Nokia 7705 Service Aggregation Router
Legacy Interface Cards

As communications networks and applications are rapidly migrating to IP/MPLS and Ethernet infrastructures, many mission-critical and enterprise networks still have operational systems that rely on serial data and analog voice interfaces that must be supported. The higher-speed network interfaces used in PDH and SONET/SDH networks (T1/E1, T3/E3 and OC-n/STM-n) will remain in use for many years as networks transition to packet.

The Nokia 7705 Service Aggregation Router (SAR) supports a broad range of legacy data and voice interfaces, allowing networks to be upgraded to IP/MPLS for advanced services delivery, while maintaining support for existing operational systems.

Features and benefits

- Support for legacy and advanced services is provided over a single network with extensive network and service management capabilities.
- Legacy network interfaces simplify the transition from TDM-based PDH/SONET/SDH network infrastructures to IP/MPLS.
- Legacy voice and serial data interfaces integrated within the 7705 SAR system eliminate the need for a separate T1/E1 channel bank or multiplexer, providing capital and operational cost savings.
- Service interworking with IP, Frame Relay and High Level Data Link Control (HDLC) pseudowires provides flexibility, as well as bandwidth and cost optimization for serial data interfaces.
- Nokia’s patented Asymmetrical Delay Control (ADC) feature is used by electrical utilities to manage packet network asymmetry for proper operation of current differential teleprotection relays.
- The Nokia Network Services Platform (NSP) provides industry-leading network and service management for lower operational costs.
- Service Portal Express enables automatic controlled work order process and comprehensive report generation.

- 16-port T1/E1 ASAP card
- 32-port T1/E1 ASAP card
- 4-port DS3/E3 card
- 2-port OC-3/STM-1 channelized card
- 4-port OC-3/STM-1 clear channel card
- 4-port OC-3/STM-1 – 1-port OC-12/STM-4 card
- 12-port Serial Data Interface (SDI) card
- 8-port C37.94 teleprotection card
- 8-port Voice & Teleprotection (VT) card
- 6-port E&M analog interface card
- 8-port FXO card
- 6-port FXS card
- Integrated Services card
Technical specifications

Legacy network interface cards
Existing services can be transported over a new IP/MPLS network using the 7705 SAR-8/18 legacy network interface cards. Alternatively, these legacy network interface cards can be used to deliver new IP/MPLS services while using an existing PDH/SONET/SDH backbone for transport. They are able to support TDM, ATM, Frame Relay, HDLC, as well as IP services.

16/32-port T1/E1 ASAP cards
The T1/E1 Any Service Any Port (ASAP) cards provide standard T1/E1 ports capable of carrying multiple service types over IP/MPLS, as well as existing TDM networks.

- 16-port or 32-port variants
- DIN-connector access with optional RJ-45 and BNC panels
- Synchronization options – loop, node, adaptive clock recovery (ACR)/Differential clock recovery (DCR)
- -48/+24 V DC
- MPLS pseudowire support:
  - TDM circuit emulation (Cpipe/Epipe)
  - Circuit Emulation Service over Packet-Switched Network (CESoPSN)
  - Structure Agnostic TDM over Packet (SAToP)
  - Metro Ethernet Forum (MEF) 8 to 64 kb/s level
  - Frame Relay (Fpipe)
  - HDLC (Hpipe)
  - IP (Ipipe)
- IP services

4-port DS3/E3 card
The DS3/E3 card provides standard DS3/E3 ports capable of carrying multiple service types over IP/MPLS, as well as existing TDM networks.

- 4 ports
- Configurable DS3 or E3 operation
- Access or network links

SONET/SDH cards
This family of SONET/SDH cards provides TDM, ATM, Packet over SONET (PoS), and PPP/Multi-Link PPP (MLPPP) services

- Configurable SONET or SDH operation
- Small form-factor pluggable (SFP) interface
- Network links with MLPPP (n x DS1/E1)
- Loop or node timing
- -48/+24 V DC
- 2-port OC-3/STM-1 channelized card
  - T1/E1 ATM/Inverse Multiplexing over ATM (IMA) (access)
  - TDM at the T3, T1/E1, 64 kb/s levels
  - PPP/MLPPP
  - Automatic protection switching (APS)/Multi-chassis APS (MC-APS) (TDM)
- 4-port OC-3/STM-1 clear channel card
  - ATM (access)
  - POS (network)
- 4-port OC-3/STM-1 or 1-port OC-12/STM-4 card
  - Configurable as 4-port OC-3/STM-1 or 1-port OC-12/STM-4
  - Channelized to T1/E1 with DCR for access or MLPPP for network applications
  - Clear channel POS for network links
  - APS/MC-APS for TDM services, APS for POS
Legacy serial data and voice interface cards

12-port Serial Data Interface (SDI) cards (SDIv2/v3)

The SDI cards provide 12 serial data ports configurable as RS-232, V.35, X.21 or RS-530/RS-422 interfaces, permitting transport of legacy services over an IP/MPLS network. Cables connect the SDI card to interface-specific panels for connector access. RS-530/RS-422 functionality is only available on the SDIv3 version.

- Typical applications for the SDI card include SCADA (RS-232, X.21), electrical utility teleprotection (RS-232, X.21), serial data encryption network interconnect (RS-232, RS-530) and remote router backhaul (V.35).

- Separate distribution panels/cables for port access:
  - RS-232 – DB-25 connectors
  - V.35 – M34 connectors
  - X.21 – DB-15 connectors
  - RS-530/RS-422 - DB-25 connectors

- Selectable data terminal equipment (DTE)/data circuit-terminating equipment (DCE) operation

- Multiple options for transporting serial data:
  - High Capacity Multiplexing (HCM) for TDM transport of sub-rate data within a 64 kb/s timeslot (CESoPSN)
  - Transparent mode (Tr) for n x 64 kb/s TDM traffic. This can be as standard TDM traffic or an IP/Frame Relay or HDLC pseudowire.
  - Raw Sockets (RS) for transport of async RS-232 data as an IP service.
  - Serial SAToP (SS) – for transport of additional speeds as well as supporting serial DCR (SDIv3 only)

Table 1. SDI interface speeds/transport options

<table>
<thead>
<tr>
<th>Speed (kb/s)</th>
<th>RS-232</th>
<th>V.35</th>
<th>X.21</th>
<th>RS-530 (SDIv3 only)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sync</td>
<td>Async</td>
<td>Sync</td>
<td>Sync</td>
</tr>
<tr>
<td>0.6</td>
<td>HCM, SS</td>
<td>HCM, RS</td>
<td></td>
<td>Sync</td>
</tr>
<tr>
<td>1.2</td>
<td>HCM, SS</td>
<td>HCM, RS</td>
<td></td>
<td>HCM, HCM</td>
</tr>
<tr>
<td>2.4</td>
<td>HCM, SS</td>
<td>HCM, RS</td>
<td></td>
<td>SSC</td>
</tr>
<tr>
<td>4.8</td>
<td>HCM, SS</td>
<td>HCM, RS</td>
<td></td>
<td>SSC</td>
</tr>
<tr>
<td>9.6</td>
<td>HCM, SS</td>
<td>HCM, RS</td>
<td></td>
<td>SSC</td>
</tr>
<tr>
<td>16</td>
<td>HCM, SS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.2</td>
<td>HCM, SS</td>
<td>HCM, RS</td>
<td></td>
<td>SSC, HCM</td>
</tr>
<tr>
<td>38.4</td>
<td>HCM, SS</td>
<td>HCM, RS</td>
<td></td>
<td>SSC, HCM</td>
</tr>
<tr>
<td>56</td>
<td>HCM, SS</td>
<td></td>
<td></td>
<td>SSC</td>
</tr>
<tr>
<td>57.6</td>
<td></td>
<td>RS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Tr, SS</td>
<td>Tr</td>
<td>Tr</td>
<td>SSC</td>
</tr>
<tr>
<td>115.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>128 – 1920 kb/s in increments of 128 kb/s</td>
<td>Tr</td>
<td>Tr</td>
<td></td>
<td>SSC</td>
</tr>
<tr>
<td>2048 (SDIv3 only)</td>
<td>Tr</td>
<td>Tr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2048 – 16384 kb/s in increments of 1024 kb/s</td>
<td></td>
<td></td>
<td></td>
<td>SSC</td>
</tr>
</tbody>
</table>
• MPLS pseudowire support:
  - CESoPSN/SAToP (Cpipe)
  - Frame Relay (Fpipe) – V.35, X.21, RS-530/RS-422 n x 64 kb/s only
  - HDLC (Hpipe) – V.35, X.21, RS-530/RS-422 n x 64 kb/s only
  - IP (Ipipe) – V.35, X.21, RS-530/RS-422 n x 64 kb/s only
• Multiple timing/synchronization options:
  - Asynchronous
  - Synchronous
  - Slave
  - External
  - Terminal Timing (SDlv3 only)
  - Serial DCR to provide serial timing across MPLS networks (SDlv3 only)
• RS-232, X.21 and RS-530/RS-422 MDDB SCADA support using the 7705 Integrated Services Card
• -48 V DC/+24 V DC

6-port E&M card
The E&M card provides six analog interfaces that are used to deliver capabilities, such as SCADA, tone-based teleprotection, and Land Mobile Radio (LMR) base station backhaul. The E&M card utilizes CESoPSN TDM pseudowires (Cpipes) for transport across the IP/MPLS network.
• Six ports
• 2-wire or 4-wire operation
• 600Ω impedance
• Selectable μ-law or A-law companding for worldwide use
• E&M signaling Type I, Type II, and Type V supported
• ABCD signaling bit support: Option for no signaling for transmission-only applications
• Multiple multi-frame option minimizes network bandwidth utilization
• Designed for short reach, on-premise use (200Ω maximum loop length)
• RJ-45 connector access on faceplate
• PCM multi-drop SCADA and voice conference bridging support using the Integrated Services Card
• -48 V DC

8-port C37.94 teleprotection card
The 8-port C37.94 teleprotection card provides up to eight multimode or singlemode optical interfaces to connect TDM teleprotection relays across an electrical utility’s IP/MPLS network using CESoPSN TDM pseudowires (Cpipes).
• Compliant with IEEE C37.94-2017
• N x 64 kb/s optical interface
• 50/62.5 micron multimode fiber
• LC optical connectors (ST connectors via adapter cable)
• Low-latency for teleprotection applications
• -48/+24 V DC
Distance:
• Short reach: 2 km (9/13 dB link budget)
• Long reach: 20 km (13 dB link budget)

8-port Voice and Teleprotection (VT) card
The VT card is a multipurpose device with a number of interfaces for applications that require analog voice and specific digital interfaces needed for electrical utility teleprotection applications. All interfaces utilize CESoPSN TDM pseudowires for transport across the MPLS network. The physical interfaces are:
• 2-port Foreign eXchange – Subscriber (FXS) for connection to telephone sets
• 2-port Foreign eXchange – Office (FXO) for connection to the central office/PBX
• 2-port ITU-T G.703 co-directional 64 kb/s digital interface for teleprotection relay interconnect
• 2-port IEEE C37.94 Optical Teleprotection Interface (TPIF)
• -48/+24 V DC
FXS/FXO features:
• 600Ω impedance
• Selectable μ-law or A-law companding for worldwide use
• Loop Start (LS) signaling for Off-Premises eXtension (OPX) applications and Private Line Automatic Ringdown (PLAR) signaling (FXS-only) for direct site-to-site hot-line options
• On-card ringing support with multiple frequency options (FXS)
• ITU-T G.712 transmission performance
• Programmable Transmission Level Points (TLPs)
• Designed for short-reach, on-premise use (200Ω maximum loop length)
• RJ-45 connector access (two FXS or FXO ports/connector)

G.703 co-directional features:
• Single 64-kb/s channel over G.703 bi-polar encoded signal
• 4-wire physical interface
• Low-latency capability for teleprotection applications
• RJ-45 connector access

C37.94 Optical TPIF features:
• Compliant with IEEE C37.94
• n x 64 kb/s optical interface
• 50/62.5 micron multimode fiber
• 2-km reach (9/13 dB link budget)
• ST optical connectors
• Low-latency for teleprotection applications

8-port FXO card
The FXO card provides eight FXO interfaces for high-density connection to a central PBX/switch. The FXO card utilizes CESoPSN TDM pseudowires (Cpipes) for transport across the IP/MPLS network.

• 600Ω impedance
• Selectable μ-law or A-law companding for worldwide use
• LS signaling
• ITU-T G.712 transmission performance
• Programmable TLPs

• Designed for short-reach, on-premise use (200Ω maximum loop length)
• RJ-45 connector access (two FXS ports/connector)
• -48/+24 V DC

6-port FXS card
The FXS card provides six FXS interfaces for high-density connection to remote telephone sets (OPX). The FXS card utilizes CESoPSN TDM pseudowires (Cpipes) for transport across the IP/MPLS network.

• 600Ω impedance
• Selectable μ-law or A-law companding for worldwide use
• LS and PLAR signaling
• ITU-T G.712 transmission performance
• Programmable TLPs
• Designed for short-reach, on-premise use (200Ω maximum loop length)
• RJ-45 connector access (two FXS ports/connector)
• -48/+24 V DC

Integrated Services Card (ISC)
The ISC card allows legacy TDM SCADA applications to be carried over an IP/MPLS network, deferring the need to upgrade the application to IP. The ISC provides the ability for the SCADA master to broadcast to multiple remote terminal units (RTUs) and only receive data from an active RTU. Support for redundant SCADA masters is provided (manual and automatic switchover).

Applications supported on the ISC are:
• MDDB. MDDB allows a central SCADA master to communicate with multiple RTUs using RS-232 serial links.
• PCM multidrop bridging. PCM bridging is the same as MDDB except the RTUs use 4-wire E&M analog modems at the RTUs.
**Physical specifications (all cards)**

The legacy interface cards can be inserted into any one of the six adapter card slots in the 7705 SAR-8, or in any one of the twelve adapter card slots on the right-hand side of the 7705 SAR-18.

### Ordering information

<table>
<thead>
<tr>
<th>Part number</th>
<th>Part name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3HE02775AB</td>
<td>16-port T1/E1 ASAP card v2</td>
<td>16 T1 or E1 ports capable of providing TDM, IP, ATM, Frame Relay and HDLC transport</td>
</tr>
<tr>
<td>3HE02781AA</td>
<td>32-port T1/E1 ASAP card</td>
<td>32 T1 or E1 ports capable of providing TDM, IP, ATM, Frame Relay and HDLC transport</td>
</tr>
<tr>
<td>3HE04962AA</td>
<td>4-port DS3/E3 card</td>
<td>Four-port DS3 or E3</td>
</tr>
<tr>
<td>3HE07938AA</td>
<td>4-port OC-3/STM-1 1-port OC-12/STM-4 card</td>
<td>Four OC-3/STM-1 or one OC-12/STM-4 ports</td>
</tr>
<tr>
<td>3HE03125AA</td>
<td>4-port OC-3/STM-1 card</td>
<td>Four OC-3/STM-1 selectable ports capable of providing packet over SONET/SDH (PoS) network link or ATM access</td>
</tr>
<tr>
<td>3HE03127AA</td>
<td>2-port OC-3/STM-1 channelized card</td>
<td>Two OC-3/STM-1 selectable ports providing TDM transport channelized to the 64 kb/s level</td>
</tr>
<tr>
<td>3HE03391AB</td>
<td>12-port Serial Data Interface v2 (SDIv2) card</td>
<td>12 serial ports can be configured as RS-232, V.35 and X.21 interfaces for TDM, FR, HDLC and IP (TDM-only for RS-232)</td>
</tr>
<tr>
<td>3HE03391AC</td>
<td>12-port Serial Data Interface v3 (SDIv3) card</td>
<td>12 serial ports can be configured as RS-232, V.35, X.21, and RS-422/RS-530 interfaces for TDM, FR, HDLC and IP (TDM-only for RS-232) with additional speeds, synchronization functionality, and maintenance capability</td>
</tr>
<tr>
<td>3HE03126AA</td>
<td>6-port E&amp;M card</td>
<td>Six analog interfaces used to deliver capabilities such as SCADA, tone-based teleprotection, Land Mobile Radio (LMR) base-station backhaul</td>
</tr>
<tr>
<td>3HE12504AA</td>
<td>8-port C37.94 teleprotection card</td>
<td>Eight C37.94-compliant SMF or MMF LC SFP ports for electrical utility teleprotection applications</td>
</tr>
<tr>
<td>3HE06006AA</td>
<td>8-port Voice and Teleprotection (VT) card</td>
<td>A multipurpose device with a number of interfaces for applications that require analog voice and specific digital interfaces needed for electrical utility teleprotection applications</td>
</tr>
<tr>
<td>3HE06794AA</td>
<td>8-port FXO card</td>
<td>Eight analog FXO interfaces to a central PBX</td>
</tr>
<tr>
<td>3HE02780AA</td>
<td>6-port FXS card</td>
<td>Six analog FXS subscriber interfaces from local telephone set</td>
</tr>
<tr>
<td>3HE07942AA</td>
<td>Integrated Services Card</td>
<td>Application resource card providing serial Multi-Drop Data Bridging (MDDB), analog PCM multidrop and voice conference bridging capabilities</td>
</tr>
</tbody>
</table>

### Dimensions and weight

- Height: 2.24 cm (0.9 in)
- Width: 17.0 cm (6.7 in)
- Depth: 22.0 cm (8.7 in)
- Weight: 0.38 kg (0.86 lb)

### Temperature range

- Operating temperature: -40°C to 65°C (-40°F to 149°F)