Nokia 7250 IXR-X series Interconnect Routers

Release 25

The Nokia 7250 IXR-X series platforms deliver up to 14.4 Tb/s full duplex capacity and support 10GE to 400GE interfaces in a compact 1RU form factor. They are highly scalable, with deep buffers, advanced security, and operational simplicity, and are designed for data center spine-and-leaf and multi-access edge-computing, as well as access, aggregation, and 5G interconnect applications for AI and cloud providers, telecommunications providers, and mission-critical enterprise environments.

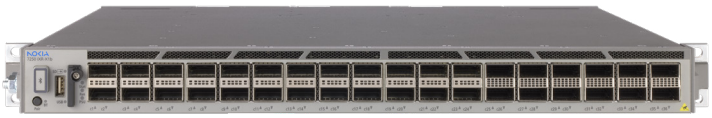
Overview

Exponential data growth, ever-increasing AI and high-performance computing workloads, and the rise of edge computing to process data closer to users are driving the need for higher speeds and capacity in data center networks. In addition, a comprehensive set of features that enable flexible interconnectivity within and across networks is required.

In WAN applications, it is optimized for next generation IP mobile transport (anyhaul), fixed-mobile convergence, residential and business access and aggregation.

Scaling capacity demands at higher speeds are easily met with the Nokia 7250 IXR-X series. It offers variant options of 7.2 Tb/s full duplex (FD) and 14.4 Tb/s FD in a compact 1RU form factor. It supports 400G QSFP-DD and 100G QSFP28 optics with flexible optical breakouts to deliver high-density 400GE, 100GE, 40GE, 25GE and 10GE interfaces.

Powered by the Nokia Service Router (SR) Linux network operating system (NOS), the 7250 IXR-X series provides a secure, robust networking foundation and value-added capabilities for cloud-native architectures, offering scalable automation and unmatched extensibility.



7250 IXR-X1b

7250 IXR-X3b

Platform variants

With line rate switching capacity and deep buffers, the Nokia 7250 IXR-X series provides versatility, offering a full range of speeds, flexible breakout capabilities, and an extensive portfolio of pluggable optics for maximum configuration options – all in a fixed configuration, 1RU form factor.

- 7250 IXR-X1b
  - 7.2 Tb/s FD, fixed system, 1RU
  - 24 x 100G QSFP28 connectors
  - 12 x 400G QSFP-DD connectors
  - Optical breakout options include 4x10G, 4x25G, 2x100G, 4x100G[1]
  - Supports up to 96 x 10GE/25GE ports and 72 x 100GE ports
  - Mesh air intakes for superior cooling
  - 8 GB packet buffer
- 7250 IXR-X3b
  - 14.4 Tb/s FD, fixed system, 1RU
  - 36 x 100G QSFP-DD connectors
  - Optical breakout options include 4x10G, 4x25G, 2x100G, 4x100G[1]
  - Supports up to 144 x 10GE/25GE and 144 x 100GE ports
  - Mesh air intakes for superior cooling
  - 16 GB packet buffer

Universal connectors

The 7250 IXR-X series design enables seamless integration of a broad range of optics, maximizing configuration options and empowering operators to tailor network designs to their evolving needs.

The 400G QSFP-DD connectors are fully backward compatible to QSFP28-DD and QSFP28, with each cage supporting any breakout combination. Pluggable Digital Coherent Optics (DCO) 100G/400G ZR/ZR+ are also supported on the platform.

Network security

The Nokia 7250 IXR-X series hardware provides user plane protection through low-latency, line-rate encryption based on MACsec. This ensures that data is safeguarded against snooping or tampering by any intermediate device or network. Furthermore, the hardware supports IPsec without requiring dedicated appliances.[2]

The 7250 IXR-X series with Root-of-Trust features a multi-core x86e CPU that delivers control plane scalability and performance, crucial for data center leaf-spine designs. It includes 80G SSD of integrated storage, a discrete trusted platform module, and 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 provisioned with Nokia Initial Device Identity (IDevID) and Initial Attestation Key (IAK). TPM 2.0 technology supports secure boot and measured boot, utilizing hardware-processed security keys for enhanced security over software-processed keys.

Advance timing and sync capabilities

The 7250 IXR-X series is equipped with a high-precision clock to meet the strict timing requirements of applications such as 5G transport. The platform supports both Sync-E and IEEE 1588, offering precise time synchronization for various applications.

Innovative hardware design

The 7250 IXR-X series is designed with a component- minimizing approach to ensure that only essential components are used, and system layouts are optimized, leveraging Nokia intellectual property throughout. Fewer components increase system reliability and reduce power consumption.

The intellectual property integrated into the hardware design of each variant includes the integration of the Bell Labs 1588 algorithm, honeycomb mesh air intakes, and leverages the capabilities of the chipset

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

2 Planned future capability

in each platform to its maximum potential. The net result includes leading low power consumption, a design optimized for the supply chain, and inherent support for highly sustainable networks.

Honeycomb mesh air intakes on the platform not only create a 90% open faceplate, compared to a 50 - 60% open faceplate with holes punched in bent metal but also create a full Faraday Cage for the platform. This ensures that EMI is always best isolated platform-to-platform.

The 7250 IXR-X series shares common fans and power supply units (PSUs) with the 7250 IXR-X1/X3. Redundant fans and PSUs enhance network availability.

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 7220 IXR-X series implements 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 data center networks, the primary challenges are scalability and/or 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. SR Linux delivers an extensible and open infrastructure that 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, telecommunications 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

Operations teams 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.

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.

The work of the Ultra Ethernet Consortium (UEC) is bringing enhancements that make Ethernet the best choice for AI network infrastructures.

The 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).

SR Linux supports ECN and PFC congestion management techniques and traffic prioritization capabilities that let you deliver lossless Ethernet networking. It also supports superior telemetry, manageability, ease of automation and resiliency features that are essential for high-performance AI infrastructures.

Network automation

The 7250 IXR-X series products, 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.

Technical specifications

Table 1. Nokia 7250 IXR-X series specifications

Feature	7250 IXR-X1b	7250 IXR-X3b
System throughput (FD)	7.2 Tb/s	14.4 Tb/s
Connectors	• 12 x 400G QSFP-DD • 24 x 100G QSFP28	• 36 x 400G QSFP-DD
Optical breakouts	4x100G, 2x100G, 4x25G, 4x10G	4x100G, 2x100G, 4x25G, 4x10G
Control interfaces	Console, management, Bluetooth, USB, SD slot with security cover	
Security	MACsec/IPsec[3] Root-of-Trust TPM2.0, Secure boot	
Timing and synchronization	• Stratum 3E oscillator • ITU-T Synchronous Ethernet (SyncE) • IEEE 1588v2 PTP Clock Types – Boundary clock • IEEE 1588v2 PTP Profiles: – ITU-T G.8275.1 – ITU-T G.8275.2 with PTS • ITU-T G.8273.2 Class D performance • IEEE 1588v2 PTP Encapsulations: – Ethernet – UDP/IPv4 • RFC 5905 Network Time Protocol (NTP)	
CPU speed, number of cores	2.5 GHz, 8 cores	2.5 GHz, 8 cores
System memory	32 GB	32 GB
Packet forwarding rate per system (max.)	80 GB SSD	80 GB SSD
Internal storage	80GB SSD	80GB SSD
Memory buffer size	8 GB	16 GB
Dimensions	• Height: 1RU, 4.5 cm (1.75 in) • Depth: 54.6 cm (21.5 in) • Width: 44.45 cm (17.5 in)	• Height: 1RU, 4.5 cm (1.75 in) • Depth: 64.7 cm (25.5 in) • Width: 44.45 cm (17.5 in)
Common equipment redundancy	Power supplies (1+1), cooling fans (n+1)	
Power supply options	Modular AC or DC power supplies	
Power requirements	• HV AC input (rated): 200 V AC to 240 V AC, 50 Hz to 60 Hz • DC input (rated): -48 V DC/-60 V DC	
Cooling	• Modular replaceable fans (3 total) • Front-to-back airflow	
Normal operating temperature range	0°C to +40°C (32°F to +104°F) sustained	
Normal operating altitude	Up to 13,123 ft (4000 m)[4]	
Shipping and storage temperature	-40°C to +70°C (-40°F to +158°F)	
Normal humidity	5% to 95%, non-condensing	

3 Planned future capability

4 Contact Nokia for implementation details

Table 2. Nokia 7250 IXR-X series maximum density

Ethernet speed	7250 IXR-X1b	7250 IXR-X3b
10GE*	96	144
25GE*	96	144
40GE*	36	36
100GE	72	144
400GE	12	36

* Future software support

Software features[5]

The Nokia 7250 IXR-X series platforms support the following SR Linux software features, among others.

Open Linux support

- Support for unmodified Linux kernel
- Linux control groups (cgroupsv2)

Layer 2 features

- Ethernet IEEE 802.1Q (VLAN) and 802.1ad (+QnQ) 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

Layer 3 features

- IPv4/v6 routing
- 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
- IS-IS v4/v6
- Graceful restart client for IS-IS
- Open Shortest Path First (OSPFv2 and OSPFv3)
- Static routes for IPv4/v6
- Equal cost multi-path (ECMP) with consistent and resilient hashing and configurable hash fields
- IPv6 flow label hashing
- BGP maintenance modes
- BGP route flap damping
- Bi-directional forwarding detection (BFD), micro BFD (uBFD)
- 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 protocol
  - 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 host route mobility
- Provider edge-to-customer edge (PE-CE BGP path attribute propagation in EVPN
- EVPN IP aliasing

5 Some platforms may have feature exclusions or exceptions

- 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
- 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
- Priority Flow Control (PFC)

Operations, administration and maintenance

- 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)
- Service Activation Testhead

System management and automation

- Native model-driven architecture, configuration candidates, exclusive mode, checkpoints and rollbacks
  - Support for SR Linux and OpenConfigdata models
- Management interfaces: gNMI, gRPC Routing Information Base Interface (gRIBI), JSON-RPC and CLI (transactional, Python CLI and CLI plugins)
- gRPC network operations interface (gNOI)
- gRPC Network Security Interface (gNSI)
- P4 runtime packet extraction and injection
- Per-user configurable options for CLI
- 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
- Password complexity policies and lockout management
- Access to common Linux utilities: Bash, cron and Python
- Syslog RFC 5424
- Telemetry
  - Subscription-based telemetry for modeled data structures, either on change or sampled
  - sFlow
  - Logging infrastructure
- Telemetry-driven event management
- Python-based Zero Touch Provisioning (ZTP)
- Address management: Dynamic HostConfiguration Protocol (DHCP) v4/v6 relay
- DHCP v4/v6 server with static allocations
- Interactive mirroring

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 redundant fan and power configurations in data center hardware platforms
- BGP fast reroute using labeled/unlabeled unicast routes
- Graceful restart client for BGPv4/v6

Security

- Distributed and aggregated ACLs and policers for control and management plane
- Layer 3, Layer 4 Control Plane Policing (CoPP)
- Mirroring to Switch Port Analyzer (SPAN) and Encapsulated Remote SPAN (ERSPAN)
- MAC security (MACsec) and Internet Protocol Security (IPsec)[6]
- Secure boot
- Disk encryption

AI data center networking

- RDMA over converged Ethernet (RoCEv2)
- Explicit Congestion Notification (ECN)
- Priority Flow Control (PFC)
- Data Center Quantized Congestion Notification (DCQCN)
- Compatibility with UEC Specification 1.0 capabilities

Standards compliance[7]

Environmental

- ATIS-0600015.03
- 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)
- GR-63-CORE
- GR-295-CORE
- GR-3160-CORE
- VZ.TPR.9205
- VZ.TPR.9203 (Data Centers)

Safety

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

6 Future software release

7 System design intent is according to the listed standards. Refer to product documentation for detailed compliance status

Electromagnetic compatibility

- AS/NZS CISPR 32 (Class A)
- ATIS-600315.01.2015
- BT GS-7
- EN 300 386
- EN 301 489-1
- EN 301 489-17 (Bluetooth)
- BSMI CNS 15936 (Taiwan)
- EN 55035
- EN 55032 (Class A)
- ES 201 468
- ETSI EN 300 132-2 (LVDC)
- ETSI EN 300 132-1 (AC)
- FCC Part 15 (Class A)
- GR-1089-CORE
- ICES-003 (Class A)
- IEC 61000-3-2
- IEC 61000-3-3
- IEC CISPR 35
- IEC CISPR 32 (Class A)
- IEC 61000-6-2
- IEC 61000-6-4
- 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
- EC/EN 61000-4-11 Voltage Interruptions
- KS C 9832 Class A (Emissions; South Korea)
- KS C 9835 (Immunity; South Korea)
- KS C 3124 (South Korea)
- KS C 3126 (Bluetooth; South Korea)
- VCCI CISPR32 Class A (Japan)

Directives, regional approvals and certifications

- DIRECTIVE 2011/65/EU RoHS
- DIRECTIVE 2012/19/EU WEEE
- DIRECTIVE 2014/30/EU EMC
- DIRECTIVE 2014/35/EU LVD
- DIRECTIVE 2014/53/EU RED
- MEF CE 3.0 compliant
- Australia: RCM Mark
- United Kingdom: UKCA Mark
- China RoHS: CRoHS
- Europe: CE Mark
- Japan: VCCI Mark
- South Korea: KC Mark
- Taiwan: BSMI Mark
- TL9000
- ISO 14001
- ISO 9001

About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

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