Nokia 7750 Service Router and Nokia 7450 Ethernet Service Switch

Input/Output Modules

Delivering up to 4.0 Tb/s full duplex (FD) per-slot performance, Nokia 7750 Service Router (SR) and Nokia 7450 Ethernet Service Switch (ESS) Input/Output Modules (IOMs) provide highly scalable IP/MPLS routing and packet processing capabilities, supporting the full array of IP network functions and services.

Nokia IOMs perform packet lookups, traffic classification, packet processing and forwarding, service enablement and QoS. Using highly programmable Nokia FP network processing silicon, IOMs deliver line-rate performance that does not degrade as advanced capabilities and applications are enabled. By distributing routing and processing on a per-slot basis, overall Nokia 7750 SR system performance scales linearly with the addition of each IOM to the system.

The versatility and flexibility provided by the combination of Nokia IOMs and media dependant adapters (MDAs) enables exceptional modularity and investment protection. It allows operators to mix and match IOMs with MDA types in a single chassis while supporting the full array of IP networking functions and services and protecting hardware investments over time. It also allows operators to take advantage of the FP programmability and licensing to rapidly respond to evolving requirements with minimal impact and capital outlay.

The Nokia IOM-s is based on the Nokia FP4 network processing silicon. It is available in two variants and delivers up to 3.0 Tb/s FD per-slot performance in the 7750 SR-2s, SR-7s and SR-14s. With intelligent aggregation (IA) capacity increases up to

IOM-s

IOM5-e

IOM4-e

IOM-e

IOM-a

4 Tb/s FD. Smaller licenced versions provide flexible entry points with growth options to tune capacity and functionality according to evolving needs, including intelligent aggregation options—all enabled through in-place software feature upgrades, without hardware replacement.

The 7750 SR-1s is available in a modular variant. It has an integrated 3.0 Tb/s FD IOM-s based on the Nokia FP4 and delivers up to 6.0 Tb/s half duplex (HD) performance. The SR-1s is software upgradable through in-place feature upgrades, without hardware replacement.

The IOM5-e leverages the Nokia FP4 to deliver up to 1.5 Tb/s FD (non-redundant) and 1.2 Tb/s FD (redundant) per-slot performance on the 7750 SR-12e. On SR-7 and SR-12 systems, the IOM5-e supports up to 400 Gb/s FD (redundant) and up to 800 Gb/s FD (non-redundant) per-slot performance. The 7750 SR-1 has an integrated Nokia IOM5-e based on the Nokia FP4 and delivers up to 3.0 Tb/s HD performance. The IOM5-e and SR-1 licenses are software upgradable through in-place feature upgrades, without hardware replacement.

Nokia IOM4-e variants leverage the 400 Gb/s FP3 to deliver up to 200 Gb/s FD per-slot performance and are supported on the 7750 SR-7, SR-12 and SR-12e systems.

The Nokia IOM-e and IOM-a are also FP3-based and deliver up to 200 Gb/s and 100 Gb/s per-slot capacity, respectively, for the 7750 SR-e and 7750 SR-a. Their innovative design provides direct interconnect to other IOM-e and IOM-a modules, enabling a fabricless system.

Features and benefits

Deterministic performance

Nokia IOMs leverage Nokia FP network processing silicon, which combines a disaggregated, fully buffered chipset architecture and intelligent memory design to provide deterministic packet forwarding performance at scale, without compromise, even when complex processing-intensive operations are required. With the FP traffic manager, buffering is always deterministic, ensuring consistent system performance even when IP, MPLS, QoS and access control list (ACL) capabilities are scaled concurrently. IOMs deliver line-rate performance that does not degrade as advanced capabilities and applications are enabled.

By contrast, performance of products with partially buffered chipset architectures typically results in non-deterministic behavior and unpredictable system operation as the scale on the chipset increases.

Versatile configurations

Nokia IOMs insert into the 7750 SR chassis slot to deliver a single, versatile platform capable of satisfying multiple roles in a network. The modular 7750 SR system architecture enables operators to mix and match Nokia IOMs with a broad range of compact MDA types and the Integrated Service Adapter-2 (ISA-2) to meet networking requirements with reduced TCO and investment protection.

Nokia IOMs enable the full complement of the Nokia Service Router Operating System (SR OS) capabilities to support the full array of functions and services required for IP networking in any slot.

For webscale companies, Nokia IOMs enable data center and point of presence (PoP) edge functions, including aggregation, gateway, interconnect and internet/peering. In the PoP, IOMs support internet/peering edge and backbone router functions.

For service providers, Nokia IOMs are deployed in WAN and aggregation networks to support IP edge and gateway functions, including: access aggregation for broadband services and Broadband Network Gateway (BNG) for residential subscriber management; provider edge (PE) for enterprise VPN, internet access, and cloud and data center interconnect (DCI) services; and PE for backhaul, IPsec and security gateway, WLAN gateway and hybrid access gateway in IP mobile anyhaul. In data centers, IOM support includes gateway, interconnect and internet/peering.

For enterprises, Nokia IOMs provide high-performance networking for cloud, data center and WAN applications.

The Nokia IOM-s is a full-slot module and supports up to two MDA-s adapter types. The 7750 SR-1s modular variant has an integrated 3.0 Tb/s IOM-s and supports up to two MDA-s adapters.

The Nokia IOM5-e is a full-slot module and supports up to two 750 Gb/s FD MDA-e-XP adapters. The 7750 SR-1 with the integrated IOM5-e also supports up to two Nokia MDA-e-XP adapters.

The Nokia IOM4-e and IOM4-e-B are full-slot modules and support up to two 100 Gb/s FD MDA-e and 40 Gb/s ISA-2 types.

The Nokia IOM-e is a full-slot card that supports up to four 100 Gb/s MDA-e and 40 Gb/s ISA-2 types. The Nokia IOM-a supports up to two 100 Gb/s MDA-a-XP and 25 Gb/s MDA-a types.

Flexible licensing

IOM licenses add flexibility for tailoring and tuning the 7750 SR to customers' evolving needs. As a result, operators pay only for the functionality they require. This flexibility also allows for seamless growth options through simple in-place feature upgrades without changing IOM hardware.

With the FP4-based IOM-s and IOM5-e, a pay-as-you-grow license model is available. Capacity licenses provide bandwidth, connector and intelligent aggregation mode options. Functional licenses scale services through control options on egress hardware queues and egress policers. Each IOM-s and IOM5-e supports multiple combinations of these licenses to scale all attributes of capacity and functionality while protecting hardware investments. The IOM-s and IOM5-e can be operationalized without the need to ever upgrade licenses.

Advanced feature licenses for IOM4-e variants, the IOM-e and the IOM-a offer tiered levels of functionality for Layer 2- and Layer 3-based services. IOMs with Layer 3 feature licenses can add optional virtual private routed network (VPRN) licenses that determine IP VPN scaling supported on the IOM. Advanced feature licensing also includes security gateway, WLAN gateway, data center gateway, telemetry and application assurance applications.

Energy efficiency for sustainability

Energy-efficient design innovations of the Nokia 7750 SR-s and 7750 SR increases the sustainability of IP networks through reduced emissions.

The FP4 chipset architecture enables line card designs with fewer FP4 complexes and fewer components on each board to lower power consumption. The FP4 memory architecture is also exceptionally power-efficient. Power consumption scales with licensing level to drastically reduce power when only a fraction of a line card is in use. With Nokia FP4, these and other mechanisms are dynamic, enabling each 7750 SR-s and 7750 SR system to quickly and automatically adapt to lower power consumption.

The IOM-s and MDA-s combination has dedicated air cooling channels, dual-sided circuit boards and no stacked optical cages. This design improves energy efficiency with reduced component pre-heating and even cooling to all cages to support 400G ZR and 400G ZR+ optics. The IOM5-e and MDA-e-XP also combine for an energy efficient design and has ample cooling to support 400G ZR and 400G ZR+ optics.

Intelligent aggregation

To cost-effectively meet the most stringent high-density aggregation scenarios, FP4 enables unprecedented intelligent aggregation capabilities. This allows the 7750 SR to handle much more aggregation than capacity in an exceptionally smart way. The pre-classification and pre-buffering capabilities of FP4 allow for the 7750 SR to support up to three times intelligent aggregation per FP4-based line card. Packet priority is always respected and delivers leading ingress buffering and shaping in a fully deterministic way.

The 3.0 Tb/s FD IOM-s supports up to 4.0 Tb/s FD of IA. The 7750 SR-1s, with the integrated IOM-s, supports up to 8.0 FD Tb/s HD of IA. The IOM5-e supports up to 1.2 Tb/s FD of IA on the SR-7 and SR-12 and up to 4.0 Tb/s FD of IA on the 7750 SR-12e. The 7750 SR-1, with the integrated IOM5-e, supports up to 8.0 Tb/s HD of IA.

This differentiated approach to aggregation allows multiple network layers to be collapsed into a single layer, enables superior peering capabilities, and provides industry-leading support for a high degree of fractional flows. Where competing solutions do not support native aggregation or will drop traffic indiscriminately when oversubscribed, all generations of FP are always deterministic and fully scheduled based on strict QoS priorities.

Proven OS, simplified integration

Running the SR OS, Nokia delivers a single OS across all 7750 SR platforms. Common across all Nokia IP routing platforms, the SR OS leverages 20 years of software innovation, field validation and maintenance. Ground-breaking reliability features such as nonstop 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 other 7750 SR variants effortless. The Nokia Network Services Platform (NSP) enables operators to minimize operational costs and complexity with a converged and consistent management and a software-defined networking (SDN) solution that spans the entire IP routing portfolio and select products in optical transport, access and wireless.

Technical specifications

IOM overview

Table 1 provides a technical overview and summarizes IOM support on the 7750 SR and the 7450 ESS*.

Table 1. Nokia 7750 SR IOM summary

	7750 SR	7750 SR	7750 SR	7750 SR-e	7750 SR-a
	IOM-s	IOM5-e	IOM4-e	IOM-e	IOM-a
IOM capacity (FD)	SR-2s/7s/14s: • 1.5 Tb/s IOM-s: 1.5 Tb/s • 3.0 Tb/s IOM-s: 3.0 Tb/s	Redundant: • SR-7/12: 400 Gb/s • SR-12e: 1.2 Tb/s Non-redundant: • SR-7/12: 800 Gb/s • SR-12e: 1.5 Tb/s	200 Gb/s	200 Gb/s	100 Gb/s
IOM capacity with IA (FD) (Max)	• 1.5 Tb/s IOM-s: 4.0 T/bs • 3.0 Tb/s IOM-s: 4.0 Tb/s	• SR-7/12: 1.2 Tb/s • SR-12e: 4.0 Tb/s	400 Gb/s	400 Gb/s	100 Gb/s
Network processing technology	FP4	FP4	FP3	FP3	FP3
Supported chassis	SR-2s, SR-7s, SR-14s	SR-7, SR-12, 12e	SR-7, SR-12, SR-12e	SR-1e, SR-2e, SR-3e	SR-a4, SR-a8
Adapters per IOM	2	2	2	4	4
Hot swappable	Yes	Yes	Yes	Yes	Yes
MDA and ISA2 types supported	MDA-s	MDA-e-XP	MDA-e and MS-ISA2	MDA-e and MS-ISA2	MDA-a-XP and MDA-a
ITU-T Sync-E/ IEEE 1588v2	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Dimensions	• Height: 6.01 cm (2.37 in) • Width: 40.6 cm (16.0 in) • Depth: 39.14 cm (15.41 in)	• Height: 3.6 cm (1.4 in) • Width: 42.5 cm (16.7 in) • Depth: 43.2 cm (17 in)	• Height: 3.6 cm (1.4 in) • Width: 42.5 cm (16.7 in) • Depth: 43.2 cm (17 in)	• Height: 7.11 cm (2.8 in) • Width: 25.91 cm (10.2 in) • Depth: 29.21 cm (11.5 in)	• Height: 3.6 cm (1.4 in) • Width: 38.9 cm (15.3 in) • Depth: 22.9 cm (9.0 in)
Weight	9.1 kg (20.0 lb)	6.12 kg (13.5 lb)	5.08 kg (11.2 lb)	4.0 kg (8.82 lb)	2.84 kg (6.25 lb)

* The IOM4-e, IOM4-e-B, and IOM3-XP-C are permitted for use in 7450 ESS-7 and ESS-12 systems. The new 7450 ESS-system-type BOF option allows a 7750 SR-7-B or SR-12-B chassis to operate as a 7450 ESS-7 or ESS-12 chassis.

Table 2. Nokia 7750 SR-s IOM-s variant and capacity licencing overview

	7750 SR-1s (modular)* Slot capacity licenses (FD)	7750 SR-2s Slot capacity licenses (FD)	7750 SR-7s Slot capacity licenses (FD)	7750 SR-14s Slot capacity licenses (FD)
3.0 Tb/s IOM-s	1.6 Tb/s with IA up to 4.0 Tb/s	1.6 Tb/s with IA up to 4.0 Tb/s	1.6 Tb/s with IA up to 4.0 Tb/s	1.6 Tb/s with IA up to 4.0 Tb/s
	2.4 Tb/s with IA up to 4.0 Tb/s	2.4 Tb/s with IA up to 4.0 Tb/s	2.4 Tb/s with IA up to 4.0 Tb/s	2.4 Tb/s with IA up to 4.0 Tb/s
	3.0 Tb/s with IA up to 4.0 Tb/s	3.0 Tb/s with IA up to 4.0 Tb/s	2.4 Tb/s with IA up to 4.0 Tb/s	2.4 Tb/s with IA up to 4.0 Tb/s
1.5 Tb/s IOM-s	—	800 Gb/s with IA up to 4.0 Tb/s	800 Gb/s with IA up to 4.0 Tb/s	800 Gb/s with IA up to 4.0 Tb/s
	—	1.5 Tb/s with IA up to 4.0 Tb/s	1.5 Tb/s with IA up to 4.0 Tb/s	1.5 Tb/s with IA up to 4.0 Tb/s

* Integrated IOM-s

Table 3. Nokia IOM5-e licencing overview

Type	System	Capabilities	
		Capacity licenses - per slot (FD)	Functional licenses
IOM5-e 400G	SR-7/SR-12 SR-12e	400 Gb/s with IA of 1.2 Tb/s (redundant) 400 Gb/s with IA of 4.0 Tb/s (redundant)	• Core routing • Edge routing • High-scale edge routing
IOM5-e 800G	SR-7/SR-12 SR-12e	800 Gb/s with IA of 1.2 Tb/s (non-redundant) 800 Gb/s with IA of 4.0 Tb/s (redundant)	• Core routing • Edge routing • High-scale edge routing
IOM5-e	SR-7/SR-12 SR-12e	800 Gb/s with IA of 1.2 Tb/s (non-redundant) 1.2 Gb/s with IA of 4.0 Tb/s (redundant) 1.5 Gb/s with IA of 4.0 Tb/s (non-redundant)	• Core routing • Edge routing • High-scale edge routing

Table 4. Nokia 7750 SR and 7450 ESS IOM feature licenses*

Feature license	Description	Notes
L3BQ	Layer 3 Basic Queuing	• Full IPv4/IPv6 routing with 8 ingress/8 egress queues per port • No support for hierarchical policing
L2HQ	Layer 2 High Queuing	• 7450 ESS feature set equivalence with IOM3-XP • Full queuing; policing support for Layer 2 features
L3HQ	Layer 3 High Queuing	• Full queuing and hierarchical policing • Full IPv4/IPv6 routing

* Layer 3 routing and services capabilities supported in mixed mode on the 7450 ESS

Table 5. Nokia 7750 SR and 7450 ESS IOM VPRN feature licenses*

Feature license	Notes
Infrastructure VPRN	Support for up to 8 VPRN instances per IOM licensed with L3BQ or L3HQ
Service VPRN	Support for fully scaled VPRN instances per IOM licensed with L3BQ or L3HQ
MS-ISA2	Requires the purchase of Right to Use (RTU) licenses. Please contact your Nokia sales representative for pricing information on service licenses.

* Layer 3 routing and services capabilities supported in mixed mode on the 7450 ESS

Note: Refer to the 7750 SR and 7450 ESS product and release documentation for system details on dimensions, weights, hardware, safety standards, compliance agency certifications and protocol support.

About Nokia

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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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