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Nokia 7220 IXR-D series Interconnect Routers for SR Linux

Release 21

As part of the Nokia Data Center Fabric solution, the Nokia 7220 IXR-D series platforms are designed for the leaf and spine layers of data center fabrics, delivering high-scale interconnectivity for webscale, service provider, enterprise data center and cloud environments.

Overview

The Nokia Data Center platforms include the 7250 IXR-6/IXR-10, the Nokia 7220 IXR-H series and the 7220 IXR-D series of interconnect routers—all of which implement the Nokia Service Router Linux (SR Linux) network operating system (NOS). This data sheet discusses the 7220 IXR-D series, which consists of the 7220 IXR-D1, the 7220 IXR-D2, the7220 IXR-D2L, the 7220 IXR-D3 and the 7220 IXR-D3L.

High-bandwidth servers are driving the need for higher port speeds and density in data center architectures. Similarly, the need for more power-efficient and state-of-the-art hardware designs is driving the modernization of network aggregation and interconnect within data centers.

The 7220 IXR-D series routers are high-performance, fixed-configuration routers designed for data center leaf-spine deployments. They offer 100GE, 50GE, 40GE, 25GE, 10GE and 1GE interfaces for intra-fabric and server connectivity.

The 7220 IXR-D series delivers a robust and comprehensive set of capabilities, including IP routing, Ethernet VPN (EVPN), Layer 2 Ethernet, QoS, router security, warm reboot resiliency, model-driven management, and scalable telemetry.

The 7220 IXR-D series is available in five variants.

7220 IXR-D1 48T 4SFP+

7220 IXR-D2 48SFP28 8QSFP28

7220 IXR-D2L 48SFP28 8QSFP28

7220 IXR-D3 32QSFP28 2SFP+

7220 IXR-D3L 32QSFP28 2SFP+

7220 IXR-D1 48T 4SFP+

The 7220 IXR-D1 is 1 RU high with a system capacity of 176 Gb/s HD. It is equipped with 48 10/100/1000 Mb/s RJ45 ports and 4 SFP+ ports.

The SFP+ ports include hardware support for native 10GE speeds. The 7220 IXR-D1 is optimized for leaf-spine designs, which require server connectivity at 1GE speeds.

The 7220 IXR-D1 supports two power supplies with 1+1 redundancy using either AC or DC

power options. The system supports both front-to-back and back-to-front airflow configuration with 3 N+1 hot-swappable fans.

7220 IXR-D2 48SFP28 8QSFP28
7220 IXR-D2L 48SFP28 8QSFP28

The 7220 IXR-D2 platforms are 1 RU high with a system capacity of 4.0 Tb/s HD. They are equipped with 48 25GE SFP28 ports and 8 100GE QSFP28 ports.

The 7220 IXR-D2L platforms are 1 RU high with a system capacity of 4.0 Tb/s HD. They are equipped with 48 25GE SFP28 ports, 8 100GE QSFP28 ports and 2 10GE SFP+ ports.

All QSFP28 ports include hardware support for native 100GE and 40GE speeds. The QSFP28 ports also include hardware support for breakout options for 50GE, 25GE and 10GE speeds.

The SFP28 ports include hardware support for native 25GE,10GE and 1GE speeds. These port options provide high-performance intra-fabric uplinks, storage and server connectivity.

The 7220 IXR-D2L and 7220 IXR-D2 platforms support two power supplies with 1+1 redundancy using either AC or DC power options.

The 7220 IXR-D2L platform supports front-to-back airflow configuration with 6 N+1 hot-swappable fans. The 7220 IXR-D2 platform supports both front-to-back and back-to-front airflow configuration with 4 N+1 hot-swappable fans.

7220 IXR-D3 32QSFP28 2SFP+
7220 IXR-D3L 32QSFP28 2SFP+

The 7220 IXR-D3 and 7220 IXR-D3L platforms are 1 RU high with a system capacity of 6.4 Tb/s HD. They are equipped with 32 100GE QSFP28 ports and 2 SFP+ ports.

All QSFP28 ports include hardware support for native 100GE and 40GE speeds. The QSFP28 ports also include hardware support for breakout options for 50GE, 25GE and 10GE speeds. The SFP+ ports include hardware support for native 10GE speeds. These port options provide exceptional flexibility in a variety of leaf or spine deployment configurations.

The 7220 IXR-D3 and 7220 IXR-D3L platforms support two power supplies with 1+1 redundancy using either AC or DC power options.

The 7220 IXR-D3L platform supports front-to-back airflow configuration with 6 N+1 hot-swappable fans. The 7220 IXR-D3 platform supports both front-to-back and back-to-front airflow configuration with 5 N+1 hot-swappable fans.

Nokia Service Router Linux (SR Linux)

Nokia Service Router Linux (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-D series implements Nokia SR Linux.

SR Linux is a key component of the Nokia Data Center Fabric solution, which also includes the Nokia Fabric Services Platform and the Nokia Data Center 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.

Webscale, service provider and enterprise data centers are increasingly adopting leaf-spine fabric designs using enhanced IP routing with Multiprotocol-Border Gateway Protocol (MP-BGP), EVPN and Virtual Extensible LAN (VXLAN) protocols. By using field-proven protocol stacks, data center operators can immediately benefit from the stability, scalability and interoperability of a resilient NOS.

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.

Nokia Fabric Services System

The Nokia Fabric Services System is a declarative, intent-based automation and operations toolkit that delivers agile and scalable network operations for data center and cloud environments.

Scalable automation for all phases of data center fabric operations

The Fabric Services System implements intent-based approaches to simplify all phases of data center fabric operations, including Day 0 design, Day 1 deployment and Day 2+ configuration, operation, measurement and analysis.

The system uses the Kubernetes framework and benefits from an established open platform instead of reinventing key platform components. All fabric services use a distributed microservices approach, allowing Nokia to deliver a true cloud-native platform for automation and operations.

Digital Sandbox

The Fabric Services System delivers a cloud-native Digital Sandbox that is a true emulation of a single data center router as a containerized SR Linux (cSR Linux) instance and a fabric of multiple cSR Linux instances. The Digital Sandbox as an operational tool is capable of emulating a data center fabric, application workloads and external BGP speakers.

Setting up the data center fabric with intent-based approaches

The Fabric Services System allows operators to represent the design and configuration of the data center fabric in an intent-based, declarative way. This approach provides a strong NetOps foundation that leverages DevOps principles and fits into the bigger movement toward infrastructure as code (IaC).

Design intent, fabric intent and workload intent can be validated on the Fabric Services System Digital Sandbox, allowing operations teams to manage the risk of a change confidently and quickly. The Digital Sandbox allows the operator to first try out the changes, perform detailed validations and then apply the changes to the production network.

Fabric operations

After the data center fabric is designed and deployed, the Day 2+ operations phase begins. Because new workloads can still be created during this phase, workload intent can also be leveraged here. Other types of intent are also supported in this phase, including design intent, maintenance intent, topology intent and deviation intent. These intents allow the network operator to define, in an abstract manner, the desired end state of the fabric.

The Fabric Services System combines design intent with all the telemetry data collected from the fabric and presents the data in a context relevant to the operational task. These contextual views combined with the Digital Sandbox enable the operations team to deliver agility with confidence and removes the barriers between cross-functional teams.

Fabric integrations

The Fabric Services System enables a flexible, cloud-native approach for external integrations, resulting in faster, customized integration in customer environments. The system can be integrated with compute virtualization, storage solutions, in-house operational tools and cloud environments.

The cloud-native integration model enables data center teams to develop their integrations in a loosely coupled manner that fits into a standard Kubernetes framework.

Software features

The 7220 IXR-D series supports, but is not limited to, the following SR Linux software features.

For additional details about SR Linux, including NOS architecture and differentiators, see the Nokia Service Router Linux data sheet.

Open Linux support

- Support for unmodified Linux kernel
- Access to Linux tools, patching and packaging
- Containerized SR Linux
- Linux control groups (cgroupsv2)

Layer 2 features

- Dot1q and untagged sub-interfaces
- Ethernet IEEE 802.1Q (VLAN) 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
- MAC storm control
- Media access control (MAC) loop prevention
- Virtual routing and forwarding (VRF): MAC-VRF

Layer 3 features

- IPv4/v6 routing
- BGP with iBGP/eBGP:
  Support for IPv4/v6, including:
  - Core Prefix independent convergence
  - 4-byte autonomous system number
  - Route reflector
  - Dynamic BGP
  - eBGP multi-hop
- IS-IS v4/v6
- OSPFv2 and OSPFv3
- Static routes for IPv4/v6
- Equal cost multi-path with consistent and resilient hashing and configurable hash fields
- IPv6 flow label hashing
- VRF: Multiple VRF support
- Maintenance modes
- Bi-directional forwarding detection (BFD), micro BFD (mBFD)
- Interfaces: Loopback interfaces, Integrated Routing and Bridging (IRB)
- Routing policy: Layer 3/Layer 4 access control list (ACLs) with validation; accept, reject and log actions

Network virtualization[1]

- 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 customer edge (PE-CE) BGP path attribute propagation in EVPN

QoS

- Intelligent packet classification, including IPv4, IPv6 match-criteria-based classification
- Queuing/scheduling:
  - Strict priority
  - Weighted Round Robin (WRR)
  - Weighted Random Early Detection (WRED)
  - Explicit Congestion Notification (ECN)
- QoS classification based on DiffServ Code Point (DSCP)

System management and automation

- Native model-driven architecture, configuration candidates, exclusive mode, checkpoints, rollbacks
- Management interfaces: gNMI, JSON, CLI (transactional, Python CLI, CLI plugins)
- Per-user configurable options for CLI
  - Local Authentication, Authorization and Accounting (AAA) with Role Based Access Control (RBAC)
  - Terminal Access Controller Access Control System (TACACS+) AAA via privilege levels
- Access to common Linux utilities: Bash, cron, and Python
- Telemetry:
  - Subscription-based telemetry for modeled data structures, either changed or sampled
  - sFlow
  - Logging infrastructure
- Python-based Zero Touch Provisioning (ZTP)
- Address management: Dynamic Host Configuration Protocol (DHCP) v4/v6 relay
- DHCP v4/v6 server with static allocations
- Interactive mirroring
- Unified Forwarding Tables (UFT) profiles

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1   Supported on Nokia 7220 IXR D2, D2L, D3 and D3L platforms.

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- 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), Link LLDP and BFD
  - Native support for streaming telemetry

Resiliency

- Support for redundant fan and power configurations in data center hardware platforms
- Support for hot-swappable, redundant control and fabric modules
- Warm reboot[2] to perform soft reset or trigger an in-service software upgrade (ISSU)
  - Nonstop forwarding (NSF)
  - Graceful restart client for BGPv4/v6

2   Supported on Nokia 7220 IXR D2, D2L, D3 and D3L platforms.

Security

- Distributed and aggregated ACLs and policers for control and management plane
- Mirroring from interface/sub-interface or ingress ACL
- Mirroring to Switch Port Analyzer[3] (SPAN) and Encapsulated Remote SPAN (ERSPAN)
- IPv6 Router Advertisements (RA) guard

Learn more

To learn more about the Data Center Switching Fabric solution, see the web page

Technical specifications

Table 1. 7220 IXR-D series specifications

Feature	7220 IXR-D1	7220 IXR-D2 7220 IXR-D2L	7220 IXR-D3 7220 IXR-D3L
System throughput Half duplex (HD)	176 Gb/s	4.0 Tb/s	6.4 Tb/s
Ports	• 4 x SFP+ • 48 x RJ45	7220 IXR-D2 • 8 x QSFP28/QSFP+ • 48 x SFP28 7220 IXR-D2L • 8 x QSFP28/QSFP+ • 48 x SFP28 • 2 x SFP+	• 32 x QSFP28/QSFP+ • 2 x SFP+
Hardware support (maximum ports per chassis)			
100GE	Not applicable	8	32
50GE*	Not applicable	16	64
40GE	Not applicable	8	32
25GE	Not applicable	48	128

*   Future deliverable

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Feature	7220 IXR-D1	7220 IXR-D2 7220 IXR-D2L	7220 IXR-D3 7220 IXR-D3L
10GE	4	• 7220 IXR-D2: 48 • 7220 IXR-D2L: 50	130
1GE SFP		• 7220 IXR-D2: 48 • 7220 IXR-D2L: 50	
1000/100/10	48		
Management ports	1x 1000BASE-T	1x 1000BASE-T	1x 1000BASE-T
USB ports	1x USB2.0	2x USB2.0	1x USB2.0
Console port	1x RJ45	1x RJ45	1x RJ45
Processor	4-core x 86	4-core x 86	4-core x 86
Power supplies	1+1 redundant AC or -48V DC • 240W AC • 550W DC	1+1 redundant AC or -48V DC 7220 IXR-D2 • 650W AC • 800W DC 7220 IXR-D2L • 650W AC • 650W DC	1+1 redundant AC or -48V DC 7220 IXR-D3 • 650W AC • 800W DC 7220 IXR-D3L • 650W AC • 650W DC
Hot-swappable power supplies	Yes	Yes	Yes
Fan modules	• 3 fans, N+1 redundant • Front-to-back or back-to-front airflow	7220 IXR-D2 • 4 fans, N+1 redundant • Front-to-back or back-to-front airflow 7220 IXR-D2L • 6 fans, N+1 redundant • Front-to-back or back-to-front* airflow	7220 IXR-D3 • 5 fans, N+1 redundant • Front-to-back or back-to-front airflow 7220 IXR-D3L • 6 fans, N+1 redundant • Front-to-back or back-to-front* airflow
Hot-swappable fan modules	Yes	Yes	Yes
Dimensions	• Height: 4.35 cm (1.75 in); 1 RU • Width: 43.85 cm (17.26 in) • Depth: 46 cm (18.11 in) • Fits in standard 19-in mounting rack	7220 IXR-D2 • Height: 4.35 cm (1.75 in); 1 RU • Width: 43.85 cm (17.26 in) • Depth: 46 cm (18.11 in) • Fits in standard 19-in mounting rack 7220 IXR-D2L • Height: 4.35 cm (1.75 in); 1 RU • Width: 43.85 cm (17.26 in) • Depth: 55 cm (21.65 in) • Fits in standard 23-in mounting rack	7220 IXR-D3 • Height: 4.35 cm (1.75 in); 1 RU • Width: 43.85 cm (17.26 in) • Depth: 46 cm (18.11 in) • Fits in standard 19-in mounting rack 7220 IXR-D3L • Height: 4.35 cm (1.75 in); 1 RU • Width: 43.85 cm (17.26 in) • Depth: 55 cm (21.65 in) • Fits in standard 23-in mounting rack
4-post mounting	Yes; rail kit option	Yes; rail kit option	Yes; rail kit option

* Future deliverable

Feature	7220 IXR-D1	7220 IXR-D2 7220 IXR-D2L	7220 IXR-D3 7220 IXR-D3L
Discrete Trusted Platform Module (TPM)	Yes	Yes	Yes
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	-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

Standards compliance[3]

Environmental

- ATT-TP-76200[4]
- ETSI EN 300 019-2-1; Storage Tests
- ETSI EN 300 019-2-2; Transportation Tests
- ETSI EN 300 019-2-3; Operational Tests
- ETSI EN 300 753 Acoustic Noise (Class 3.2)
- GR-63 CORE Level 2
- GR-3160

Safety

- AS/NZS 60950.1
- AS/NZS 62368.1
- CB certificate with all National Deviations and/or other compliance certificates
- FDA CDRH 21-CFR 1040
- IEC/EN 60825-1
- IEC/EN 60825-2
- IEC/UL/CSA/EN/BS 60950-1
- IEC/UL/CSA/EN/BS 62368-1

Electromagnetic compatibility

- AS/NZS CISPR32 Class A
- CISPR 24
- CISPR 35
- CISPR 32 Class ACNS 13438 Class A
- EN 55024
- EN 55032 Class A
- EN 55035
- ETSI EN 300 132-1
- ETSI EN 300 132-2
- ETSI EN 300 386
- FCC Part 15 Class A
- GR-1089 Core
- ICES-003 Class A
- IEC/EN 61000-3-2
- IEC/EN 61000-3-3
- 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
- IEC/EN 61000-6-2
- IEC/EN 61000-6-4
- ITU-T K.20
- KCC Korea-Emissions & Immunity (in accordance KN32/KN35)
- VCCI Class A

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

4   Partially compliant. Contact Nokia for compliance details.

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Directives and regional approvals

- Directive 2011/65/EU RoHS
- Directive 2012/19/EU WEEE
- Directive 2014/30/EU EMC
- Directive 2014/35/EU Low LVD
- CE Mark: Europe
- CRoHS: China RoHS
- KC Mark: South Korea
- RCM Mark: Australia
- UKCA Mark: United Kingdom
- VCCI Mark: Japan