Nokia 7220 IXR-D series
Interconnect Routers for SR Linux
Release 24

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 enterprise, service provider and webscale data center and cloud environments.

Overview

The Nokia Data Center platforms include the Nokia 7250 IXR-6e/10e, the Nokia 7250 IXR-6/10, the Nokia 7220 IXR-H series and the Nokia 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-D2L, the 7220 IXR-D3L, the 7220 IXR-D4 and the 7220 IXR-D5.

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 platforms designed for data center leaf-spine deployments. They offer 400GE, 200GE, 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-D2L 48SFP28 8QSFP28 2SFP+
7220 IXR-D3L 32QSFP28 2SFP+
7220 IXR-D4 28QSFP28 8QSFPDD
7220 IXR-D5 32QSFPDD 2SFP+
**7220 IXR-D1 48T 4SFP+**

The 7220 IXR-D1 is 1 RU high with a system capacity of 88 Gb/s full duplex (FD). It is equipped with 48 10/100/1000 Mb/s RJ45 ports and four 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 three N+1 hot-swappable fans.

**7220 IXR-D2L 48SFP28 8QSFP28 2SFP+**

The 7220 IXR-D2L platform is 1 RU high with a system capacity of 2.0 Tb/s FD. It is equipped with 48 25GE SFP28 ports, eight 100GE QSFP28 ports and two 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 platform supports two power supplies with 1+1 redundancy using either AC or DC power options.

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

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

The 7220 IXR-D3L platform is 1 RU high with a system capacity of 3.2 Tb/s FD. It is equipped with 32 100GE QSFP28 ports and two 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-D3L platform supports two power supplies with 1+1 redundancy using either AC or DC power options.

The system supports front-to-back and back-to-front airflow configuration with six N+1 hot-swappable fans.

**7220 IXR-D4 28QSFP28 8QSFPDD 2SFP+**

The 7220 IXR-D4 is 1 RU high with a system capacity of 6.0 Tb/s FD. It is equipped with 28 100GE QSFP28 ports and eight 400GE QSFP-DD ports.

All QSFP-DD ports include hardware support for native 400GE, 100GE, 50GE and 40GE speeds. These port options provide exceptional flexibility in a variety of leaf or spine deployment configurations.

The 7220 IXR-D4 supports two power supplies with 1+1 redundancy using either AC or DC power options.

The system supports front-to-back and back-to-front airflow configuration with six N+1 hot-swappable fans.

**7220 IXR-D5 32QSFPDD 2SFP+**

The 7220 IXR-D5 is 1 RU high with a system capacity of 12.8 Tb/s FD. It is equipped with 32 400GE QSFP-DD ports and two SFP+ ports.

All QSFP-DD ports include hardware support for native 400GE, 200GE, 100GE, 50GE and 40GE 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-D5 supports two power supplies with 1+1 redundancy using either AC or DC power options.

The system supports front-to-back and back-to-front airflow configuration with six N+1 hot-swappable fans.
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-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 System 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.

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

**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.
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, which is a true emulation of a single data center router as an SR Linux container instance and a fabric of multiple SR Linux container 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 remove 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\(^1\). 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
- SR Linux container
- Linux control groups (cgroupsv2)

\(^1\) Some platforms may have feature exclusions or exceptions
Platform features

- Dynamic Ternary Content Addressable Memory (TCAM) table allocation

Layer 2 features

- Dot1q and untagged sub-interfaces, including VLAN ranges on bridged 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
- Media access control (MAC) loop prevention
- MAC storm control
- Virtual routing and forwarding (VRF): MAC-VRF
- MAC access control lists (ACLs) with validation: accept, reject and log actions
- Multicast Listener Discovery (MLD) snooping in Layer 2 broadcast domains

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
  - BGP unnumbered
  - eBGP multi-hop
  - Add-paths for IPv4 and IPv6 routes
- IS-IS v4/v6
- Open Shortest Path First: 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)
- Proxy Address Resolution Protocol (ARP)/ neighbor discover (ND)
- 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.
  - Route leaking between network instances
- Layer 3/Layer 4 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

QoS

- Intelligent packet classification, including IPv4, IPv6 match-criteria-based classification
- Ingress per forwarding class sub-interface policing
- Queueing/scheduling:
  - Strict priority
  - Weighted Round Robin (WRR)
  - Weighted Random Early Detection (WRED)
  - Explicit Congestion Notification (ECN)
• QoS classification and marking based on DiffServ Code Point (DSCP)
• Ingress DSCP rewrite
• QoS classification and marking based on IEEE 802.1p
• Multi-field classification

System management and automation
• Native model-driven architecture, configuration candidates, exclusive mode, checkpoints, rollbacks
  – Support for SR Linux and OpenConfig\textsuperscript{2} data 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)
• 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 via privilege levels
• 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 Host Configuration Protocol (DHCP) v4/v6 relay
• DHCP v4/v6 server with static allocations
• Interactive mirroring
• Unified Forwarding Tables (UFT) profiles

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

Resiliency
• Support for redundant fan and power configurations
• Warm reboot to perform soft reset or trigger an in-service software upgrade (ISSU)
  – Nonstop forwarding (NSF)
  – Graceful restart client for BGPv4/v6

Security
• Distributed and aggregated ACLs and policers for control and management plane
• Layer 2 through Layer 4 Control Plane Policing (CoPP)
• Mirroring from interface/sub-interface or ingress ACL
• Mirroring to Switch Port Analyzer (SPAN) and Encapsulated Remote SPAN (ERSPAN)
• IPv6 router advertisements guard

Timing and synchronization\textsuperscript{3}
• Built-in Stratum 3E clock
• ITU-T Synchronous Ethernet (SyncE)

\textsuperscript{2} Future software release
\textsuperscript{3} Timing and synchronization supported on 7220 IXR-D5
• IEEE 1588v2
  - Boundary clock (BC)
  - Profiles: ITU-T G.8275.1
  - Ethernet encapsulation
• RFC 5905 Network Time Protocol (NTP)

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

Learn more
To learn more about the Nokia Data Center Fabric solution, see the web page.

Technical specifications

Table 1. 7220 IXR-D series specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>7220 IXR-D1</th>
<th>7220 IXR-D2L</th>
<th>7220 IXR-D3L</th>
<th>7220 IXR-D4</th>
<th>7220 IXR-D5</th>
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<td>3.2 Tb/s</td>
<td>6.0 Tb/s</td>
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<td>1+1 redundant AC: 100V to 240V DC:~48V/~60V 650W AC 800W DC</td>
<td>1+1 redundant AC: 100V to 240V DC:~48V/~60V 650W AC 800W DC</td>
<td>1+1 redundant AC: 100V to 240V DC:~48V/~60V 1500W AC 1600W DC</td>
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<td>* Future deliverable</td>
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### Feature

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<th>7220 IXR-D4</th>
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<td><strong>Fan modules</strong></td>
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<td>3 fans, N+1 redundant</td>
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<tr>
<td>Front-to-back or back-to-front airflow</td>
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<td>6 fans, N+1 redundant</td>
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<td>Front-to-back or back-to-front airflow</td>
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<td>6 fans, N+1 redundant</td>
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<td>6 fans, N+1 redundant</td>
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<td>Front-to-back or back-to-front airflow</td>
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<td><strong>Hot-swappable fan modules</strong></td>
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<td>Yes</td>
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<td>Height: 4.35 cm (1.75 in); 1 RU Width: 43.85 cm (17.26 in) Depth: 40 cm (15.75 in) Fits in standard 19-in mounting rack</td>
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<td>Height: 4.31 cm (1.70 in); 1 RU Width: 43.84 cm (17.26 in) Depth: 53.6 cm (21.10 in) Fits in standard 19-in mounting rack</td>
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<td>Height: 4.35 cm (1.75 in); 1 RU Width: 43.84 cm (17.26 in) Depth: 59 cm (23.23 in) Fits in standard 19-in mounting rack</td>
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<td><strong>Weight</strong></td>
<td>7.5 kg (16.53 lb) (unpopulated)</td>
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<td>7.88 kg (17.37 lb) (unpopulated)</td>
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<td>9.5 kg (20.94 lb) (fully populated)</td>
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<td><strong>Discrete Trusted Platform Module (TPM)</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Normal operating temperature range</strong></td>
<td>0°C to +40°C (32°F to +104°F) sustained</td>
<td>0°C to +40°C (32°F to +104°F) sustained</td>
<td>0°C to +40°C (32°F to +104°F) sustained</td>
<td>0°C to +40°C (32°F to +104°F) sustained</td>
<td>0°C to +40°C (32°F to +104°F) sustained</td>
</tr>
<tr>
<td><strong>Shipping and storage temperature</strong></td>
<td>-40°C to +70°C (-40°F to +158°F)</td>
<td>-40°C to +70°C (-40°F to +158°F)</td>
<td>-40°C to +70°C (-40°F to +158°F)</td>
<td>-40°C to +70°C (-40°F to +158°F)</td>
<td>-40°C to +70°C (-40°F to +158°F)</td>
</tr>
<tr>
<td><strong>Normal humidity</strong></td>
<td>5% to 95%, non-condensing</td>
<td>5% to 95%, non-condensing</td>
<td>5% to 95%, non-condensing</td>
<td>5% to 95%, non-condensing</td>
<td>5% to 95%, non-condensing</td>
</tr>
</tbody>
</table>

**Certain airflow configurations and the use of reduced case temperature optics may reduce the maximum operating temperature**

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### Standards compliance

#### Environmental and NEBS
- 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

#### Safety
- AS/NZS 62368-1
- FDA CDRH 21 CFR 1040
- IEC/BS/EN 60825-1
- IEC/BS/EN 60825-2
- IEC/UL/CSA/BS/EN 62368-1

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

5 Certain airflow configurations will impact acoustics. Please contact Nokia for details.
Electromagnetic compatibility

- AS/NZS CISPR 32 Class A
- BS EN 55035
- BS EN 61000-3-2
- BS EN 61000-3-3
- BS EN 55032 Class A
- BSMI CNS 15936 Class A
- BT GS-7
- EN 55035
- EN 55032 Class A
- ETSI EN 300 132-1 (AC)
- ETSI EN 300 132-2 (LVDC)
- ETSI EN 300 386
- ETSI ES 201 468
- FCC Part 15 Class A
- ICES-003 Class A
- IEC CISPR 32 Class A
- IEC CISPR 35
- IEC/ EN 61000-3-2
- IEC/EN 61000-3-3
- IEC/EN 61000-6-2
- IEC/EN 61000-6-4
- KCC Korea - Immunity KS C 9835
- KCC Korea - Emissions KS C 9832
- VCCI Class A

Directives and regional approvals

- 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

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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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