Nokia 7750 Service Router and Nokia 7450 Ethernet Service Switch
Integrated Media Modules

Delivering up to 400 Gb/s (full duplex) per-slot performance, Nokia 7750 Service Router (SR) and Nokia 7450 Ethernet Service Switch (ESS) Integrated Media Modules (IMMs) combine high-density Ethernet interfaces with highly scalable IP/MPLS routing and packet processing capabilities to support the full array of IP network functions, services and applications.

Nokia IMMs are designed to enable network operators to stay ahead of evolving service demands driven by the cloud, 5G and the Internet of Things.

Using highly programmable Nokia FP3 network processing (NP) silicon, the IMM forwarding complex performs packet lookups, traffic classification, packet processing and forwarding, service enablement and QoS. Nokia FP3 NP silicon ensures deterministic packet forwarding performance at full bandwidth, even when complex and processing-intensive applications are required.

IMMs are full-slot, hot-swappable modules that also provide the physical termination, specific interface ports, physical media and optical functions over Gigabit Ethernet (GE), 10GE, 40GE and 100GE interfaces. For added flexibility, combination IMM variants provide two interface speeds on the same module. A combination IMM is also available with 10GE or 100GE interfaces plus an embedded Integrated Service Adapter 2 (ISA2) to extend networking functionality and processing capabilities for deeper levels of differentiated services and applications.
Nokia IMMs provide the full complement of Nokia Service Router Operating System (SR OS) capabilities to support the full array of functions, services and applications required for IP networking.

For service providers, they enable advanced residential, mobile and enterprise services. This includes comprehensive support for linear TV, video on demand, internet access, mobile backhaul, enterprise virtual private network (VPN) services internet access, and cloud and data center interconnect services.

For webscale companies, they support data center aggregation, gateway and interconnect, PoP edge, internet peering and backbone router functions.

For enterprises, they provide high-performance Ethernet and IP networking plus cloud, data center and wide area networking applications.

Features and benefits

- Powered by the Nokia FP3 technology, IMMs deliver line rate performance that does not degrade as advanced services and applications are enabled
- Highly programmable FP3 technology enables rapid service adaptation to support emerging technologies, protocols, services and applications
- By distributing routing and processing on a per-slot basis, overall system performance scales linearly with the addition of each IMM to the system
- Flexible, tiered feature licensing allows customers to pay for only the functionality they require, and allows for in-place feature upgrades without changing the IMM hardware
- Advanced H-QoS and enhanced subscriber management for assured service delivery on a per-subscriber and per-service basis
- Line rate access control list (ACL) filtering with configurable ingress/egress ACLs for highly enhanced subscriber management, security and control
- ITU-T Synchronous Ethernet (Sync-E) and IEEE 1588v2 to distribute precision network timing and synchronization
- The combination IMM with embedded ISA2 use subscriber, service and application intelligence to provide up to 40 Gb/s data path connectivity to any chassis port to support value-added services and applications
- 100GE IMM with integrated tunable DWDM optics and configurable wavelengths reach up to 80 km without requiring optical signal amplification and supports up to 1000 km with optical line system, allowing the 7750 SR and 7450 ESS to be interconnected directly to existing DWDM systems
- Support the same client optics density on 10G ports with tunable SFP+ for DWDM applications
- Pluggable optics (including CSFP, SFP, SFP+, XFP, QSFP+, CFP and CFP4) with Digital Diagnostic Monitoring (DDM) for extended OAM support
- Management provided by the Nokia Network Services Platform (NSP)
Technical specifications

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

Table 1. Nokia 7750 SR and 7450 ESS IMMs summary

<table>
<thead>
<tr>
<th>IMM type</th>
<th>Ports</th>
<th>Connector type</th>
<th>Slot throughput (full duplex)</th>
<th>Maximum density 7750 SR/7450 ESS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SR-12e</td>
</tr>
<tr>
<td>10/100/1000BASE</td>
<td>160 or 80</td>
<td>CSFP or SFP</td>
<td>200 Gb/s</td>
<td>1440 or 720</td>
</tr>
<tr>
<td>10/100/1000BASE</td>
<td>48</td>
<td>SFP</td>
<td>50 Gb/s</td>
<td>432</td>
</tr>
<tr>
<td>10GBASE</td>
<td>40</td>
<td>SFP+</td>
<td>400 Gb/s</td>
<td>360</td>
</tr>
<tr>
<td>10GBASE/100/100BASE (combination)</td>
<td>10/20</td>
<td>SFP+/SFP</td>
<td>200 Gb/s</td>
<td>90/180</td>
</tr>
<tr>
<td>10GBASE + 7 x 50 ISA2 (combination)</td>
<td>10</td>
<td>SFP+</td>
<td>200 Gb/s</td>
<td>90</td>
</tr>
<tr>
<td>10GBASE</td>
<td>12, 20</td>
<td>SFP+</td>
<td>120 Gb/s, 200 Gb/s</td>
<td>108, 180</td>
</tr>
<tr>
<td>40BASE</td>
<td>6</td>
<td>QSFP+</td>
<td>200 Gb/s</td>
<td>54</td>
</tr>
<tr>
<td>40BASE/100/100BASE (combination)</td>
<td>3/20</td>
<td>QSFP+/SFP</td>
<td>200 Gb/s</td>
<td>27/180</td>
</tr>
<tr>
<td>100BASE</td>
<td>4</td>
<td>CFP</td>
<td>400 Gb/s</td>
<td>36</td>
</tr>
<tr>
<td>100BASE</td>
<td>4</td>
<td>CXP</td>
<td>400 Gb/s</td>
<td>36</td>
</tr>
<tr>
<td>100BASE</td>
<td>1, 2</td>
<td>CFP</td>
<td>200 Gb/s, 9, 18</td>
<td>10, 20</td>
</tr>
<tr>
<td>100BASE/100BASE (combination)</td>
<td>1/10</td>
<td>CFP/SFP+</td>
<td>200 Gb/s, 9/90</td>
<td>10/100</td>
</tr>
<tr>
<td>100BASE + 7 x 50 ISA2 (combination)</td>
<td>1</td>
<td>CFP</td>
<td>200 Gb/s</td>
<td>9</td>
</tr>
<tr>
<td>100BASE IMM (Integrated DWDM tunable optics)</td>
<td>1</td>
<td>LC</td>
<td>100 Gb/s</td>
<td>9</td>
</tr>
</tbody>
</table>

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

Tables 2 and 3 summarize the IMM feature licenses offered on 7750 SR and 7450 ESS systems. The features supported on an IMM are determined by the feature license purchased with the IMM. Feature licenses for IMMs are offered with tiered levels of functionality for Layer 2 and Layer 3. IMMs with Layer 3 feature licenses can add optional Virtual Private Routed Network (VPRN) licenses that determine IP VPN scaling supported on the IMM. IMM licensing gives customers the flexibility to purchase the license that meets current requirements, with an option for a simple, in-place upgrade to additional features without changing the IMM hardware.

Table 2. Nokia 7750 SR and 7450 ESS IMM feature licenses*

<table>
<thead>
<tr>
<th>Feature license</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>L3BQ</td>
<td>Layer 3 Basic Queuing</td>
<td>• Full IPv4/IPv6 routing with 8 ingress/8 egress queues per port</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No support for hierarchical policing</td>
</tr>
<tr>
<td>L2HQ</td>
<td>Layer 2 High Queuing</td>
<td>• 7450 E SS feature set equivalence with IOM3-XP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Full queuing, policing support for Layer 2 features</td>
</tr>
<tr>
<td>L3HQ</td>
<td>Layer 3 High Queuing</td>
<td>• Full queuing and hierarchical policing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Full IPv4/IPv6 routing</td>
</tr>
</tbody>
</table>

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

- Standard full-slot form factors are common to all variants
  - Height: 3.6 cm (1.4 in)
  - Width: 42.5 cm (16.7 in)
  - Depth: 43.2 cm (17 in)
- 160/80-port GE IMM - CSFP/SFP
  - 7.3 kg (16.1 lb)
- 48-port GE IMM - SFP
  - 6 kg (13.2 lb)
- 40-port 10GE IMM - SFP+
  - 7.2 kg (15.9 lb)
- 10-port 10GE - SFP+ plus 20-port GE - SFP
  - 6.1 kg (13.4 lb)
- 10-port 10GE - SFP+ plus ISA2
  - 7.3 kg (16 lb)
- 20-port 10GE IMM - SFP+
  - 5.8 kg (12.8 lb)
- 12-port 10GE IMM - SFP+
  - 5.8 kg (12.8 lb)
- 6-port 40GE IMM - QSFP+
  - 7.1 kg (15.7 lb)
- 3-port 40GE - QSFP+ plus 20-port GE - SFP
  - 6.2 kg (13.7 lb)
- 4-port 100GE IMM - CFP4
  - 7.2 kg (15.9 lb)
- 4-port 100GE IMM - CXP
  - 7.2 kg (15.9 lb)
- 2-port 100GE IMM - CFP
  - 6.1 kg (13.4 lb)
- 1-port 100GE - CFP plus 10-port 10GE - SFP+
  - 6.3 kg (13.9 lb)
- 1-port 100GE - CFP plus ISA2
  - 7.3 kg (16 lb)
- 1-port 100GE IMM — CFP
  - 6.1 kg (13.4 lb)
- 1-port 100GE IMM — tunable DWDM
  - 6.8 kg (15 lb)

Feature and protocol support highlights

Feature and protocol support in the Nokia 7750 SR includes but is not limited to:

IP and MPLS routing features

- IP unicast routing: Routing Information Protocol (RIP), Intermediate System-to-Intermediate System (IS-IS), Open Shortest Path First (OSPF), Multiprotocol Border Gateway Protocol (MBGP), Unicast Reverse Path Forwarding (uRPF), comprehensive control plane protection features for security, and IPv4 and IPv6 feature parity
- IP multicast routing: Internet Group Management Protocol (IGMP), Multicast Listener Discovery (MLD), Protocol Independent Multicast (PIM), Multicast Source Discovery Protocol (MSDP), and IPv4 and IPv6 feature parity

1 Dimensions and weights are approximate and subject to change. Refer to the appropriate installation guide for the current dimensions and weights.

2 When used in the 7450 ESS, some of these capabilities require the system to be configured in mixed mode.
**Layer 3 features**
- IP-VPN, enhanced internet services, EVPN for Layer 3 services with integrated routing and bridging (EVVPN-IRB), and Multicast VPN (MVPN), which includes Inter-AS MVPN and Next Generation MVPN (NG-MVPN)

**System features**
- Ethernet satellites: Port expansion through local or remote Nokia 7210 Service Access Switch (SAS)-S series GE, 10GE, 100GE and SONET/SDH satellite variants, offering 24/48xGE ports, 64xGE/10GE ports or legacy SONET/SDH ports over GE, 10GE and 100GE uplinks
- OAM: Extensive fault and performance Operations, Administration and Maintenance (OAM) includes Ethernet Connectivity Fault Management (CFM) (IEEE 802.1ag, ITU-T Y.1731), Ethernet in the First Mile (EFM) (IEEE 802.3ah), Bidirectional Forwarding Detection (BFD), Cflowd, Two-Way Active Measurement Protocol (TWAMP), and a full suite of MPLS OAM tools
- Timing: ITU-T Synchronous Ethernet (SyncE), IEEE 1588v2 (PTP), Network Time Protocol (NTP), BITS ports (T1, E1, 2M), and 1PPS
- QoS: Flexible intelligent packet classification; ingress and egress hierarchical QoS with multitiered shaping and two-tiered, class fair hierarchical policing; advanced, scalable network and service QoS, and end-to-end consistent QoS regardless of oversubscription or congestion
- High availability: Nonstop routing, nonstop services, in-service software upgrade (ISSU), fast reroute for IP, RSVP, LDP and segment routing, pseudowire redundancy, ITU-T G.8031 and G.8032, weighted ECMP, and weighted, mixed-speed link aggregation

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3 Requires CPM5, an appropriate chassis mode, and an uplink via an FP2-based IMM/IOM at a minimum for 7750 SR systems and requires CPM5, the chassis set to mixed mode, and an uplink via an FP2-based IMM/IOM at a minimum for 7450 ESS systems

4 Requires redundant 7750 SR and 7450 ESS control processor modules (CPMs)
Management features

- Model-driven network element management through CLI, NETCONF and gRPC/gNMI using YANG models
- Full SNMP management support, including configuration
- Comprehensive network and node management through the Nokia NSP

Refer to the 7750 SR and 7450 ESS data sheets and product documentation for full system details on safety standards, compliance agency certifications and protocol support.