Nokia 7250 IXR-10/IXR-6/IXR-s Interconnect Routers

Release 23

The Nokia 7250 Interconnect Router (IXR) family addresses evolving demands driven by the cloud, 5G and the Internet of Things. The IXR-10, IXR-6 and IXR-s[1] routers enable high-scale interconnectivity in data centers and across WANs and aggregation networks in service provider, enterprise and webscale environments.

Interconnect routers complement IP edge and core router platforms to deliver enhanced, cost-effective IP network architectures. The 7250 IXR delivers a comprehensive set of IP/MPLS, synchronization and quality of service (QoS) capabilities. Flexible traffic management includes big buffering, per-port queuing, shaping and policing.

High-density aggregation

The 7250 IXR is optimized for high-density aggregation, and is equipped with high-performance 100GE (Gigabit Ethernet), 50GE[2], 40GE, 25GE, 10GE and GE interfaces to scale networks to meet evolving traffic demands.

Differentiated service support

Per-service, hierarchical queuing features support differentiated QoS, which is ideal for any-G aggregation and fixed-mobile network convergence. These features also help industrial enterprises attain IT/OT (informational technology/operational technology) convergence by simultaneously carrying both their business and operational traffic.
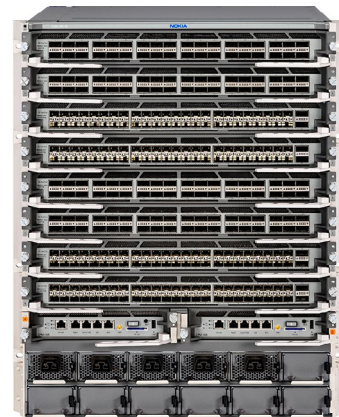
7250 IXR-10
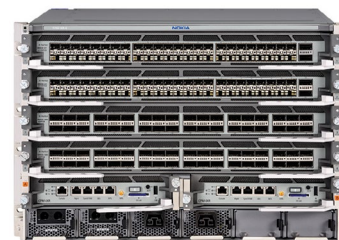
7250 IXR-6

7250 IXR-s

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1   The 7250 IXR-10, IXR-6 and IXR-s are part of the 7250 IXR product family. Additional data sheets are available for other models in this product family.
    The 7250 IXR10, IXR-6 and IXR-s are referred to collectively as the 7250 IXR throughout this data sheet.
2   50GE is a future software deliverable.

High availability

The 7250 IXR sets the benchmark for high availability. The 7250 IXR-10 and IXR-6 systems support a full suite of 1+1 control, 5+1 fabric, and redundant fan and power configurations.

In addition to full hardware redundancy, the robust Nokia Service Router Operating System (SR OS) supports numerous features to maximize network stability, ensuring that IP/MPLS protocols and services run without interruption. These features include innovative nonstop routing, nonstop services and stateful failover.

Automation

To simplify and automate network operations, the 7250 IXR enables model-driven network management features through the Nokia SR OS and is managed by the Nokia Network Services Platform (NSP). The Nokia NSP offers a rich set of service management features that automate new service delivery and reduce operating cost.

Standards-based software-defined networking (SDN) interfaces enable best-path computation to be offloaded to path computation elements (PCEs) such as the Nokia NSP. The 7250 IXR operates as a path computation client (PCC), collecting and reporting per-link and per-service delay, jitter and loss metrics as well as port utilization levels, for efficient path computation.

Software features

The 7250 IXR supports, but is not limited to, the following features.

Services

- Point-to-point Ethernet pseudowires/virtual leased line (VLL)
- Ethernet Virtual Private Network (EVPN)
  - Virtual Private Wire Service (EVPN-VPWS)
  - Virtual Private LAN Services (EVPN-VPLS): IPv4 and IPv6 support, including Virtual Router Redundancy Protocol (VRRP)
  - Multihoming with single active or active/active mode

- Multipoint Ethernet VPN services with VPLS based on Targeted Label Distribution Protocol (T-LDP) and Border Gateway Protocol (BGP)
- Routed VPLS with Internet Enhanced Service (IES) or IP-VPN, IPv4 and IPv6
- Ingress and egress VLAN manipulation for Layer 2 services
- IP VPN Virtual Private Routed Network (VPRN), Inter-Autonomous System (Inter-AS) Option A, B and C
- IPv6 VPN Provider Edge (6VPE)

Network protocols

- Segment routing
  - Intermediate System-to-Intermediate System (SR-ISIS) and Open Shortest Path First (SR-OSPF)
  - Traffic engineering (SR TE) IPv4, IPv6
- MPLS label edge router (LER) and label switching router (LSR) functions
  - Label Distribution Protocol (LDP)
  - Resource Reservation Protocol with traffic engineering (RSVP-TE)
- BGP - Labeled Unicast (BGP-LU) (IETF RFC 3107) route tunnels
- IP routing
  - Dual-stack Interior Gateway Protocol (IGP)
  - Multi-topology, multi-instance Intermediate System to Intermediate System (IS-IS)
  - Multi-instance OSPF
  - Multiprotocol BGP (MP-BGP)
  - BGP-LU support in edge, area border router (ABR) and autonomous system boundary router (ASBR) roles
  - Usage-triggered download of BGP label routes to Label - Forwarding Information Base (L-FIB)
  - Accumulated IGP (AIGP) metric for BGP
  - BGP monitoring protocol (BMP)
  - BGP route-reflector for EVPN and IP-VPN with VPNv4 and VPNv6 address families (AFs)
  - BGP confederations
  - IGP and BGP shortcuts

- Layer 3 Multicast – base routing
  - Internet Group Management Protocol (IGMP)
  - Protocol Independent Multicast – Sparse Mode (PIM-SM), Source Specific Multicast (SSM)
  - Multicast Listener Discovery (MLD)
- Layer 3 Multicast - VPRN (7250-IXR-s)
  - Next-generation multicast VPNs (NG-MVPN)
  - SSM with multicast LSPv4 (mLDPv4)
  - IGMP/MLD
  - IGMP/MLD on Routed VPLS Interface
- Layer 2 Multicast
  - IGMP/MLD snooping

SDN

- SR-TE LSPs, RSVP-TE LSPs
  - PCC initialized, PCC controlled
  - PCC initialized, PCE computed
  - PCC initialized, PCE controlled
- SR-TE LSPs: PCE initialized, PCE controlled (7250 IXR-s)
- Topology discovery: BGP-Link State (BGP LS) IPv4 and IPv6
- Telemetry: streaming interface statistics, service delay and jitter metrics
- Netflow/cflowd

Load balancing and resiliency

- Nonstop routing (7250 IXR-10 and IXR-6)
- Segment routing topology-independent loop-free alternate (TI-LFA) and remote loop-free alternate (rLFA)
- LDP LFA and rLFA
- IEEE 802.3.ad Link Aggregation Group (LAG) and multi-chassis (MC) LAG
- Pseudowire and LSP redundancy
- IP and MPLS load balancing by equal-cost multipath (ECMP)
- Weighted LAG hash
- VRRP
- Ethernet Ring Protection Switching ITU-T G.8032v2 (7250 IXR-s)

- Configurable polynomial and hash seed shift
- Entropy label (IETF RFC 6790)
- RSVP-TE Fast Reroute (FRR)
- BGP Edge and Core Prefix Independent Convergence (BGP PIC)

Platform

- Ethernet IEEE 802.1Q (VLAN) and 802.1ad (QinQ) with 9k jumbo frames
- Detailed forwarded and discarded counters for service access points (SAPs) and network interfaces in addition to port-based statistics: per Virtual Output Queue (VoQ) packet and byte counters (7250 IXR-s)
- VLAN range-based SAPs
- Dynamic Host Configuration Protocol (DHCP) server for IPv4 IES, VPNv4
- DHCP relay, IPv4 and IPv6, IES, IP-VPN, EVPN-VPLS
- Accounting records

QoS and traffic management

- Hierarchical QoS (7250 IXR-s)
  - Hierarchical egress schedulers and shapers per forwarding class, SAP, network interface, port or LAG
  - Port sub-rate
- Intelligent packet classification, including MAC, IPv4, IPv6 match-criteria-based classification
- Granular rate enforcement with up to 32 policers per SAP/VLAN, including broadcast, unicast, multicast and unknown policers
- Hierarchical policing for aggregate rate enforcement
- Strict priority, weighted fair queuing schedulers
- Congestion management via weighted random early discard (WRED)
- Egress marking or re-marking

System management

- Simple Network Management Protocol (SNMP)
- Model-driven (MD) management interfaces
  - NETCONF
  - MD CLI
  - Remote Procedure Call (gRPC)
- Comprehensive management with Nokia NSP

Operations, administration and maintenance

- IEEE 802.1ag, ITU-T Y.1731: Ethernet Connectivity Fault Management for both fault detection and performance monitoring, including delay, jitter and loss tests

- Ethernet bandwidth notification with egress rate adjustment

- IEEE 802.3ah: Ethernet in the First Mile

- Bidirectional Forwarding Detection IPv4 and IPv6

- Micro-BFD - per member link (7250 IXR-s)

- Two-Way Active Measurement Protocol (TWAMP), TWAMP Light

- A full suite of MPLS OAM tools, including LSP and virtual circuit connectivity verification ping

- Service assurance agent

- Mirroring with slicing support:
  - Port
  - VLAN
  - Filter output: Media Access Control (MAC), IPv4/IPv6 filters
  - Local/remote

- Port and VLAN loopback with MAC swap

- Configuration rollback

- Zero Touch Provisioning (ZTP) capable

Security

- MACsec on all ports (7250 IXR-10 and IXR-6)

- Remote Authentication Dial-In User Service (RADIUS), Terminal Access Controller Access Control System Plus (TACACS+), and comprehensive control-plane protection capabilities

- MAC-, IPv4- and IPv6-based access control lists and criteria-based classifiers

- Secure Shell (SSH)

Hardware overview

7250 IXR-10 and IXR-6 platforms

The 7250 IXR-10 and IXR-6 share common integrated media module (IMM) cards, control processor modules (CPMs) and power supply units (PSUs).

Each chassis uses an orthogonal direct cross-connect architecture, with IMMs connecting in front and switch fabrics and fans connecting at the rear. The lack of a backplane, midplane or midplane connector system provides a compact chassis design, optimal cooling and easy capacity upgrades.

The 7250 IXR supports a 5+1 switch fabric design for full fabric redundancy with graceful degradation. Fans and switch fabrics are separate, ensuring a complete separation of cooling from the dataplane and enabling non-service-impacting fan replacement options. The system uses a complete Faraday Cage design to ensure EMI containment, a critical requirement for platform evolution that will support next-generation application-specific integrated circuits (ASICs).

7250 IXR-10 and IXR-6 control plane

Control-plane performance is a key requirement in networking. Multicore CPUs with support for symmetric multiprocessing (SMP) provide leading capabilities in task distribution and concurrent processing, leveraging the hardened capabilities of the SR OS. This is a capability common to all platforms in the 7250 IXR product series.

The 7250 IXR-10/IXR-6 supports dual-redundant CPMs for hot-standby control-plane redundancy and supports 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 data loads. The distributed architecture also improves system security.

Power supplies

The 7250 IXR-10/IXR-6 platforms support 12 and 6 PSUs respectively, allowing for full N+M (N is active and M is the number of protecting power supplies) power supply redundancy and full power feed redundancy. In contrast to systems with fewer power supplies, the 7250 IXR provides added headroom for power growth for system enhancements with next-generation ASICs.

On the IXR-10/IXR-6, two PSU variants are available: a low-voltage DC PSU (LVDC) and a combined high-voltage DC (HVDC) and AC PSU. The PSUs are fully interchangeable between the chassis variants. The HVDC PSU option enables OPEX and CAPEX savings as a result of the power-supply and infrastructure design.

The 7250 IXR-s supports two PSUs with 1+1 redundancy with support for either AC or LVDC power options.

Technical specifications

Table 1. 7250 IXR6-10/IXR-6/IXR-s specifications

	7250 IXR-10	7250 IXR-6	7250 IXR-s
System configuration	Dual hot-standby CPMs	Dual hot-standby CPMs	Single integrated CPM
System throughput: Full duplex IMIX traffic	28.8 Tb/s	14.4 Tb/s	800 Gb/s
Switch fabric capacity per module: Full duplex (FD)	• 5.76 Tb/s • Single-stage fabric with graceful degradation • Separate fan tray from switch fabric	• 2.88 Tb/s • Single-stage fabric with graceful degradation • Separate fan tray from switch fabric	Integrated
Card slot throughput: FD per slot	3.6 Tb/s	3.6 Tb/s	n/a
Card slots	8	4	n/a
Service interfaces	n/a	n/a	• 6 x QSFP28/QSFP+ 100/40GE • 48 x SFP+/SFP 10/1GE
Control interfaces	Console, management, Synchronous Ethernet (SyncE)/1588, OES, BITS, Bluetooth, USB, 1PPS, SD slot		Console, management, USB, SD slot

Timing and synchronization	• Built-in Stratum 3E clock
	• ITU-T Synchronous Ethernet (SyncE)
	• IEEE 1588v2
	  – Boundary clock (BC), slave clock (SC)
	  – Profiles: IEEE 1588v2 default, ITU_T G.8265.1, ITU-T G.8275.1
	  – UDP/IPv4 and Ethernet encapsulations
	• Nokia Bell Labs IEEE 1588v2 algorithm
	• IETF RFC 5905 Network Time Protocol (NTP)
	• Building Integrated Timing Supply (BITS) ports (T1, E1, 2M) and pulse-per second (1PPS) timing
			• Built-in Stratum 3E clock
			• ITU-T SyncE
			• ITU-T G.8262.1 eEEC
			• IEEE 1588v2
			  – BC
			  – Profile: ITU-T G.8275.1
			  – Ethernet encapsulation
			• ITU-T G.8273.2 Class C[3]
			• IETF RFC 5905 NTP
			• Support for GNSS SFP

Memory buffer size	Per card (see Table 2)	Per card (see Table 2)	8 GB
Redundant hardware	• Dual redundant CPMs • Switch fabric redundancy (5+1) • Power redundancy (M+N) • Fan redundancy (N+1)		• Power redundancy (1+1) • Fan redundancy (5+1)
Dimensions	• Height: 57.78 cm (22.75 in); 13 RU • Width: 44.45 cm (17.5 in) • Depth: 81.28 cm (32.0 in) Fits in standard 19-in rack	• Height: 31.15 cm (12.25 in); 7 RU • Width: 44.45 cm (17.5 in) • Depth: 81.28 cm (32.0 in) Fits in standard 19-in rack	• Height: 4.35 cm (1.75 in); 1 RU • Width: 43.84 cm (17.26 in) • Depth: 51.5 cm (20.28 in) Fits in standard 19-in rack

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3   For noise generation

Power	• 12 PSUs with N+M redundancy • LVDC input (single feed, rated): -48 V DC/-60 V DC • HVDC input (rated): 240 V DC/380 V DC • AC input (rated): 220 V AC to 240 V AC, 50 Hz/60 Hz • Front-bottom mounted	• 6 PSUs with N+M redundancy • LVDC input (single feed, rated): -48 V DC/-60 V DC • HVDC input (rated): 240 V DC/380 V DC • AC input (rated): 220 V AC to 240 V AC, 50 Hz/60 Hz • Front-bottom mounted	• 2 PSUs with 1+1 redundancy • LVDC input (single feed, rated): -48 V DC/-60 V DC • AC input (rated): 100 V AC to 240 V AC, 50 Hz/60 Hz • Rear mounted
Cooling	• 3 trays of 3 ultra-quiet fans • Fan trays separate from switch fabric • Safety electronic breaks on removal • Front-to-back airflow • Fan filter door kit (optional)	• 3 trays of 2 ultra-quiet fans • Fan trays separate from switch fabric • Safety electronic breaks on removal • Front-to-back airflow • Fan filter door kit (optional)	• 6 trays of 1 ultra-quiet fan each • Fan trays separate from switch fabric • Safety electronic breaks on removal • Front-to-back airflow
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		

Note: Throughout this table, n/a = not applicable.

Optical breakout solutions available on QSFP28/QSFP+ ports:

- 7250 IXR-10, IXR-6: 4 x 25GE and 4 x 10GE
- 7250 IXR-s: 4 x 10GE

Table 2. Nokia 7250 IXR-10 and IXR-6 IMM cards

Card name	Details	
36-port 100GE	• 36 x 100GE QSFP28/QSFP+ 100/40GE • MACsec on all ports • 48 GB packet buffer	
2-port 100GE + 48-port 10GE	• 2 x 100GE QSFP28/QSFP+ 100/40GE • 48 x SFP+/SFP 10/1GE • MACsec on all ports • 8 GB packet buffer	

Table 3. Maximum platform density per port speed

Port speed	7250 IXR-10	7250 IXR-6	7250 IXR-s
• 100/40GE • 10/1GE	• 288 x 100/40GE • 384 x 10/1 GE + 16 x 100/40GE	• 144 x 100/40GE • 192 x 10/1GE + 8 x 100/40GE	• 6 x 100/40GE • 48 x 10/1GE

Standards compliance[4]

Environmental

- ATIS-0600015.03
- ATT-TP-76200
- 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 (CO)

Safety

- AS/NZS, UL/CSA, IEC/EN 60950-1
- CSA/UL 62368-1 NRTL
- AS/NZS, UL/CSA, IEC/EN 62368-1 CE Mark
- IEC 60529 IP20
- IEC/EN 60825-1
- IEC/EN 60825-2
- IEC 62368-1 CB Scheme

Electromagnetic compatibility

- AS/NZS CISPR 32 (Class A)
- BT GS-7
- EN 300 386
- EN 55024
- EN 55032 (Class A)
- ES 201 468
- ETSI EN 300 132-3-1 (7250 IXR-10 and IXR-6)
- ETSI EN 300 132-2 (LVDC)
- ETSI EN 300 132-3 (AC)
- FCC Part 15 (Class A)

- GR-1089-CORE
- ICES-003 (Class A)
- IEC 61000-3-2
- IEC 61000-3-3
- 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
- IEC/EN 61000-4-11 Voltage Interruptions
- ITU-T K20
- ITU-T L.1200
- KCC Korea-Emissions & Immunity (in accordance with KN32/35)
- VCCI (Class A)

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
- MEF CE 3.0 compliant
- NEBS Level 3
  - Australia: RCM Mark
  - China RoHS: CRoHS
  - Europe: CE Mark
  - Japan: VCCI Mark
  - South Korea: KC Mark

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