

Nokia 7950 Extensible Routing System

Expandable Media Adapters

Nokia Expandable Media Adapters (XMAs) provide flexible and cost-efficient 10GE, 40GE, 100GE and 400GE interface options for the 7950 XRS family that support the full range of functional requirements for IP routing, Multiprotocol Label Switching (MPLS), internet peering, infrastructure services and IP/optical integration.

Nokia's industry-leading 3 Tb/s FP4 network processor powers a new generation of XMAs with ultra-high density, 400GE QSFP-DD and 100GE QSFP28 port configurations, with flexible breakout options for 10GE, 40GE and 100GE interfaces. Software configurable licensing enables flexible pay-as-you-grow options per line card to expand capacity and QoS scaling capabilities, or upgrade functionality to support various high performance edge and core routing applications as your needs evolve, without replacing hardware.

All XMA variants can be equipped in any platform of the 7950 XRS family. A flexible software licensing scheme allows for customizing the XMAs for diverse core router tasks such as provider routing, Border Gateway Protocol (BGP) peering, MPLS switching, and Layer 2/Layer 3 virtual private network (VPN) infrastructure services, with configurable quality of service (QoS) granularity.

The versatility and flexibility provided by the 7950 XRS Media Adapters enables operators to consolidate core routing systems on a common platform, to protect hardware investments over time and to rapidly respond to evolving requirements with minimal impact and capital outlay.



12-port 400G universal QSFP-DD XMA



24-port 100G universal QSFP28 XMA



6-port 100G CFP2-DCO XMA



4-port 100GE CFP2 XMA (FP3)



40-port 10GE SFP+ XMA (FP3)

Each XMA contains one or two FP-based forwarding complexes that perform functions such as packet lookups, traffic classification, processing and forwarding, service enablement and QoS. Each XMA also provides specific interface ports, physical media and optical functions. XMA's are equipped in an XRS Control Module (XCM), which contains a slot-level control plane subsystem with a dedicated multicore CPU and 4G DDR3 memory, and the fabric interface based on two T-chips to interconnect to the system switching fabric modules (SFM's).

Each XCM can host two XMA's. The 7950 XRS-20 and 20e each use dedicated XCM variants, and can equip a total of 10 XCM's per chassis. The XCM variants powered by the T3 chip offer 800G full duplex aggregate slot capacity to a pair of FP3 XMA's. XCM2 variants powered by the T4 chip support FP4 XMA's, and require switching fabric modules based on the S4 chip (SFM2). The XCM2 variant for the XRS-20 offers 3.2 Tb/s full duplex

aggregate slot capacity, and the XRS-20e variant offers 4.8 Tb/s. SFM2 supports both XCM and XCM2 and is common for the 7950 XRS-20 and 20e. The Control Processor Modules (CPM's) are common as well, and support both FP3 and FP4 system configurations.

The XMA-XCM concept (see Table 1) enables exceptional modularity and investment protection by decoupling the forwarding logic from control and switching logic. It allows network operators to mix FP4 and FP3 XMA's in a single chassis, and provides the flexibility to upgrade to higher system slot capacity without having to replace existing XMA's. The XCM concept also gives a cost-efficient option to pre-equip XMA's by only powering those that are providing services. Distributing certain control plane capabilities on the XCM's also improves control plane scalability and in-service hardware upgrade performance.

Figure 1. XMA-XCM modular hardware architecture

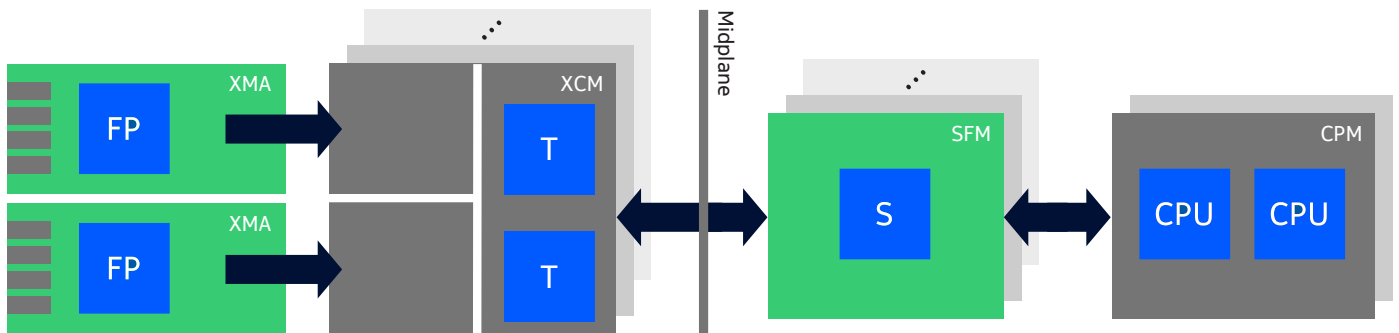


Table 1. Hardware combinations and system configurations

XRS media adapters (XMA)	XMA Control Modules (XCM)	Switch Fabric Modules (SFM)	Control Processor Modules (CPM)
Forwarding complex and port interfaces	Slot-level control and memory	Switching fabric	System-level control, routing and processing
400G XMA (2xFP3)	XCM-20 (800G FD), 10 per XRS-20	SFM (7+1 redundancy)	CPM (1:1 redundancy)
400G XMA (2xFP3)	XCM-20e (800G FD), 10 per XRS-20e	SFM (7+1 redundancy)	CPM (1:1 redundancy)
2.4T XMA (2xFP4)	XCM2-20 (3.2T FD), 10 per XRS-20	SFM2 (7+1 redundancy)	CPM (1:1 redundancy)
2.4T XMA (2xFP4)	XCM2-20e (4.8T FD), 10 per XRS-20e	SFM2 (7+1 redundancy)	CPM (1:1 redundancy)

Features and benefits

Optimize capacity and flexibility

Traditional core routers deploy custom ASICs that optimize forwarding capacity and port density but often trade off service capabilities, which reduces deployment flexibility and versatility. The Nokia 7950 XRS rejects compromises and avoid dilemmas by leveraging programmable 3 Tb/s network processing silicon—the Nokia FP4 chipset. State-of-the-art 16nm 2.5/3D FinFETPlus technology enables FP4 to deliver 6 times the scale and twice the efficiency of FP3. And it adds enhanced packet intelligence and control capabilities to support emerging requirements for dynamic flow optimization, network slicing and distributed denial of service (DDoS) mitigation for cloud, 5G and Internet of Things applications.

As a result, the XRS platform combines tremendous forwarding performance with unprecedented hardware flexibility. Where alternative core routers have to resort to multiple line card variants and additional platforms to cover the spectrum of core routing needs, the 7950 XRS can bring it all on one platform with common hardware and excellent investment protection.

Line card licenses allow for tailoring and tuning the 7950 XRS system to customers' evolving needs. Capacity licenses enable software configurable pay-as-you-grow expansion options for universal XMA hardware to increase interface capacity and queuing scale as your traffic demands evolve. MPLS, IP core routing, advanced BGP peering, VPN service, virtual private LAN service (VPLS) and advanced QoS and security capabilities can be unlocked through a simple license upgrade, without hardware changes or maintenance windows.

Whether deployed in the metro core, in the IP backbone, as a data center gateway or an internet peering point, the 7950 XRS will meet your networking needs.

Performance and resource efficiency

The FP4 chipset offers deterministic packet forwarding performance under full load, even when complex packet lookup and advanced traffic management operations are required. The P4 chip performs packet processing and integrates intelligent lookup memory to optimize packet lookup operations, and traffic management is performed separately by the Q4 chip. This approach gives the flexibility to optimize line cards designs for different queuing and scheduling requirements.

The FP4 chipset enables line card designs with an optimal geometry for 100GE and 400GE interfaces at full rate, and pave the way to supporting terabit-rate clear channel interfaces.

High-performance, 3 Tb/s silicon also helps to reduce the number of hardware components. XMA modules share two FP4 complexes and are able to drive 24 QSFP28 ports at 100 Gb/s rates or 12 QSFP-DD ports up to 400 Gb/s rates, and even 2 ports at Terabit line rates in future. Conversely, competing line card designs with lower speed silicon typically replicate memory for each forwarding complex in separate hardware slices, demonstrate choppy forwarding performance with limited traffic management, and are unable to support 1TE interfaces in future.

Innovation to rely on

While the Nokia 7950 XRS is a highly innovative platform, it leverages field-proven and time-tested technology. The FP3 and FP4 network processors that power the 7950 XRS interface cards also drive the line cards of the Nokia 7750 Service Router (SR) platform. Currently in its fourth generation, FP routing silicon has evolved in a mature and field-proven technology.

The FP4 chipset enables the 7950 XRS to run the same Nokia Service Router Operating System (SR OS) used in the 7750 Service Routing family, and leverage over a decade of software innovation, field validation and maintenance. Groundbreaking reliability features such as non-stop routing and services were first introduced in the SR OS and set new industry standards on availability.

Operators familiar with the SR OS will find qualification and operational integration of the 7950 XRS effortless. The Nokia Network Services Platform (NSP) enables operators to minimize operational costs and complexity with a converged and consistent management and Carrier SDN WAN solution that spans the entire routing portfolio and select products in optical transport, access and wireless.

Leading performance

- Universal 400GE QSFP-DD ports with flexible 10, 40, 100 and 400GE breakout options and intelligent fan-in/fan-out aggregation.
- Universal 100GE QSFP28 ports with high density 10GE and 40GE breakout options with support for SR and LR optics
- Support for 400ZR and ZR+ digital coherent optics in QSFP56-DD and CFP2 pluggable form factors
- XMA are usable across all XRS platform variants to optimize investments and sparing
- Pluggable optics with Digital Diagnostic Monitoring (DDM) for extended operations, administration, and maintenance (OAM) support

Rich capabilities

- Flexible, tiered feature licensing model to pay for only the functionality required, and in-place feature upgrades without changing the hardware
- Scalable IPv4/IPv6 unicast routing (BGP, Open Shortest Path First (OSPF), and Intermediate System-to-Intermediate System (IS-IS) with traffic engineering extensions) covering all-IP core needs
- Scalable IPv4/IPv6 multicast routing (PIM, MSDP)
- MPLS label edge router (LER) and label switch router (LSR)
- Multi-instance IS-IS and OSPF segment routing support
- Layer 2 and Layer 3 virtual leased line (VLL) and VPN services

- Configurable QoS granularity from 8 ingress and 8 egress to 128,000 ingress and 128,000 egress queues per port

Seamless operation

- Runs same SR OS binary for reliable, seamless and consistent performance
- Extensive OAM tool set, which provides tightly integrated visibility, management and control of the platform, network and services
- WAN and LAN PHY support options for 10GE cards
- Hot-replaceable
- Multivendor SDN control integration through OpenFlow and NETCONF/YANG support
- Service automation and cross-layer network management through the Nokia NSP

Technical specifications

Table 2. Supported XMA and licensing options for Nokia 7950 XRS-20 and XRS-20e

XMA hardware description	XMA licensing options		Maximum density per slot: 7950 XRS-20 / XRS-20e			
	Connectors	Capacity	10GBASE	40GBASE	100GBASE	400GBASE
12p QSFPDD universal XMA with intelligent fan-in/out and flexible breakout for 10, 40, 100 and 400 GBASE	8	1.6 Tb/s	80 / 80	8 / 8	16 / 16	4 / 4
	12	2.4 Tb/s	80 / 120	8 / 12	16 / 24	4 / 6
	12	4 Tb/s	80 / 120	8 / 12	16 / 40*	4 / 8*
24p QSFP28 universal XMA with flexible breakout for 10, 40 and 100 GBASE	12	1.2 Tb/s	120 / 120	12 / 12	12 / 12	-
	16	1.6 Tb/s	160 / 160	16 / 16	16 / 16	-
	24	2.4 Tb/s	160 / 240	24 / 24	16 / 24	-
6p CFP2-DCO clear channel	6	1.2 Tb/s	-	-	12* / 12	-

XMA hardware description	XMA licensing options		Maximum density per slot: 7950 XRS-20 / XRS-20e			
	Connectors	Capacity	10GBASE	40GBASE	100GBASE	400GBASE
4p 100GBASE CFP2	4	400 Gb/s	-	-	-	4 / 4
40p 10GBASE SFP+	40	400 Gb/s	-	40 / 40	-	-

* With intelligent fan-in/fan-out aggregation

Physical dimensions

XMA (400G)

- Height: 392.4 mm (15.45 in)
- Width: 42.9 mm (1.69 in)
- Depth: 460.7 mm (18.14 in)
- Weight: 7.7 kg (16.7 lbs)

XMA (2.4T)

- Height: 392.4 mm (15.45 in)
- Width: 42.9 mm (1.69 in)
- Depth: 460.7 mm (18.14 in)
- Weight: 7.8 kg (17.2 lb)

10GBASE LAN and WAN PHY

- LAN and WAN PHY support options for 10GE cards

QoS support

Configurable through software licenses from 8 ingress and 8 egress queues per port to a total of:

- 128,000 shared queues per FP3 C-XMA
- 256,000 shared queues per FP3 XMA
- 512,000 shared queues per FP4 XMA

MAC address capacity

- IP core:
 - Up to 128,000 media access control (MAC) forwarding information base (FIB) entries per XMA
- Higher scale enabled through additional licenses

IP FIB capacity

- LSR license: 64,000 FIB entries (IPv4 + IPv6)
- IP core license: 1 million FIB entries (IPv4 + IPv6)
- Higher scale enabled through additional licenses

Please refer to the Nokia 7950 XRS data sheet and product information for full system details on safety standards, compliance, agency certifications and protocol support.



About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering the future where networks meet cloud to realize the full potential of digital in every industry.

Through networks that sense, think and act, we work with our customers and partners to create the digital services and applications of the future.

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