immediately benefit from the stability, scalability and interoperability of a resilient NOS.

For Wide Area Networks (WAN), SR Linux delivers a rich set of IP routing, MPLS and Segment Routing labeled-forwarding capabilities together with EVPN-VXLAN for both IP and MAC-VRF transport supporting data center gateway, Provider Edge and Border Router applications. These capabilities include extensive EVPN and OAM features that can power the most demanding, dynamic, and reliable Ethernet and IP/MPLS networks.

Scalable streaming telemetry

SR Linux was built with an open, scalable telemetry framework at its core, internally using gRPC, gRPC Network Management Interface (gNMI) and protobufs. Because SR Linux is natively model driven, it is immediately ready for streaming telemetry without requiring any translation layers.

Superior CLI programmability and integration of third-party applications

Operators can leverage command line interface (CLI) plugins to completely customize the way the CLI operates, plugging in Linux commands or pulling the state/configuration from various locations, combining them with system state/configuration to allow advanced logic.

SR Linux allows third-party applications to be fully integrated into the system and given all the same benefits as Nokia applications. This includes consistent configuration via YANG, telemetry support, life cycle management and visibility of system resources.

SR Linux offers a state-of-the-art NetOps Development Kit (NDK) for data center teams to develop new applications and operational tools in the language of their choice with deep programmatic access to, and control of, the entire system.

AI data center networking

The Nokia AI data center networking solution provides the reliability, simplicity and flexibility you need to build and deploy network infrastructures that can meet the requirements of current and future AI workloads.

Nokia is at the forefront of defining and testing the evolution of Ethernet for AI. Nokia is an active member of the Ultra Ethernet Consortium (UEC) which is bringing enhancements that make Ethernet the best choice for AI network infrastructures. Nokia's solution is AI-ready and UEC-compatible with support for Remote Direct Memory Access over Converged Ethernet (RoCEv2) and Data Center Quantized Congestion Notification (DCQCN). Nokia is also implementing key features within the latest UEC spec.

Nokia also follows and participates in Open Compute Project (OCP) which is driving various new standards for Ethernet. One notable specification is Multipath Reliable Connection (MRC) that builds upon the existing RoCEv2 Ethernet framework to enable scalable, high-performance AI/ML workloads over multipath best-effort networks by specifying architectural extensions for multipath load balancing, reliability, and congestion control.

Network automation

The 7250 IXR-6e, IXR-10e and IXR-18e, powered by the SR Linux NOS, can be deployed across a wide range of applications. Nokia's network automation platforms deliver solutions that meet the requirements of every network domain.

The Nokia Event-Driven Automation (EDA) is a Kubernetes-native, declarative, intent-based automation platform that automates the entire data center fabric lifecycle—from Day 0 design through to Day 2+ operations.

Built on a cloud-native microservices architecture, the EDA continuously reconciles desired and observed state using real-time streaming telemetry to ensure the network operates as intended. It abstracts multivendor complexity, enables network-wide transactional changes with rollback, and embeds a real-time Digital Twin for safe validation before deployment. It complements SR Linux and SR OS, delivering reliable, simplified, and adaptable operations for AI, cloud, and enterprise data center environments.

The Nokia Network Services Platform (NSP) provides IP network automation, a consistent user experience, and management capabilities across all Nokia IP routing platforms. It reduces risk and accelerates implementation with prepackaged software and services.

Nokia is the right partner to accompany you on your journey to network automation in all network domains.

Hardware overview

The IXR-6e, IXR-10e and IXR-18e delivers massive scalability, openness, aggregation and inter-connectivity for cloud environments as well as interconnects for AI and HPC workloads.

Modular and high-availability platforms

The 7250 IXR-6e and IXR-10e share common CPMs, IMM cards and PSUs.The 7250 IXR-18e has a unique CPM.

The 7250 IXR-6e, IXR-10e and IXR-18e supports dual CPMs, redundant PSUs and fabric configurations that support redundancy as well as graceful degradation.

The 7250 IXR-6e, IXR-10e and IXR-18e uses an orthogonal direct cross connect architecture that allows for the full front and full back of the chassis to be used for air intake and exhaust.

The system configuration allows for IMMs connecting in front and switch fabrics and fans connecting at the rear. Fans and switch fabrics are decoupled to ensure that fan failures never result in packet loss if a fan fails and needs replacement.

Next-generation ASICs require advanced EMI containment without compromising critical airflow and increasing fan power. Nokia's unique mesh air intake and exhaust design solve these problems by delivering a Faraday cage design. It provides exceptional cooling, advanced power efficiency and superior EMI containment.

The IXR-6e and IXR-10e provide generational upgrades starting with J2C+ and where they can be upgraded to J3. Generational fans in the system ensure that fans are reusable across the upgrade,

in addition to CPMs, PSUs and IMMs that are all backward compatible.

Nokia offers an eight-switch fabric design for both the 400G and 100G IMMs, reducing overall power consumption using fewer fabric ASICS. It reduces overall trace length all while improving resiliency when compared to systems offering a six-SFM design.

WIth the introduction of the 36 x 800GE IMM, the IXR-6e and IXR-10e move to a seven-SFM configuration—and the IXR-18e is introduced with a 14-SFM configuration.

The 7250 IXR-6e supports two SFM configurations; the 7250 IXR-10e supports three SFM configurations across two generations of ASICs (J2C+ and J3). The 7250 IXR-18e supports a single SFM configuration with J3 only.

Switch Fabric Module 1 (SFM1)

The SFM1 is supported only on the 7250 IXR-10e and is optimized for high-density 100GE data center leaf-spine designs. Using an 8+0 switch fabric design with graceful degradation for the IXR-10e only, the system supports line rate 100GE line cards in all slots and line rate 400GE line cards in the top two slots of the 7250 IXR-10e chassis. This configuration delivers ultimate power efficiency for 100G aggregation in ways that competing systems cannot.

Switch Fabric Module 2 (SFM2)

The SFM2 is optimized for high-density 400GE data center leaf-spine designs. For both the IXR-6e and IXR-10e, the SFM2 supports a 7+1 switch fabric configuration for full fabric redundancy with graceful degradation. The SFM2 supports line rate 400GE and 100GE line cards in all slots.

Switch Fabric Module 3 (SFM3)

The SFM3 is required for the 36 x 800GE IMM deployments. The 7250 IXR-6e, IXR-10e and IXR-18e support a distinct SFM3 variant.

When deployed in the IXR-6e and IXR-10e, the systems use a seven-SFM configuration. When used in the IXR-18e, the system uses a 14-SFM configuration.

Control Processor Module (CPM)

The 7250 IXR-6e, IXR-10e and IXR-18e supports multiple CPM variants. Individual CPM4/CPM5 variants support Root of Trust (RoT) features. In addition, a CPM4 variant with RoT and synchronization features is supported on with J2C+ and J3 QSFP-DD IMM's.

The CPM4/CPM5 with RoT features a multi-core x86e CPU that delivers control plane scalability and performance—a key requirement for data center leaf-spine designs.

The 7250 IXR-6e, IXR-10e and IXR-18e supports dual CPMs and a fully distributed control infrastructure with dedicated CPUs per line card. Compared to single monolithic control plane systems, this distributed architecture provides optimized control plane processing without any detrimental impacts to the central CPM during system maintenance, IMM commissioning and heavy traffic loads. The distributed architecture also improves system security and greatly improves IGP/EGP convergence times.

The CPM4/CPM5 with RoT supports an integrated 120G SSD, a discrete trusted platform module and is designed to meet all demanding performance benchmarks.

The CPM4/CPM5 with RoT enables Secure Boot to ensure that the software executed by the system is trusted. The Trusted Platform module (TPM 2.0) is provisioned with Nokia Initial Device Identity (IDevID) and Initial Attestation Key (IAK).

Integrated Media Module (IMM)

IMMs are line cards providing integrated processing and physical interfaces on a single module. IMMs are hot-swappable and provide high-capacity Ethernet interfaces with full duplex (FD) per-slot capacity up to 28.8 Tb/s.

All IMMs natively support line rate MACsec and IPsec in hardware without the need to purchase specific part numbers, which complicates deployments and sparing.

With support for a 36-port 800GE QSFP-DD IMM, a 36-port 400GE QSFP-DD IMM and a 60-port 100GE QSFP28 IMM, a full range of densities are available.

Hardware breakout on the 60-port 100GE IMM is also industry leading without the same trade-offs that come with lower density 100GE competitor line cards.

Power Supply Unit (PSU)

The 7250 IXR-6e, IXR-10e and IXR-18e platforms support up to 9, 12 and 24 PSUs respectively, allowing for full N+N power supply redundancy along with full power feed redundancy. The 7250 IXR-6e/10e/18e provides added room for power growth to support system enhancements with next-generation ASICs.

Two PSU variants are available: a 3,000 watt DC PSU and a 3,000 watt AC PSU. The PSUs are fully interchangeable between the chassis variants. Each individual PSU supports dual-feed inputs. The PSUs are rated at a Platinum efficiency level, with the DC PSU delivering up to 93% efficiency while the AC PSU delivers up to 94% efficiency.

System scale and performance

Platform-specific scale and performance information is available and can be provided on request.

Technical specifications

Table 1. Nokia 7250 IXR-6e, IXR-10e and IXR-18e specifications

Feature	7250 IXR-6e	7250 IXR-10e	7250 IXR-18e
System throughput: Full duplex (FD)	Up to 115.2 Tb/s with latest-generation cards	Up to 230.4 Tb/s with latest-generation cards	Up to 460.8 Tb/s with latest-generation cards
SFM capabilities	• Single-stage fabric with graceful degradation • Separate fan module from switch fabric • Orthogonal direct cross-connect • Design that minimizes trace length • Ultra-efficient configuration focused on upgradability		
Maximum IMM throughput per slot (FD)	28.8 Tb/s with latest-generation IMMs	28.8 Tb/s with latest-generation IMMs	28.8 Tb/s with latest-generation IMMs
IMM slots	4	8	16
SFM slots	8	8	16
SFM cards required for J2C+ IMMs	8	8	n/a
SFM cards required for J3 IMMs	7	7	14
PSU slots	9	12	24
Control interfaces	Console, management, USB, SD slot	Console, management, USB, SD slot	Console, management, USB, SD slot
Memory buffer size	Per card (see Table 2)	Per card (see Table 2)	Per card (see Table 2)
Redundant hardware	• Dual redundant CPMs • Switch fabric redundancy (7+1, 7+0) • Power redundancy (N+N) • Fan redundancy (N+1)	• Dual redundant CPMs • Switch fabric redundancy (8+0, 7+1, 7+0)) • Power redundancy (N+N) • Fan redundancy (N+1)	• Dual redundant CPMs • Switch fabric redundancy (14+0) • Power redundancy (N+N) • Fan redundancy (N+1)
Dimensions	• Height: 44.50 cm (17.5 in); 10 RU • Width: 48.30 cm (19.0 in) • Depth: 92.20 cm (36.3 in) • Fits in standard 19-in rack	• Height: 71.00 cm (28.0 in); 16 RU • Width: 48.50 cm (19.0 in) • Depth: 92.20 cm (36.3 in) • Fits in standard 19-in rack	• Height: 155.57 cm (62.3 in); 35 RU • Width: 48.50 cm (19.0 in) • Depth: 103.12 cm (40.6 in) • Fits in standard 19-in rack
Power	• 9 PSUs with N+N redundancy • DC (dual feed): -40V DC to -72V DC • AC (dual feed): 200V AC to 240V AC, 50 Hz to 60 Hz • Front-bottom PSUs and power cabling	• 12 PSUs with N+N redundancy • DC (dual feed): -40V DC to -72V DC • AC (dual feed): 200V AC to 240V AC, 50 Hz to 60 Hz • Front-bottom PSUs and power cabling	• 24 PSUs with N+N redundancy • DC (dual feed): -40V DC to -72V DC • AC (dual feed): 200V AC to 240V AC, 50 Hz to 60 Hz • Front-bottom PSUs and power cabling
Cooling	• 4 trays of 3 ultra-quiet fans • Fan trays separate from switch fabric • Mesh air intakes and exhaust for superior air entry and exit • Safety electronic breaks on removal • Front-to-back airflow • Fan filter door kit (optional)	• 4 trays of 6 ultra-quiet fans • Fan trays separate from switch fabric • Mesh air intakes and exhaust for superior air entry and exit • Safety electronic breaks on removal • Front-to-back airflow • Fan filter door kit (optional)	• 8 trays of 6 ultra-quiet fans • Fan trays separate from switch fabric • Mesh air intakes and exhaust for superior air entry and exit • Safety electronic breaks on removal • Front-to-back airflow

Table 1. Nokia 7250 IXR-6e, IXR-10e and IXR-18e specifications (continued)

Feature	7250 IXR-6e	7250 IXR-10e	7250 IXR-18e
Normal operating temperature range	0°C to +40°C (32°F to +104°F) sustained	0°C to +40°C (32°F to +104°F) sustained	0°C to +40°C (32°F to +104°F) sustained
Shipping and storage temperature range	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)
Normal humidity	5% to 95%, non-condensing	5% to 95%, non-condensing	5% to 95%, non-condensing

Table 2. Nokia 7250 IXR-6e, IXR-10e and IXR-18e CPM/IMM options

Module type	Details	
CPM4 (Supported on 7250 IXR-6e/IXR-10e with J2C+, J3 line cards)	• 8-core x86 at 2.5 GHz CPU • 2 threads per core • 32 GB DRAM • 120 GB SSD • TPM 2.0 • Root of Trust (RoT)	
CPM4 with Synchronization (Supported on 7250 IXR-6e/IXR-10e with J2C+, J3 line cards)	• 8-core x86 at 2.5 GHz CPU • 2 threads per core • 32 GB DRAM • 120 GB SSD • TPM 2.0 • Root of Trust (RoT) • SyncE/1588	
CPM5 (Supported on 7250 IXR-18e)	• 8-core x86 at 2.5 GHz CPU • 2 threads per core • 32 GB DRAM • 120 GB SSD • TPM 2.0 • Root of Trust (RoT)	
36-port 800GE (Supported on 7250 IXR-6e/IXR-10e IXR-18e)	• 36 x 800G QSFP-DD • Requires SFM3 • Native hardware support for 800GE, 400GE, and 100GE • Flexible optical breakouts*: 2 x 400G, 8 x 100G, 2 x 100G and 8 x 50G • 32 GB packet buffer • 40 GB SSD • 4-core x86 at 2.5 GHz, 16 GB DRAM • Dedicated separate thumb screws and ejectors • Mesh air intakes for superior cooling • SyncE/1588	
36-port 800GE (Supported on 7250 IXR IXR-6e/IXR-10e/IXR-18e)	• 36 x 800G OSFP • Requires SFM3 • Native hardware support for 800GE, 400GE, and 100GE • Flexible optical breakouts*: 2 x 400G, 8 x 100G, 2 x 100G and 8 x 50G • 32 GB packet buffer • 40 GB SSD • 4-core x86 at 2.5 GHz, 16 GB DRAM • Dedicated separate thumb screws and ejectors • Mesh air intakes for superior cooling	

* Some breakout options require future software support and specific DAC cables

Table 2. Nokia 7250 IXR-6e, IXR-10e and IXR-18e CPM/IMM options (continued)

Module type	Details	
36-port 400GE (Supported on 7250 IXR-6e/IXR-10e)	• 36 x 400G QSFP-DD • Supported with SFM1, SFM2 and SFM3 • Native hardware support for 400GE, 100GE and 40GE • Flexible optical breakouts*: 4 x 100G, 2 x 100G, 8 x 50G, 2 x 50G, 4 x 25G and 4 x 10G • 16 GB packet buffer • 60 GB SSD • 4-core x86 at 2.5 GHz, 16 GB DRAM • Dedicated separate thumb screws and ejectors • Mesh air intakes for superior cooling • Can be mixed with 36 x 800G IMM when used with SFM3 on IXR-6e/10e	
60-port 100GE (Supported on 7250 IXR-6e/IXR-10e)	• 60 x 100G QSFP28 • Supported with SFM1, SFM2 and SFM3 • Native hardware support for 100GE and 40GE • Flexible optical breakouts*: 2 x 50G, 4 x 25G and 4 x 10G • 8 GB packet buffer • 60 GB SSD • 4-core x86 at 2.5 GHz, 16 GB DRAM • Dedicated separate thumb screws and ejectors • Mesh air intakes for superior cooling • Can be mixed with 36 x 800G IMM when used with SFM3 on IXR-6e/10e	

* Some breakout options require future software support and specific DAC cables.

Table 3. Nokia 7250 IXR-6e/IXR-10e/IXR-18e maximum density

Ethernet speed	7250 IXR-6e	7250 IXR-10e	7250 IXR-18e
10GE	576	1,152	NA
25GE	576	1,152	NA
40GE	240	480	NA
50GE*	1,152	2,304	4,608
100GE	1,152	2,304	4,608
400GE	288	576	1,152
800GE	144	288	576

* Future software support

Table 4. Nokia 7250 IXR-6e, IXR-10e and IXR-18e IMM scale*

IMM scale	60-port 100G QSFP28	36-port 400G QSFP-DD	36-port 800G QSFP-DD/OSFP
10GE	144	144	NA
25GE	144	144	NA
40GE	60	36	NA
50GE	120	288	288
100GE	60	144	288
400GE	NA	36	72
800GE	NA	NA	36
IPsec	All ports	All ports	All ports
MACsec	All ports	All ports	All ports
Packet buffer	8 GB	16 GB	16 GB

* The port type and densities listed are dependent on software support.

Software features

The 7250 IXR-6e, IXR-10e and IXR-18e supports, but is not limited to, the following SR Linux software features:[2]

Open Linux support

- Support for unmodified Linux kernel
- Access to Linux tools, patching and packaging
- Third party containers running on SR Linux
- Linux control groups (cgroupsv2)

Platform features

- Dynamic Ternary Content Addressable Memory (TCAM) table allocation

Layer 2 features

- Dot1q and untagged sub-interfaces
- Ethernet IEEE 802.1Q (VLAN) with support for jumbo frames
- Ethernet IEEE 802.1ad (QinQ) with support for jumbo frames
- Link aggregation: Link Aggregation Group (LAG) and Link Aggregation Control Protocol (LACP)
- Link Layer Discovery Protocol (LLDP) on all interfaces
- Media access control (MAC) loop prevention
- MAC Virtual routing and forwarding (VRF): MAC-VRF
- MAC-VRF network instance with IRB interface
- Internet Group Management Protocol (IGMP) snooping and Multicast Listener Discovery (MLD) snooping in Layer 2 broadcast domains

Layer 3 features

- IPv4/v6 routing
  - Static, aggregate routes
  - IP unnumbered interfaces
  - Dual-stack Interior Gateway Protocol (IGP)
  - Multi-topology IS-IS v4/v6
  - Open Shortest Path First (OSPFv2 and OSPFv3)
  - Multiprotocol BGP (MP-BGP)
- BGP with iBGP/eBGP: Support for IPv4/v6, including:
  - Core Prefix Independent Convergence (PIC)
  - 4-byte autonomous system number
  - Route reflector
  - Dynamic BGP
  - BGP unnumbered
  - eBGP multi-hop
  - Add-paths for IPv4 and IPv6 routes
  - BGP maintenance modes
- Graceful restart client for IS-IS

2 This section provides an overview of key features supported. Some platforms may have feature exclusions or exceptions. Consult Nokia documentation for detailed feature support and interdependencies.

- Equal cost multi-path (ECMP) with consistent and resilient hashing and configurable hash fields
- IPv6 flow label hashing
- VRF: Multiple VRF support
- Layer 3 VPNs:
  - IP-VRF: Multiple VRF support
  - IP-VPN (VPN-IPv4 and VPN-IPv6 families) and EVPN Interface-less (EVPN-IFL) support EVPN Interface-less (EVPN-IFL) support
  - Multi-instance IP-VRF and EVPN-IFL in the same IP VPN
  - Inter-AS option B and Next Hop Self RR support
  - EVPN IFL IP Aliasing and unequal ECMP
- ARP/ND synchronization via EVPN on L3 interfaces (draft-ietf-bess-evpn-l3mh-proto)
- Routing policy:
  - Structured rules for accepting, rejecting and modifying routes that are learned and advertised to routing peers
  - Routes can be matched based on prefix lists, autonomous system (AS) path regular expressions, BGP communities, Address Family Indicator/Subsequent Address Family Indicator (AFI/SAFI) protocol, etc.
  - Policy-based forwarding based on DiffServ Code Point (DSCP) and/or IP
  - Route leaking between network instances
- Layer 3/Layer 4 access control lists (ACLs) with validation; accept, reject and log actions

Network virtualization

- EVPN with VXLANv4 encapsulation
- EVPN Layer 2 and Layer 3 connectivity
- EVPN all-active multi-homing; single-active multi-homing for Layer 2 and Layer 3
- EVPN Anycast multi-homing (draft-rabnag-bess-evpn-anycast-aliasing)
- EVPN host route mobility
- Provider edge-to-customer edge (PE-CE) BGP path attribute propagation in EVPN
- EVPN IP aliasing
- Service Gateway for inter-domain connectivity (EVPN-VXLAN to EVPN-VXLAN/MPLS, EVPN-VXLAN to IP-VPN)
- EVPN with MPLS encapsulation support
- EVPN VPWS service support with MPLS encapsulation
- IP VPN support (v4/v6) over MPLS
- Gateway-IP based load balancing for EVPN IP Prefix routes
- EVPN and IP-VPN Next Hop Self Route Reflector and Inter-AS model B
- EVPN-IFL with LSP ping and traceroute for SR/MPLS

MPLS and segment routing (SR)

- Interface LDP over IPv4/IPv6
  - LFA and remote-LFA (IPv4) for LDP
- MPLS LSR ECMP based on label stack, source/destination IP, source/destination port, and TEID
- SR-ISIS over IPv4/v6
- SR-TE
- Colored SR-MPLS TE-Policy
- Uncolored SR-MPLS TE-Policy
- BGP shortcuts
- Traffic engineering (SR-TE) policies with active/standby LSP redundancy
  - sBFD
  - SRLG
  - Admin-tag for constraint based SVC/shortcut to tunnel binding
- MPLS QoS via EXP to forwarding class mapping
- ICMP tunneling
- ICMP extensions for MPLS
- LSP ping and trace for LDP and SR-ISIS tunnels
- Topology Independent Loop Free Alternate for SR-ISIS and SR-TE tunnels
- LDP (LFA) fast re-route, Remote-LFA including auto-LFA

- Protocol Independent Multicast - Any Source Multicast/Protocol Independent Multicast - Source Specific Multicast (PIM-ASM/SSM)
- Internet Group Management Protocol/Multicast Listener Discovery (IGMP/MLD)

QoS

- Intelligent packet classification, including IPv4 and IPv6 match-criteria-based classification
- MPLS QoS via EXP to forwarding class mapping
- Queuing/scheduling:
  - Strict priority
  - Weighted round robin (WRR)
  - Weighted Random Early Detection (WRED)
  - Explicit Congestion Notification (ECN)
- QoS classification and marking based on DSCP
- QoS classification and marking based on IEEE 802.1p
- Priority Flow Control (PFC)
- Egress per subinterface Queuing/scheduling:
  - Strict priority
  - Weighted round robin (WRR)
  - Explicit Congestion Notification (ECN)
  - 4 hierarchy levels: FC queue/aggregate/ multiaggregate (SVLAN)/interface
  - Sophisticated egress: Buffer management with Weighted Random Early Detection (WRED) at queue/interface-pool/fp-pool levels

Flow monitoring

- IPFIX

Operations, Administration and Maintenance (OAM)

- Bidirectional Forwarding Detection (BFD), micro BFD (uBFD)
- Link Layer Discovery Protocols (LLDP)
- Ethernet Connectivity Fault Management (CFM)
- Two-Way Active Measurement Protocol (TWAMP)
- Simple TWAMP (STAMP)
  - Link measurement
  - Performance monitoring
- Mirroring Sources from interface/sub-interface or ingress ACL
- Mirroring Destinations to Local interface or remote interface

System management and automation

- Native model-driven architecture, configuration candidates, exclusive mode, checkpoints and rollbacks
  - Support for SR Linux and OpenConfig data models
- Management interfaces: gNMI, gRPC Routing Information Base Interface (gRIBI), NETCONF, JSON-RPC and CLI (transactional, Python CLI and CLI plugins)
- YANG modeled actions (CLI, NETCONF, gRPC and JSON-RPC)
- gRPC network operations interface (gNOI)
- gRPC Network Security Interface (gNSI)
- P4 runtime packet extraction and injection
- Global and per-user configurable options for CLI environment configuration
- Local Authentication, Authorization and Accounting (AAA) with Role Based Access Control (RBAC)
- Remote Authentication Dial-In User Service (RADIUS) support for AAA
- Terminal Access Controller Access Control System (TACACS+) AAA with VSAs or privilege levels
- Password complexity policies and lockout management
- Access to common Linux utilities: Bash, cron and Python
- Logging infrastructure for local and remote logs including Syslog RFC 5424 support
- Facility alarms for equipment status
- Telemetry
  - Subscription-based telemetry for modeled data structures, either on change or sampled
  - sFlow

- Telemetry-driven event management
- Python-based Zero Touch Provisioning (ZTP)
- Address management: Dynamic Host Configuration Protocol (DHCP) v4/v6 relay
- DHCP v4/v6 server with static allocations

NetOps Development Kit (NDK)

- gRPC and protobuf-based interface for tight integration
- Leverages SR Linux model-driven architecture
- Direct access to other application functionality, e.g., forwarding information base (FIB), LLDP and BFD
- Native support for streaming telemetry

Load balancing and resiliency

- Support for hot-swappable, redundant control, fabric,, fan and power configurations
- BGP fast reroute using label/unlabeled unicast routes
- VRRP v2 and v3 support

Security

- Distributed and aggregated ACLs and policers for control and management plane
- Layer 3, Layer 4 Control Plane Policing (CoPP)
- IPv6 router advertisements guard
- MAC security (MACsec)
- IPSec[3]
- Secure boot
- Disk encryption

Timing and synchronization

- Built-in Stratum 3E clock[4]
- ITU-T Synchronous Ethernet (SyncE)[4]
- IEEE 1588v2 PTP[4]
  - Boundary clock (BC)
  - Profiles: ITU-T G.8275.1, G.8275.2
  - PTP encapsulation: Ethernet, IPv4/IPv6
- Timing ports[4]
  - SyncE/1588 port
  - 1pps output port
- RFC 5905 Network Time Protocol (NTP)

AI backend data center networking[5]

- RDMA over converged Ethernet (RoCEv2)
- Explicit Congestion Notification (ECN)
- Priority Flow Control (PFC)
- Data Center Quantized Congestion Notification (DCQCN)
- Compatibility with evolving UEC and OCP capabilities

Standards compliance[6]

Environmental

- ETSI EN 300 019-2-1; Storage Tests, Class 1.2
- ETSI EN 300 019-2-2; Transportation Tests, Class 2.3
- ETSI EN 300 019-2-3; Operational Tests, Class 3.2
- ETSI EN 300 753; Acoustic Noise, Class 3.2[7]
- GR-3160-CORE

Safety

- AS/NZS 62368.1
- IEC 60529 IP20
- IEC/EN 60825-1
- IEC/EN 60825-2
- IEC/EN/UL/CSA 62368-1

Electromagnetic compatibility

- AS/NZS CISPR 32 (Class A)
- BSMI CNS 15936 (Class A)
- BT GS-7
- EN 300 386
- EN 55032 (Class A)

3 Future software release
4 Supported on the IXR-6e and IXR-10e only
5 Some platforms may have feature exclusions or exceptions.
6 System design intent is according to the listed standards. Refer to product documentation for detailed compliance status.
7 Supported on 7250 IXR-6e only.

- EN 55035
- ETSI EN 300 132-1 (AC)
- ETSI EN 300 132-2 (LVDC)
- ETSI ES 201 468
- FCC Part 15 (Class A)
- ICES-003 (Class A)
- IEC 61000-3-2
- IEC 61000-3-3
- IEC 61000-6-2
- IEC 61000-6-4
- IEC CISPR 32 (Class A)
- IEC CISPR 35
- IEC/EN 61000-4-2 ESD
- IEC/EN 61000-4-3 Radiated Immunity
- IEC/EN 61000-4-4 EFT
- IEC/EN 61000-4-5 Surge
- IEC/EN 61000-4-6 Conducted Immunity
- IEC/EN 61000-4-11 Voltage Interruptions
- KS C 9832
- KS C 9835
- VCCI (Class A)

Directives and regional approvals

- Directive 2011/65/EU RoHS (including Commission Delegated Directive EU 215/863)
- Directive 2012/19/EU WEEE
- Directive 2014/30/EU EMC
- Directive 2014/35/EU LVD
- BSMI Mark: Taiwan
- CE Mark: Europe
- CRoHS: China RoHS
- KC Mark: South Korea
- NEBS Level 3
- RCM Mark: Australia
- TEC Mark: India
- UKCA: United Kingdom
- VCCI Mark: Japan

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