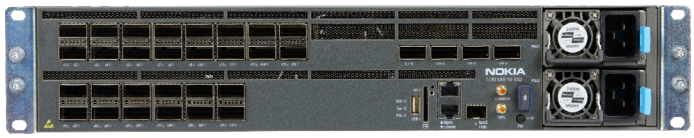
Nokia 7730 SXR-1 series Service Interconnect Routers

Release 25

The Nokia 7730 Service Interconnect Router (SXR)-1[1] series of IP routing platforms is designed for service providers and mission-critical enterprises. This series delivers high port and service density in compact, fixed, and extended-temperature form factors. Based on the fully programmable FPcx network processor, these routers provide countless benefits for scale, security, flexibility and resiliency of the network.

Networks are evolving to distribute network functions and applications closer to the user along with a network operations migration to a NetOps model. To address these requirements, we are delivering our SR Linux network operating system (NOS) with its cloud native architecture, robust foundation, scalable automation and unmatched extensibility on a set of compact, fixed, next-generation routers. These routers deliver the foundational capabilities with exceptional power efficiency and without the compromises of many alternatives.

7730 SXR-1x-44S



7730 SXR-1d-32D

Network Processor-based architecture

At 5.0Tb/s full-duplex (FD), FPcx delivers right-sized capacity to address next-generation access and aggregation requirements. With a fully programmable pipeline of eight independent clusters, each capable of running independent code, this provides un-matched flexibility to meet the needs of today as well as tomorrow. The independent nature of cluster operations enables FPcx powered platforms to be upgraded in-service, with zero packet loss, all while continuing to forward dataplane traffic without interruption. This is the first silicon of this type in the industry, and it changes the nature of how systems can be upgraded and maintained, re-defining the meaning of high availability and increasing the ease with which new services and capabilities can be deployed. A 100 percent programmable pipeline will always drive the lowest TCO with respect to any other silicon type. This completely mitigates against future unknown standards evolution allowing for a network to always run in the most efficient way possible.

1 The 7730 SXR-1 series is part of the 7730 SXR product family. Additional data sheets are available for other models in this product family.

With an ASIC architecture that delivers 8GB of egress buffer and up to 192MB of ingress buffer memory, the effectively fully buffered design of FPcx delivers an order of magnitude better capability than market silicon, directly translating design into better upstream and downstream throughput.

Speed and compact platforms

Demanding network roles demand in-house silicon. Two fixed compact platforms are available: one with a height of 1 RU and one with a height of 2 RU, all of which support an extended temperature range:

- 7730 SXR-1x-44S
  - Fixed, 5.6 Tb/s, Integrated GNSS
  - 40 x 100G SFP-DD + 4 x 400G QSFP-DD
- 7730 SXR-1d-32D
  - Fixed, 4.4 Tb/s, Integrated GNSS
  - 28 x QSFP28 + 4 x 400G QSFP-DD

All 100G SFP-DD ports support all combinations of 10G, 25G, 50G and 100G SFP-DD optics, allowing for ports to change from 10G to 100G with only a change of the optic.

All odd numbered QSFP28 ports support 4 x 25GE and 4 x 10GE breakout.

All 400G QSFP-DD ports are fully backward compatible to QSFP28-DD and QSFP28, supporting any combination of 4 x 10GE, 4 x 25GE, 100G, 2 x 100G, 4 x 100G and 1 x 400G.

All 7730 SXR platforms are designed with a capability called PCB enhanced plating (PEP). This built-in design attribute provides conformal coating level protection, without the need for conformal coating and so comes with none of the disadvantages of conformal coating. The design process is proprietary and delivers proven results compared to conformal coating.

All-in-one system synchronization

The 7730 SXR-1 series provides precise frequency and time synchronization to meet the stringent requirements of 4G/5G mobile base stations and other mission-critical networks. It improves timing accuracy over packet networks by combining built-in architectural features with port-based timestamping, dual-band Global Navigation Satellite System (GNSS) capabilities, ITU-T Synchronous Ethernet (SyncE) and the Nokia Bell Labs IEEE 1588v2 algorithm. Sync performance achieved in the 7730 SXR include G.8272 PRTC-B for GNSS and G.8262.1 eEEC for SyncE. Combine these with powerful QoS features that provide granular traffic controls reduce delay and delay variation experienced by packet synchronization technologies.

Network security

The 7730 SXR-1 series enhances network security by offering DDoS mitigation with signature-based access control lists (ACLs) to make the network part of the solution to DDoS. This is domain conjunction with the Nokia Deepfield solution. ACLs of all types scale deterministically, without performance degradation, ensuring guaranteed performance under all network scaling conditions.

With Trusted Platform Module (TPM) 2.0 technology and capabilities to support secure boot and measured boot, security is not only a network wide value add but is built into the DNA of every single platform.

Service Routing with SR Linux

Nokia SR Linux Network Operating System (NOS) is specifically designed to address the requirements of modern networking. SR Linux is an open and resilient NOS with a cloud-native software architecture, a proven and resilient foundation, and unmatched extensibility and it delivers automation at scale.

SR Linux leverages the field-proven protocol stacks and networking applications from the Nokia Service Router Operating System (SR OS) and is deployed in the networks of many customers globally.

The SR Linux EVPN and IPVPN services implementation delivers mature proven resiliency, stability, scalability and interoperability.

Scalable streaming telemetry

SR Linux is designed to meet the demands of a model-driven world where visibility—and the scalability and granularity of that visibility—are paramount. SR Linux delivers an open, extensible and performant infrastructure that allows the retrieval of fine-grained system state, setting of configuration, and a scalable interface to support more granular data with push-based streaming.

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.

Technical specifications

Table 1. 7730 SXR-1 specifications

Feature	7730 SXR-1x-44S	7730 SXR-1d-32D
System throughput: Full duplex	5.6 Tb/s	4.4 Tb/s
Service interfaces	• 4 x 400G QSFP-DD • 40 x 100G SFP-DD	• 4 x 400G QSFP-DD • 28 x QSFP28
Control interfaces	Console, management, SyncE/1588, Bluetooth, USB, GNSS in, 1PPS out, SD slot with security cover	
Security	DDoS mitigation via signature ACL TPM2.0	DDoS mitigation via signature ACL TPM2.0
Timing and synchronization	• Includes Stratum 3E oscillator • ITU-T Synchronous Ethernet (SyncE) – ITU-T G.8262.1 (eEEC) • IEEE 1588v2 clock types: Boundary, Grandmaster • IEEE 1588v2 profiles: – ITU-T G.8275.1 – ITU-T G.8275.2 with PTS • IEEE 1588v2 PTP encapsulations: – Ethernet – UDP/IPv4/IPv6 • RFC 5905 Network Time Protocol (NTP) • SyncE/IEEE1588 input and output timing port • Pulse-per-second (1PPS) output timing • Integrated GNSS receiver: – ITU-T G.8272 PRTC-B dual-band GNSS receiver	
Indicators	• Power status (A & B), fan	
Memory buffer size	384 MB ingress buffer, 16 GB egress buffer	192 MB ingress buffer, 8 GB egress buffer
Hardware redundancy	Power supplies, cooling fans N+1	
Dimensions	• Height: 1 RU, 4.5 cm (1.75 in) • Depth: 42.67 cm (16.8 in) • Width: 44.45 cm (17.5 in)	• Height: 2 RU, 8.81 cm (3.47 in) • Depth: 27.5 cm (10.83 in) • Width: 44.45 cm (17.5 in)
Power supply options	1+1 redundant, modular AC or DC power supplies	1+1 redundant, 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	
PCB enhanced plating (PEP)	Supported on all platforms	
Cooling	• Front-to-back airflow without a filter • Separate air filter kit available for 1 RU and 2 RU systems	
Normal operating temperature range	-40°C to +65°C (-40°F to +149°F) sustained	
Shipping and storage temperature	-40°C to +70°C (-40°F to +158°F)	
Normal humidity	5% to 95%, non-condensing	

Software features

The 7730 SXR-1 series supports, but is not limited to, the following features.

Open Linux support

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

Layer 2 features

- Ethernet IEEE 802.1Q (VLAN) and 802.1ad (QinQ) with support for jumbo frames
- Link Layer Discovery Protocol (LLDP)
- Ethernet Virtual Private Network (EVPN)
  - Virtual Private Wire Service (EVPN-VPWS)
  - Multihoming with single-active or all-active modes
- EVPN-MPLS support on MAC-VRFs, including support for control word
- TLDP based PWs for VPWS and VPLS services
- FAT (Flow-Aware Transport) label in EVPN-VPWS/TLDP
- Layer 2 proxy-ARP in MAC-VRF
- Layer 2 Control Protocol (L2CP) Tunnelling
- Split Horizon Groups

Layer 3 features

- IP routing
  - Static, aggregate routes for IPv4/v6
  - IP unnumbered interfaces
  - Dual-stack Interior Gateway Protocol (IGP)
  - Multi-topology IS-IS v4/v6
  - Open Shortest Path First (OSPFv2 and OSPFv3)
  - Multiprotocol BGP (MP-BGP)
- BGP with iBGP/eBGP: Support for IPv4/v6, including:
  - Core Prefix Independent Convergence (PIC)
  - Route reflector
  - Dynamic peers
  - BGP unnumbered
  - eBGP multi-hop
  - Add-paths for IPv4 and IPv6 routes
  - BGP maintenance modes
- BGP-Link State (BGP-LS)
- BGP Labeled Unicast (BGP-LS) next-hop-self
- IPv6 flow label hashing
- Layer-3 VPNs:
  - IP-VRF: Multiple VRF support
  - IP-VPN (VPN-IPv4 and VPN-IPv6 families) and EVPN Interface-less (EVPN-IFL) support
  - Multi-instance IP-VRF, with IP-VPN and EVPN-IFL in the same IP-VRF
  - Inter-AS option B and Next Hop Self RR support
  - EVPN IFL IP Aliasing and unequal ECMP
- 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
- Traffic steering to next-hop, network instance
- Multicast:
  - Internet Group Management Protocol (IGMP) v1/2 with SSM translation, IGMPv3
  - Multicast Listener Discovery (MLD)v1 with SSM translation, MLD v2
  - PIM, PIM SSM
  - NG-mVPN with mLDP
  - IGMP-MLD Policy
  - Multicast IPv4 and IPv6 policy

Tunnels

- LER and LSR with both IPv4 and IPv6 NHLFEs
  - Unnumbered subinterfaces
  - Null label
  - Load balancing in both LER and LSR roles
- SR-ISIS with MT=0/2
- Segment Routing (SR) flexible algorithms
- Loop-free Alternate (LFA), Topology independent LFA
- Colored/uncolored SR-MPLS TE-Policy
  - Explicit-path support with a mix of strict and loose hops
  - Local CSPF based path computation
  - Label stack reduction, Exclude SRLG, Delay metric
- PCE computed, PCC initialized LSPs
  - B-SID insertion/stitching
- Seamless BFD with 10ms timers
  - Hold up and down timers
- LSP redundancy with Active, Standby, and Secondary Segment-Lists
- LSP stats
  - BGP-LU
  - TE policy
- Make-before-Break (MBB)
- Fast Re-Route (FRR) protection via LFA, ti-LFA
- tag-set (a.k.a. admin-tag) for steering Services/ Shortcuts LDP
- Link-LDP with ISIS IPv4/v6 and OSPFv2/v3
  - Downstream unsolicited label distribution with ordered control
  - (LFA) fast reroute and remote LFA
  - BFD for I-LDP and t-LDP with 10ms timers
  - FEC-originate, per peer import and export policies, LDP-IGP synchronization
- Targeted LDP support

Quality of Service

- Intelligent packet classification based on combination of dot1p/dscp/mpls criteria on any type of subinterface
- Ingress dscp based remarking
- Ingress per subinterface rate limiting with 2 level policer hierarchies (per-FC and per CVLAN)
- Egress marking, and dscp-based reclassification
- Egress per subinterface Queuing/scheduling:
  - Strict priority
  - Weighted round robin (WRR)
  - 4 hierarchy levels: FC queue/aggregate/multi-aggregate (SVLAN)/interface
  - Sophisticated egress: Buffer management with Weighted Random Early Detection (WRED) at queue/interface-pool/fp-pool levels

Flow monitoring

- Cflowd IPFIX (CPU based)

Operations, administration and maintenance

- Two-Way Active Measurement Protocol (TWAMP) server and session reflector
- STAMP session reflector,
- STAMP OAM Performance Monitoring (PM) IP delay and loss measurement
- STAMP Link Measurement
- Eth-CFM; Up/Down MEP
  - Fault Mgmt, CCM, LBM, LT
  - Performance monitoring, delay and jitter

Link Layer Discovery Protocol (LLDP)

- Mirroring interface/subinterface source to local/ remote destination
- Bi-directional forwarding detection (BFD)
  - 10ms timer support
  - Asynchronous BFD liveliness support for all dynamic and static routing
  - Seamless BFD (S-BFD)
  - Micro-BFD for LAG
- LSP ping and trace for LDP and SR-ISIS tunnels

System management and automation

- Native model-driven architecture, configuration candidates, exclusive mode, checkpoints and rollbacks
  - Support for SR Linux and OpenConfig 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)
- P4 runtime packet extraction and injection
- SNMPv2c and SNMPv3 gets and traps
- Per-user configurable options for CLI
- Local, RADIUS and TACACS+ authentication, authorization and accounting with role-based access control (RBAC)
- 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
  - Logging infrastructure
- Telemetry-driven event management
- Python-based Zero Touch Provisioning (ZTP)
- Dynamic Host Configuration Protocol (DHCP) v4/v6 relay
- DHCP v4/v6 server with static allocations

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
- Link aggregation: Link Aggregation Group (LAG) and Link Aggregation Control Protocol (LACP)
- Equal Cost Multi Path (ECMP) for IPv4 and IPv6 forwarding
- Graceful restart client for IS-IS, BGPv4/v6
- VRRP v2 and v3 support

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)
- Secure boot
- Measured boot
- TPM Initial Device Identity (IDevID) and Initial Attestation Key (IAK)
- IEEE 802.1x EAP, including per host authentication

Standards compliance[2]

Environmental specifications

- ATIS-0600010.03
- 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 3.3 (with I-Temp pluggable)
- ETSI EN 300 753 Acoustic Noise Class 3.2
- GR-63-CORE
- GR-3108-CORE Class 2
- GR-3160-CORE
- VZ-TPR-9205
- VZ.TPR.9203 (CO)

Safety

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

Electromagnetic compatibility

- AS/NZS CISPR 32 Class A
- ATIS-0600315
- BS/EN 55032 Class A
- BS/EN 55035
- BS/EN/IEC 61000-3-2
- BS/EN/IEC 61000-3-3
- BSMI CNS15936 Class A
- BT GS-7
- CISPR 32 Class A
- CISPR 35
- ETSI EN 300 386
- EN 55032 Class A
- EN 55035
- ETSI ES 201 468
- ETSI EN 300 132-1
- ETSI EN 300 132-2
- FCC Part 15 Class A
- GR-1089-CORE
- ICES-003 Class A
- IEC/EN 61000-3-2
- IEC/EN 61000-3-3
- IEC/EN 61000-6-2
- IEC/EN 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
- KCC Korea-Emissions & Immunity (In accordance KS C 9832/KS C 9835)
- VCCI Class A

Radio

- EN 303 413 (GNSS)
- EN 301 489-1
- EN 301 489-17 (Bluetooth)
- EN 301 489-19 (GNSS)
- KS X 3124
- KS X 3126 (Bluetooth)
- EN 300 328 (Pre-Certified Bluetooth Module)
- FCC Part 15 Subpart C (Bluetooth)
- RSS-GEN (Pre-Certified Bluetooth Module)
- RSS-247 (Pre-Certified Bluetooth Module)

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

Power utility substations

- IEEE 1613 (Exception, forced air system)
- IEEE 1613.1
- IEC 61000-6-5
- IEC 61850-3 (Normal environmental conditions)

Directives, regional approvals and certifications

- DIRECTIVE 2011/65/EU Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment (Recast) Directive (including Commission Delegated Directive (EU) 2015/863)
- DIRECTIVE 2012/19/EU Waste Electrical and Electronic Equipment (WEEE)
- DIRECTIVE 2014/30/EU Electromagnetic Compatibility (EMC)
- DIRECTIVE 2014/35/EU Low Voltage Directive (LVD)
- DIRECTIVE 2014/53/EU Radio Equipment Directive (RED)
- MEF certification:
- For a list of Nokia CE 1.0-, CE 2.0- and CE3.0-certified products, refer to the MEF certification registry.
- NEBS Level 3:
  - BSMI Mark – Taiwan
  - CE Mark - Common Europe
  - CRoHS - China RoHS
  - KC Mark - South Korea
  - RCM Mark – Australia
  - VCCI Mark – Japan
  - UKCA Mark – 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.

Nokia Oyj
Karaportti 3
FI-02610 Espoo, Finland
Tel. +358 (0) 10 44 88 000

Document code: (November) CID214432