Nokia 7250 IXR-10e Interconnect Router for SONiC

As part of the Nokia Data Center portfolio, the Nokia 7250 IXR-10e Interconnect Router (IXR) is a terabit-scale, modular platform designed for data center spine and WAN deployments. It delivers massive scalability, flexibility and operations simplicity for data center and cloud environments.

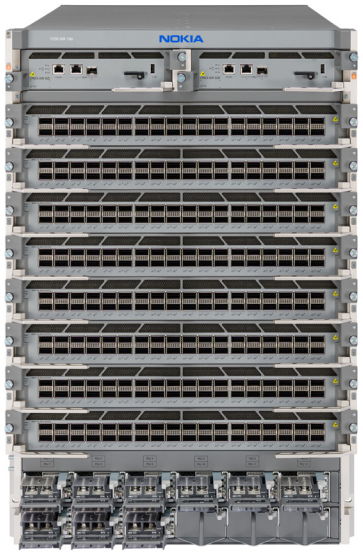
Overview

Data centers require highly scalable, modular and reliable platforms that are designed to support high-speed interfaces for current and future data center network buildouts. These platforms must also support a comprehensive set of features that enable flexible interconnectivity within and across data centers.

The Nokia 7250 IXR-10e is a high-performance, high-density, modular platform designed for data center spine and WAN deployments. It offers hardware support for 400GE, 200GE, 100GE, 50GE, 40GE, 25GE and 10GE interfaces for intra-fabric and server connectivity.

The 7250 IXR-10e is an 8-slot platform supporting a system capacity up to 115.2 Tb/s with current-generation line cards.

The system is designed to be fully upgradable to next-generation silicon evolving from 50G to 100G SERDES by leveraging true orthogonal direct cross-connect without midplane connectors.



7250 IXR-10e

Features and benefits

The Nokia 7250 IXR-10e platform delivers massive scalability, very high performance and flexibility, enabling rapid deployment and easy adaptation to evolving data center and cloud environments.

In addition to supporting fully redundant control, fabric, fan and power configurations, the 7250 IXR-10e supports 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
- Capacity expandable to support future silicon, achieved via a focus on the latest high-capacity merchant silicon

- Fabric-optimized design, ensuring upgradability for tomorrow balanced with superior efficiency today
- Power- and cooling-optimized design
- Support for 400GE ZR/ZR+ coherent optics.

These leading hardware design attributes help data center and cloud teams to achieve their goals of high availability and operations efficiency.

SONiC

Software for Open Networking in the Cloud (SONiC) is an open source network operating system (NoS) based on Linux®. SONiC offers a full suite of network functionality, including Border Gateway Protocol (BGP) and Remote Directory Memory Access (RDMA), which has been production hardened in the data centers of some of the largest cloud service providers.

SONiC offers teams the flexibility to create the network solutions they need while leveraging the collective strength of a large ecosystem and community[1].

The Nokia 7250 IXR-10e platform implements SONiC.

Software features

SONiC offers a comprehensive set of open source features that are readily available and maintained via the SONiC community. For a complete list of capabilities and software support functions, please consult the SONiC website.

Hardware overview

The Nokia 7250 IXR-10e platform delivers massive scalability, openness, aggregation and interconnectivity for data center and cloud environments.

Modular and high-availability platforms

The 7250 IXR-10e sets the benchmark for high availability, supporting a full suite of 1+1 control, 7+1 fabric, redundant fan and redundant power configurations.

The chassis uses an orthogonal direct cross-connect architecture without a midplane or series

of midplane connectors, which can permanently limit a chassis to a single generation of application-specific integrated circuits (ASICs).

The lack of a backplane, midplane or midplane connector system provides a compact chassis design, optimal cooling and easy capacity upgrades.

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.

Each fan module spans the full height of the back of the chassis and does not plug into a fan module. Alternate designs with integrated fans or fans that plug directly into switch fabric modules (SFMs) compromise on cooling and reliability.

The system uses a complete Faraday Cage design for EMI containment, a critical requirement for evolution to next-generation ASICs. This design is realized via a unique mesh air intake and exhaust system that mitigates against EMI and also provides vastly superior faceplate openness. This openness allows for more air in and out of a system compared to classic holes punched in bent metal. This design creates a unique cooling advantage for the 7250 IXR-10e compared to classic data center cooling.

An 8-SFM design instead of a 6-SFM design reduces overall power consumption because an 8-SFM design uses fewer fabric ASICs. Overall trace length is equally reduced, and resiliency is improved through the higher SFM count. This design provides an upgradable path to future-generation ASICs.

Switch Fabric Module (SFM2)

The SFM2 is optimized for high-density 400GE data center leaf-spine designs. For the 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.

1 https://sonicfoundation.dev/

Control Processor Module (CPM3)

The CPM3 features a multi-core x86e CPU that delivers control plane scalability and performance-key requirements for data center leaf-spine designs.

The 7250 IXR-10e supports dual-redundant 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.

The CPM3 supports an integrated 240G solid-state drive (SSD).

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 performance up to 14.4 Tb/s.

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

Integrated MACsec as part of the switching silicon on every ASIC, without the need for separate MACsec PHYs, also dramatically lowers power consumption compared to devices that need separate PHYs for MACsec.

With support for a 36-port QSFP-DD 400GE IMM and a 60-port QSFP28 100GE 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 Units (PSUs)

The 7250 IXR-10e platform supports up to 12 PSUs, allowing for full N+N or N+1 power supply redundancy along with full power feed redundancy. In contrast to systems with fewer power supplies, the 7250 IXR-10e provides added room for power growth to support system enhancements with next-generation ASICs.

Two PSU variants are available: a 3-kW DC PSU and a 3-kW AC PSU. The PSUs are fully interchangeable between the chassis variants. Each individual PSU supports dual-feed inputs.

Hardware optimizations for SONiC support

SONiC support on modular chassis-based hardware platforms necessitates a CPU per line card. The 7250 IXR-10e platform supports a CPU per line card and implements a dedicated system design from Day 1 to ensure ASIC upgradability generation-over-generation in combination with a CPU per line card.

Because SONiC relies on open community work and a dedicated software team associated with SONIC, successfully operationalizing SONIC requires a planned approach to support and debugging. The 7250 IXR-10e delivers on this by supporting dedicated debug ports, accessible for each individual line card, to ensure a smooth operational rollout. Without this capability, platforms cannot properly enable the potential of SONiC.

Technical specifications

Table 1. 7250 IXR-10e specifications

Feature	7250 IXR-10e
System throughput: full duplex (FD)	115.2 Tb/s with current-generation cards
Switch fabric 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 • 8-SFM design for enhanced resiliency
Maximum IMM throughput per slot (FD)	14.4 Tb/s with current-generation IMMs
IMM slots	8
Fabric slots	8
PSU slots	12
Control interfaces	Console, management, USB, SD slot
Memory buffer size	Per card (see Table 2)
Redundant hardware	• Dual redundant CPMs • Switch fabric redundancy (7+1) • Power redundancy (N+N or N+1) • Fan redundancy (N+1)
Dimensions	• Height: 71.00 cm (28.0 in); 16 RU • Width: 48.5 cm (19.0 in) • Depth: 92.20 cm (36.3 in) • Fits in standard 19-in rack
Power	• 12 PSUs with N+N redundancy • DC* (dual feed): -40 V DC to -72 V DC • AC (dual feed): 200 V AC to 240 V AC, 50 Hz to 60 Hz • Front-bottom PSUs and power cabling
Cooling	• 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)
Normal operating temperature range	0°C to +40°C (32°F to +104°F) sustained
Shipping and storage temperature	-40°C to 70°C (-40°F to 158°F)
Normal humidity	5% to 95%, non-condensing

* Future deliverable for SONiC support

Table 2. 7250 IXR-10e CPM and IMM

CPM/IMM	Details	
CPM3	• 8-core x86 @2.5GHz CPU. 2 threads per core • 32 GB DRAM • 240 GB SSD	
36-port 400GE IMM	• 36 x 400GE QSFP56-DD • Native hardware support for 400GE, 100GE and 40GE • Hardware breakout options for 4 x 100GE, 2 x 100GE, 8 x 50GE, 2 x 50GE, 4 x 25GE, and 4 x 10GE • 120 GB SSD • 8-core x86 at 2.5 GHz, 32 GB DRAM • Dedicated separate thumb screws and ejectors • Mesh air intakes for superior cooling	
60-port 100GE* IMM	• 60 x 100GE QSFP28 • Native hardware support for 100GE and 40GE • Hardware breakout options for 2 x 50GE, 4 x 25GE, 4 x 10GE • 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	

* Future deliverable for SONiC support

Table 3. 7250 IXR-10e maximum chassis density*

Ethernet speed	7250 IXR-10e
10GE	1,152
25GE	1,152
40GE	480
50GE	2,304
100GE	1,152
400GE	288

* The port densities listed correspond to the maximum ports supported and are dependent on software support.

Table 4. 7250 IXR-10e IMM scale*

IMM scale	60-port QSFP28 IMM	36-port QSFP-DD IMM
25GE	144	144
40GE	60	36
50GE	120	288
100GE	60	144
400GE	Not applicable	36
MACsec	All ports	All ports
Packet buffer	8 GB	16 GB

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

Standards compliance[2]

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)
- 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 Ed2

Electromagnetic compatibility

- AS/NZS CISPR 32 (Class A)
- BSMI CNS13438 (Class A)
- BT GS-7
- EN 300 386
- EN 301 489-1
- EN 301 489-17 (Bluetooth)
- EN 55032 (Class A)
- EN 55035
- ES 201 468
- ETSI EN 300 132-1 (AC)
- ETSI EN 300 132-2 (LVDC)
- 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
- KN 301 489-1
- KN 301 489-17 (Bluetooth)
- KS C 9832 (2019)
- KS C 9835 (2019)
- VCCI (Class A)

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

Radio

- EN 300 328 (Bluetooth)
- FCC Part 15.247 (Bluetooth)
- RSS-GEN
- RSS-247 (Bluetooth)

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
- Directive 2014/53/EU RED
- BSMI Mark: Taiwan
- CE Mark: Europe
- CRoHS: China RoHS
- KC Mark: South Korea
- NEBS Level 3
- RCM Mark: Australia
- VCCI Mark: Japan
- UKCA: United Kingdom

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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