NORTEL NETWORKS

Nortel Networks Multiservice Switch

7400/15000/20000

FP Configuration Reference

NN10600-551

Nortel Networks Multiservice Switch 7400/15000/20000

FP Configuration Reference

Publication: NN10600-551
Document status: Standard
Document version: 6.1S2
Document date: November 2004

Printed in Canada

Publication history

November 2004

6.1S2 Standard
General availability. Contains information on Nortel Networks Multiservice Switch 7400, 15000, and 20000 for the PCR6.1 release.

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About this document

This document contains reference information for all Nortel Networks Multiservice Switch function processors (FP). For each FP, the document provides a description of its functionality, configuration parameters, supported applications and services, and OSI states. To use this guide effectively, see the following sections:

- "Who should read this document and why" (page 27)
- "How this document is organized" (page 27)
- "What's new in this document" (page 28)
- "Text conventions" (page 36)
- "Related documents" (page 38)
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Who should read this document and why

This document is intended for anyone who is responsible for provisioning and testing function processors (FP).

What you need to know

Users should be familiar with the procedures to configure (provision) Nortel Networks Multiservice Switch software.

How this document is organized

This document contains reference information for all Nortel Networks Multiservice Switch FPs. Specific information includes the values you need to configure an FP, such as the port type, the number of ports, and the number of channels (if applicable). These sections also specify the types of port tests supported by that FP, provisionable components and attributes, and OSI state information.

What's new in this document

The following features were added to this document:

- "4-port multi-rate (MR) POS and ATM FP" (page 31)
- "4-port 10/100BaseT Ethernet FP" (page 32)
- "5 and 30 Minute Performance Measurements" (page 32)
- "8-port 10/100BaseT Ethernet FP" (page 32)
- "32-port DS1 and E1 MSA 1-slot FPs" (page 33)
- "Annex B support on 16-port OC-3/STM-1 POS and ATM FP" (page 33)
- "Differentiated services (DiffServ) support on 4-port gigabit Ethernet and 16-port OC-3/STM-1 POS and ATM FP" (page 33)
- "Ethernet virtual line service (EVLS)" (page 33)
- "GQM-based card network processing unit (NPU) service bundles" (page 34)
- "Link aggregation (LAG) on a 4-port gigabit Ethernet FP" (page 34)
- "PNNI local and global rerouting" (page 34)
- "Port tests for optical FP ports configured with LAPS" (page 34)
- "PORS support on 16-port OC-3/STM-1 POS ATM FP" (page 35)
- "PVG 4pGe carrier grade integration" (page 35)
- "RFC2547 support on 4-port gigabit Ethernet, 4-port 10/100 BaseT Ethernet, and 8-port 10/100 BaseT Ethernet FPs" (page 35)
- "RFC2547 support on 16-port OC-3/STM-1 POS and ATM FP" (page 35)
- "T.38 Fax & DTMF Interworking with H.323" (page 35)
- "VIPR on 4-port gigabit Ethernet, 4-port 10/100 BaseT Ethernet, and 8-port 10/100 BaseT Ethernet FPs" (page 35)
- "VIPR on 16-port OC-3/STM-1 POS and ATM FP" (page 36)

- “Virtual media inter-VR hardware connectivity” (page 36)
- “Voice services processor 3 with optical TDM interface (2pOc3ChSmIrVsp3)” (page 36)

Other changes made to this document include the following:

- The terms Passport and PVG have been rebranded in conjunction with the new Nortel Networks’ brand simplified naming format. Passport is now referred to as the Nortel Networks Multiservice Switch, and PVG is now Media Gateway 7480/15000. For more information on the product rebranding, refer to NN10600-000 *Nortel Networks Multiservice Switch 7400/15000/20000 What’s New in PCR6.1*.
- for CR Q00904657, added limitations of configuring ATMIFs for a 2pSTM1eCh FP in “2-port STM-1 electrical channelized CES/ATM/IMA configuration considerations” (page 374)
- extensively changed “Applications and services supported by function processors” (page 39) to correct information
- indicated by a cross-reference where to find SFP optical module information in these sections:
  - “4-port gigabit Ethernet configuration considerations” (page 222)
  - “16-port OC-3/STM-1 POS and ATM configuration considerations” (page 299)
  - “4-port MR POS and ATM configuration considerations” (page 330)
- added supported protocols to table “16-port OC-3/STM-1 ATM configuration parameters” (page 295)
- updated or added the FCC, Industry Canada, and JATE standards to all FPs in “DS1 FP compliance with standards” (page 92), and added TS026 to “OC-3 compliance with standards on a 32-port DS1 MSA FP” (page 97)
- updated table “Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 ATM-based FPs” (page 46) to reflect 16-port OC-3/STM-1 ATM FP support for RFC2547: IP interface of Router, LDP-DU LSR (P node), and LDP-DU LER (PE node)

- added the different ranges of card slot numbers per type of Multiservice Switch in the tables:
  - "32-port DS1 MSA configuration parameters" (page 84)
  - "32-port E1 MSA configuration parameters" (page 178)
- updated or added the CTR and TS016 standards to all FPs in "E1 FP compliance with standards" (page 186) and added TS026 to "STM-1 compliance with standards on an E1 MSA32 FP" (page 191)
- added the recommended maximum quantities of FPs that can be installed in a Multiservice Switch shelf assembly in:
  - "3-port DS3 ATM configuration considerations" (page 110)
  - "3-port E3 ATM configuration considerations" (page 199)
  - "2-port OC-3/STM-1 ATM IP configuration considerations" (page 275)
  - "3-port OC-3/STM-1 ATM configuration considerations" (page 279)
  - "2-port STM-1 electrical ATM IP configuration considerations" (page 371)
  - "2-port STM-1 electrical channelized CES/ATM/IMA configuration considerations" (page 374)
- corrected the range of channel numbers for all 24-channel DS1 FPs in "DS1 function processors" (page 57) from "0 to 23" to "0 to 23 or 1 to 24"
- corrected the range of channel numbers for all 31-channel E1 FPs in "E1 function processors" (page 151) from "0 to 30" to "0 to 30 or 1 to 31"
- added the considerations of configuring a 2-slot FP to:
  - "2-port STM-1 electrical ATM IP configuration considerations" (page 371)
  - "2-port STM-1 electrical channelized CES/ATM/IMA configuration considerations" (page 374)

- for the 4pGe FP (NTHW49), added the behavior of link aggregation (LAG) and VR static routes when a port of the FP is removed from service in "4-port gigabit Ethernet characteristics" (page 223)
- for the 16pOC3PosAtm FP (NTHW44), added the maximum value of VPTs to "16-port OC-3/STM-1 ATM configuration considerations" (page 294)
- for the NTHW44 FP, corrected the capacity of processor memory to 512 Mbytes in the table "16-port OC-3/STM-1 POS and ATM specifications" (page 306)
- for the NTNQ91 FP (2pSTM1eCh), added the impact of mismatched FPGAs to "2-port STM-1 electrical channelized CES/ATM/IMA configuration considerations" (page 374)
- removed all mention of the 1-port OC-48/STM-16 POS FP with PEC NTHW39 and card type 1pOC48SmIrPos since it is service discontinued (SDed)
- removed references to flat VR from section "PQC1-based FPs" (page 55) and the following tables:
  - "Applications/services supported by Multiservice Switch Frame-based FPs" (page 41)
  - "Applications/services supported by Multiservice Switch 7400 ATM-based and MSA32 FPs" (page 43)
  - "Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 ATM-based FPs" (page 46)
  - "Applications/services supported by Multiservice Switch Ethernet FPs" (page 49)
- alphabetized the sequence of chapters according to FP type

4-port multi-rate (MR) POS and ATM FP

The following tables and sections were either added or updated for this feature:

- "Multiservice Switch OC-12/STM-4 FPs" (page 325)
- "Common OC-12/STM-4 ATM FPs configuration considerations" (page 326)

- “4-port MR POS and ATM FP” (page 330)
- “Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 ATM-based FPs” (page 46)
- “OC-12/STM-4 FP standards compliance” (page 348)

4-port 10/100BaseT Ethernet FP

The 4-port 10/100BaseT Ethernet FP with PEC NTNQ95 and software name 4pEth100BaseT is introduced for any Multiservice Switch 7400, including the Multiservice Switch 7460.

The following sections were either added or updated for this feature:

- “Applications/services supported by Multiservice Switch Ethernet FPs” (page 49)
- “4-port 10/100 BaseT Ethernet FP” (page 217)
- “Ethernet FP OSI states” (page 242)
- “Ethernet FP standards compliance” (page 245)

5 and 30 Minute Performance Measurements

The following sections were updated for this feature:

- “VSP3 characteristics” (page 418)
- “VSP3-o characteristics” (page 422)

8-port 10/100BaseT Ethernet FP

The 8-port 10/100BaseT Ethernet FP with PEC NTNQ92 and software name 8pEth100BaseT is introduced for any Multiservice Switch 7440 switch, including the Multiservice Switch 7460.

The following sections were either added or updated for this feature:

- “Applications/services supported by Multiservice Switch Ethernet FPs” (page 49)
- “8-port 10/100BaseT Ethernet FP” (page 237)
- “Ethernet FP OSI states” (page 242)
- “Ethernet FP standards compliance” (page 245)

32-port DS1 and E1 MSA 1-slot FPs

Nortel Networks Multiservice Switch 7400 series introduces the 32-port DS1 MSA 1-slot function processors (FPs) with PEC NTNQ94 and the 32-port E1 MSA 1-slot FPs with PEC NTNQ93. This document is changed by:

- added the distinctions of the DS1 FP to "DS1 function processors" (page 57)
- added the distinctions of the E1 FP to "E1 function processors" (page 151)

There is no change to the table "Applications/services supported by Multiservice Switch 7400 ATM-based and MSA32 FPs" (page 43).

Annex B support on 16-port OC-3/STM-1 POS and ATM FP

The following sections were updated for this feature:

- "16-port OC-3/STM-1 POS and ATM characteristics" (page 302)
- "16-port OC-3/STM-1 POS and ATM configuration parameters" (page 301)
- "16-port OC-3/STM-1 POS and ATM FP compliance with standards" (page 323)

Differentiated services (DiffServ) support on 4-port gigabit Ethernet and 16-port OC-3/STM-1 POS and ATM FP

The following sections were updated for this feature:

- "4-port gigabit Ethernet characteristics" (page 223)
- "16-port OC-3/STM-1 POS and ATM characteristics" (page 302)

Ethernet virtual line service (EVLS)

The following table and section were updated for this feature:

- "Applications/services supported by Multiservice Switch Ethernet FPs" (page 49)
- "4-port gigabit Ethernet FP" (page 221)

GQM-based card network processing unit (NPU) service bundles

The following sections were updated for this feature:

- the section “16-port OC-3/STM-1 POS and ATM migration considerations” (page 309)
- the section “16-port OC-3/STM-1 POS and ATM NPU service bundles” (page 309)

Link aggregation (LAG) on a 4-port gigabit Ethernet FP

The following sections were updated for this feature:

- “Applications/services supported by Multiservice Switch Ethernet FPs” (page 49)
- “4-port gigabit Ethernet characteristics” (page 223)

PNNI local and global rerouting

The following section was updated for this feature:

- “16-port OC-3/STM-1 ATM characteristics” (page 295)

Port tests for optical FP ports configured with LAPS

You can run port tests on specific optical FPs that support being configured with line automatic protection switching (LAPS). The following sections are updated:

- “4-port OC-3/STM-1 ATM characteristics” (page 284)
- “16-port OC-3/STM-1 ATM characteristics” (page 295)
- “4-port OC-12/STM-4 ATM characteristics” (page 340)
- “4-port OC-3/STM-1 ATM FP compliance with standards” (page 318)
- “16-port OC-3/STM-1 ATM (with MT-RJ connectors) FP compliance with standards” (page 320)
- “16-port OC-3/STM-1 ATM (with LC connectors) FP compliance with standards” (page 321)
- “4-port OC-12/STM-4 ATM FP compliance with standards” (page 349)

PORS support on 16-port OC-3/STM-1 POS ATM FP

The following table and section were updated for this feature:

- “Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 ATM-based FPs” (page 46)
- “16-port OC-3/STM-1 POS and ATM characteristics” (page 302)

PVG 4pGe carrier grade integration

The following sections were updated for this feature:

- “Applications/services supported by Multiservice Switch Ethernet FPs” (page 49)
- “4-port gigabit Ethernet characteristics” (page 223)

RFC2547 support on 4-port gigabit Ethernet, 4-port 10/100 BaseT Ethernet, and 8-port 10/100 BaseT Ethernet FPs

The following table was updated for this feature:

- “Applications/services supported by Multiservice Switch Ethernet FPs” (page 49)

RFC2547 support on 16-port OC-3/STM-1 POS and ATM FP

The following table and section were updated for this feature:

- “Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 ATM-based FPs” (page 46)
- “16-port OC-3/STM-1 POS and ATM characteristics” (page 302)

T.38 Fax & DTMF Interworking with H.323

The following section was updated for this feature:

- “VSP3-o characteristics” (page 422)

VIPR on 4-port gigabit Ethernet, 4-port 10/100 BaseT Ethernet, and 8-port 10/100 BaseT Ethernet FPs

The following table was updated for this feature:

- “Applications/services supported by Multiservice Switch Ethernet FPs” (page 49)

VIPR on 16-port OC-3/STM-1 POS and ATM FP

The following table and section were updated for this feature:

- "Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 ATM-based FPs" (page 46)
- "16-port OC-3/STM-1 POS and ATM characteristics" (page 302)

Virtual media inter-VR hardware connectivity

The following section was updated:

- "Applications and services supported by function processors" (page 39)

Voice services processor 3 with optical TDM interface (2pOc3ChSmIrVsp3)

The following sections were updated for this feature:

- "Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 voice services and CES FPs" (page 54)
- "VSP3-o configuration considerations" (page 421)
- "VSP3-o characteristics" (page 422)
- "VSP3-o support of text telephony terminals" (page 426)
- "VSP3-o specifications" (page 426)
- "VSP3-o compliance with standards" (page 431)

Text conventions

This document uses the following text conventions:

- `nonproportional spaced plain type`

  Nonproportional spaced plain type represents system generated text or text that appears on your screen.

- **`nonproportional spaced bold type`**

  Nonproportional spaced bold type represents words that you should type or that you should select on the screen.

- *italics*

  Statements that appear in italics in a procedure explain the results of a particular step and appear immediately following the step.

  Words that appear in italics in text are for naming.

- `[optional_parameter]`

  Words in square brackets represent optional parameters. The command can be entered with or without the words in the square brackets.

- `<general_term>`

  Words in angle brackets represent variables which are to be replaced with specific values.

- UPPERCASE, lowercase

  Nortel Networks Multiservice Switch system commands are not case-sensitive and do not have to match commands and parameters exactly as shown in this document, with the exception of string options values (for example, file and directory names) and string attribute values.

- |

  This symbol separates items from which you may select one; for example, ON|OFF indicates that you may specify ON or OFF. If you do not make a choice, a default ON is assumed.

- ...

  Three dots in a command indicate that the parameter may be repeated more than once in succession.

The term absolute pathname refers to the full specification of a path starting from the root directory. Absolute pathnames always begin with the slash (/) symbol. A relative pathname takes the current directory as its starting point, and starts with any alphanumeric character (other than /).

Related documents

For information about types of function processors and configuring software components and attributes, see the following information sources.

- NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description*
- NN10600-120 *Nortel Networks Multiservice Switch 15000/20000 Hardware Description*
- NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*
- NN10600-050 *Nortel Networks Multiservice Switch 7400/15000/20000 Command Reference*
- NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*

How to get more help

For information on training, problem reporting, and technical support, see the “Nortel Networks support services” section in NN10600-030 *Nortel Networks Multiservice Switch 7400/15000/20000 Overview*.

Chapter 1
Applications and services supported by function processors

The following tables depict the applications and services supported by each FP. An “X” indicates that a service (listed by row) is supported on a function processor (displayed in columns). However, not all applications and services may operate concurrently on an FP.

> ***Note:*** An application is defined as a generic type, such as frame relay (FR). Each application is composed of individual services, such as FR UNI, and FR NNI in the case of frame relay.

- “Applications/services supported by Multiservice Switch Frame-based FPs” (page 41)
- “Applications/services supported by Multiservice Switch 7400 ATM-based and MSA32 FPs” (page 43)
- “Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 ATM-based FPs” (page 46)
- “Applications/services supported by Multiservice Switch Ethernet FPs” (page 49)
- “Applications/services supported by Multiservice Switch 7400 voice services and CES FPs” (page 52)
- “Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 voice services and CES FPs” (page 54)

Some table column headings use MSS in place of Multiservice Switch to accommodate readability. The term “MSS” is not an official abbreviation.

Table 1
Applications/services supported by Multiservice Switch Frame-based FPs

Applications/Services	Multiservice Switch 7400														MSS 15000 or 20000		
	SBIC/PM2 based FPs												PQC		PQC		
X = supported	8-port V.11	8-port V.35	1-port HSSI	4-port DS1	4-port DS1Ch	8-port DS1	4-port E1	4-port E1Ch	4-port E1Ch FR-ISDN	1-port DS3	1-port DS3Ch	1-port E3	32-port DS1 MSA	32-port E1 MSA	4-port DS3 Ch FR PQC2	4-port DS3 Ch FR PQC12	1-port STM1 Ch FR
Frame Relay																	
FR UNI	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FR NNI	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FR-ATM (FRF.5, FRF.8)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FR Trace	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FR ISDN									X				X	X			
Transparent Data Services																	
HTDS	X	X	X	X		X	X			X		X	X	X			
BTDS	X	X		X		X	X										
Core Networking																	
DPRS trunks	X	X	X	X		X	X			X		X	X	X			
PORS trunks	X	X	X	X		X	X			X		X	X	X			
PORS Routing Gateway													X	X			
DPN Gateway over UTP	X	X		X		X	X										
DPN Gateway over FR	X	X		X			X										
MCS Manager (for FRF.5)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(Sheet 1 of 2)																	

Table 1 (continued)
Applications/services supported by Multiservice Switch Frame-based FPs

Applications/Services	Multiservice Switch 7400														MSS 15000 or 20000		
	SBIC/PM2 based FPs												PQC		PQC		
X = supported	8-port V.11	8-port V.35	1-port HSSI	4-port DS1	4-port DS1Ch	8-port DS1	4-port E1	4-port E1Ch	4-port E1Ch FR-ISDN	1-port DS3	1-port DS3Ch	1-port E3	32-port DS1 MSA	32-port E1 MSA	4-port DS3 Ch FR PQC2	4-port DS3 Ch FR PQC12	1-port STM1 Ch FR
MPANL																	
Dedicated mode	X	X		X	X	X	X	X									
Tunnelled mode	X	X		X	X	X	X	X									
ISDN access					X			X									
IP interface of VR (for VIPR or RFC2764)																	
IP over FR with Virtual Framer	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
IP over FR with DirectConnect													X	X	X	X	X
IP over FR with IP optimized DLCI													X	X	X	X	X
IP over PPP	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
IP interface of VRF (for RFC2547)																	
IP over FR with IP optimized DLCI													X	X	X	X	X
IP over PPP													X	X	X	X	X

Note: This table does not apply to any PM1-based FPs or PQC1-based FPs. PM1-based FPs are not supported in software versions PCR5.2 and up. See “PQC1-based FPs” (page 55).

(Sheet 2 of 2)

Table 2
Applications/services supported by Multiservice Switch 7400 ATM-based and MSA32 FPs

Applications/Services	CQC-based ATM FPs						PQC-based ATM-IP FPs						
X = supported	2-port JT2 ATM	8-port DS1 ATM	8-port E1 ATM	3-port DS3 ATM	3-port E3 ATM	3-port OC3/STM1 ATM	3-port DS3 ATM IP	3-port E3 ATM IP	2-port OC3/STM1 ATM IP	2-port STM1e ATM IP	2-port STM1e Ch CES/ATM/IMA	32-port DS1 MSA	32-port E1 MSA
ATM													
ATM bearer service	X	X	X	X	X	X	X	X	X	X	X	X	X
ATM networking (UNI, PNNI, IISP, AINI)	X	X	X	X	X	X	X	X	X	X	X	X	X
ATM termination of FR-ATM	X	X	X	X	X	X	X	X	X			X	X
IMA		X	X								X	X	X
Core Networking													
DPRS trunks	X	X	X	X	X	X	X	X	X	X		X	X
PORS trunks	X	X	X	X	X	X	X	X	X	X		X	X
PORS Routing Gateway							X	X	X	X		X	X
DPN Gateway													
MCS Manager (for FRF.5)	X	X	X	X	X	X	X	X	X	X		X	X
IP over ATM (AtmMpe): IP interface of:													
VR (VIPR)		X*	X*	X*	X*	X*	X	X	X	X		X	X
cVR (RFC2764 access)		X*	X*	X*	X*	X*	X	X	X	X		X	X
VCG (RFC2764 trunking)							X	X	X	X		X	X
VRF (RFC2547 access)							X	X	X	X		X	X
Router (RFC2547 trunking)							X	X	X	X		X	X
(Sheet 1 of 3)													

Table 2 (continued)
Applications/services supported by Multiservice Switch 7400 ATM-based and MSA32 FPs

Applications/Services	CQC-based ATM FPs						PQC-based ATM-IP FPs						
X = supported	2-port JT2 ATM	8-port DS1 ATM	8-port E1 ATM	3-port DS3 ATM	3-port E3 ATM	3-port OC3/STM1 ATM	3-port DS3 ATM IP	3-port E3 ATM IP	2-port OC3/STM1 ATM IP	2-port STM1e ATM IP	2-port STM1e Ch CES/ATM/IMA	32-port DS1 MSA	32-port E1 MSA
IP over ATM over IMA: IP interface of:													
VR (VIPR) or cVR (RFC2764)		X*	X*									X	X
VCG (RFC2764)												X	X
VRF or Router (RFC2547)												X	X
MPLS RFC2547 (Router model)													
LDP-DU LSR (P node)													
LDP-DU LER (PE node)							X	X	X	X		X	X
IP over MPLS (Router model)**													
RSVP-TE LSR													
RSVP-TE LER													
Virtual media													
(Sheet 2 of 3)													

Table 2 (continued)
Applications/services supported by Multiservice Switch 7400 ATM-based and MSA32 FPs

Applications/Services	CQC-based ATM FPs						PQC-based ATM-IP FPs						
X = supported	**2-port JT2 ATM**	**8-port DS1 ATM**	**8-port E1 ATM**	**3-port DS3 ATM**	**3-port E3 ATM**	**3-port OC3/STM1 ATM**	**3-port DS3 ATM IP**	**3-port E3 ATM IP**	**2-port OC3/STM1 ATM IP**	**2-port STM1e ATM IP**	**2-port STM1e Ch CES/ATM/IMA**	**32-port DS1 MSA**	**32-port E1 MSA**
Inter-VR HW connectivity ***							X	X	X	X	X	X	X

* IP is supported on CQC-based FPs only if used with an ILS forwarder card.

** MPLS services on the VR Model are not supported in PCR5.2 and up.

*** Inter-VR hardware connectivity is only available on Media Gateway VSP2 (on Multiservice Switch 15000) and VSP3-o cards. Only traffic to or from these VSP cards is provisioned on the InterVR link.

Note: This table does not apply to any 8 Mbyte CQC-based FPs or PQC1-based FPs. 8 Mbyte CQC-based FPs are not supported in PCR4.1 and up. See "PQC1-based FPs" (page 55).

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Table 3
Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 ATM-based FPs

Applications/Services	Electrical			Optical									
X = supported	4-port DS3 Ch ATM/IMA	12-port DS3 ATM	12-port E3 ATM	4-port OC3/STM1 ATM (PQC2)	4-port OC3/STM1 ATM (PQC12)	16-port OC3/STM1 ATM (PQC2)	16-port OC3/STM1 POS and ATM *	1-port OC12/STM4 ATM	4-port OC12/STM4 ATM (PQC2)	4-port OC12/STM4 ATM (PQC12)	4-port MR POS and ATM (GQM)	1-port OC48/STM16 ATM	1-port OC48/STM16 POS
ATM													
ATM bearer service	X	X	X	X	X	X	X	X	X	X	X	X	
ATM networking (UNI, PNNI, IISP, AINI)	X	X	X	X	X	X	X	X	X	X	X	X	
ATM termination of FR-ATM	X	X	X	X	X	X		X	X	X		X	
IMA	X												
Core Networking													
DPRS trunks		X	X	X	X	X	X	X	X	X	X	X	
PORS trunks		X	X	X	X	X	X	X	X	X	X	X	
PORS Routing Gateway		X	X	X	X	X		X	X	X	X	X	
DPN Gateway													
MCS Manager (for FRF.5)													
IP over ATM (AtmMpe): IP interface of:													
VR (VIPR)		X	X	X	X	X	X	X		X		X	
cVR (RFC2764 access)		X	X	X	X	X		X		X		X	
VCG (RFC2764 trunking)		X	X	X	X	X		X		X		X	
(Sheet 1 of 3)													

Table 3 (continued)
Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 ATM-based FPs

Applications/Services	Electrical			Optical									
X = supported	4-port DS3 Ch ATM/IMA	12-port DS3 ATM	12-port E3 ATM	4-port OC3/STM1 ATM (PQC2)	4-port OC3/STM1 ATM (PQC12)	16-port OC3/STM1 ATM (PQC2)	16-port OC3/STM1 POS and ATM *	1-port OC12/STM4 ATM	4-port OC12/STM4 ATM (PQC2)	4-port OC12/STM4 ATM (PQC12)	4-port MR POS and ATM (GQM)	1-port OC48/STM16 ATM	1-port OC48/STM16 POS
VRF (RFC2547 access)		X	X	X	X	X	X	X		X		X	
Router (RFC2547 trunking)					X		X			X			
IP over ATM over IMA: IP interface of:													
VR (VIPR) or cVR (RFC2764)													
VCG (RFC2764)													
VRF or Router (RFC2547)													
MPLS RFC2547 (Router model)													
LDP-DU LSR (P node)					X		X			X			
LDP-DU LER (PE node)					X		X			X			
IP over MPLS (Router model)**													
RSVP-TE LSR													
(Sheet 2 of 3)													

Table 3 (continued)
Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 ATM-based FPs

Applications/Services	Electrical			Optical									
X = supported	4-port DS3 Ch ATM/IMA	12-port DS3 ATM	12-port E3 ATM	4-port OC3/STM1 ATM (PQC2)	4-port OC3/STM1 ATM (PQC12)	16-port OC3/STM1 ATM (PQC2)	16-port OC3/STM1 POS and ATM *	1-port OC12/STM4 ATM	4-port OC12/STM4 ATM (PQC2)	4-port OC12/STM4 ATM (PQC12)	4-port MR POS and ATM (GQM)	1-port OC48/STM16 ATM	1-port OC48/STM16 POS
RSVP-TE LER													

*Some applications supported on this GQM FP are mutually exclusive. For more information, see table NPU service bundles available for the 16-port OC3/STM-1 POS ATM FP in NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

** MPLS services on the VR Model are not supported in PCR5.2 and up.

Note: This table does not apply to PQC1 version of any FP. See "PQC1-based FPs" (page 55).

(Sheet 3 of 3)

Table 4
Applications/services supported by Multiservice Switch Ethernet FPs

Applications/Services	Multiservice Switch 7400				MSS 15000 or 20000
	SBIC/PM2-based FPs		PQC12-based FPs		GQM-based FPs
X = supported	6-port 10BaseT Ethernet	2-port 100BaseT Ethernet	4-port 10/100 BaseT Ethernet	8-port 10/100 BaseT Ethernet	4-port Gigabit Ethernet
IP over Ethernet with VIPR					
IP interface of VR	X	X	X	X	X
VLAN			X	X	X
LAG					X*
IP over Ethernet with RFC2764					
IP interface of cVR	X	X			
IP interface of VCG					
VLAN					
LAG					
IP over Ethernet with RFC2547					
IP interface of VRF (port mode)			X	X	X
IP interface of VRF over VLAN			X	X	X
IP interface of Router (port mode)					X
IP interface of Router over VLAN					
LAG					
(Sheet 1 of 3)					

Table 4 (continued)
Applications/services supported by Multiservice Switch Ethernet FPs

Applications/Services	Multiservice Switch 7400				MSS 15000 or 20000
	SBIC/PM2-based FPs		PQC12-based FPs		GQM-based FPs
X = supported	6-port 10BaseT Ethernet	2-port 100BaseT Ethernet	4-port 10/100 BaseT Ethernet	8-port 10/100 BaseT Ethernet	4-port Gigabit Ethernet
MPLS RFC2547 (Router model)					
LDP-DU LSR (P node): port mode					X
LDP-DU LER (PE node): port mode					X
IP over MPLS (Router model)**					
RSVP-TE LSR: port mode					
RSVP-TE LER: port mode					X*
Ethernet virtual line service (EVLS)					
End-to-end EVLS					X*
Single-ended EVLS (performance enhancement solution)					X*
Media Gateway					
Non-switched voice over ATM					
Switched voice over ATM					
(Sheet 2 of 3)					

Table 4 (continued)
Applications/services supported by Multiservice Switch Ethernet FPs

Applications/Services	Multiservice Switch 7400				MSS 15000 or 20000
	SBIC/PM2-based FPs		PQC12-based FPs		GQM-based FPs
X = supported	**6-port 10BaseT Ethernet**	**2-port 100BaseT Ethernet**	**4-port 10/100 BaseT Ethernet**	**8-port 10/100 BaseT Ethernet**	**4-port Gigabit Ethernet**
Switched voice over IP					X
Virtual media					
Inter-VR HW connectivity			X	X	

* Consult release notes for Controlled Release vs. GA status of these features.

** MPLS services on the VR Model are not supported in PCR5.2 and up.

Note: This table does not apply to any PM1-based FPs. PM1-based FPs are not supported in software version PCR5.2 and up.

(Sheet 3 of 3)

Table 5
Applications/services supported by Multiservice Switch 7400 voice services and CES FPs

Applications/Services	MVP-E					Media Gateway			CES				
X = supported	1-port DS1 MVPe	1-port E1 MVPe	1-port TTC2M MVPe	4-port DS1 MVPe	4-port E1 MVPe	VSP2	32-port E1 TDM	2-port DS3 Ch TDM	4-port DS1 AAL1	4-port E1 AAL1	32-port DS1 MSA	32-port E1 MSA	2-port STM1e CES/ATM/IMA
Voice-related services													
BTDS	X	X		X	X								
HTDS											X	X	
Voice service (VS)	X	X	X	X	X								
Voice Networking (Vnet)	X	X	X	X	X								
CAS	X	X	X	X	X								
DCME (Q.50)		X											
ETSI Qsig	X	X		X	X								
ETSI Qsig segmentation	X	X		X	X								
EuroIsdn		X			X								
MCDN	X	X		X	X								
MPANL	X	X											
Protocol gateways	X	X		X	X								
Media Gateway													
Non-switched voice over ATM						X	X	X					
Switched voice over ATM						X	X	X					
Switched voice over IP						X	X	X					
(Sheet 1 of 2)													

Table 5 (continued)
Applications/services supported by Multiservice Switch 7400 voice services and CES FPs

Applications/Services	MVP-E					Media Gateway			CES				
X = supported	1-port DS1 MVPe	1-port E1 MVPe	1-port TTC2M MVPe	4-port DS1 MVPe	4-port E1 MVPe	VSP2	32-port E1 TDM	2-port DS3 Ch TDM	4-port DS1 AAL1	4-port E1 AAL1	32-port DS1 MSA	32-port E1 MSA	2-port STM1e CES/ATM/IMA
CES													
Unstructured (DS1/E1)									X	X	X	X	X
Basic Structured									X	X	X	X	
Structured with CAS									X	X	X	X	

Note: Legacy voice (8 Megabyte PM1) FPs and MVP (non-MVPe) FPs are not supported in software versions PCR5.2 and up, so they are not listed here. These FPs are: 1-port DS1V, 1-port E1V, 1-port J2MV, 1-port DS1 MVP, 1-port E1 MVP, and 1-port TTC2M MVP.

(Sheet 2 of 2)

Table 6
Applications/services supported by Multiservice Switch 15000 and Multiservice Switch 20000 voice services and CES FPs

Applications/Services	Media Gateway				Media Gateway and CES	CES
X = supported	VSP2	VSP3/VSP3-o	2-port DS3 TDM	32-port E1 TDM	4-port OC3/STM1 Ch TDM/CES	4-port DS3 Ch CES
Media Gateway						
Non-switched Media Gateway over ATM	X		X	X	X	
Switched Media Gateway over ATM	X	X	X	X	X	
Switched Media Gateway over IP	X	X	X	X	X	
CES						
Unstructured (DS1/E1)					X	X
Basic Structured					X	X
Structured with CAS						

PQC1-based FPs

The tables of supported services do not apply to PQC1-based FPs. Some Nortel Networks Multiservice Switch 7400/15000/20000 FPs have old PQC1 versions (also known as PQC1.0 or PQC6v1), as described in the FP Technologies section of each FP's description in this NTP. Software support is available for PQC1-based FPs; however, not all services or features are supported.

In particular, for FP types that support IP, their PQC1 versions do not support RFC2764 or RFC2547 IP-VPNs. PQC1-based FPs can not be used on the access side (IP interface of the cVR or VRF) or trunk side (IP interface of the VCG or RFC2547 Router) of RFC2764 or RFC2547 IP-VPNs. PQC1-based FPs are supported for VIPR (IP interface of a VR that does not connect to a VCG), except on FP types where the tables in this chapter show the PQC2 version does not support IP.

Chapter 2
DS1 function processors

Nortel Networks Multiservice Switch DS1 function processors (FPs) support voice, frame, and ATM services with a line speed of 1.544 Mbit/s. The configuration reference information can help you when you configure and maintain DS1 FPs.

Navigate to the information about each FP using the table “Multiservice Switch DS1 FPs” (page 58).

For information about OSI states, see “DS1 FP OSI states” (page 88).

For information about standards compliance, see “DS1 FP compliance with standards” (page 92).

For the applications and services that are supported by these FPs, see “Applications and services supported by function processors” (page 39).

Table 7
Multiservice Switch DS1 FPs

FP service type	Link to FP reference information
Voice	"Common DS1 voice service FPs configuration considerations" (page 59) "Common DS1 voice service FPs characteristics" (page 59) "1-port DS1 MVP-E FP" (page 60) "4-port DS1 MVP-E FP" (page 62)
ATM	"Common DS1 ATM service FPs configuration considerations" (page 65) "Common DS1 ATM service FPs characteristics" (page 65) "4-port DS1 AAL1 FP" (page 66) "3-port DS1 ATM FP" (page 68) "8-port DS1 ATM FP" (page 70)
Frame	"Common DS1 frame service FPs configuration considerations" (page 73) "Common DS1 frame service FPs characteristics" (page 73) "4-port DS1 FP" (page 74) "8-port DS1 FP" (page 76) "4-port DS1Ch FP" (page 78)
Multiservice	"32-port DS1 MSA FPs" (page 81)

Common DS1 voice service FPs configuration considerations

If you are setting up a DS1 trunk between two Nortel Networks Multiservice Switch nodes that are co-located, you must set the attribute *clockingSource* as one of the following combinations:

- local at one end and line at the other
- module at one end and line at the other
- module at both ends

A 64 kbit/s timeslot is available for the 'D' channel on ISDN links or the signaling channel on common channel signaling (CCS) links.

You can configure the following:

- voice encoding rate to dynamically downspeed when congestion occurs within the network
- gain adjustment in 2 dB steps between +6 dB and -6 dB
- separate encoding rates for modem and facsimile data

Common DS1 voice service FPs characteristics

Nortel Networks Multiservice Switch DS1 voice service FPs can be used to provide access from customer equipment such as a private automatic branch exchange (PABX), to the Multiservice Switch network. These FPs process any combination of voice and bit transparent data services.

All DS1 voice service FPs support both channel associated signaling (CAS) and common channel signaling (CCS). They use adaptive differential pulse code modulation (ADPCM) to encode voice data at compression rates of 24, or 32 kbit/s and 2100 Hz inband tone detection to identify modem and facsimile data. They convert time-sliced transparent data into data channel packets without processing.

Supported features include:

- bidirectional µ-Law (North American) to A-Law (international) conversion of 64 kbit/s voice data

- speech activity detection (SAD) to suppress the silence between speech bursts
- fax idle suppression (FIS) to suppress silent periods between data bursts
- echo cancellation on all voice channels
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)
- the DS1 MVP-E FP supports audio handling capabilities for both ingress and egress traffic including congestion management and control of cell delay variation and network loss planning
    - For detailed information about the audio handling capabilities of the DS1 MVP-E FP, see NN10600-750 *Nortel Networks Multiservice Switch 7400 Operations: Voice Transport*.

1-port DS1 MVP-E FP

The PEC for the 1-port DS1 MVP-enhanced on-board ECAN (MVP-E) is NTNQ85. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “1-port DS1 MVP-E configuration considerations” (page 60).

For information about the characteristics of this FP, see “1-port DS1 MVP-E characteristics” (page 61).

1-port DS1 MVP-E configuration considerations

Before you begin configuring the 1-port DS1 MVP-E FP, see “1-port DS1 MVP-E configuration parameters” (page 60).

Table 8
1-port DS1 MVP-E configuration parameters

Parameter	Values
Card Type <type>	1pDS1Mvpe (for DS1 MVP-E)
Port Type <port>	DS1
(Sheet 1 of 2)	

Table 8 (continued)
1-port DS1 MVP-E configuration parameters

Parameter	Values
Port Number <n>	0
Channel Number	0 to 23 or 1 to 24
Timeslot	1 to 24
Clocking Source	local, line, module
(Sheet 2 of 2)	

1-port DS1 MVP-E characteristics

The DS1 MVP-E may also be referred to as the One-port DS1 Multipurpose Voice Platform enhanced on-Board ECAN. The DS1 MVP-E FPs support voice services for Nortel Networks Multiservice Switch 7400 node using switched or permanent virtual connections (SVC or PVC), according to the service. They are capable of tandem node detection for processing voice data.

The MVP-E contains a daughter card that supports internal echo cancellation in compliance with ITU-T G.165 and G.168.

Supported features of the 1-port DS1 MVP-E include:

- voice compression at:
  - 24 and 32 kbit/s using ADPCM encoding, in compliance with ITU-T G.726
  - 16 kbit/s using low delay - coded excited linear predictive (LD-CELP), in compliance with ITU-T G.728
  - 8 kbit/s using conjugated structure algebraic code excited linear predictive (CS-ACELP) encoding, in compliance with ITU-T G.729
- modem and fax compression at 32 kbit/s using ADPCM encoding, in compliance with ITU-T G.726
- bidirectional µ-Law (North American) to A-Law (international) conversion of 64 kbit/s voice data in compliance with ITU-T G.711
- fax modulation and demodulation (fax relay) at rates up to 9.6 kbit/s

See also “1-port DS1 MVP-E specifications” (page 62).

Table 9
1-port DS1 MVP-E specifications

Specification	Description
effective data rate	1.536 Mbit/s
sparing supported	one-for-one only with same FP type (1-port MVP-E to 1-port MVP-E)
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC
access mode	24 channels
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	8 Mbyte

4-port DS1 MVP-E FP

The PEC for this FP is NTNQ89. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port DS1 MVP-E configuration considerations” (page 62).

For information about the characteristics of this FP, see “4-port DS1 MVP-E characteristics” (page 63).

4-port DS1 MVP-E configuration considerations

Before you begin configuring the 4-port DS1 MVP-E, consider the following:

- All ports must be configured as CAS or CCS rather than a combination of these two protocols.
- See also “4-port DS1 MVP-E configuration parameters” (page 63).

Table 10
4-port DS1 MVP-E configuration parameters

Parameter	Value
Card Type <type>	4pDS1Mvpe
Port Type <port>	DS1
Port Number <n>	0 to 3
Channel Number	0 to 23 or 1 to 24
Timeslot	1 to 24
Clocking Source	local, line, module

4-port DS1 MVP-E characteristics

This FP supports voice networking and voice and bit transparent data services over permanent virtual circuit (PVC) connections. Each port can process 24 channels.

The 4-port DS1 MVP-E works only with a second generation control processor (CP2). A maximum of eight FPs can be installed on the shelf due to restrictions of the CP. This FP interworks only with software levels PCR2.3 or higher. At PCR 4.2 or higher, it can interwork with the 1-port MVP-E running Release 7.0. Note that this FP does not support interworking to any DS1 voice FPs (VFP).

Supported features include:

- voice, modem, and fax compression using standards-based encoding algorithms
- suppression of idle frames during speech calls and facsimile transmissions
- contains a daughter card that supports internal echo cancellation in compliance with ITU-T G.164, G.165, and G.168
- detects DTMF digits and supports out-of-band DTMF tone transmission
- CCS-to-CAS protocol gateway

See also “4-port DS1 MVP-E specifications” (page 64).

Table 11
4-port DS1 MVP-E specifications

Specification	Description
effective data rate	1.536 Mbit/s
sparing supported	one-for-one only with same FP type (4-port MVP-E to 4-port MVP-E)
network clock synchronization supported	yes
minimum software level required	PCR2.3
FP technologies	PPC, PQC2.0
access mode	24 channels
normal memory	64 Mbyte

Common DS1 ATM service FPs configuration considerations

> ***Note:*** This information applies to all DS1 ATM service FPs unless specifically indicated.

Before you begin configuring a DS1 ATM service FP, consider the following:

- You must link the ports to an ATM interface before they can provide any service. For more information, see the section on provisioning the AtmInterface component in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- The ports are individually provisionable. For each port, the entire payload bandwidth is a single clear channel. The channel operates at 24 x 64 Kbit/s.
- When you add a port, the system automatically creates the subcomponents chan/0, chan/0 cell. Only one channel can be activated under one DS1 component. Chan/0 must be deleted before adding another Chan/<1-23>.
- For the 3-port and 8-port DS1 ATM FPs, you must use the full number of timeslots on a channel. For the 4-port AAL1 FP, you must provision all timeslots when using unstructured services.
- For the 3-port and 8-port DS1 ATM FPs, the cell payload is scrambled by default, according to ITU-T Recommendation I.432. You can turn cell payload scrambling off for a port on an ATM card. However, when cell payload scrambling is turned off for ATM ports, there is a possibility of false cell header delineation errors.

Common DS1 ATM service FPs characteristics

The 3-port and 8-port DS1 ATM FPs support ATM user-to-network-interfaces (UNIs) and ATM network-to-network-interfaces (NNIs) that can operate from either side of the user/network boundary. These FP types support Nortel Networks Multiservice Switch node-to-Multiservice Switch node communication and communication between Multiservice Switch nodes and external ATM devices.

All DS1 ATM service FPs also support processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

4-port DS1 AAL1 FP

The PEC for this FP is NTNQ47. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port DS1 AAL1 configuration considerations” (page 66).

For information about the characteristics of this FP, see “4-port DS1 AAL1 characteristics” (page 67).

4-port DS1 AAL1 configuration considerations

Before you begin configuring the 4-port DS1 AAL1, see the table “4-port DS1 AAL1 configuration parameters” (page 66).

Table 12
4-port DS1 AAL1 configuration parameters

Parameters	Values
Card Type <type>	4pDS1Aal1
Port Type <port>	DS1
Port Number <n>	0 to 3
Channel Number	0 to 23 or 1 to 24
Timeslot	1 to 24
Clocking Source	module

To prevent having too many timeslots exceeding the bandwidth of the FP, a semantic check in the software prevents too many timeslots from being configured when the FP is running structured services. There is no limit when the card is running unstructured services. The actual bandwidth that is used for each service on a card is calculated as follows.

((configured_timeslot times max_*partialFill*) + (configured_*partialFill* minus one)) divided by configured_*partialFill*

The attribute *partialFill* defines the configured (provisioned) partial fill level and is the number of octets of the AAL1 cell that will be used for data. The remaining octets are padded with the pattern specified by the attribute *idlePattern*. The formula provides the calculations for a DS1 card in the table “4-port DS1 AAL1 bandwidth limitations” (page 67).

Table 13
4-port DS1 AAL1 bandwidth limitations

Effective size of the largest service	At least one configured CAS structured service	No configured CAS structured service
1 to 12 timeslots	96 total timeslots	88 total timeslots
13 to 18 timeslots	96 total timeslots	77 total timeslots
19 to 24 timeslots	96 total timeslots	72 total timeslots

4-port DS1 AAL1 characteristics

This FP supports ATM services on Nortel Networks Multiservice Switch 7400 nodes and carries constant bit rate (CBR) traffic over ATM networks.

The 4-port DS1 AAL1 FP supports one circuit emulation service (CES) per channel as defined in the ATM Forum CES Interoperability Specification. However, the FP must be completely configured either for unstructured or structured services. A combination of services on an FP is not supported. For FPs configured with structured services, the connections can be a combination of basicStructured and casStructured services.

See also “4-port DS1 AAL1 specifications” (page 68).

Table 14
4-port DS1 AAL1 specifications

Specification	Description
effective data rate	1.544 Mbits
sparing supported	one-for-one
access mode	single
fast RAM	not applicable
normal memory	16 Mbyte
network clock synchronization supported	yes
minimum software level required	not applicable
FP technologies	PDC1.1, CQC

3-port DS1 ATM FP

The PEC for this FP is NTNQ45. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “3-port DS1 ATM configuration considerations” (page 68).

For information about the characteristics of this FP, see “3-port DS1 ATM characteristics” (page 69).

3-port DS1 ATM configuration considerations

Before you begin configuring the 3-port DS1 ATM FP, consider the following:

- An ILS Forwarder card is required for IP support on CQC-based FPs. The combination of a CQC-based FP and an ILS Forwarder card supports IP, but not IP VPN (tunneling with VCG). See NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description* for information on the ILS Forwarder card.
- See also “3-port DS1 ATM configuration parameters” (page 69).

Table 15
3-port DS1 ATM configuration parameters

Parameter	Value
Card Type	3pDS1Atm
Port Type	DS1
Port Number <n>	0 to 2
Channel Number	1 to 3
Timeslot	1 to 24
Line Type	esf
Clocking Source	local, module

3-port DS1 ATM characteristics

This FP supports ATM services on Nortel Networks Multiservice Switch 7400 nodes.

See also “3-port DS1 ATM specifications” (page 69).

Table 16
3-port DS1 ATM specifications

Specification	Description
effective data rate	1.536 Mbit/s
sparing supported	one-for-one
access mode	direct framing
network clock synchronization supported	yes
minimum software level required	not applicable
FP technologies	PDC1.1, CQC
fast RAM	512 kbyte
normal memory	16 Mbyte
shared memory	2 Mbyte

8-port DS1 ATM FP

The PEC for this FP is NTNQ49. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “8-port DS1 ATM configuration considerations” (page 70).

For information about the characteristics of this FP, see “8-port DS1 ATM characteristics” (page 71).

8-port DS1 ATM configuration considerations

Before you begin configuring the 8-port DS1 FP, consider the following:

- Certain provisioning restrictions apply when you configure both independent ATM links and IMA virtual links on the same FP. For more information see NN10600-730 *Nortel Networks Multiservice Switch 7400/15000/20000 Inverse Multiplexing for ATM Operations*.
- If traffic shaping (per-VC queueing) is enabled, you can only use port instances 0 to 3 for independent ATM links. For IMA link groups, you can use any port.
- An ILS Forwarder card is required for IP support on CQC-based FPs. The combination of a CQC-based FP and an ILS Forwarder card supports IP, but not IP VPN (tunneling with VCG). See NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description* for information on the ILS Forwarder card.
- See also “8-port DS1 ATM configuration parameters” (page 70).

Table 17
8-port DS1 ATM configuration parameters

Parameters	Values
Card Type <type>	8pDS1Atm
Port Type <port>	DS1
Port Number <n>	0 to 7
Channel Number	0 to 23 or 1 to 24
(Sheet 1 of 2)	

Table 17 (continued)
8-port DS1 ATM configuration parameters

Parameters	Values
Timeslot	1 to 24
Clocking Source	local, line, module
(Sheet 2 of 2)	

8-port DS1 ATM characteristics

This FP supports ATM services on Nortel Networks Multiservice Switch 7400 nodes.

The 8-port DS1 ATM FP can be used by the inverse multiplexing for ATM (IMA) feature as part of an IMA virtual link with up to 8 physical links. The resulting bandwidth for the IMA virtual link can be N x 1.524 Mbit/s, where N =1 to 8.

See also “8-port DS1 ATM specifications” (page 71).

Table 18
8-port DS1 ATM specifications

Specification	Description
effective data rate	When a physical link is part of IMA group the resulting bandwidth for the IMA group can be N x 1.524 Mbit/s, where N = 1 to 8.
sparing supported	one-for-one sparing available on up to four ports using one termination panel
access mode	direct framing
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	2 Mbyte
network clock synchronization supported	yes
(Sheet 1 of 2)	

Table 18 (continued)
8-port DS1 ATM specifications

Specification	Description
minimum software level required	not applicable
FP technologies	PDC1.1, CQC
(Sheet 2 of 2)	

Common DS1 frame service FPs configuration considerations

Note: This information applies to all DS1 frame service FPs unless specifically indicated.

Before you begin configuring the DS1 frame service FPs, consider the following:

- When you add a port, the system automatically adds the component chan/0 below the DS1 component.
- For the non-channelized FPs, the ports are individually provisionable.
- For the non-channelized FPs, in single access mode, all ports can be used (each port supports one Nx56 kbit/s channel or one Nx64 kbit/s channel, where N=1 to 24). In fractional access mode, only two ports can be used (each port supports up to four Nx64). In combined access mode, three ports can be used (one fractional, two single channel).
- For the non-channelized FPs, you can assign a set of timeslots to a channel. For example, you can set <timeslots> to “4 6 8 10 14 22.”

Common DS1 frame service FPs characteristics

Note: This information applies to all DS1 frame service FPs unless specifically indicated.

The DS1 frame service FPs can provide data interfaces for T1 lines to external or third-party equipment. In addition, these FPs can connect to DPN-100 as primary rate peripheral interfaces (PR PIs) which allows Nortel Networks Multiservice Switch nodes to act as a high-throughput packet router for DPN-100. The PR PIs are daisy-chained in DPN-100. The DS1 frame service FPs operate in fractional link mode, giving each PR PI its own fraction of the link bandwidth.

Between two Multiservice Switch nodes, the non-channelized frame service FPs operate with multiplexed fractional channels where a lower bandwidth trunk is needed, or as a single clear or fractional channel where a higher bandwidth trunk is needed

All DS1frame service FPs support processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

4-port DS1 FP

The PEC for this FP is NTNQ14. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port DS1 configuration considerations” (page 74).

For information about the characteristics of this FP, see “4-port DS1 characteristics” (page 75).

4-port DS1 configuration considerations

Before you begin configuring a 4-port DS1 FP, consider the following:

- You can add up to 4 channels on ports 1 and 3 if the other two ports are disabled.
- For the timeslot data rate, if you select doNotOverride, the card type and zeroCoding attribute value determines the data rate. If you set the zeroCoding attribute to AMI, set the date rate to 56K. Otherwise, your channel can experience data errors.
- See also “4-port DS1 configuration parameters” (page 74).

Table 19
4-port DS1 configuration parameters

Parameter	Values
Card Type <type>	DS1
Port Type <port>	DS1
Port Number <n>	0 to 3
Port configuration	fractional link or clear channel (non-channelized) mode
Channel Number	1 to 3
Timeslot	1 to 24
(Sheet 1 of 2)	

Table 19 (continued)
4-port DS1 configuration parameters

Parameter	Values
Timeslot data rate	doNotOverride or 56K
Clocking Source	local, line, module
(Sheet 2 of 2)	

4-port DS1 characteristics

This FP provides support for frame-relay services and transparent data requirements, such as bit and HDLC transparent data services on Nortel Networks Multiservice Switch 7400 nodes.

See also “4-port DS1 specifications” (page 75).

Table 20
4-port DS1 specifications

Specification	Description
effective data rate	1.536 Mbit/s
sparing supported	one-for-one
access mode	single, fractional, combined
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	0.5 Mbyte
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC

8-port DS1 FP

The PEC for this FP is NTNQ16. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “8-port DS1 configuration considerations” (page 76).

For information about the characteristics of this FP, see “8-port DS1 characteristics” (page 77).

8-port DS1 configuration considerations

Before you begin configuring the 8-port DS1 FP, consider the following:

- You can add up to four channels on ports 1 and 5 with the other six ports disabled. When you add a port, the system automatically adds the component chan/0 below the DS1 component. On the IMA interfaces, the system also adds a chan/0 cell component beneath the DS1 component.
- See also “8-port DS1 configuration parameters” (page 76).

Table 21
8-port DS1 configuration parameters

Parameter	Values
Card Type <type>	8pDS1
Port Type <port>	DS1
Port Number <n>	0 to 7
Port configuration	fractional link or clear channel (non-channelized) mode
Channel Number	1 to 7
Timeslot	1 to 24
Clocking Source	local, line, module

8-port DS1 characteristics

This FP supports frame-relay services on Nortel Networks Multiservice Switch 7400 nodes. Supported features include fast one-for-one equipment protection.

See also “8-port DS1 specifications” (page 77).

Table 22
8-port DS1 specifications

Specification	Description
effective data rate	1.536 Mbit/s
sparing supported	one-for-one
access mode	single, fractional, combined
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	0.5 Mbyte
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC

4-port DS1Ch FP

The PECs for this FP are:

- NTNQ17
- NTNQ18
- NTNQ19 (for wireless applications)

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch*.

For the information you need to configure this FP, see “4-port DS1Ch configuration considerations” (page 78).

For information about the characteristics of this FP, see “4-port DS1Ch characteristics” (page 79).

4-port DS1Ch configuration considerations

Before you begin configuring the 4-port DS1Ch FP, see “4-port DS1Ch configuration parameters” (page 78).

Table 23
4-port DS1Ch configuration parameters

Parameter	Values
Card Type	DS1C
Port Type	DS1
Port Number	0 to 3
Port configuration	fractional link or clear channel (non-channelized) mode
Channel Number	0 to 23 or 1 to 24
Timeslot	1 to 24
Clocking Source	local, line, module

4-port DS1Ch characteristics

This FP supports up to 96 separate frame-relay services on Nortel Networks Multiservice Switch 7400 nodes. It is available in standard or premium format. Use the premium format for high capacity Frame Relay applications.

Supported features include fast one-for-one equipment protection.

See also “8-port DS1 specifications” (page 77).

Table 24
8-port DS1 specifications

Specification	Description
effective data rate	1.536 Mbit/s
sparing supported	one-for-one
access mode	single, fractional, combined
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	0.5 Mbyte
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC

See also “4-port DS1Ch specifications” (page 80).

Table 25
4-port DS1Ch specifications

Specification	Description
effective data rate	1.536 Mbit/s
sparing supported	one-for-one
network clock synchronization supported	no
minimum software level required	not applicable
FP technologies	PM2, SBIC
access mode	single, fractional, fully channelized (any mix of these access modes is allowed on each port)
fast RAM	not applicable
normal memory	• PEC NTNQ17 - 16 Mbyte • PEC NTNQ18 - 32 Mbyte • PEC NTNQ19 - 64 Mbyte
shared memory	8 Mbyte

32-port DS1 MSA FPs

The 32-port DS1 MSA FPs all offer the basic multi-service access (MSA) functionality. Two versions also have two integrated OC-3 interfaces. The line speed for each OC-3 port is 155.52 Mbit/s.

The PECs for the FPs are listed in "32-port DS1 MSA PECs" (page 81).

Table 26
32-port DS1 MSA PECs

FP name	PEC
32-port DS1 MSA 2-slot FP	NTNQ74 (formerly NTY180)
32-port DS1 MSA 1-slot FP	NTNQ94AA
32-port DS1 MSA 1-slot FP with the new framer version for PCR 6.1 or later	NTNQ94BA
32-port DS1 MSA 2-slot FP with 2-port (protected) OC-3 multimode	NTNQ76 (formerly NTY182)
32-port DS1 MSA 2-slot FP with 2-port (protected) OC-3 single-mode	NTNQ78 (formerly NTY184)

For the information you need to configure these FPs, see "32-port DS1 MSA configuration considerations" (page 81).

For information about the characteristics of these FPs, see "32-port DS1 MSA characteristics" (page 85).

32-port DS1 MSA configuration considerations

Before you begin configuring a 32-port DS1 MSA FP, consider the following.

- For PQC2.0-based FPs, you must have a minimum software load of CA02S8A before installing the FP. Inserting the FP into a system running an earlier load will damage the FP, requiring it to be returned to Nortel Networks for repair.
- The 32-port DS1 MSA FP interworks with only CP2 control processors (or later types of CPs) in the same shelf assembly.

- Each of the 32 DS1 ports can be used channelized or unchannelized.
- When you add a port, the system automatically creates a Channel 0 component.
- Only ports 0 to 29 can be used for ATM UNI. IMA can use all 32 ports, but ports 30 and 31 can only be used in a group that also contains at least one of the ports 0 to 29. All 32 ports can be used for non-ATM services (for example, CES or FR).
- For unstructured services, you must provision all timeslots. For Fractional ATM interfaces, use any combination of timeslots numbered from 1 to 24.
- Traffic shaping is supported if the total number of timeslots selected is 7 or more.
- Setting the *ifAdminStatus* attribute under port or channel is not supported.
- You can use port type OC-3 only if the FP has the two integrated OC-3 ports.
- The 2-slot MSA32 FP can be plugged into any pair of adjacent slots except slot 0 (zero), which must be occupied by a CP; a second CP would require slot 15 in a Multiservice Switch 7480. When configuring a 2-slot FP, only set the *cardtype* attribute of the lowest slot number of the pair.
- Up to 15 DS1 MSA 1-slot FPs can be configured in a Multiservice Switch 7480. It is recommended that no more than 8 active or Main MSA FPs (with the attribute mainCard under the component Lp) occupy the same shelf. The total of 8 excludes any spare FPs (with the attribute spareCard).
    - — Deploying more than 8 active MSA32 FPs risks affecting the shelf's capability to provide MSA services. The amount of risk and the extent of impact depends on the engineering limitations imposed by any Multiservice Switch 7400 node. Calculate the total bandwidth of all active ports to ensure that the backplane capacity is not exceeded.
    - — Accounting of services is available for only the first 8 MSA32 1-slot FPs in sequence from slot 1 (as opposed to the sequence of the CP becoming aware of the FPs or the position of a spare in a group).

— Nortel Networks Multiservice Data Manager (MDM) cannot handle receiving many alarms and accounting data simultaneously from more than 8 MSA32 FPs in the shelf.

- When a Multiservice Switch 7480 has 14 DS1 1-slot FPs, the maximum number of DS1 ports is 448 (14 cards with 32 ports each), which is twice as many if the shelf had 7 DS1 2-slot FPs. To accommodate the 14 cards, the connection space required by the FPs must not exceed the connection space that is supported by the available CP2 memory or by the total number of DLCIs in the shelf. The total number of DLCIs can be 24000.
- When replacing a 2-slot FP (for example, NTNQ74) with a 1-slot FP (NTNQ94), configure the lower slot number and decommission the higher slot number in preparation for another FP. This method is supported by the FP maintenance procedures in NN10600-175 *Nortel Networks Multiservice Switch 7400 Hardware Installation, Maintenance, and Upgrade*.
- The 1-slot NTNQ94AA FPs and the 2-slot NTNQ74 FPs can replace each other or be deployed in the same sparing configuration. The NTNQ94BA cannot be used with FPs running software prior to PCR 6.1. The BA version operates with PCR 6.1 or later because of its different framer version.
- The combinations of 1-slot and 2-slot FPs for sparing configurations are listed in the section on MSA32 DS1 or E1 termination panels in NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description*.
- Nortel Networks Multiservice Data Manager (MDM) version 14.3 displays both the 1-slot and 2-slot versions of the DS1 FPs.
- See also “32-port DS1 MSA configuration parameters” (page 84).

Table 27
32-port DS1 MSA configuration parameters

Parameter	Values
Card slot (for 2-slot FPs with 1 CP)	1 to 14 in a 16-slot Multiservice Switch 7480 1 to 6 in an 8-slot Multiservice Switch 7460 1 to 3 in a 5-slot Multiservice Switch 7440 1 in a 3-slot Multiservice Switch 7420
Card slot (for 2-slot FPs with 2 CPs)	1 to 13 in a 16-slot Multiservice Switch 7480 1 to 5 in an 8-slot Multiservice Switch 7460 1 or 2 in a 5-slot Multiservice Switch 7440
Card slot (for 1-slot FPs with 1 CP)	1 to 15 in a 16-slot Multiservice Switch 7480 1 to 7 in an 8-slot Multiservice Switch 7460 1 to 4 in a 5-slot Multiservice Switch 7440 1 or 2 in a 3-slot Multiservice Switch 7420
Card slot (for 1-slot FPs with 2 CPs)	1 to 14 in a 16-slot Multiservice Switch 7480 1 to 6 in an 8-slot Multiservice Switch 7460 1 to 3 in a 5-slot Multiservice Switch 7440 ***Note:*** A 3-slot Multiservice Switch 7420 does not support using 2 CPs.
Card types	32pDs1Msa for NTNQ74 32pDs1Msa for NTNQ94 32pDs1MsaMtp for NTNQ76 32pDs1MsaStp for NTQ78
Port types	DS1, and OC-3 on NTNQ76 or NTNQ78
Port numbers	0 to 31 for DS1, 0 and 1 for OC-3
Port configuration for DS1 ports	fractional link or clear channel (non-channelized) mode
Port configuration for OC-3 ports	B-ISDN
DS1 channel numbers	0 to 23 or 1 to 24
DS1 timeslots	1 to 24
Clocking source for DS1 ports	local, line, module, srts, and adaptive; board-level for the transmit clocks
(Sheet 1 of 2)	

Table 27 (continued)
32-port DS1 MSA configuration parameters

Parameter	Values
Clocking source for OC-3 ports	line, local, module
Single bit HEC error correction	user-enabled, user-disabled (default is user-disabled)
(Sheet 2 of 2)	

32-port DS1 MSA characteristics

The 32-port DS1 MSA FPs support frame relay, IP, and ATM services on Nortel Networks Multiservice Switch 7400 nodes. Each can simultaneously provide different types of services on separate channels within a DS1 port or on the whole port, including:

- Frame Relay ISDN dialup and frame relay service on DS0, NxDS0 and DS1 services
- ATM service on DS1 or NxDS1 through IMA
- AAL1 CES of DS0, NxDS0 and DS1 over PORS and ATM
- Fractional ATM, allowing an ATM interface to share a port with other services. Only one ATM interface can be configured per port.

  Note: When a 32-port DS1 MSA FP is provisioned for both ingress and egress traffic such that the optical port is providing the backbone connection and the DS1 ports are providing access connections, a slower response time for some applications may occur.

Supported features include:

- one-for-one equipment protection up to 100 milliseconds
- supports PPP/ATM interworking (PPP/ATM I/W) through a PPP access link (RFC 1661) using ATM MPE (RFC1483)
- Frame Relay/ATM interworking
- processing and transmission of synchronization status messages (SSM) on the optical ports within the network clock synchronization system (NCS)
- ATM traffic management including fair queueing and traffic shaping

- ATM congestion management strategies, including partial packet discard (PPD), late packet discard (LPD), early packet discard (EPD) and weighted random early discard (WRED)
- IP packet forwarding in hardware, access to Multiservice Switch virtual routers (VRs), and IP tunneling
- supports IP encapsulation over ATM (RFC 2684), PPP (RFC 1661), and Frame Relay (RFC 1490)
- IP VPN over ATM IMA and IP VPN over MPLS over ATM IMA
- IP class of service (CoS)
- virtual framers with both ends on a single FP as well as on two FPs
- up to 250 virtual framers per FP

  Note: The 32-port DS1 MSA FP with an integrated OC-3 interface also supports up to 250 virtual framers per FP.

See also the table “32-port DS1 MSA specifications” (page 86).

Table 28
32-port DS1 MSA specifications

Specification	Description
sparing supported	• one-for-n cold equipment sparing, where n is one to six depending on the type of sparing panel (the limitations by panel are indicated in the section on MSA32 termination panels in NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description*) • one-for-n sparing behavior enhancement
processor memory	128 Mbyte
network clock synchronization	supported
synchronization status messages (SSM)	supported (optical port only)
SRTS clocking	supported
(Sheet 1 of 2)	

Table 28 (continued)
32-port DS1 MSA specifications

Specification	Description
adaptive clocking	supported
minimum software level required	PCR 1.2.8 PCR 6.1 for NTNQ94BA
FP technologies for older PECs	PPC, AQM1.1, PQC1.0
FP technologies for newer PECs	PPC, AQM1.1, PQC2.0
(Sheet 2 of 2)	

DS1 FP OSI states

This section lists the following OSI state tables for DS1 FPs.

- For all DS1 FPs, see “DS1 component state combination” (page 88).
- For all DS1 FPs except ATM or AAL1 FPs, see “DS1 Test component state combination” (page 89).
- For all DS1 FPs except 3-port and 8-port ATM FPs, see “DS1 Channel (Chan) component state combination” (page 89).
- For 3-port and 8-port ATM FPs see:
  - “DS1 ATM Channel (Chan) component state combination” (page 90)
  - “DS1 ATM Test component state combination” (page 90)
- For 1-port DS1 voice FP, see “DS1 Framer component state combination” (page 91).

Table 29
DS1 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The DS1 port is inoperable due to at least one of the following alarms. • losAlarm • lofAlarm • rxAisAlarm.
Unlocked, Enabled, Busy	The DS1 component is in use.
Locked, Enabled, Idle	A lock/lock operator command is in effect. The DS1 component is ready to service a user. A test is running.
Locked, Disabled, Idle	• Some hardware test failed. • The DS1 component is in the locked state. • External factors render the DS1 port inoperable.

Table 30
DS1 Channel (Chan) component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	External factors render the Chan component inoperable because of DS1 alarms.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes.
Unlocked, Enabled, Busy	The Chan component is in use. The Chan component can only service one user at a time.
Locked, Enabled, Idle	A lock operator command is in effect. The Chan component is otherwise ready to service a user. A test is running.
Locked, Disabled, Idle	Some hardware test failed or the Chan component is in the locked state.

Table 31
DS1 Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Busy	The Test component is in use. A DS1 or Chan component creates a Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

Table 32
DS1 ATM Channel (Chan) component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The Chan component is inoperable because of DS1, E1 or lcdAlarm alarms. The associated port component is locked.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes.
Unlocked, Enabled, Busy	The Chan component is in use. The Chan component can only service one user at a time.
Unlocked, Enabled, Idle	The Chan component is not in use. The component is waiting for binding to an AtmIf component.
ShuttingDown, Enabled, Busy	A lock operator command is in effect. The system is waiting for a bound application to suspend.
Locked, Disabled, Idle	A hardware test failed or the Chan component is in the locked state.

Table 33
DS1 ATM Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Busy	The Test component is in use. A Chan, DS1, or E1 component creates a Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

Table 34
DS1 Framer component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	A component that the Framer component depends on is not available. A likely cause is that the port component (for example, a DS1 component) is locked for testing.
Unlocked, Enabled, Busy	The Framer component is in use. The Framer component services only one user (an application component) at a time.

DS1 FP compliance with standards

For information about compliance of each FP type, see:

- "1-port DS1 MVP-E compliance with standards" (page 92)
- "4-port DS1 MVP-E compliance with standards" (page 92)
- "3-port DS1 ATM compliance with standards" (page 93)
- "8-port DS1 ATM compliances" (page 94)
- "4-port DS1 AAL1 compliance with standards" (page 95)
- "4-port DS1 compliance with standards" (page 96)
- "4-port DS1Ch compliance with standards" (page 96)
- "32-port DS1 MSA compliance with standards" (page 96)
- "OC-3 compliance with standards on a 32-port DS1 MSA FP" (page 97)

1-port DS1 MVP-E compliance with standards

The DS1 MVP-E FPs comply with the applicable sections of these recommendations:

- FCC part 68/TIA 968-A
- Industry Canada CS-03-Issue 8 Part II
- ITU-T G.703 (excluding Annex B)
- ITU-T G.704
- ITU-T G.706
- ITU-T G.733
- JATE

4-port DS1 MVP-E compliance with standards

The 4-port DS1 MVP-E FPs comply with the applicable sections of these recommendations:

- FCC part 68/TIA 968-A
- Industry Canada CS-03-Issue 8 Part II
- ITU-T G.164

- ITU-T G.165
- ITU-T G.168
- ITU-T G.711
- ITU-T G.726
- ITU-T G.728
- ITU-T G.729 Annex A
- ITU-T T.30
- ITU-T V.17
- ITU-T V.21
- ITU-T V.27ter
- ITU-T V.29
- JATE

3-port DS1 ATM compliance with standards

The DS1 ATM FP complies with the applicable sections of these standards:

- ANSI T1.102-199X Section 6.4
- ANSI T1.107-1988 and T1.107a-1990 Sections 5.1 and 5.22
- ANSI T1.403-1989
- ANSI T1.231-1993, Section 6: all required and some optional parameters; Section 9: current, previous, and recent 15 minute and day counts and thresholding are not implemented
- ANSI T1E1.2/94-002R1, 1994 Sections 10 and 15.3
- ATM Forum ATM User-Network Interface Specification, Draft Version 3.1 Part II, 1994 Section II.3, except cell payload scrambling is enabled by default, with the option to disable it
- FCC part 68/TIA 968-A
- Industry Canada CS-03-Issue 8 Part II
- ITU-T G.703, 1991 Section 2
- ITU-T G.704, 1988 Section 2.1

- ITU-T G.706, 1988 Section 2
- ITU-T G.733, 1972 Section 4
- ITU-T I.432 Sections 4.3 to 4.5
- ITU-T G.804, 1993 Section 2
- ITU-T G.821
- ITU-T G.823
- JATE
- Telcordia TR-TSV-000773, 1993 Section 3
- Telcordia TR-NWT-000499, 1991 Sections 9.2 and 10.2

8-port DS1 ATM compliances

The 8-port DS1 ATM FP complies with the applicable sections of these standards:

- AF-PHY-0016.000 (except Section 3.2)
- ANSI T1.107-1995 Section 6.2
- ANSI T1.403-1995 (non-compliant with Section 7.4)
- ANSI T1.231-1993, Section 6: all required and some optional parameters; Section 9: current, previous, and recent 15 minute and day counts and thresholding are not implemented
- ANSI T.408-1990 (except Section 8.4.3.2)
- ANSI T1.646-1995, Sections 10,11,15.3
- ATM Forum ATM User-Network Interface Specification, Draft Version 3.1 Part II, 1994 Section II.3
- FCC part 68/TIA 968-A
- Industry Canada CS-03-Issue 8 Part II
- ITU-T G.703, 1991 Section 2
- ITU-T G.704, 1995 Section 2.1
- ITU-T G.706, 1991 Section 2
- ITU-T G.733, 1988 Section 4

- ITU-T I.432 1993 Sections 4.3 to 4.5
- ITU-T G.804, 1993 Section 2
- ITU-T G.821, 1988
- ITU-T G.824, 1993
- JATE
- Telcordia TR-TSV-000773, 1993 Section 3
- Telcordia TR-NWT-000499, 1991 Sections 9.2 and 10.2

4-port DS1 AAL1 compliance with standards

The DS1 AAL1 FP complies with the applicable sections of these standards:

- ANSI T1.107
- ANSI T1.403
- ANSI T1.627
- ANSI T1.630
- ATMF AF_SAA_0032.000
- FCC part 68/TIA 968-A
- Industry Canada CS-03-Issue 8 Part II
- ITU-T G.703
- ITU-T G.704
- ITU-T G.706
- ITU-T G.824
- ITU-T I.431
- ITU-T I.361
- ITU-T I.363.1
- JATE
- Telcordia TR-NWT-000170

4-port DS1 compliance with standards

The 4-port DS1 FP complies with the applicable sections of these North American DS1 interconnect standards:

- FCC part 68/TIA 968-A
- Industry Canada CS-03-Issue 8 Part II
- JATE

4-port DS1Ch compliance with standards

The 4-port DS1Ch FP complies with the applicable sections of these North American DS1 interconnect standards:

- FCC part 68/TIA 968-A
- Industry Canada CS-03-Issue 8 Part II
- JATE

32-port DS1 MSA compliance with standards

The 32-port DS1 MSA FP complies with the applicable sections of these North American DS1 interconnect standards:

- ANSI T1.102
- ANSI T1.403
- ANSI T1.630
- FCC part 68/TIA 968-A
- Industry Canada CS-03-Issue 8 Part II
- ITU-T G.703
- ITU-T G.704
- ITU-T G.706
- ITU-T G.824
- ITU-T I.363.1
- JATE

OC-3 compliance with standards on a 32-port DS1 MSA FP

When a 32-port DS1 MSA FP has the optional optical ports, the OC-3 ATM portion of the 2-slot FP complies with the applicable sections of the following standards:

- “SONET” (page 97)
- “SDH” (page 98)

SONET
ATM Forum

- AF-UNI-0010.002 (ref. [28])
  - — complies to section 2.1
- AF-TEST-0024.000 (ref. [31])

Telcordia

- GR-253-CORE (ref. [35]):
  - — Complies to all required and applicable items for STS-3 ATM operation.
  - — Note that the following optional bytes are not supported by OC-3 ATM IPs:
    E1: Orderwire
    F1: Section User Channel
    D1-D3: Section Data Communication Channel
    J1: STS Path Trace
    F2: Path User Channel
    N1: Tandem Connection Maintenance/Path Data Channel
- TR-NWT-001112 (ref. [38])

ANSI

- T1.105-1995 (ref. [12])
- T1.231-1993 (ref. [22]):
  - — complies to section 8 for all SONET alarms and statistics listed in Section 3.2.3 on page 8.
- T1.646-1995 (ref. [24], supersedes T1.624)

- T1E1.2/96-002 (ref. [25])
- 216 MD-1998.0041 - Version 01.05 - released - 1998-07-31 (PP504, P6.0)

SDH
ITU-T

- ETS 300 417 (previously ETS DE/TM-01015) (ref. [40])
- G.707 (ref. [45], replaces G.708. G.709) complies except for section 9.2.2.11 Table 5 which states that on receipt of an MS-AIS signal, line-timing should not be used.

  Note: the following optional bytes are not supported by OC-3 ATM IPs:

  — E1: Orderwire

  — F1: Section User Channel

  — D1-D3: Section Data Communication Channel

  — J1: STS Path Trace

  — F2: Path User Channel

  — N1: Tandem Connection Maintenance/Path Data Channel
- G.782 (ref. [48])
- G.783 (ref. [49])
- G.813 (ref. [51])
- G.821
- G.825 (ref. [54])

  — complies, except may not meet wander requirements
- G.957 (ref. [56])

  Note: the OC-3 ATM IP single mode FP is classified as application code L-1.1
- G.958 (ref. [57])
- I.432 (ref. [58])

- — complies to section 2 (Physical Medium at 155 520 kbit/s)
- — complies to section 4 (TC Sublayer) except:
- — Section 4.2.1.2: Physical layer cells are not guaranteed to be inserted in the cell
- — stream every 27 cells
- — Section 4.2.1.3: Physical layer OAM cells are not implemented

- TS026

Chapter 3
DS3 function processors

Nortel Networks Multiservice Switch DS3 function processors (FPs) support Frame-based and ATM services with a maximum line speed of 44.736 Mbit/s. The configuration reference information can help you when you configure and maintain DS3 FPs.

Navigate to the reference information about each FP using the table “Multiservice Switch DS3 FPs” (page 102).

For information about OSI states, see “DS3 FP OSI states” (page 134).

For information about standards compliance, see “DS3 FP standards compliance” (page 142).

For information about applications and services for these FPs, see “Applications and services supported by function processors” (page 39).

Table 35
Multiservice Switch DS3 FPs

FP service type	Link to FP reference information
Frame-based FPs	• "1-port DS3 FP" (page 103) • "1-port DS3Ch FP" (page 104) • "4-port DS3Ch FR FP" (page 121)
ATM FPs	• "2-port DS3Ch TDM FP" (page 107) • "3-port DS3 ATM FP" (page 110) • "3-port DS3 ATM IP FP" (page 112) • "4-port DS3Ch AAL1 CES FP" (page 114) • "4-port DS3Ch ATM FP" (page 118) • "4-port DS3Ch FR FP" (page 121) • "12-port DS3 ATM FP" (page 128) • "Common channelized DS3 ATM FP configuration considerations" (page 133) • "Common non-channelized DS3 ATM FP configuration considerations" (page 132)

1-port DS3 FP

The PECs for the 1-port DS3 are:

- NTNQ23
- NTNQ24

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “1-port DS3 configuration considerations” (page 103).

For information about the characteristics of this FP, see “1-port DS3 characteristics” (page 104).

1-port DS3 configuration considerations

Before you begin configuring a 1-port DS3 FP, consider the following:

- You must link the ports to a frame relay interface before they can provide any service. See provisioning a *Framer* component in NN10600-901 *Nortel Networks Multiservice Switch 7400/15000/20000 Frame Relay Configuration Management*
- The entire payload bandwidth is used as a single clear channel that supports high-level data link control (HDLC) and Nortel Networks Multiservice Switch proprietary trunk protocol.
- See also “1-port DS3 configuration parameters” (page 103).

Table 36
1-port DS3 configuration parameters

Parameter	Values
Card type <cardtype>	DS3
Port type <port>	DS3
Port number <m>	0
Clocking source	local, module, line

1-port DS3 characteristics

This FP provides support for frame-relay services on Nortel Networks Multiservice Switch 7400 nodes. It is available in standard or premium format. Use the premium format for high capacity Frame Relay applications.

The single port is comprised of a transmit coaxial cable connector and a receive coaxial cable connector.

The 1-port DS3 FP also supports processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

See also the table “1-port DS3 specifications” (page 104).

Table 37
1-port DS3 specifications

Specification	Description
effective data rate	43.008 Mbit/s
sparing supported	one-for-one
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC
fast RAM	not applicable
normal memory	• PEC NTNQ23 - 16 Mbyte • PEC NTNQ24 - 32 Mbyte
shared memory	2 Mbyte

1-port DS3Ch FP

The PEC for the 1-port DS3 Channelized (Ch) is NTNQ26. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “1-port DS3Ch configuration considerations” (page 105).

For information about the characteristics of this FP, see “1-port DS3Ch characteristics” (page 106).

1-port DS3Ch configuration considerations

Before you begin configuring a 1-port DS3Ch FP, consider the following:

- You must link the ports to a frame relay interface before they can provide any service. See provisioning a *Framer* component in NN10600-901 *Nortel Networks Multiservice Switch 7400/15000/20000 Frame Relay Configuration Management*
- You can configure the ports on DS3Ch FPs to operate in fractional mode. Fractional mode means that each port on a DS3Ch FP can support 1 to 28 DS1 tributaries, and each DS1 tributary can have 1 to 24 timeslots.
- When you add a DS3 component, the system automatically creates DS1/1 as a tributary port beneath a DS3 port.
- When you add a DS1 component, the system automatically adds a Channel/0 component that contains 24 provisioned timeslots.
- You can assign a set of timeslots to a channel. For example, you can set <timeslots> to “4 6 8 10 14 22.”
- Each timeslot represents a 56 kbit/s or 64 kbit/s portion of the total bandwidth of a DS3Ch port. Timeslots can be grouped together to form fractions (also known as channels). Fractions allow you to provision n x 56 kbit/s or n x 64 kbit/s links on a DS3Ch port, where n is 1 to 24.
- See also “1-port DS3Ch configuration parameters” (page 105).

Table 38
1-port DS3Ch configuration parameters

Parameter	Values
Card type <cardtype>	1pDS3C
Port type <port>	DS3, DS1
(Sheet 1 of 2)	

Table 38 (continued)
1-port DS3Ch configuration parameters

Parameter	Values
DS3 Port number <m>	0
Tributary DS1 Port number <q>	1-28
Number of channels <p>	1
Timeslot per channel	1-24
Timeslot data rate for DS1 port <rate>	doNotOverride, 56K
DS3 Clocking source	local, module
Tributary DS1 port clocking source	local, line, module
(Sheet 2 of 2)	

1-port DS3Ch characteristics

This FP provides support for frame-relay services on Nortel Networks Multiservice Switch 7400 nodes. It provides access to external or third-party network equipment and to a DPN-100 through an M13 multiplexer.

The 1-port DS3Ch FP also supports processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

See also the table “1-port DS3Ch specifications” (page 106).

Table 39
1-port DS3Ch specifications

Specification	Description
effective data rate	43.008 Mbit/s
sparing supported	• one-for-one • one-for-n, where n=1-4 • one-for-n sparing behavior enhancement
access mode	single
(Sheet 1 of 2)	

Table 39 (continued)
1-port DS3Ch specifications

Specification	Description
fast RAM	not applicable
normal memory	32 Mbyte
shared memory	2 Mbyte
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC
(Sheet 2 of 2)	

2-port DS3Ch TDM FP

The PECs for the 2-port DS3Ch TDM FP are:

- NTFN91 and NTFN93 (Nortel Networks Multiservice Switch 7400 nodes)
- NTHW91 and NTHW90 (Multiservice Switch 15000 and Multiservice Switch 20000 nodes)

NTFN93 and NTHW90 are available from PCR5.2 onwards. They support identical functionality to the previous codes and can be used in one-for-one or one-for-n sparing configurations alongside NTFN91 and NTHW91. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “2-port DS3Ch TDM configuration considerations” (page 108).

For information about the characteristics of this FP, see “2-port DS3Ch TDM characteristics” (page 108).

2-port DS3Ch TDM configuration considerations

Before you begin configuring a 2-port DS3Ch TDM FP, consider the following:

- When you add a *DS1* component, the system creates a *TrunkConditioning* (*TC*) component beneath the *Channel* component.
- The ports on the DS3C TDM FPs operate in fractional mode. Fractional mode means that each port can support 1 to 28 DS1 tributary ports. Each DS1 port supports one channel that can have 1 to 24 timeslots. Each timeslot represents a 64 kbit/s portion of bandwidth.
- See also “1-port DS3Ch TDM configuration parameters” (page 108).

Table 40
1-port DS3Ch TDM configuration parameters

Parameter	Values
Card type <cardtype>	2pDS3cAal
Port type <port>	DS3, DS1
DS3 Port number <m>	0, 1
Tributary DS1 Port number <q>	1-28
Number of DS1 channels	1
DS3 Clocking source	local, line
Tributary DS1 port clocking source	local, module

2-port DS3Ch TDM characteristics

The 2-port DS3Ch TDM FP supports PVG services on Nortel Networks Multiservice Switch 7400 nodes, and Multiservice Switch 15000 and Multiservice Switch 20000 nodes. This FP provides a gateway between a TDM network and an ATM or IP network.

The 2-port DS3C TDM FP provides support for PVG services on Multiservice Switch 15000 and Multiservice Switch 20000 nodes. You can use the monitor ports (Tx monitor) to connect to test equipment and test the card while it is in service. It carries a -26dB tap of the transmit (Tx) connector signal. The 9-pin subminiature D-type connector provides one-for-one sparing capability. For information on provisioning the monitor ports, see NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

Supported features include

- structured AAL service over the node backplane
- access to VSP3
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also the table “2-port DS3Ch TDM specifications” (page 109).

Table 41
2-port DS3Ch TDM specifications

Specification	Description
effective data rate	44.21 Mbit/s
sparing supported	one-for-one
access mode	direct framing
fast RAM	512 kbyte
normal memory	16 Mbyte
shared memory	1 Mbyte
network clock synchronization supported	yes (DS1 level of channelization only)
minimum software level required for NTFN91 and NTHW91	not applicable
minimum software level required for NTFN93 and NTHW90	PCR5.2
FP technologies	PDC1.1, CQC

3-port DS3 ATM FP

The PEC for the 3-port DS3 ATM is NTNQ51. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “3-port DS3 ATM configuration considerations” (page 110).

For information about the characteristics of this FP, see “3-port DS3 ATM characteristics” (page 111).

3-port DS3 ATM configuration considerations

Before you begin configuring a 3-port DS3 ATM FP, consider the following:

- The three ports are individually provisionable
- An ILS Forwarder card is required for IP support on CQC-based FPs. The combination of a CQC-based FP and an ILS Forwarder card supports IP, but not IP VPN (tunneling with VCG). See NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description* for information on the ILS Forwarder card.
- Up to seven 3-port DS3 ATM FPs can be configured in a Multiservice Switch 7480. It is recommended that no more than five active or Main FPs (with the attribute mainCard under the component Lp) occupy the same shelf assembly. The total of two excludes any spare FPs (with the attribute spareCard).
  - — Deploying more than five active 3-port DS3 ATM FPs risks affecting the shelf’s capability to provide services. The amount of risk and the extent of impact depends on the engineering limitations imposed by any Multiservice Switch 7400 node and depends on all of the FPs in a shelf simultaneously bursting up to their maximum line rates. Each active port sending AAL1 CES constantly sends more than its line rate onto the backplane. Calculate the total bandwidth of all active ports to ensure that the backplane capacity is not exceeded.
- See also “3-port DS3 ATM configuration parameters” (page 111).

Table 42
3-port DS3 ATM configuration parameters

Parameter	Values
Card type <cardtype>	3pDS3Atm
Port type <port>	DS3
Port number <m>	0 - 2
Clocking source	local, module, line, or otherPort

3-port DS3 ATM characteristics

Nortel Networks Multiservice Switch DS3 ATM FPs support ATM User-Network-Interfaces (UNIs) or ATM Multiservice Switch node-Multiservice Switch node-Interfaces (MMIs). Ports can operate on either side of a user/network boundary.

These FPs provide interfaces for Multiservice Switch node-to-Multiservice Switch node communication, and for communication between Multiservice Switch and external ATM devices. They support an ATM interface that can support a number of Multiservice Switch trunks or ATM bearer services

The 3-port DS3 ATM FP also supports processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

The 3-port DS3 ATM FP provides support for ATM services on Multiservice Switch 7400 nodes.

See also the table “3-port DS3 ATM specifications” (page 111).

Table 43
3-port DS3 ATM specifications

Specification	Description
effective data rate	44.21 Mbit/s
sparing supported	one-for-one
(Sheet 1 of 2)	

Table 43 (continued)
3-port DS3 ATM specifications

Specification	Description
access mode	direct framing
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	2 Mbyte
network clock synchronization supported	yes
minimum software level required	not applicable
FP technologies	PDC1.1, CQC
(Sheet 2 of 2)	

3-port DS3 ATM IP FP

The PECs for the 3-port DS3 ATM IP FPs are:

- NTJS13BA
- NTJS13CA
- NTJS13DA
- NTNQ68AA

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “3-port DS3 ATM IP configuration considerations” (page 112).

For information about the characteristics of this FP, see “3-port DS3 ATM IP characteristics” (page 113).

3-port DS3 ATM IP configuration considerations

Before you begin configuring a DS3 ATM IP, consider the following:

- The three ports are individually provisionable
- See also “3-port DS3 ATM IP configuration parameters” (page 113).

Table 44
3-port DS3 ATM IP configuration parameters

Parameter	Values
Card type <cardtype>	3pDS3Atm2
Port type <port>	DS3
Port number <m>	0 to 2
Clocking source	local, line, module

3-port DS3 ATM IP characteristics

Nortel Networks Multiservice Switch DS3 ATM FPs support ATM user-network-interfaces (UNIs) or ATM Multiservice Switch node-Multiservice Switch node-Interfaces (MMIs). Ports can operate on either side of a user/network boundary.

These FPs provide interfaces for Multiservice Switch node-to-Multiservice Switch node communication, and for communication between Multiservice Switch and external ATM devices. They support an ATM interface that can support a number of Multiservice Switch trunks or ATM bearer services.

The 3-port DS3 ATM IP FP may also be referred to as the 3-port DS3 ATM2 SGAF or the 3pDS3A.

Supported features include:

- feature rich ATM traffic management functions, including fair queuing and traffic shaping
- line rate frame forwarding on all ports and increased frame forwarding rates for many services
- platform for ATM Forum traffic management phase 4 (TM4.0)
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also the table "3-port DS3 ATM IP specifications" (page 114).

Table 45
3-port DS3 ATM IP specifications

Specification	Description
sparing supported	one-for-one using 3-port DS3 ATM termination panels
processor memory	64 Mbyte
network clock synchronization supported	yes
minimum software level required	not applicable
FP technologies	• PEC NTJS13BA - PPC, AQM1.0, PQC1.0 • PEC NTJS13CA - PPC, AQM1.1, PQC1.0 • PEC NTJS13DA - PPC, AQM1.1, PQC2.0 • PEC NTNQ68AA - PPC, AQM1.1, PQC2.0

4-port DS3Ch AAL1 CES FP

The PEC for the 4-port DS3Ch AAL1 CES FP is NTHR91. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port DS3Ch AAL1 CES configuration considerations” (page 115).

For information about the characteristics of this FP, see “4-port DS3Ch AAL1 CES characteristics” (page 116).

4-port DS3Ch AAL1 CES configuration considerations

Before you begin configuring a 4-port DS3Ch AAL1 CES FP, consider the following:

- The 4-port DS3Ch AAL1 CES FP is a time division multiplexed FP. For this TDM FP to provide a CES associated with an ATM FP (for example, CBR) you must link to an Aal1Ces interface.
- The attribute *mapping* can only be set to “direct” mapping. Cells are directly mapped into the DS3 payloads by default for the 4-port ATM-based DS3 FPs.
- When you add a port, the system automatically provisions C-Bit parity mode for the DS3 component. If you do not want to use C-Bit parity mode, turn it off.

  `set lp/<n> DS3/<m> cBitParity off`

- Default timeslot data rate for DS1 port is doNotOverride. When DS1 zero coding is none, the user data rate is 64K; when it is bit7stuffing, the user data rate is 56K.
- The DS1 *customerIdentifier* must be the same as the DS3’s.
- The attribute *applicationFramerName* must remain empty.
- When configuring the Aal1Ces component:
  - — The *dummyDataByte* attribute can only be set to the “OxFF” value
  - — If the channel is linked to a CES component and its service type is unstructured, then there must not be a TC component under the channel component. That is, there can be one channel with 24 timeslots.
  - — If the channel is linked to a CES component and its service type is structured, then there must be a TC component under the channel component. That is, there must be one timeslot per channel, up to 24 channels.
  - — The channel attribute *timeslots* contains a list of 0-23 defined timeslots with values from 0-23.
  - — The value of the attribute *customerIdentifier* and its parent DS1 component *customerIdentifier* must be the same.

— The value of the *timeslotDataRate* attribute can only be "doNotOverride"

- It can be configured to provide cold standby, which, like any standby, can be used to spare similar types of FPs
- It supports a warm hitless migration of a software upgrade when configured for one-for-one equipment protection

  See also the chapter on configuring equipment protection (sparing) and the chapter on hitless services in NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

- See "4-port DS3Ch AAL1 CES configuration parameters" (page 116).

Table 46
4-port DS3Ch AAL1 CES configuration parameters

Parameter	Values
Card type <cardtype>	4pDS3ChAal1
Port type <port>	DS3, DS1
DS3 Port number <m>	0 to 3
Port configuration	channelized
Tributary DS1 Port number <q>	1 to 28
DS1 line type	unframed, d4, or esf
Number of DS1 channels	1, Chan/<1-23>
Timeslots	1 to 24
Timeslot data rate for DS1 port	doNotOverride, 56K, 64K
DS3 clocking source	local, module
DS1 tributary port clocking source	sameAsDs3

4-port DS3Ch AAL1 CES characteristics

The 4-port DS3Ch AAl1 CES FP provides AAL1 for CES over multiple DS1 channels through DS3 lines. This time division multiplexed (TDM) FP also provides a gateway interface to ATM FPs. The fanin and fanout of channelized service connections from the FP into a Nortel Networks Multiservice Switch ATM network can provide multiple services on the same FP port. The FP

The 4-port DS3Ch AAL1 CES FP supports ATM services on Multiservice Switch 15000 and Multiservice Switch 20000 nodes.

Supported features include:

- four fully channelized ports
- DS1 trunk conditioning
- up to 28 DS1s per DS3 port with up to 24 channels per DS1, each channel with 1 to 24 Kbits/s (DS0) timeslots. Each of the 24 timeslots can be associated with only one channel. For example, you can have 24 channels with 1 timeslot each or 1 channel with 24 timeslots, or any combination in between.
- up to 24 channels per DS1 tributary, each supporting one time slot, one data channel for the full DS1 stream, or a combination
- up to 112 DS1 tributaries, or ATM user-to-network interfaces (UNIs)
- up to 254 CES virtual channel connections (VCCs) per DS3
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also the table “4-port DS3Ch AAL1 CES specifications” (page 118).

Table 47
4-port DS3Ch AAL1 CES specifications

Specification	Description
sparing supported	• supports one-for-n sparing behavior enhancement • supports operation with a one-for-six sparing panel such as the NTQS31, where up to 6 FPs can be spared (backed up) by one FP, all of the same FP type in the same shelf • supports warm equipment protection with a one-for-one sparing panel such as the NTHR79
FP technologies	PPC, PQC2.0

4-port DS3Ch ATM FP

The PECs for the 4-port DS3Ch ATM FPs are:

- NTHR31BA
- NTHR31CA
- NTHR31DA

For a full list of PECs (including vintages) of supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port DS3Ch ATM configuration considerations” (page 119).

For information about the characteristics of this FP, see “4-port DS3Ch ATM characteristics” (page 120).

4-port DS3Ch ATM configuration considerations

Before you begin configuring a 4-port DS3Ch ATM FP, consider the following:

- The ports on the FP can be configured as channelized. It supports 28 DS1 within the DS3, in which the DS1s can be grouped together to a maximum of 8 DS1s per IMA group. A maximum of 14 IMA groups can be configured per DS3 port.
- When you add a port, the system automatically provisions C-Bit parity mode for the DS3 component. If you do not want to use C-Bit parity mode, turn it off.

  ```
  set lp/<n> DS3/<m> cBitParity off
  ```

- Cells are directly mapped into the DS3 payloads by default for the 4-port ATM-based DS3 FPs.
- The cell payload is scrambled by default, according to ITU-T Recommendation I.432. You can turn cell payload scrambling off for a port on an ATM card. However, when cell payload scrambling is turned off for ATM ports, there is a possibility of false cell header delineation errors.
- See also “4-port DS3Ch ATM configuration parameters” (page 119).

Table 48
4-port DS3Ch ATM configuration parameters

Parameter	Values
Card type <cardtype>	4pDS3ChAtm
Port type <port>	DS3
DS3 Port number <m>	0 to 3
Tributary DS1 Port number <q>	1 to 28
Number of DS1 channels	1, Chan/<0 to 23>
Timeslots	1 to 24
Timeslot data rate for DS1 port	doNotOverride
(Sheet 1 of 2)	

Table 48 (continued)
4-port DS3Ch ATM configuration parameters

Parameter	Values
DS3 Clocking source	local, module
Tributary DS1 port clocking source	sameAsDs3
(Sheet 2 of 2)	

4-port DS3Ch ATM characteristics

This FP supports ATM services on Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes.

Supported features include:

- inverse multiplexing for ATM with inverse multiplexing for ATM (IMA) groups spanning multiple DS1s within each DS3 port (2 to 28 links)
- supports up to 14 IMA groups within a DS3 port
- has four DS3 ports channelized at DS1 levels (4 DS3 ports x 28 DS1s/DS3 = 112 channels)
- supports up to 112 ATM user-to-network interfaces (UNIs)
- hitless service when configured for one-for-one equipment protection
- hitless software migration when configured for one-for-one equipment protection
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also the table “4-port DS3Ch ATM specifications” (page 121).

Table 49
4-port DS3Ch ATM specifications

Specification	Description
sparing supported	• one-for-n sparing where n is 1 to 4 • one-for-n sparing behavior enhancement • supports operation with a one-for-six sparing panel such as the NTQS31, where up to 6 FPs can be spared (backed up) by one FP, all of the same FP type in the same shelf
processor memory	1024 channels per card
minimum software level required	PCR1.3
FP technologies	• PEC NTHR31BA - PPC, AQM1.0, PQC1.0 • PEC NTHR31CA - PPC, AQM1.1, PQC1.0 • PEC NTHR31DA - PPC, AQM1.1, PQC2.0

4-port DS3Ch FR FP

The PECs for the 4-port DS3Ch FR FPs are:

- NTHR88 (PQC6v2 (also known as PQC2.0) version of 4-port DS3Ch FR FP)
- NTHR89 (PQC12-based 4-port DS3 channelized FR FP)

  Note: When neither PEC is mentioned specifically, assume the text applies to both PECs.

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port DS3Ch FR configuration considerations” (page 122).

For information about the characteristics of this FP, see “4-port DS3Ch FR characteristics” (page 126).

4-port DS3Ch FR configuration considerations

Before you begin configuring the 4-port DS3Ch FR FP, consider the following.

> **CAUTION**
> **Risk of port lockup following an interruption of a software migration**
> If a 4-port DS3 Ch FR FP (NTHR88 or NTHR89) is removed from the shelf, locked in software, or loses power during the reboot sequence of a software migration, then one or more of the FP ports may not work when it is replaced on the shelf, unlocked, or powered again.
>
> To avoid any service interruptions, do not remove a 4-port DS3 Ch FR FP from the shelf, lock the card, or cut off power for at least one minute after the logical processor (LP) is enabled.
>
> A dual-bank flash programming mode prevents potential lockup in most software migrations. If an interruption occurs during the flash memory programming phase of the software download to the internal processors, then those processors with a partially programmed flash memory will be disabled until reprogrammed.

- You must link the ports to a frame relay interface before they can provide any service. See provisioning a *Framer* component in NN10600-901 *Nortel Networks Multiservice Switch 7400/15000/20000 Frame Relay Configuration Management*
- If you change the provisioning of a Nortel Networks Multiservice Switch 15000 or Multiservice Switch 20000 DS3 from channelized to unchannelized or vice versa, you must reset the FP to ensure full connectivity.
- The 4-port DS3Ch FP does not support both channelized and unchannelized configurations at the same time.

- A DS3/x is configured as unchannelized by default. Once a DS1/y is provisioned under a DS3x, the DS3/x is automatically changed to channelized and the hardware is reconfigured. Deleting a DS1/y under the same DS3/x will change the DS3/x back to unchannelized and reconfigure the hardware.
- To create an unchannelized virtual framer, each virtual framer must have an lp/* DS3/x port without an application linked to that port. If a port is not added, the virtual framer will be channelized.
- If you configure the FP for multi-link frame relay (MLFR), use the following values to help you set component attributes:
  - MLFR/0-27 must be linked to DS3/0
  - MLFR/28-55 must be linked to DS3/1
  - MLFR/56-83 must be linked to DS3/2
  - MLFR/84-111 must be linked to DS3/3

  Note: If all the links of the same *Mlfr* component are not bound to *DS1 Channel/0* components under the same DS3, a semantic check error will be displayed.

- It is recommended that the largest allowed DPRS packet size (attribute *mod vcs maxSubnetPacketSize*) not be set larger than 4096 bytes. Additionally, the largest allowed frame size (attribute *fru/* dl/* sp maximumFrameSize*) should not be set larger than 4096 bytes. These settings will prevent frame segmentation and recombination for normal traffic.
- When you add a DS1 component, the system automatically adds a Channel/0 component that contains no provisioned timeslots.

  The following list outlines the channel limitations that exist due to the hardware limitations of the FP:
  - Each group of DS1s (DS1 to DS14 and DS15 to DS28) which consists of 14 components each, supports a maximum of 128 channels.
  - Each DS3 port supports a maximum of 256 channels.
  - Each 4-port DS3Ch FR FP supports a maximum of 1024 channels.

- The ports on the FP can be configured as either unchannelized or channelized. When unchannelized, the entire payload bandwidth functions as single clear channel. When channelized there are 28 DS1 within a DS3. Each DS1 can then be channelized to 24 DS0 timeslots.
- You can assign up to 24 timeslots to a channel.

  The following list outlines the timeslot limitations:

  — Each timeslot assigned to a channel must be in the same DS1.

  — Each timeslot can only be assigned to a channel once.

  — Each group of DS1s (DS1 to DS14 and DS15 to DS28) which consists of 14 components each supports a maximum of 336 timeslots.

  — Each DS3 port supports a maximum of 672 timeslots.

  — Each 4-port DS3Ch FR FP supports a maximum of 2688 timeslots.

  Note: If you download and display information from a provisioning file, the timeslot value of none displays as a “0”. However, you can not use the value “0” to provision a timeslot.

- You can provision a frame relay service, either FrUni, FrNni, or FrAtm, with channels defined with a timeslot value of none. This timeslot value allows for the pre-provisioning of frame relay services without assigning specific DS0 timeslots to a channel thereby saving bandwidth. Once the user creates a framer component with a timeslot value of none provisioned, the channel is in a ready, enabled, idle state and does not transfer data. Since there is no bandwidth for timeslot none and the link can not carry traffic, the following are inoperable or unprovisionable

  — LMI

  — DLCI

  Note: The timeslot value of none requires Multiservice Switch software release 2.2 or later.

- See also “4-port DS3Ch FR configuration parameters” (page 125).

Table 50
4-port DS3Ch FR configuration parameters

Parameter	Values
Card type <cardtype>	4pDS3Ch
Port type <port>	DS3, DS1
DS3 Port number <m>	0 to 3
Tributary DS1 Port number <q>	1 to 28
Port configuration	channelized, unchannelized
Number of DS1 channels	up to 24, Chan/0-Chan/23
Timeslots per channel	none, 1 to 24
Timeslot data rate for DS1 port	doNotOverride
DS3 Clocking source	local, module
Tributary DS1 port clocking source	sameAsDs3

Removing timeslot value none provisioning prior to reverting software

Provisioning the timeslot value of none is only supported on Nortel Networks Multiservice Switch software release 2.2 and later. Before reverting from a 2.2 release or later, to an earlier release that does not support provisioning the timeslot value of none, you need to change all timeslots provisioned to the value of none to other values or delete all applications, either FrUni, FrNni, or FrATM, which are bound to channels whose timeslots are set to none. These channels need to be deleted as well. If you are reverting to a Multiservice Switch software release 2.2 or later, no adjustment to the timeslot value is necessary.

To change the provisioning of the timeslots from none to other valid values, see NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

Delete the specific Frame Relay application by using one of the following commands

```
delete FrUni/<n>
```

```
delete FrNni/<n>

delete FrAtm/<n>
```

The letter *n* in these commands refers to the instance number of the FR UNI, FR NNI, or FR-ATM interface.

Delete those channels provisioned with the timeslots value of none associated with the specific Frame Relay application deleted above by using the following command which contains sample instance numbers

```
delete Lp/2 DS3/0 DS1/11 Chan/0
```

The channel instance number of *0* in this command is a channel with the timeslot value of none provisioned using the following command

```
set Lp/2 DS3/0 DS1/11 Chan/0 timeslots !none
```

Verify that the configuration changes you have made are acceptable and then activate them by using the following commands

```
check prov

activate prov
```

4-port DS3Ch FR characteristics

This FP supports frame relay and IP services on Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes, including multi-link frame relay (MLFR) service for FR UNI and FR NNI connections, which provides physical interface emulation for frame relay devices.

Supported features of the 4-port DS3Ch FR include:

- frame-based inverse multiplexing function, sometimes referred to as an IMUX
- FR to ATM network interworking or service interworking
- IP packet forwarding in hardware, access to Multiservice Switch virtual routers (VRs), and IP tunneling
- segmentation and reassembly of FR to AAL5 ATM cells
- four DS3 ports supporting unchannelized DS3 or channelized to 1024 DS0 channels per card
- up to 256 HDLC channels per DS3 port

- creation of superchannels containing up to 24 DS0
- up to 250 virtual framers per FP
- up to 4 unchannelized virtual framers per FP
- IP encapsulation over PPP (RFC 1661) and over FR (RFC 1490)
- VR-to-VR and VCG-based IP VPNs
- IP class of service (CoS)
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

The PQC12-based 4-port DS3 channelized FR FP (PEC NTHR89) has the following distinct characteristics:

- higher frame and cell processing capacity equivalent to OC-12 line rates
- greater IP capabilities
- fast hardware data path support for DPRS loadspreading, frame relay access, and frame relay to ATM interworking, resulting in faster data transmission and higher data throughput

  Note: To take advantage of the enhanced frame relay and DPRS performance capabilities of the PQC12-based FP, the loadspreadfast algorithm must be used. For more information about this forwarding policy, see NN10600-425 *Nortel Networks Multiservice Switch 7400/15000/20000 Operations: Dynamic Packet Routing System*.

See also the table “4-port DS3Ch FR specifications” (page 128).

Table 51
4-port DS3Ch FR specifications

Specification	Description
sparing supported	• one-for-n sparing behavior enhancement • operation with a one-for-six sparing panel such as the NTQS31, where up to 6 FPs can be spared (backed up) by one FP, all of the same FP type in the same shelf
processor memory	128 Mbyte SDRAM
network clock synchronization supported	line, local, module
channelization	• 1024 channels/FP in channelized mode • 4 channels/FP in clear channel mode
minimum software level required	• PEC NTHR88 - PCR1.3 • PEC NTHR89 - PCR3.0
FP technologies	• PEC NTHR88 - PPC, PQC2.0 • PEC NTHR89 - PPC, PQC12

12-port DS3 ATM FP

The PECs for the 12-port DS3 ATM FPs are:

- NTHR23BA
- NTHR23CA
- NTHR23DA

For a full list of PECs (including vintages) for supported FPs, see Nortel Networks Multiservice Switch Release Notes.

For the information you need to configure this FP, see “12-port DS3 ATM configuration considerations” (page 129).

For information about the characteristics of this FP, see “12-port DS3 ATM characteristics” (page 129).

12-port DS3 ATM configuration considerations

Before you begin configuring a 12-port DS3 ATM FP, consider the following:

- For NTHR23CA and later versions, you must have a minimum software of CA01S2A before installing the FP. Inserting the FP into a system running an earlier load will damage the FP, requiring it to be returned to Nortel Networks for repair.
- See also “12-port DS3 ATM configuration parameters” (page 129).
- See also the chapter on configuring equipment protection (sparing) and the chapter on hitless services in NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

Table 52
12-port DS3 ATM configuration parameters

Parameter	Values
Card type <cardtype>	12pDS3Atm
Port type <port>	DS3
Port number <p>	0 to 11
Clocking source	module, line, local, otherPort

12-port DS3 ATM characteristics

Nortel Networks Multiservice Switch DS3 ATM FPs support ATM user-network-interfaces (UNIs) or ATM Nortel Networks Multiservice Switch node-to-node-interfaces (MMIs). Ports can operate on either side of a user/network boundary.

These FPs provide interfaces for Multiservice Switch node-to-Multiservice Switch node communication, and communication between Multiservice Switch and external ATM devices. They support an ATM interface that can support a number of Multiservice Switch trunks or ATM bearer services.

This FP supports ATM services on Multiservice Switch 15000s and Multiservice Switch 20000s.

The 12-port DS3 ATM FP has three cable bundles with eight coax cables in each bundle and with an 8W8 mini-coax cable connector at one end and an 8W8 or BNC connectors at the other end.

Supported features include

- hitless service when configured for one-for-one equipment protection
- hitless software migration when configured for one-for-one equipment protection
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also the table “12-port DS3 ATM specifications” (page 130).

Table 53
12-port DS3 ATM specifications

Specification	Description
sparing supported	• one-for-n sparing behavior enhancement • supports operation with a one-for-six sparing panel such as the NTQS31, where up to 6 FPs can be spared (backed up) by one FP, all of the same FP type in the same shelf
total egress ATM buffer (cells)/port @ 3k connections/FP	51.4k
processor memory	• 128 Mbyte SDRAM • 16 Mbyte FLASH (EPROM)
network clock synchronization supported	module, line, local otherport
channelization	clear
(Sheet 1 of 2)	

Table 53 (continued)
12-port DS3 ATM specifications

Specification	Description
minimum software level required	PCR1.1.2
FP technologies	• PEC NTHR23BA - PPC, AQM1.0, PQC1.0 • PEC NTHR23CA - PPC, AQM1.1, PQC1.0 • PEC NTHR23DA - PPC, AQM1.1, PQC2.0
(Sheet 2 of 2)	

Common non-channelized DS3 ATM FP configuration considerations

- For all ATM FPs you must link the ports to an ATM interface before they can provide any service. For more information, see the section on provisioning the AtmInterface component in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- The ports on a DS3 ATM FP are not channelized. The entire payload bandwidth functions as a single clear channel.
- The cell payload is scrambled by default, according to ITU-T Recommendation I.432. You can turn cell payload scrambling off for a port on an ATM card. However, when cell payload scrambling is turned off for ATM ports, there is a possibility of false cell header delineation errors.
- When you add a port, the system automatically creates an ATMCell subcomponent. The system also automatically provisions C-Bit Parity mode. If you do not want to use C-Bit Parity mode, use the command

  set lp/<n> DS3/<m> cBitParity off
- Cells are directly mapped into the DS3 payloads by default. You can use plcp cell mapping instead of the default direct mapping for a port on a DS3. Use the command

  set lp/<n> DS3/<m> mapping plcp
- The mapping affects the reference source used when line clocking source is selected. For direct mapping, the received DS3 bitstream at 44.736 MHz or 34.368 MHz determines the clock. For plcp mapping, the received PLCP framing at 8 kHz determines the clock.

Common channelized DS3 ATM FP configuration considerations

- For all ATM FPs you must link the ports to an ATM interface before they can provide any service. For more information, see the section on provisioning the AtmInterface component in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- The DS3Ch FPs support DS1 tributary ports beneath each DS3 port.Most generic procedures in this guide and the NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures* do not show commands that take into account a hierarchy of ports (DS1 under DS3). Remember to include the DS1 hierarchy when you issue commands. For example, to set provisionable DS1 attributes, use the command

  ```
  set lp/<n> DS3/<m> DS1/<q> <attribute>
  <attributevalue>
  ```

  To display DS1 tributary port information, use the command

  ```
  display lp/<n> DS3/<m> DS1/<q>
  ```

  To lock a DS1 tributary port, use the command

  ```
  lock lp/<n> DS3/<m> DS1/<q>
  ```

- When you add a *DS3* component, the system automatically creates *DS1/1*. You can create up to 28 DS1s for each *DS3* component.
- When you add a DS1 component, the system automatically adds a Channel 0 component that contains 24 provisioned timeslots. The channel component uses all timeslots by default and none can be added or removed. Only one channel can be activated under one DS3 DS1 component. Chan/0 can be deleted and another channel added, Chan/<1 to 23>.
- Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes synchronize the transmit clock for all ports from the same reference. There is only one transmit clock on the card and all ports must share it. At the DS3 level, all DS3 components on the card must have the same *clockingSource*.

DS3 FP OSI states

This section lists the following OSI state tables for DS3 FPs:

- For all non-ATM FPs, except the 4-port DS3Ch FR FP:
  - “DS3 component state combination” (page 135)
  - “DS3 Test component state combination” (page 136)
- In addition, for the 2-port DS3Ch TDM FP, see
  - “DS1 component state combination” (page 88)
  - “DS1 Channel (Chan) component state combination” (page 89)
  - “DS1 Test component state combination” (page 89)
- For all ATM, AAL1, and Frame-based FPs except the 4-port DS3Ch FR FP, see:
  - “DS3 ATM component state combination” (page 136)
  - “DS3 ATM Test component state combination” (page 137)
- For the 4-port DS3 Ch FR FP (NTHR88 and NTHR89) OSI states:
  - “DS3 channelized component state combination” (page 138)
  - “DS3 channelized frame relay Test component state combination” (page 139)
  - “DS1 component state combination” (page 140)
  - “DS1 Channel (Chan) component state combination” (page 140)

Table 54
DS3 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The DS3 interface is inoperable due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisAlarm • rxRaiAlarm or the far end DS3 interface is requesting the local interface to loop back the incoming signal.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes. The line input is recognized as good. Clocks are available.
Unlocked, Enabled, Busy	The DS3 component is in use. The DS3 component services only one user (for example a Framer component) at a time.
Locked, Enabled, Idle	A port and line test is in progress.
Locked, Disabled, Idle	A hardware test failed and the DS3 component is put in the locked state. A lock operator command is in effect.

Table 55
DS3 Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Busy	The Test component is in use. A V35, X21, DS1, E1, CHAN, DS3, or E3 component creates the Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

Table 56
DS3 ATM component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The DS3 interface is inoperable due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisAlarm • rxRaiAlarm • lcdAlarm • rxIdle Or the far-end DS3 interface sends a request to the local end to loop back the incoming signal. When the PLCP option is turned on, PLCP lofAlarm and PLCP rxRaiAlarm also disable the component.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes. The line input is recognized as good. Clocks are available.
(Sheet 1 of 2)	

Table 56 (continued)
DS3 ATM component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Enabled, Busy	The DS3 component is in use. The DS3 component services only one user (an ATM interface component) at a time.
Unlocked, Enabled, Shutting Down	A lock command is in effect against the DS3 component. The DS3 component is waiting for the ATM interface component to go into a disabled mode before it completes the lock sequence and shuts down.
Locked, Enabled, Idle	A lock operator command is in effect. The DS3 component is operating in test mode (availabilityStatus: inTest).
Locked, Disabled, Idle	A lock operator command is in effect. The component is in one of the following conditions: • Left offline. (availabilityStatus: offline) • Some hardware test failed. (availabilityStatus: failed) • If running in test mode external factors cause errors (availabilityStatus: inTest). Bad line state and excessive line state changes are possible causes.
(Sheet 2 of 2)	

Table 57
DS3 ATM Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Idle	The hardware component is locked. You can perform a port and line test.
Unlocked, Enabled, Busy	The Test component is in use. A Chan, DS1, E1, DS3, E3, V35, X21, Sonet, or Sdh component creates a Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

Table 58
DS3 channelized component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The DS3 interface is inoperable due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisAlarm • rxRaiAlarm • lcdAlarm • rxIdle Or the far-end DS3 interface sends a request to the local end to loop back the incoming signal.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes as is provisioning of the The line input is recognized as good. Clocks are available.
Unlocked, Enabled, Busy	The *DS3* component is in use. The *DS3* component services only one user (an *Framer* component) at a time.
Shutting Down, Enabled, Busy	A lock command is in effect against the *DS3* component. The *DS3* component is waiting for the *Framer* component to go into a disabled mode before it completes the lock sequence and shuts down.
Locked, Enabled, Idle	A lock operator command is in effect. The *DS3* component is operating in test mode (availabilityStatus: inTest).
(Sheet 1 of 2)	

Table 58 (continued)
DS3 channelized component state combination

Combination (Administrative, Operational, Usage)	Details
Locked, Disabled, Idle	A lock operator command is in effect. The component is in one of the following conditions: • Left offline (availabilityStatus: offline) • Some hardware test failed (availabilityStatus: failed) • If running in test mode external factors cause errors (availabilityStatus: inTest). Bad line state and excessive line state changes are possible causes.
Note: On a 4-port DS3 channelized frame relay FP, provisioning the timeslot of the Framer component to the value of none and not locking its application result in the OSI state of Unlocked, Enabled, Idle.	
(Sheet 2 of 2)	

Table 59
DS3 channelized frame relay Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the *Test* component. Start test requests will be rejected.
Locked, Disabled, Idle	The hardware component is locked. You can perform a port and line test.
Locked, Enabled, Idle	The *Test* component is in use. A *Chan*, *DS1, or DS3,* component creates a *Test* component. The *Test* component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

Table 60
DS1 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The DS1 port is inoperable due to at least one of the following alarms. • losAlarm • lofAlarm • rxAisAlarm
Unlocked, Enabled, Busy	The DS1 component is in use.
Locked, Enabled, Idle	A lock/lock operator command is in effect. The DS1 component is ready to service a user. A test is running.
Locked, Disabled, Idle	• A hardware test failed. • The *DS1* component is in the locked state. • External factors render the DS1 port inoperable.

Table 61
DS1 Channel (Chan) component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	External factors render the Chan component inoperable because of DS1 alarms.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes.
Unlocked, Enabled, Busy	The Chan component is in use. The Chan component can only service one user at a time.
Locked, Enabled, Idle	A lock operator command is in effect. The Chan component is otherwise ready to service a user. A test is running.
(Sheet 1 of 2)	

Table 61 (continued)
DS1 Channel (Chan) component state combination

Combination (Administrative, Operational, Usage)	Details
Locked, Disabled, Idle	A hardware test failed or the Chan component is in the locked state.
Note: On a 4-port DS3 channelized frame relay FP, provisioning the timeslot of the Chan component to the value of none and not locking the Chan component result in the OSI state of Unlocked, Enabled, Idle.	
(Sheet 2 of 2)	

Table 62
DS1 Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Busy	The Test component is in use. A DS1 or Chan component creates a Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

DS3 FP standards compliance

This section lists the standards compliance for the DS3 FPs:

- "1-port DS3 compliance with standards" (page 142)
- "1-port DS3C compliance with standards" (page 142)
- "4-port DS3Ch FR compliance with standards" (page 144)
- "2-port DS3C TDM compliance with standards" (page 145)
- "3-port DS3 ATM compliance with standards" (page 145)
- "3-port DS3 ATM IP compliance with standards" (page 146)
- "4-port DS3Ch ATM compliance with standards" (page 148)
- "4-port DS3Ch with AAL1 CES compliance to standards" (page 148)
- "12-port DS3 compliance with standards" (page 149)

1-port DS3 compliance with standards

The 1-port DS3 FP complies with the applicable sections of these standards:

- ANSI T1.102.1989
- ANSI T1.107A.1990
- ANSI T1.404
- Telcordia TR-TSY-000499

1-port DS3C compliance with standards

The 1-port DS3C FP complies with the applicable sections of these North American DS3 interconnect standards:

- ANSI T1.102.1989, Section 5
- ANSI T1.107A.1990, Section 8.1 DS3 Frame Structure, except for the following sections:
  - 8.1.2 Application Identification Channel Signal (DS3 M-Frame applications)
  - 8.1.4.1 Line Loopback
  - 8.1.4.2 Payload Loopback, and DS1 Tributary channelization

- 8.2 DS3 Application: M23 Multiple 7 DS2 Channels
- 8.3 DS3 Application: Synchronous DS3 M13 Multiplex - 28 DS1 Channels
- 8.4 DS3 Application: Asynchronous DS3 C-bit Parity - 28 DS1 Channels

- ANSI T1.404, 1989, except for the following sections:
  - 5.4 Signal Formats (SYNTRAN)
  - 6.2 DS3 Multiplex Formats
  - 7.2 Synchronous DS3 Signal
- Telcordia TR-TSY-000499, complies to the DS3 main framing structure, except for:
  - DS1 Tributary channelization
- CCITT G.703, Section 5 Interface at 44,736 kbit/s

The DS3 interface supports the following standards:

- G.703 Section 5; Interface at 44.736 Mbit/s
- G.753
- T1.102-1993 Electrical Specification
- T1.404-1994 DS3 Metallic Interface Specification
- T1.107-1988 Format Specifications
  - Section 8, excluding sections 8.2., 8.3
- T1.107a-1990 section 8.2 M23 Multiplex - 7 DS2 channels, excluding section 8.2.1
- T1.107a-1990 section 8.4 Asynchronous Cbit Parity - 28 DS1 channels. Section 8.4.7 is not supported. In section 8.4.3.1 only the following FEAC alarm codes are supported:
  - DS3 Eqpt. Failure (SA)
  - DS3 LOS, DS3 Out-of-Frame
  - DS3 AIS rcvd

— DS3 Idle rcvd

The DS1 interface supports the following standards:

- G.703; Section 2: Interface at 544 kbit/s
- G.704
  - Section 2.1, excluding section 2.1.3.1.3
  - Section 3.1, excluding sections 3.1.3.2
- G.706; Section 2
- G.733; Section 4
- G.821 All sections
- T1.107-1988 Format Specifications; Section 5, excluding sections 5.2.1.3.2, 5.6, 5.8, 5.9

4-port DS3Ch FR compliance with standards

The 4-port DS3Ch FR FP complies with the applicable sections of these standards:

- ANSI T1.102-199X, Section 6.4
- ANSI T1.107-1998 and T1.107a-1990, Sections 8.1, 8.4, except 8.4.7
- ANSI T1.404-19XX
- ANSI T1.231-1993 Sections 7 and 9 except 15 minute and day counts and thresholds
- ANSI T1E1.2/94-002R1, 1994, Sections 9 and 15.2
- ANSI T1.646-1995
- ATM Forum ATM User-Network Interface Specification Draft Version 3.1, 1994.
- ATM Forum AF-PHY-0054.000
- ATM Forum AF-TEST-0023.000, except items 3.3.7 and 3.3.8: C-bit terminal-to-terminal data link is not supported; and item 3.6.2: by default cell payload scrambling is enabled
- ATM Forum AF-TEST-0082.000

- ITU-T G.824
- Telcordia TR-TSV-000773, 1993, Section 4
- Telcordia TR-NWT-000499, 1991, Sections 10.5.1 and 10.5.3
- Telcordia TR-TSY000009, Sections 2.6 (DS3 coding) and 4.1 (Condition monitoring and failure detection thresholds)

2-port DS3C TDM compliance with standards

The DS3C TDM FP complies with the following DS3 standards:

- ANSI T1.102-1993
- ANSI T1.107-1988, Section 8; excluding section 8.2
- ANSI T1.107a-1990, Section 8; excluding sections 8.2, 8.3, and 8.4.7; in section 8.4.3.1, only the following alarm codes are supported: DS3 Eqpt. Failure (SA), DS3 LOS, DS3 Out-of-Frame, DS3 AIS rcvd and DS3 Idle rcvd
- ANSI T1.231-1993, Section 7; excluding section 9
- ANSI T1.404-1994
- ITU-T G.703, 1991, Section 5
- ITU-T G.753

The DS3C TDM FP complies with the following DS1 standards:

- ANSI T1.107-1988, Section 5; excluding sections 5.2.1.3.2, 5.3, 5.8, 5.9, and 5.10
- ANSI T1.231-1993, Section 6; excluding section 9
- ITU-T G.704, Section 2.1
- ITU-T G.706, Section 2
- ITU-T G.733, Section 4
- TR62415

3-port DS3 ATM compliance with standards

The DS3 ATM FP complies with the applicable sections of these standards:

- ANSI T1.102-199X, Section 6.4

- ANSI T1.107-1988 and T1.107a-1990, Sections 8.1, 8.4, except 8.4.7
- ANSI T1.404-19XX
- ANSI T1.231-1993, Sections 7 and 9 except 15 minute and day counts and thresholding
- ANSI T1E1.2/94-002R1, 1994, Sections 9 and 15.2
- ATM Forum ATM User-Network Interface Specification Draft Version 3.1, 1994
- ITU-T G.703, 1991, Section 5
- ITU-T G.752, 1988, Section 1.3 except justification
- ITU-T G804, 1993, Section 7
- ITU-T I.432 - B-ISDN, Sections 4.3 to 4.5
- Telcordia TR-TSV-000773, 1993, Section 4
- Telcordia TR-NWT-000499, 1991, Sections 10.5.1 and 10.5.3

3-port DS3 ATM IP compliance with standards

The 3-port DS3 ATM IP FP complies with the applicable sections of these standards:

ATM Forum

- AF-UNI-0010.002 (ref. [28])
  - — complies with section 2.2 (DS3 Physical Layer Interface)
- AF-PHY-0054.000 (ref. [27])
- AF-TEST-0023.000 (ref. [30]). Complies except for:
  - — items 3.3.7 and 3.3.8: C-bit terminal-to-terminal data link is not supported
  - — item 3.6.2: By default cell payload scrambling is enabled
- AF-TEST-0082.000 (ref. [32])

ANSI

- T1.102-1993 (ref. [11]):
  - — complies to section 6.4 (DS3 level specification)

- T1.107-1995 (ref. [21]):
  - — complies to section 9.1 (DS3 frame structure)
  - — complies to section 9.3 (C-bit parity) except:
  - — Section 9.3.7 (Terminal-to-terminal path maintenance data link)
- T1.231-1993 (ref. [22]):
  - — complies to section 7 for all DS3 alarms and statistics listed in Section 3.2.4 on page 10
- T1.404-1994 (ref. [23]):
- T1.646-1995 (ref. [24], supersedes T1.624):

Telcordia

- TR-TSV-000773, (ref. [36]):
- TR-TSY-000009 (ref. [34]):
  - — complies to section 2.6 (DS3 coding)
  - — complies to section 4.1 (Condition monitoring and failure detection thresholds)

ITU-T

- G.703 (ref. [44]):
  - — complies to section 5 (Interface at 44.736 Mbit/s)
- G.775 (ref. [47]):
  - — 218 MD-1998.0041 - Version 01.05 - released - 1998-07-31 (PP504, P6.0)
- G.804 (ref. [50]):
  - — complies to section 7 (Mapping of ATM cells into 44.736 Mbit/s)
- G.824 (ref. [53]):
- I.432 (ref. [58]):
  - — complies to section 4.3 (HEC)
  - — complies to section 4.4 (Idle cells)
  - — complies to section 4.5 (Cell delineation and scrambling)

4-port DS3Ch ATM compliance with standards

The 4-port DS3Ch ATM FP complies with the applicable sections of these standards:

- ANSI T1.107, April 1989 - "Digital Hierarchy Formats Specifications"
- ANSI T1.107a, 1990 - "Supplement to formats specifications (DS3 format applications)"
- ANSI T1.404, 1989 - "Network-to-Customer Installation - DS3 Metallic Interface Specification"
- Electromagnetic Radiation: FCC Part 15B Class B, EN5502 Class B
- Electromagnetic Immunity: EN50082-1
- Electromagnetic Discharge: Telcordia TR-NWT-1089, EN50082-1
- ITU-T G.704 "Synchronous Frame Structures used at Primary and Secondary Hierarchical Levels"
- ITU-T G.706 "Frame Alignment and Cyclic redundancy Check (CRC) Procedures Relating to Basic Frames Structures Defined in recommendation G.704
- Safety: UL 1950, CSA C22.2 No. 950-M89. IEC 950, EN60950

4-port DS3Ch with AAL1 CES compliance to standards

The 4-port DS3Ch with AAL1 CES complies with the applicable sections of these standards:

- ANSI T1.102-1993, "Digital Hierarchy - Electrical Interfaces"
- ANSI T1.107-1988, "Digital Hierarchy - Formats Specifications", excluding section 8.2 in Interface Rate (DS3)
- ANSI T1.107a, 1990 - "Digital Hierarchy - Supplements to formats specifications (DS3 format applications)", excluding sections 8.2 and 8.3 in Interface Rate (DS3), excluding terminal-to-terminal path maintenance data link in section 8.4.7, and for section 8.4.3.1, the supported FEAC alarm codes are DS3 Eqpt. Failure (SA), DS3 LOS, OOF, AIS received, and Idle received

- ANSI T1.231-1993, “Digital Hierarchy - Layer 1 in-service digital transmission performance monitoring, section 7 and excluding from section 9 current, previous, and recent 15-minute and day counts, and thresholding
- ANSI T1.404, 1994 - “Network-to-Customer Installation - DS3 Metallic Interface Specification”
- Electromagnetic Radiation: FCC Part 15B Class B, EN5502 Class B
- Electromagnetic Immunity: EN50082-1
- Electromagnetic Discharge: Telcordia TR-NWT-1089, EN50082-1
- ITU-T G.703, 1991, “Physical/Electrical Characteristics of Hierarchical Digital Interfaces”, section 5, interface at 44.736 Mbit/s
- ITU-T G.753, all sections
- Safety: UL 1950, CSA C22.2 No. 950-M89. IEC 950, EN60950

12-port DS3 compliance with standards

The 12-port DS3 FP complies with the applicable sections of these standards:

- ANSI T1.102-199X, Section 6.4
- ANSI T1.107-1998 and T1.107a-1990, Sections 8.1, 8.4, except 8.4.7
- ANSI T1.404-19XX
- ANSI T1.231-1993 Sections 7 and 9, except 15 minute and day counts and thresholds
- ANSI T1E1.2/94-002R1, 1994, Sections 9 and 15.2
- ANSI T1.646-1995
- ITU-T G.824
- ATM Forum ATM User-Network Interface Specification Draft Version 3.1, 1994.
- ATM Forum AF-PHY-0054.000
- ATM Forum AF-TEST-0023.000, except items 3.3.7 and 3.3.8: C-bit terminal-to-terminal data link is not supported; and item 3.6.2: by default cell payload scrambling is enabled

- ATM Forum AF-TEST-0082.000
- Telcordia TR-TSV-000773, 1993, Section 4
- Telcordia TR-NWT-000499, 1991, Sections 10.5.1 and 10.5.3
- Telcordia TR-TSY000009, Sections 2.6 (DS3 coding) and 4.1 (Condition monitoring and failure detection thresholds)

Chapter 4
E1 function processors

Nortel Networks Multiservice Switch E1 function processors (FPs) support voice, Frame-based, and ATM services with a line speed of 2.048 Mbit/s. The configuration reference information can help you when you configure and maintain E1 FPs.

Navigate to the information about each FP using the table “Multiservice Switch E1 FPs” (page 152).

For information about OSI states, see “E1 FP OSI states” (page 182).

For information about standards compliance, see “E1 FP compliance with standards” (page 186).

For the applications and services that are supported by these FPs, see “Applications and services supported by function processors” (page 39).

Table 63
Multiservice Switch E1 FPs

FP service type	Link to FP reference information
Voice	"Common E1 voice service FP characteristics" (page 152) "1-port E1 MVP-E FP" (page 152) "4-port E1 MVP-E FP" (page 155)
ATM	"Common E1 ATM FP configuration considerations" (page 158) "3-port E1 ATM FP" (page 158) "8-port E1 ATM FP" (page 160) "4-port E1 AAL1 FP" (page 163) "32-port E1 TDM FP" (page 165)
Frame-based	"Common E1 frame-based FP configuration considerations" (page 168) "4-port E1 FP" (page 170) "4-port E1Ch FP" (page 172)
Multiservice	"32-port E1 MSA FPs" (page 175)

Common E1 voice service FP characteristics

The E1 FPs that support voice services can be used to provide customer equipment access to Nortel Networks Multiservice Switch networks. These FPs support any combination of voice and bit transparent data services.

All E1 voice service FPs support processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

For detailed information about the audio handling capabilities of the MVP-E FP, see NN10600-750 *Nortel Networks Multiservice Switch 7400 Operations: Voice Transport*, or NN10600-760 *Nortel Networks Multiservice Switch 7400 Operations: DCME Voice Service* .

1-port E1 MVP-E FP

The PEC for the 1-port E1 MVP - enhanced on-board ECAN (MVP-E) is NTNQ86. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “1-port E1 MVP-E configuration considerations” (page 153).

For information about the characteristics of this FP, see “1-port E1 MVP-E characteristics” (page 153).

1-port E1 MVP-E configuration considerations

Before you begin configuring a 1-port E1 MVP-E, consider the values in the table “1-port E1 MVP-E voice configuration parameters” (page 153).

Table 64
1-port E1 MVP-E voice configuration parameters

Parameter	Values
Card type <cardtype>	1pE1Mvpe (for E1 MVP-E)
Port type <port>	E1
Port number <n>	0
Channel number <p>	0 to 30 or 1 to 31
Timeslot	1 to 31
Clocking source	local, line, module

1-port E1 MVP-E characteristics

The E1 MVP-E FP has a single port that provides access to Nortel Networks Multiservice Switch networks from customer equipment, such as a Private Branch Exchange (PBX). The port can process 30 channels that support voice and bit transparent data services. The FP supports channel associated signaling (CAS) and common channel signaling (CCS) protocol.

Supported features include:

- either switched or permanent virtual circuit (SVC or PVC) connections, according to the service
- a number of audio handling capabilities for both ingress and egress traffic to conserve bandwidth and ensure quality, including the following:

- compression of voice, modem and facsimile calls using standards-based encoding algorithms
- congestion management
- suppression of idle frames during speech calls and facsimile transmissions
- internal echo cancellation. The E1 MVP-E FP contains a daughter card that supports internal echo cancellation according to ITU-T G.165 and G.168.
- detection of 2100 Hz tones (identifying modem and facsimile transmissions) and DTMF digits
- control of cell delay variation and network loss planning
- μ-Law (North American) to A-Law (international) conversion of 64 kbit/s voice data according to ITU-T G.711

See also "1-port E1 MVP-E specifications" (page 154).

Table 65
1-port E1 MVP-E specifications

Specification	Description
effective data rate	1.920 Mbit/s
sparing supported	one-for-one sparing between MVP-E-to-MVP-E.
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC
access mode	31 channels
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	8 Mbyte

4-port E1 MVP-E FP

The PEC for the 4-port E1 multipurpose voice platform (MVP) is NTNQ88. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port E1 MVP-E configuration considerations” (page 155).

For information about the characteristics of this FP, see “4-port E1 MVP-E characteristics” (page 156).

4-port E1 MVP-E configuration considerations

Before you begin configuring the 4-port E1 MVP-E FP, consider the following:

- This FP supports interworking only with software levels PCR2.3 or higher. The 4-port E1 MVP-E in PCR 4.2 or higher can interwork with the 1-port MVP-E running Release 7.0. Note that this FP does not support interworking to any E1 voice FP.
- All ports must be provisioned as CAS or CCS rather than a combination of these two protocols.
- There are 32 timeslots on each port. Timeslot 0 is used for framing and cannot be used for data. If the channel-associated signaling (CAS) is chosen, only 30 channels are available. Timeslot 16 is used exclusively for signaling in CAS and CCS.
- See also “4-port E1 MVP-E voice configuration parameters” (page 155).

Table 66
4-port E1 MVP-E voice configuration parameters

Parameter	Values
Card type <cardtype>	4pE1Mvpe
Port type <port>	E1
Port number <n>	0 to 3
Port configuration	fractional link or clear channel (non-channelized)
(Sheet 1 of 2)	

Table 66 (continued)
4-port E1 MVP-E voice configuration parameters

Parameter	Values
Channel number <p>	0 to 31
Timeslot	1 to 31
Clocking source	local, line, module
(Sheet 2 of 2)	

4-port E1 MVP-E characteristics

Each port can process 31 channels that support voice networking and voice and bit transparent data services. This FP supports channel associated signaling (CAS) and common channel signaling (CCS) protocols.

The 4-port E1 MVP-E is supported only with a second generation control processor (CP2).

Supported features include:

- permanent virtual circuit (PVC) connections
- out-of-band DTMF tone transmission
- CCS-to-CAS protocol gateway
- a number of audio handling capabilities for both ingress and egress traffic to conserve bandwidth and ensure quality, including the following:
  - compression of voice, modem and facsimile calls using standards-based encoding algorithms
  - congestion management
  - suppression of idle frames during speech calls and facsimile transmissions
  - internal echo cancellation. The 4-port E1 MVP-E FP contains a daughter card that supports internal echo cancellation according to ITU-T B.164, G.165 and G.168.
  - detection of 2100 Hz tones (identifying modem and facsimile transmissions) and DTMF digits

— control of cell delay variation and network loss planning

— bidirectional µ-Law (North American) to A-Law (international) conversion of 64 kbit/s voice data according to ITU-T G.711

See also:

- “4-port E1 MVP-E specifications” (page 157)

Table 67
4-port E1 MVP-E specifications

Specification	Description
effective data rate	1.920 Mbit/s
sparing supported	one-for-one sparing between like FPs only (that is, 4-port MVP-E to 4-port MVP-E)
network clock synchronization supported	yes
minimum software level required	PCR2.3
access mode	31 channels
normal memory	64 Mbyte
FP technologies	PPC, PQC2.0

Common E1 ATM FP configuration considerations

Before you begin configuring an E1 ATM FP, consider the following:

- For all E1 ATM FPs, except for the 32-port E1 TDM, you must link the ports to an ATM interface before they can provide any service. For more information, see the section on provisioning the AtmInterface component in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- The ports on all ATM FPs are individually provisionable.

3-port E1 ATM FP

The PEC for the 3-port E1 ATM is NTNQ46. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “3-port E1 ATM configuration considerations” (page 158).

For information about the characteristics of this FP, see “3-port E1 ATM characteristics” (page 159).

3-port E1 ATM configuration considerations

Before you begin configuring the 3-port E1 ATM FP, consider the following:

- The entire payload bandwidth on each port is a single clear channel. This channel operates at: 30 x 64 kbit/s.
- When you add an E1 port, the system automatically creates the subcomponents chan/0, chan/0 cell, and Test.
- You must use all timeslots.
- The cell payload is scrambled by default, according to ITU-T Recommendation I.432. You can turn cell payload scrambling off for a port on an ATM card. However, when cell payload scrambling is turned off for ATM ports, there is a possibility of false cell header delineation errors.

- An ILS Forwarder card is required for IP support on CQC-based FPs. The combination of a CQC-based FP and an ILS Forwarder card supports IP, but not IP VPN (tunneling with VCG). See NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description* for information on the ILS Forwarder card.
- See also “3-port E1 ATM configuration parameters” (page 159).

Table 68
3-port E1 ATM configuration parameters

Parameter	Values
Card type <cardtype>	3pE1Atm
Port type <port>	E1
Port number <n>	0 to 2
Channel number <p>	0 to 30 or 1 to 31
Timeslot	• 1 to 15 for E1A CAS linetype • 17 to 31 for E1A CCS linetype
Clocking source	local, module

3-port E1 ATM characteristics

This FP supports ATM services on Nortel Networks Multiservice Switch 7400 nodes. It supports ATM user-network-interfaces (UNIs) or ATM Multiservice Switch node-to-Multiservice Switch node-interfaces (MMIs). This FP can operate from either side of the user/network boundary.

The 3-port E1 ATM FP also supports processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

See also “3-port E1 ATM specifications” (page 160).

Table 69
3-port E1 ATM specifications

Specification	Description
effective data rate	1.984 Mbit/s
sparing supported	one-for-one
network clock synchronization supported	yes
minimum software level required	not applicable
access mode	G.704 direct framing
normal memory	16 Mbyte
shared memory	2 Mbyte
FP technologies	PDC1.1, CQC

8-port E1 ATM FP

The PEC for the 8-port E1 ATM is NTNQ50. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “8-port E1 ATM configuration considerations” (page 160).

For information about the characteristics of this FP, see “8-port E1 ATM characteristics” (page 162).

8-port E1 ATM configuration considerations

Before you begin configuring an 8-port E1 ATM FP, consider the following:

- This FP supports inverse multiplexing for ATM (IMA). The number of physical links that may form an IMA group can be an integer value between 1 and 8. The resulting bandwidth for the IMA group can be N x 1.920 Mbit/s, where N = 1 to 8.
- When you add a port, the system automatically adds the subcomponents chan/0 and chan/0 cell. Only one channel can be activated under one E1 component. Chan/0 can be deleted to add another Chan/<1-31>.

- You must use all timeslots.
- The attribute *lineType* defines the framing mode used on E1 ports. CCS (common channel signaling) is the only valid value. It indicates that timeslots 1 to 15 and 17 to 31 are all available for data.
- If traffic shaping (per-VC queueing) is enabled, you can only use ports 0 to 3 for independent ATM links. For IMA link groups, you can use any port.
- The entire payload bandwidth is a single clear channel. The channel operates at 30 x 64 Kbit/s.
- The cell payload is scrambled by default, according to ITU-T Recommendation I.432. You can turn cell payload scrambling off for a port on an ATM card. However, when cell payload scrambling is turned off for ATM ports, there is a possibility of false cell header delineation errors.
- An ILS Forwarder card is required for IP support on CQC-based FPs. The combination of a CQC-based FP and an ILS Forwarder card supports IP, but not IP VPN (tunneling with VCG). See NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description* for information on the ILS Forwarder card.
- See also “8-port E1 ATM configuration parameters” (page 161).

Table 70
8-port E1 ATM configuration parameters

Parameter	Values
Card type <cardtype>	8pE1Atm
Port type <port>	E1
Port number <n>	0 to 7
Channel number <p>	0 to 30 or 1 to 31
Line type	CCS
Timeslot	1 to 15 and 17 to 31
Clocking source	local, line, module

8-port E1 ATM characteristics

The 8-port E1 ATM FP supports ATM services for Nortel Networks Multiservice Switch 7400 nodes, and processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

This FP also supports inverse multiplexing for ATM (IMA). It can support both independent ATM links and IMA virtual links on the same FP; however, certain provisioning restrictions apply. Each independent link or IMA virtual link supports ATM user-network-interfaces (UNIs) and ATM Multiservice Switch node-to-Multiservice Switch node-interfaces (MMIs) that can operate from either side of the user/network boundary. For more information, see NN10600-730 *Nortel Networks Multiservice Switch 7400/15000/20000 Inverse Multiplexing for ATM Operations*.

See also “8-port E1 ATM specifications” (page 162).

Table 71
8-port E1 ATM specifications

Specification	Description
effective data rate	1.920 Mbit/s
sparing supported	one-for-one sparing
network clock synchronization supported	yes
minimum software level required	not applicable
access mode	G.704 direct framing
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	2 Mbyte
FP technologies	PDC1.1, CQC

4-port E1 AAL1 FP

The PEC for the 4-port E1 AAL1 is NTNQ48. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port E1 AAL1 configuration considerations” (page 163).

For information about the characteristics of this FP, see “4-port E1 AAL1 characteristics” (page 164).

4-port E1 AAL1 configuration considerations

Before you begin configuring a 4-port E1 AAL1 FP, consider the following:

- For unstructured services, you must provision all timeslots. The entire payload bandwidth is a single clear channel.
- When you add a port, the system automatically creates a Channel 0 component.
- See the table “4-port E1 AAL1 configuration parameters” (page 163).

Table 72
4-port E1 AAL1 configuration parameters

Parameter	Values
Card type <cardtype>	4pE1Aal1
Port type <port>	E1
Port number <n>	0 to 3
Channel number <p>	0 to 30 or 1 to 31
Timeslot	1 to 31
Clocking source	module

To prevent having too many timeslots exceeding the bandwidth of the FP, a semantic check in the software prevents too many timeslots from being configured when the FP is running structured services. There is no limit when the card is running unstructured services. The actual bandwidth that is used for each service on a card is calculated as follows.

((configured_timeslot times max_*partialFill*) + (configured_*partialFill* minus one)) divided by configured_*partialFill*

The attribute *partialFill* defines the configured (provisioned) partial fill level and is the number of octets of the AAL1 cell that will be used for data. The remaining octets are padded with the pattern specified by the attribute *idlePattern*. The formula provides the calculations for an E1 card in the table “4-port E1 AAL1 bandwidth limitations” (page 164).

Table 73
4-port E1 AAL1 bandwidth limitations

Effective size of the largest service	At least one configured CAS structured service	No configured CAS structured service
1 to 12 timeslots	72 total timeslots	106 total timeslots
13 to 18 timeslots	65 total timeslots	98 total timeslots
19 to 24 timeslots	62 total timeslots	94 total timeslots
25 to 30 timeslots	60 total timeslots	92 total timeslots

4-port E1 AAL1 characteristics

This FP supports ATM services on Nortel Networks Multiservice Switch 7400 nodes.

Supported features include:

- carries constant bit rate (CBR) or ‘circuit’ traffic over ATM networks
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

- one circuit emulation service (CES) per channel as defined in the ATM Forum CES Interoperability Specification. However, the FP must be completely configured either for unstructured or structured services. A combination of services on an FP is not supported. For FPs configured with structured services, the connections can be a combination of basicStructured and casStructured services.

See also “4-port E1 AAL1 specifications” (page 165).

Table 74
4-port E1 AAL1 specifications

Specification	Description
effective data rate	2.048 Mbit/s
sparing supported	one-for-one
network clock synchronization supported	yes
minimum software level required	not applicable
access mode	single
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	0
FP technologies	PDC1.1, CQC

32-port E1 TDM FP

The PECs for the 32-port E1 time division multiplexing (TDM) FP are:

- NT0461 and NT0464 for Nortel Networks Multiservice Switch 7400 nodes
- NTHW92 and NTHW81 for Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes

NT0464 and NTHW81 are available from PCR5.2 onwards. They support identical functionality to the previous codes and can be used in one-for-one or one-for-n sparing configurations alongside NT0461 and NTHW92. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “32-port E1 TDM configuration considerations” (page 166).

For information about the characteristics of this FP, see “32-port E1 TDM characteristics” (page 167).

32-port E1 TDM configuration considerations

Before you begin configuring a 32-port E1 TMD FP, consider the following:

- Each port of the 32-port E1 TDM FP is individually accessible and configurable in conjunction with the multiport aggregate device. Each port supports one channel. Each channel can have 1 to 31 timeslots. Each timeslot represents a 64 kbit/s portion of bandwidth.
- When you add an *E1* component, the system automatically creates a *Channel/0* component that contains 31 provisioned timeslots, numbered 1 to 31. The system also creates a *TrunkConditioning* (*TC*) component beneath the *Channel* component.
- The *timeslotDataRate* attribute beneath a *Channel* component must be set to doNotOverride.
- The *lineType* attribute beneath an *E1* component must be set to ccs.
- See also “32-port E1 TDM configuration parameters” (page 166).

Table 75
32-port E1 TDM configuration parameters

Parameter	Values
Card type <cardtype>	32pE1Aal
Port type <port>	E1
Port number <n>	1 to 32
(Sheet 1 of 2)	

Table 75 (continued)
32-port E1 TDM configuration parameters

Parameter	Values
Channel number <p>	0
Timeslot	1 to 31
Clocking source	local, module
(Sheet 2 of 2)	

32-port E1 TDM characteristics

The 32-port E1 TDM FP supports PVG services on Nortel Networks Multiservice Switch nodes as the interface to the TDM network. It supports switched and non-switched gateways between a TDM network and an ATM network. This FP has two sets of coax connectors (each set has a transmit and a receive connector) that each support 16 E1 ports, for a total of 32 structured E1 ports.

The 32-port E1 TDM FP transports common channel signaling and can transport channel associated signaling using NSTA unsignaled trunks for non-switched voice gateways.

The 32-port E1 TDM FP provides support for PVG services on Multiservice Switch 15000 and Multiservice Switch 20000 nodes. You can use the monitor ports to connect to test equipment and test the card while it is in service. It carries a -26dB tap of the transmit (Tx) connector signal. The 9-pin subminiature D-type connector provides one-for-one sparing capability. For information on provisioning the monitor ports, see NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

Supported features include:

- up to 992 64 kbit/s timeslots
- E1 level clocking and synchronization
- structured AAL service over the Nortel Networks Multiservice Switch backplane
- supports access to VSP3

- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also "32-port E1 TDM specifications" (page 168).

Table 76
32-port E1 TDM specifications

Specification	Description
effective data rate	31.74 MBit/s (per port)
sparing supported	one-for-one
network clock synchronization supported	yes (at E1 level of hierarchy)
minimum software level required for NTFN91 and NTHW91	not applicable
minimum software level required for NTFN93 and NTHW90	PCR5.2
FP technologies	PDC1.1, CQC
access mode	G704 framing
fast RAM	1 Mbyte
normal memory	16 Mbyte
shared memory	N/A

Common E1 frame-based FP configuration considerations

Before you begin configuring any frame-based E1 FPs, consider the following:

- Although the E1 standard provides 32 timeslots, only 30 or 31 timeslots are available for user data. The remaining 1 or 2 timeslots are reserved for signaling and control. Timeslot 0 is used for framing and cannot be used for data. If you use channel-associated signaling (CAS), only 30 channels are available.
- You can assign a set of timeslots to a channel. For example, you can set <timeslots> to "4 6 8 10 14 22." If you set the E1 *lineType* attribute to CAS (channel associated signaling), you cannot use timeslot 16.

- If you install an E1 trunk between two Nortel Networks Multiservice Switch nodes, you must set the attribute *clockingSource* to one of the following combinations:
  - local at one end and line at the other
  - module at one end and line at the other
  - or module at both ends

4-port E1 FP

The PEC for the 4-port E1 is NTNQ15. For a full list of PECs (including vintages) for supported FPs, see Nortel Networks Multiservice Switch Release Notes.

For the information you need to configure this FP, see “4-port E1 configuration considerations” (page 170).

For information about the characteristics of this FP, see “4-port E1 characteristics” (page 171).

4-port E1 configuration considerations

Before you begin configuring the 4-port E1 FP, consider the following:

- In single access mode, all ports can be used (each port supports one Nx56 kbit/s channel or one Nx64 kbit/s channel, where N is 1 to 30). In fractional access mode, only two ports can be used (each port supports up to four Nx64). In combined access mode, three ports can be used (one fractional, two single channel).
- You can add up to four channels on ports 1 and 3 if the other two ports are disabled.
- See also “4-port E1 configuration parameters” (page 170).

Table 77
4-port E1 configuration parameters

Parameter	Values
Card type <cardtype>	E1
Port type <port>	E1
Port number <m>	0 to 3
Port configuration	fractional link or clear channel (non-channelized) mode
Channel number <p>	1 to 3
Timeslot <timeslot>	1 to 31
(Sheet 1 of 2)	

Table 77 (continued)
4-port E1 configuration parameters

Parameter	Values
Timeslot data rate <rate>	doNotOverride or 56K
Clocking source	local, line, module
(Sheet 2 of 2)	

4-port E1 characteristics

The 4-port E1 FP provides frame relay access services, and transparent data requirements, such as bit and HDLC transparent data services on Nortel Networks Multiservice Switch 7400 nodes. It provides a connection to external or third-party equipment.

This FP connects to DPN-100 primary rate peripheral interfaces (PR PIs) which allows a Multiservice Switch node to act as a high-throughput packet router for DPN-100. The PR PIs are daisy-chained in DPN-100. The E1 FP operates in fractional link mode, giving each PR PI its own fraction of the link bandwidth.

The 4-port E1 FP operates between two Multiservice Switch nodes with multiplexed fractional channels where a lower bandwidth trunk is needed, or as a single clear or fractional channel where a higher bandwidth trunk is needed.

The 4-port E1 FP also supports processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

See also “4-port E1 specifications” (page 171).

Table 78
4-port E1 specifications

Specification	Description
effective data rate	1.920 Mbit/s
sparing supported	one-for-one
(Sheet 1 of 2)	

Table 78 (continued)
4-port E1 specifications

Specification	Description
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC
access mode	single, fractional, combined
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	0.5 Mbyte
(Sheet 2 of 2)	

4-port E1Ch FP

The PECs for the 4-port E1 Channelized FP are:

- NTNQ20
- NTNQ21
- NTNQ22 (for wireless applications)

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port E1Ch configuration considerations” (page 172).

For information about the characteristics of this FP, see “4-port E1Ch characteristics” (page 173).

4-port E1Ch configuration considerations

Before you begin configuring the 4-port E1Ch FP, consider the following:

- The system automatically adds channel 0.
- See also “4-port E1Ch configuration parameters” (page 173).

Table 79
4-port E1Ch configuration parameters

Parameter	Values
Card type <cardtype>	E1C
Port type <port>	E1
Port number <m>	0 to 3
Port configuration	fractional link or clear channel (non-channelized) mode
Channel number <p>	0 to 30 or 1 to 31
Timeslot <timeslot>	1 to 31
Clocking source	local, line, module

4-port E1Ch characteristics

This FP supports frame-relay services on Nortel Networks Multiservice Switch 7400 nodes. It provides access to external or third-party network equipment and to DPN-100.

The 4-port E1Ch FP is available in standard, premium or CTR_4 compliant formats. Use the premium format for high capacity Frame Relay applications. Use the CTR_4 compliant format for connecting to ISDN networks in Europe.

Supported features include:

- up to 124 separate Frame Relay services
- fast one-for-one equipment protection
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also “4-port E1Ch specifications” (page 174).

Table 80
4-port E1Ch specifications

Specification	Description
effective data rate	1.920 Mbit/s
sparing supported	one-for-one
network clock synchronization supported	no
minimum software level required	not applicable
FP technologies	PM2, SBIC
access mode	single, fractional, fully channelized (any mix of these access modes is allowed on each port)
fast RAM	not applicable
normal memory	• PEC NTNQ20 -16 Mbyte • PEC NTNQ21 - 32 Mbyte • PEC NTNQ22 - 64 Mbyte
shared memory	8 Mbyte

32-port E1 MSA FPs

The 32-port E1 MSA FPs all offer the basic multi-service access (MSA) functionality. Two versions also have two integrated STM-1 interfaces. The line speed for each STM-1 port is 155.52 Mbit/s.

The PECs for the FPs are listed in “32-port E1 MSA PECs” (page 175).

Table 81
32-port E1 MSA PECs

FP	PEC
32-port E1 MSA 2-slot FP	NTNQ69 (formerly NTJS80)
32-port E1 MSA 1-slot FP	NTNQ93AA
32-port E1 MSA 1-slot FP with the new framer version for PCR 6.1 and later	NTNQ93BA
32-port E1 MSA 2-slot FP with 2-port (protected) STM-1 multimode	NTNQ71 (formerly NTJS82)
32-port E1 MSA 2-slot FP with 2-port (protected) STM-1 single-mode	NTNQ73 (formerly NTJS84)

For the information you need to configure this FP, see “32-port E1 MSA configuration considerations” (page 175).

For information about the characteristics of this FP, see “32-port E1 MSA characteristics” (page 179).

32-port E1 MSA configuration considerations

Before you begin configuring a 32-port E1 MSA FP, consider the following:

- For PQC2.0-equipped FPs, you must have a minimum software load of CA02S8A before installing the FP. Inserting the FP into a system running an earlier load will damage the FP, requiring it to be returned to Nortel Networks for repair.
- The 32-port E1 MSA interworks with only CP2 control processors (or a later type) in the same Nortel Networks Multiservice Switch shelf.

- Each of the 32 E1 access ports can be used channelized or unchannelized
- Only ports 0 to 29 can be used for ATM UNI. IMA can use all 32 ports, but ports 30 and 31 can only be used in a group that also contains at least one of the ports 0 to 29. All 32 ports can be used for non-ATM services (for example, CES or FRS).
- For unstructured services, you must provision all timeslots.
- For unstructured CES, all 32 timeslots are available. For structured CES, HDLC and ATM services timeslot 0 is used for framing and cannot be used for data. If channel-associated signaling (CAS) is in use, only 30 channels are available, as CAS uses timeslot 16.
- For Fractional ATM interfaces, any combination of up to 30 timeslots numbered from 1 to 31 can be used. The only exception is with a CAS line type; in this instance, timeslot 16 (the E1 signaling channel) cannot be used.
- Traffic shaping is supported if the total number of timeslots selected is 7 or more.
- Setting the *ifAdminStatus* attribute under port or channel is not supported.
- You can use port type STM-1 only if the FP has the two integrated STM-1 ports.
- The 2-slot card can occupy any pair of adjacent slots except slot 0 (zero), which must be occupied by a CP; a second CP would require slot 15 in a Multiservice Switch 7480. When configuring a 2-slot FP, only set the *cardtype* attribute of the lowest slot number of the pair.
- Up to 15 E1 MSA 1-slot FPs can be configured in a Multiservice Switch 7480. It is recommended that no more than 8 active or Main MSA (with the attribute mainCard under the component Lp) occupy the same shelf. The total of 8 excludes any spare FPs (with the attribute spareCard).
  - — Deploying more than 8 active MSA32 FPs risks affecting the shelf's capability to provide MSA services. The amount of risk and the extent of impact depends on the engineering limitations imposed by any Multiservice Switch 7400 node. Calculate the total bandwidth

of all active ports to ensure that the backplane capacity is not exceeded.

— Accounting of services is available for only the first 8 MSA 1-slot FPs in sequence from slot 1 (as opposed to the sequence of the CP becoming aware of the FPs or the position of a spare in a group).

— Nortel Networks Multiservice Data Manager (MDM) cannot handle receiving many alarms and accounting data simultaneously from more than 8 MSA32 FPs in the shelf.

- When a Multiservice Switch 7480 has 14 E1 1-slot FPs, the maximum number of E1 ports is 448 (14 cards with 32 ports each), which is twice as many if the shelf had 7 E1 2-slot FPs. To accommodate the 14 cards, the connection space required by the FPs must not exceed the connection space that is supported by the available CP2 memory or by the total number of DLCIs in the shelf. The total number of DLCIs can be 24000.
- When replacing a 2-slot FP (for example, NTNQ69) with a 1-slot FP (NTNQ93), configure the lower slot number and decommission the higher slot number in preparation for another FP. This method is supported by the FP maintenance procedures in NN10600-175 *Nortel Networks Multiservice Switch 7400 Hardware Installation, Maintenance, and Upgrade*.
- The 1-slot NTNQ93AA FPs and the 2-slot NTNQ69 FPs can replace each other or be deployed in the same sparing configuration. The NTNQ93BA cannot be used with FPs running software prior to PCR 6.1. The BA version operates with PCR 6.1 or later because of its different framer version.
- The combinations of 1-slot and 2-slot FPs for sparing configurations are listed in the section on MSA32 DS1 or E1 termination panels in NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description*.
- Nortel Networks Multiservice Data Manager (MDM) version 14.3 displays both the 1-slot and 2-slot versions of the E1 FPs.
- See also “32-port E1 MSA configuration parameters” (page 178).

Table 82
32-port E1 MSA configuration parameters

Parameter	Values
Card slot (for 2-slot FPs with 1 CP)	1 to 14 in a 16-slot Multiservice Switch 7480 1 to 6 in an 8-slot Multiservice Switch 7460 1 to 3 in a 5-slot Multiservice Switch 7440 1 in a 3-slot Multiservice Switch 7420
Card slot (for 2-slot FPs with 2 CPs)	1 to 13 in a 16-slot Multiservice Switch 7480 1 to 5 in an 8-slot Multiservice Switch 7460 1 or 2 in a 5-slot Multiservice Switch 7440
Card slot (for 1-slot FPs with 1 CP)	1 to 15 in a 16-slot Multiservice Switch 7480 1 to 7 in an 8-slot Multiservice Switch 7460 1 to 4 in a 5-slot Multiservice Switch 7440 1 or 2 in a 3-slot Multiservice Switch 7420
Card slot (for 1-slot FPs with 2 CPs)	1 to 14 in a 16-slot Multiservice Switch 7480 1 to 6 in an 8-slot Multiservice Switch 7460 1 to 3 in a 5-slot Multiservice Switch 7440 ***Note:*** A 3-slot Multiservice Switch 7420 does not support using 2 CPs.
Card Types	32pE1Msa for NTNQ69 32pE1Msa for NTNQ93 32pE1MsaMtp for NTNQ71 32pE1MsaStp for NTNQ73
Port Type	E1, and STM-1 on NTNQ71 or NTNQ72
Port Number	0 to 31
Port configuration for E1 ports	fractional link or clear channel (non-channelized) mode
Port configuration for STM-1 ports	B-ISDN
Channel number	0 to 30 or 1 to 31
Timeslot	1 to 31
Clocking source for E1 ports	local, line, module, srts, and adaptive; board-level for the transmit clocks on both ports
Clocking source for STM-1 ports	line, local, module

32-port E1 MSA characteristics

The 32-port E1 MSA FP provides support for frame relay, voice, IP, and ATM services on Nortel Networks Multiservice Switch 7400 nodes. It can simultaneously provide different types of services on separate channels within an E1 port or on the whole port, including:

- Frame Relay ISDN dialup and frame-relay service on DS0, NxDS0 and E1 services
- ATM service on E1 or NxE1 through IMA
- AAL1 CES on DS0, NxDS0 and E1 over PORS and ATM
- Fractional ATM, allowing an ATM interface to share a port with other services (only one ATM interface can be configured per port)

  Note: If a single 32-port E1 MSA FP is provisioned for both ingress and egress traffic such that the optical port is providing the backbone connection and the E1 ports are providing access connections, a slower response time for some applications may occur.

Supported features include:

- one-for-one equipment protection up to 100 milliseconds
- PPP/ATM interworking (PPP/ATM I/W) through a PPP access link (RFC 1661) using ATM MPE (RFC1483)
- Frame Relay/ATM interworking
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

  Note: Synchronization status messages are processed on the optical port only.

- ATM traffic management including fair queueing and traffic shaping
- ATM congestion management strategies, including partial packet discard (PPD), late packet discard (LPD), early packet discard (EPD) and weighted random early discard (WRED)
- IP packet forwarding in hardware, access to Multiservice Switch virtual routers (VRs), and IP tunneling

- IP encapsulation over ATM (RFC 2684), PPP (RFC 1661), and Frame Relay (RFC 1490)
- IP class of service (CoS)
- virtual framers with both ends on a single FP as well as on two FPs
- up to 250 virtual framers per FP

  Note: The 32-port E1 MSA FP with an integrated optical interface also supports up to 250 virtual framers per FP.

See also “32-port E1 MSA specifications” (page 180).

Table 83
32-port E1 MSA specifications

Specification	Description
optical port maximum line speed	155.52 Mbit/s
sparing supported	• one-for-n cold equipment sparing, where n is one to six depending on the type of sparing panel (the limitations by panel are indicated in the section on MSA32 termination panels in NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description*) • one-for-n sparing behavior enhancement
processor memory	128 Mbyte
network clock synchronization	supported
synchronization status messages	supported (optical port only)
synchronization status messages	transmission supported (processing supported on optical port only)
SRTS clocking	supported
adaptive clocking	supported
(Sheet 1 of 2)	

Table 83 (continued)
32-port E1 MSA specifications

Specification	Description
minimum software level required	PCR 1.2.8 PCR 6.1 for NTNQ94BA
FP technologies for old PECs	PPC, AQM1.1, PQC1.0
FP technologies for new PECs	PPC, AQM1.1, PQC2.0
(Sheet 2 of 2)	

E1 FP OSI states

This section lists the following OSI state tables for E1 FPs.

- For all FPs, see “E1 component state combination” (page 183).
- For voice, frame-based, and MSA FPs, see “E1 Channel (Chan) component state combination” (page 183).
- For voice and Frame-based FPs see “E1 Test component state combination” (page 184).
- For 1-port E1 voice and 4-port E1 MVP-E FPs, see “E1 voice Framer component state combination” (page 184).
- For TDM, AAL1, and ATM FPs, see:
  - “E1 ATM Channel (Chan) component state combination” (page 185)
  - “E1 ATM Test component state combination” (page 185)

32-port E1 MSA OSI states

Use these tables to determine the OSI states for this FP:

- “E1 component state combination” (page 183)
- “E1 Channel (Chan) component state combination” (page 183)

Table 84
E1 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The E1 port is inoperable due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisAlarm • multifrmLofAlarm • rxMultifrmRaiAlarm • txMultifrmRaiAlarm.
Unlocked, Enabled, Busy	The E1 component is in use.
Locked, Enabled, Idle	A lock/lock operator command is in effect. The E1 component is ready to service a user. A test is running.
Locked, Disabled, Idle	• Some hardware test failed. • The E1 component is in the locked state. • External factors render the E1 port inoperable.

Table 85
E1 Channel (Chan) component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	External factors render the Chan component inoperable because of E1 alarms.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes.
Unlocked, Enabled, Busy	The Chan component is in use. The Chan component can only service one user at a time.
(Sheet 1 of 2)	

Table 85 (continued)
E1 Channel (Chan) component state combination

Combination (Administrative, Operational, Usage)	Details
Locked, Enabled, Idle	A lock operator command is in effect. The Chan component is otherwise ready to service a user. A test is running.
Locked, Disabled, Idle	Some hardware test failed or the Chan component is in the locked state.
(Sheet 2 of 2)	

Table 86
E1 Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Busy	The Test component is in use. An E1, or CHAN component creates a Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

Table 87
E1 voice Framer component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	A component that the Framer component depends on is not available. A likely cause is that the port component (for example, a V35 component) is locked for testing.
Unlocked, Enabled, Busy	The Framer component is in use. The Framer component services only one user (an application component) at a time.

Table 88
E1 ATM Channel (Chan) component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The Chan component is inoperable because of DS1, E1 or lcdAlarm alarms. The associated port component is locked.
Unlocked, Enabled, Idle	Not in use. Provisioning or binding processes are possible causes.
Unlocked, Enabled, Busy	The Chan component is in use. The Chan component can only service one user at a time.
Unlocked, Enabled, Idle	The Chan component is not in use. The Chan component is waiting for binding to an ATmIf component.
ShuttingDown, Enabled, Busy	A lock operator command is in effect. The system is waiting for a bound application to suspend.
Locked, Disabled, Idle	A hardware test failed or the Chan component is in the locked state.

Table 89
E1 ATM Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Busy	The Test component is in use. A Chan, DS1, or E1 component creates a Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

E1 FP compliance with standards

This section lists the standards compliance for E1 FPs:

- “1-port E1 MVP-E compliance with standards” (page 186)
- “4-port E1 MVP-E compliance with standards” (page 186)
- “3-port E1 ATM compliance with standards” (page 187)
- “8-port E1 ATM compliances” (page 187)
- “4-port E1 AAL1 compliance with standards” (page 188)
- “32-port E1 TDM compliances” (page 188)
- “4-port E1 compliance with standards” (page 189)
- “4-port E1C compliance with standards” (page 190)
- “E1 MSA32 compliance with standards” (page 190)
- “STM-1 compliance with standards on an E1 MSA32 FP” (page 191)

1-port E1 MVP-E compliance with standards

The E1 MVP-E FPs comply with the applicable sections of these international, European, and Australian E1 interconnect standards:

- ITU-T G.703 (excluding Annex B)
- ITU-T G.704
- ITU-T G.706
- ITU-T G.732

4-port E1 MVP-E compliance with standards

The 4-port E1 MVP-E FPs comply with the applicable sections of these recommendations:

- Australian Standard TS016
- CTR 12/13 and/or TBR 12/13 - Common Technical Requirements
- ITU-T G.164
- ITU-T G.165
- ITU-T G.168

- ITU-T G.711
- ITU-T G.726
- ITU-T G.728
- ITU-T G.729 Annex A
- ITU-T T.30
- ITU-T V.17
- ITU-T V.21
- ITU-T V.27ter
- ITU-T V.29

3-port E1 ATM compliance with standards

The 3-port E1 ATM FP complies with the applicable sections of these standards:

- Australian Standard TS016
- CTR 12/13 and/or TBR 12/13 - Common Technical Requirements
- ITU-T G.703, 1991 Section 6
- ITU-T G.704, 1988 Section 5
- ITU-T G.706, 1988 Section 4
- ITU-T G.732, 1972 Section 4
- ITU-T G.804, 1993 Section 3
- ITU-T I.432 Sections 4.3 to 4.5
- ITU-T G.821
- ITU-T G.823

8-port E1 ATM compliances

The 8-port E1 ATM FP complies with the applicable sections of these standards:

- CTR 12/13 and/or TBR 12/13 - Common Technical Requirements
- Australian Standard TS016

- ITU-T G.703, 1991, Section 6
- ITU-T G.704, 1995, Section 5.1
- ITU-T G.706, 1991, Section 4
- ITU-T G.732, 1988, Section 4
- ITU-T G.804, 1993, Section 3
- ITU-T I.432, 1993, Section 4.3, Section 4.4, Section 4.5
- ITU-T G.821, 1988
- ITU-T G.824, 1993

4-port E1 AAL1 compliance with standards

The 4-port E1 AAL1 FP complies with the applicable sections of these standards:

- ANSI T1.627
- ANSI T1.630
- ATMF AF_SAA_0032.000
- Australian Standard TS016
- CTR 12/13 and/or TBR 12/13 - Common Technical Requirements
- ITU-T G.703
- ITU-T G.704
- ITU-T G.706
- ITU-T G.823
- ITU-T I.431
- ITU-T I.361
- ITU-T I.363.1
- Telcordia TR-NWT-000170

32-port E1 TDM compliances

The 32-port E1 TDM FP complies with the following standards:

- Australian Standard TS016

- CTR 12/13 and/or TBR 12/13 - Common Technical Requirements
- ITU-T G.703, Section 6
- ITU-T G.704, Sections 2.3, 2.3.2, 2.3.3, 5.1.1, 5.1.2, 5.1.3, 5.1.3.1
- ITU-T G.706, Section 4
- ITU-T G.732, Section 4
- ITU-T G.821
- ITU-T G.823
- ITU-T 1.412, Sections 3.1, 3.3
- ITU-T 1.431, Section 5

Multiport aggregate device compliance

The multiport aggregate device complies with the following standards

- Australian Standard TS016
- CTR 12/13 and/or TBR 12/13 - Common Technical Requirements
- EN 55022, 1994
- EN 50082-1, 1992
- EN 60950/A4, 1996
- ITU-T G.703
- ITU-T G.753
- ITU-T G.823
- ITU-T G.824

4-port E1 compliance with standards

The E1 FP complies with the applicable sections of these international, European, and Australian E1 interconnect standards:

- CTR 12/13 and/or TBR 12/13 - Common Technical Requirements
- Australian Standard TS016
- ITU-T G.703 (excluding Annex B)
- ITU-T G.704

- ITU-T G.706
- ITU-T G.732

4-port E1C compliance with standards

The 4-port E1C FP complies with the applicable sections of these international, European, and Australian E1 interconnect standards:

- Australian Standard TS016
- CTR 12/13 and/or TBR 12/13 - Common Technical Requirements
- ETSI Specification No. TBR 12
- ETS 300 011 (ETSI TBR.4) European ISDN primary rate access (FP model NTNQ1CBA only)
- German Specification No. BAPT 221 ZV15 MU9a/b
- ITU-T G.703, 1991 Section 6
- ITU-T G.704, 1988 Section 5
- ITU-T G.706, 1988 Section 4
- ITU-T G.732, 1972 Section 4
- ITU-T G.804, 1993 Section 3
- ITU-T I.432 Sections 4.3 to 4.5
- ITU-T G.821
- ITU-T G.823
- UK Specification OTR001

E1 MSA32 compliance with standards

The E1 FP complies with the applicable sections of these international, European, and Australian E1 interconnect standards:

- Australian Standard TS016
- CTR 12/13 and/or TBR 12/13 - Common Technical Requirements
- ITU-T G.703 (excluding Annex B)
- ITU-T G.704

- ITU-T G.706
- ITU-T G.732
- ITU-T G.823
- ITU-T I.363.1

STM-1 compliance with standards on an E1 MSA32 FP

When an E1 MSA32 FP has the optional optical ports, the STM-1 ATM portion of the 2-slot FP complies with the applicable sections of the following standards:

- “SONET” (page 191)
- “SDH” (page 192)

SONET

ATM Forum

- AF-UNI-0010.002 (ref. [28])
  - Complies to section 2.1.
- AF-TEST-0024.000 (ref. [31])

Telcordia

- GR-253-CORE (ref. [35]):
  - Complies to all required and applicable items for STS-3 ATM operation.
  - Note that the following optional bytes are not supported by OC-3 ATM IPs:

    E1: Orderwire
    F1: Section User Channel
    D1-D3: Section Data Communication Channel
    J1: STS Path Trace
    F2: Path User Channel
    N1: Tandem Connection Maintenance/Path Data Channel
- TR-NWT-001112 (ref. [38])

ANSI

- T1.105-1995 (ref. [12])
- T1.231-1993 (ref. [22]):
  - — Complies to section 8 for all SONET alarms and statistics listed in Section 3.2.3 on page 8.
- T1.646-1995 (ref. [24], supersedes T1.624)
- T1E1.2/96-002 (ref. [25])
- 216 MD-1998.0041 - Version 01.05 - released - 1998-07-31 (PP504, P6.0)

SDH

ITU-T

- Australian Standard TS026
- G.707 (ref. [45], replaces G.708. G.709) complies except for section 9.2.2.11 Table 5 which states that on receipt of an MS-AIS signal, line-timing should not be used.

  Note: the following optional bytes are not supported by OC-3 ATM IPs:

  - — E1: Orderwire
  - — F1: Section User Channel
  - — D1-D3: Section Data Communication Channel
  - — J1: STS Path Trace
  - — F2: Path User Channel
  - — N1: Tandem Connection Maintenance/Path Data Channel
- G.782 (ref. [48])
- G.783 (ref. [49])
- G.813 (ref. [51])
- G.821
- G.825 (ref. [54])

— complies, except may not meet wander requirements

- G.957 (ref. [56])

  Note: the OC-3 ATM IP single mode FP is classified as application code L-1.1.

- G.958 (ref. [57])
- I.432 (ref. [58])
  - — complies to section 2 (Physical Medium at 155 520 kbit/s)
  - — complies to section 4 (TC Sublayer) except:
  - — Section 4.2.1.2: Physical layer cells are not guaranteed to be inserted in the cell
  - — stream every 27 cells.
  - — Section 4.2.1.3: Physical layer OAM cells are not implemented.
- ETS 300 417 (previously ETS DE/TM-01015) (ref. [40])

Chapter 5
E3 function processors

Nortel Networks Multiservice Switch E3 function processors (FPs) support Frame-based and ATM services with a maximum line speed of 34.368 Mbit/s. The configuration reference information can help you when you configure and maintain E3 FPs.

Navigate to the reference information about each FP using the table "Multiservice Switch E3 FPs" (page 195).

For information about OSI states, see "E3 FP OSI states" (page 207).

For information about standards compliance, see "E3 FP standards compliance" (page 209).

For information about applications and services for these FPs, see "Applications and services supported by function processors" (page 39).

Table 90
Multiservice Switch E3 FPs

FP service type	Link to FP reference information
Frame-based FPs	"1-port E3 frame-based FP" (page 196)
ATM FPs	"Common E3 ATM FP configuration considerations" (page 198) "Common E3 ATM FP characteristics" (page 199) "3-port E3 ATM FP" (page 199) "3-port E3 ATM IP FP" (page 202) "12-port E3 ATM FP" (page 204)

1-port E3 frame-based FP

The PEC for the 1-port E3 is NTNQ25. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “1-port E3 configuration considerations” (page 196).

For information about the characteristics of this FP, see “1-port E3 characteristics” (page 197).

1-port E3 configuration considerations

Before you begin configuring the 1-port E3 FP, consider the following:

- Within the Nortel Networks Multiservice Switch subnet, the end-to-end E3 trunk facility must be a structured or framed, full, single clear-channel E3, that is used for non-substrate applications.
- The entire payload bandwidth is used as a single clear channel. This channel supports high-level data link control (HDLC) and Multiservice Switch proprietary trunk protocol.
- A receive clock is synchronized from the stream of data incoming on the line. The node can use this receive clock as a synchronization reference. Conversely, the clock used to transmit the data on the line can be generated with reference to the master synchronization clock of the node. Therefore, you can provision E3 FPs to act as synchronization interfaces between Multiservice Switch nodes.
- See also “1-port E3 configuration parameters” (page 196).

Table 91
1-port E3 configuration parameters

Parameter	Values
Card type <cardtype>	E3
Port type <port>	E3
(Sheet 1 of 2)	

Table 91 (continued)
1-port E3 configuration parameters

Parameter	Values
Port number <m>	0
Clocking source	local, line, module, or otherPort
(Sheet 2 of 2)	

1-port E3 characteristics

The 1-port E3 FP provides support for frame-relay services on Nortel Networks Multiservice Switch 7400 nodes. The single port is comprised of a transmit coaxial cable connector and a receive coaxial cable connector. This FP provides interfaces for Multiservice Switch node-to-Multiservice Switch node communication, and a connection for one E3 Multiservice Switch 7400 trunk.

The 1-port E3 FP also supports processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

See also “1-port E3 specifications” (page 197).

Table 92
1-port E3 specifications

Specification	Description
effective data rate	34.09 Mbit/s
sparing supported	one-for-one
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC
fast RAM	512 kbyte
normal memory	16 Mbyte
shared memory	2 Mbyte

Common E3 ATM FP configuration considerations

Before you begin configuring an E3 ATM FP, consider the following.

- For all ATM FPs you must link the ports to an ATM interface before they can provide any service. For more information, see the section on provisioning the AtmInterface component in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- The ports on an E3 ATM FP are not channelized. The entire payload bandwidth functions as a single clear channel.
- The cell payload is scrambled by default, according to ITU-T Recommendation I.432. You can turn cell payload scrambling off for a port on an ATM card. However, when cell payload scrambling is turned off for ATM ports, there is a possibility of false cell header delineation errors.
- When you add a port, the system automatically creates subcomponents *AtmCell* and *G832*.
- The system directly maps cells into the E3 payloads by default. To use PLCP cell mapping instead of the default direct mapping for a port on an E3, set the *mapping* attribute:

  ```
  set lp/<n> E3/<m> mapping plcp
  ```

  The mapping affects the reference source when you select the line clocking source. For direct mapping, the received E3 bitstream at or 34.368 MHz determines the clock. For PLCP mapping, the received PLCP framing at 8 kHz determines the clock.

- E3 ATM FPs use the framing format defined by ITU-T G.832 by default, although the older format defined by ITU-T G.751 is still available. If the port is an E3 port, and you want to use the older framing format defined in ITU-T G.751, change the *framing* attribute:

  ```
  set lp/<n> E3/<m> framing g751
  ```

  After setting the framing format to G751, delete the G832 component (automatically generated when the VCC is created).

Common E3 ATM FP characteristics

Nortel Networks Multiservice Switch E3 ATM FPs support ATM user-to-network-interfaces (UNIs) or ATM Multiservice Switch node-to-Multiservice Switch node-interfaces (MMIs). Ports can operate on either side of a user/network boundary.

These FPs provide interfaces for Multiservice Switch node-to-Multiservice Switch node communication, and for communication between Multiservice Switch and external ATM devices. They support an ATM interface that can support a number of Multiservice Switch trunks or ATM bearer services.

All E3 ATM FPs also supports processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

3-port E3 ATM FP

The PEC for the 3-port E3 ATM FP is NTNQ52. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “3-port E3 ATM configuration considerations” (page 199).

For information about the characteristics of this FP, see “3-port E3 ATM characteristics” (page 200).

3-port E3 ATM configuration considerations

Before you begin configuring a 3-port E3 ATM, consider the following.

- The three ports are individually provisionable.
- An ILS Forwarder card is required for IP support on CQC-based FPs. The combination of a CQC-based FP and an ILS Forwarder card supports IP, but not IP VPN (tunneling with VCG). See NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description* for information on the ILS Forwarder card.

- Up to seven 3-port E3 ATM FPs can be configured in a Multiservice Switch 7480. It is recommended that no more than five active or Main FPs (with the attribute mainCard under the component Lp) occupy the same shelf assembly. The total of two excludes any spare FPs (with the attribute spareCard).
  — Deploying more than five active 3-port E3 ATM FPs risks affecting the shelf's capability to provide services. The amount of risk and the extent of impact depends on the engineering limitations imposed by any Multiservice Switch 7400 node and depends on all of the FPs in a shelf simultaneously bursting up to their maximum line rates. Each active port sending AAL1 CES constantly sends more than its line rate onto the backplane. Calculate the total bandwidth of all active ports to ensure that the backplane capacity is not exceeded.
- See also "3-port E3 ATM configuration parameters" (page 200).

Table 93
3-port E3 ATM configuration parameters

Parameter	Values
Card type <cardtype>	3pE3Atm
Port type <port>	E3
Port number <m>	0 to 2
Clocking source	local, module, line, or otherPort

3-port E3 ATM characteristics

The 3-port E3 ATM FP supports ATM services on Nortel Networks Multiservice Switch 7400 nodes.

See also "3-port E3 ATM specifications" (page 201).

Table 94
3-port E3 ATM specifications

Specification	Description
effective data rate	34.10 Mbit/s
sparing supported	one-for-one
network clock synchronization supported	yes
minimum software level required	not applicable
FP technologies	PDC1.1, CQC
access mode	G.751 direct framing
normal memory	16 Mbyte
shared memory	2 Mbyte

3-port E3 ATM IP FP

The PECs for the 3-port E3 ATM IP FP are:

- NTJS11BA
- NTJS11CA
- NTJS11DA
- NTNQ67

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “3-port E3 ATM IP configuration considerations” (page 202).

For information about the characteristics of this FP, see “3-port E3 ATM IP characteristics” (page 203).

3-port E3 ATM IP configuration considerations

Before you begin configuring the 3-port E3 ATM IP FP, consider the following.

- The three ports are individually provisionable.
- See also “3-port E3 ATM IP configuration parameters” (page 202).

Table 95
3-port E3 ATM IP configuration parameters

Parameter	Values
Card type <cardtype>	3pE3Atm2
Port type <port>	E3
Port number <m>	0 to 2
Clocking source	local, module, line, or otherPort

3-port E3 ATM IP characteristics

The 3-port E3 ATM IP FP supports ATM services on Nortel Networks Multiservice Switch 7400 nodes. This FP provides a platform for ATM Forum traffic management phase 4 (TM4.0).

Supported features include:

- feature rich ATM traffic management functions, including fair queuing and traffic shaping
- line rate frame forwarding on all ports and increased frame forwarding rates for many services

See also “3-port E3 ATM IP specifications” (page 203).

Table 96
3-port E3 ATM IP specifications

Specification	Description
sparing supported	one-for-one sparing using 3-port E3 ATM IP termination panels
network clock synchronization supported	yes
fast RAM	not applicable
normal memory	64 Mbyte
network clock synchronization supported	local, line, module, or otherPort
minimum software level required	not applicable
FP technologies	• PEC NTJS11BA - PPC, AQM1.0, PQC1.0 • PEC NTJS11CA - PPC, AQM1.1, PQC1.0 • PEC NTJS11DA - PPC, AQM1.1, PQC2.0 • PEC NTNQ67 - PPC, AQM1.1, PQC2.0

12-port E3 ATM FP

The PECs for the 12-port E3 ATM FP are:

- NTHR25BA
- NTHR25CA
- NTHR25DA

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “12-port E3 ATM configuration considerations” (page 204).

For information about the characteristics of this FP, see “12-port E3 ATM characteristics” (page 205).

12-port E3 ATM configuration considerations

Before you begin configuring the 12-port E3 ATM FP, consider the following.

- For NTHR25CA and later versions, you must have a minimum software load of CA01S2A before installing the FP. Inserting the FP into a system running an earlier load will damage the FP, requiring it to be returned to Nortel Networks for repair.
- If you set the *clockingSource* attribute for one port to line, you must set the *clockingSource* attribute for the other port to otherPort.
- See also the chapter on configuring equipment protection (sparing) and the chapter on hitless services in NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.
- See also “12-port E3 ATM configuration parameters” (page 205).

Table 97
12-port E3 ATM configuration parameters

Parameter	Values
Card type <cardtype>	12pE3Atm2
Port type <port>	E3
Port number <m>	0 to 11
Clocking source	local, module, line, or otherPort

12-port E3 ATM characteristics

The 12-port E3 ATM FP may also be referred to as the 12-port E3 ATM IP FP. This provides support for ATM services on Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes. It has three cable bundles with eight coax cables in each bundle and with an 8W8 mini-coax cable connector at one end and 8W8 or BNC connectors at the other end.

Supported features include:

- hitless services when configured for one-for-one equipment protection
- hitless software migration when configured for one-for-one equipment protection

See also “12-port E3 ATM specifications” (page 206).

Table 98
12-port E3 ATM specifications

Specification	Description
total egress ATM buffer (cells)/port @ 3k connections/FP	51.4k
sparing supported	• one-for-n sparing behavior enhancement • operation with a one-for-six sparing panel such as the NTQS31, where up to 6 FPs can be spared (backed up) by one FP, all of the same FP type in the same shelf
network clock synchronization supported	yes
minimum software level required	PCR1.1
processor memory	• 128 Mbyte SDRAM • 16 Mbyte FLASH (EPROM)
FP technologies	• PEC NTHR25BA - PPC, AQM1.0, PQC1.0 • PEC NTHR25CA - PPC, AQM1.1, PQC1.0 • PEC NTHR25DA - PPC, AQM1.1, PQC2.0

E3 FP OSI states

These tables contain information about E3 OSI states:

- “E3 component state combination” (page 207)
- “E3 Test component state combination” (page 208)

Table 99
E3 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The E3 interface is inoperable due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisAlarm • rxRaiAlarm or the far-end E3 interface requests the local interface to loop back the incoming signal.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes. The line input is recognized as good. Clocks are available.
Unlocked, Enabled, Busy	The E3 component is in use. The E3 component services only one user (for example, a Framer component) at a time.
Locked, Enabled, Idle	A port and line test is in progress.
Locked, Disabled, Idle	Some hardware test failed and the E3 component is in the locked state by the operator. A lock operator command is in effect.

Table 100
E3 Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. The system will reject Start test requests.
Unlocked, Enabled, Busy	The Test component is in use. A V35, X21, DS1, E1, CHAN, DS3, or E3 component creates a Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

E3 FP standards compliance

This section lists the standards compliance for the E3 FPs:

- “1-port E3 compliance with standards” (page 209)
- “3-port E3 ATM compliance with standards” (page 209)
- “3-port E3 ATM IP compliance with standards” (page 210)
- “12-port E3 ATM compliance with standards” (page 211)

1-port E3 compliance with standards

The 1-port E3 FP complies with the applicable sections of these standards:

- British Telecom RC 6367A
- ITU-T G.703, 1991, Section 8
- ITU-T G.751, 1988, Section 1.4 complies to the E3 main framing structure. Tributary (E1 channelization) is not supported
- ITU-T G.823, 1993, Section 2.1, except Network Operator and General Purpose Communication Channel service
- ETS 300 166 Version 3 (October 15, 1992)
- SIN 219

3-port E3 ATM compliance with standards

The 3-port E3 ATM FP complies with the applicable sections of the following standards:

- ETS 300 214, 1992, PLCP framing format
- ETS DE/BTC-02053, 1994, 34 Mbit/s service
- ETS DE/BTC-02055, 1994, D34S service
- ETS DE/BTC-02058, 1994, D34S service
- ITU-T G.703, 1991, Section 8
- ITU-T G.751, 1988, Section 1.4 complies to the E3 main framing structure. Tributary (E1 channelization) is not supported
- ITU-T G.823, March, 1993 (jitter and wander)

- ITU-T G.832, November, 1995 (Transport of SDH Elements on PDH Networks: Frame and Multiplexing Structures), Section 2.1, except Network Operator and General Purpose Communication Channel service
- ITU-T I.432 - B-ISDN, Sections 4.3 to 4.5
- ITU-T G804, 1993, Section 6

3-port E3 ATM IP compliance with standards

The 3-port E3 ATM IP FP complies with the applicable sections of the following standards:

ATM Forum

- AF-PHY-0034.000 (ref. [26])

ITU-T

- G.703 (ref. [44]):
  - complies to section 8 (Interface at 34.368 Mbit/s)
- G.751 (ref. [46]):
  - complies to section 1.4 (Multiplexing four digital signals at 8448 kbit/s)
  - complies to section 2.0 (Digital multiplex equipment operating at 34368 kbit/s)
- G.775 (ref. [47])
- G.783 (ref. [44])
  - complies to section 6.2 (G.703 interfaces)
- G.804 (ref. [50])
  - complies to section 6 (Mapping of ATM cells into 34.368 Mbit/s)
- G.823 (ref. [52])
- G.832 (ref. [55])
  - complies to section 2.1 (Frame structure at 34.368 Mbit/s) except:
  - does not support the NR (network operator) and GC (general purpose
  - communications channel) bytes of the E3 G.832 framing structure

- I.432 (ref. [58])
  - complies to section 4.3 (HEC)
  - complies to section 4.4 (Idle cells)
  - complies to section 4.5 (Cell delineation and scrambling)

ETSI

- ETS 300 214 (ref. [39])
- ETS 300 686 (ref. [41])
  - complies to section 4.2 (Electrical characteristics - 34 Mbit/s).
- ETS 300 687 (ref. [42]):
- ETS 300 689 (ref. [43]):

Telcordia

- GR-1110-CORE - Broadband Switching System (BBS) Generic Requirements
- GR-1113-CORE - Asynchronous Transfer Mode (ATM) and Adaptation Layer (AAL)
- Protocol Generic Requirements
- GR-1248-CORE - Generic Requirements for Operations of ATM Network Element

12-port E3 ATM compliance with standards

The 12-port E3 ATM FP complies with the applicable sections of the following standards:

- CTR24
- ITU-T G.703, 1991, Section 8
- ITU-T G.751, 1988, Section 1.4 complies with the E3 main framing structure. Section 2.0 (Digital multiplex equipment operating at 34368 kbit/s)
- ITU-T G.775
- ITU-T G.783
- ITU-T G.804

- ITU-T G.823, March, 1993 (jitter and wander)
- ITU-T G.832, November, 1995 (Transport of SDH Elements of PDH Networks: Frame and Multiplexing Structures), Section 2.1, except Network Operator and General Purpose Communication Channel service
- ITU-T 1.432 - B-ISDN, Sections 4.3 to 4.5
- TS016, except for the lack of isolated ground as a requirement for customer premises equipment (CPE); because Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes are central office equipment, that ground is not required.

Chapter 6
Ethernet function processors

Nortel Networks Multiservice Switch Ethernet function processors (FPs) support IP and ATM services. The configuration reference information can help you when you configure and maintain Ethernet FPs.

Navigate to the reference information about each FP using the table “Multiservice Switch Ethernet FPs” (page 213).

For information about OSI states, see “Ethernet FP OSI states” (page 242).

For information about standards compliance, see “Ethernet FP standards compliance” (page 245).

For information about applications and services for these FPs, see “Applications and services supported by function processors” (page 39).

Table 101
Multiservice Switch Ethernet FPs

FP service type	Link to FP reference information
IP	“2-port 100BaseT Ethernet FP” (page 214)
	“4-port 10/100 BaseT Ethernet FP” (page 217)
	“6-port 10BaseT Ethernet FP” (page 234)
	“8-port 10/100BaseT Ethernet FP” (page 237)
IP and ATM	“4-port gigabit Ethernet FP” (page 221)

2-port 100BaseT Ethernet FP

The PEC for the 2-port 100BaseT Ethernet FP is NTNQ37. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For information you need to configure this FP see “2-port 100BaseT Ethernet configuration considerations” (page 214).

For information about the characteristics of this FP, see “2-port 100BaseT Ethernet characteristics” (page 215).

2-port 100BaseT Ethernet configuration considerations

Before you begin configuring a 2-port 100BaseT Ethernet FP, consider the following:

- To use hardware switching, only provision one La component. Otherwise, provision one La component for each port. When you add a La component, the system automatically adds a Framer subcomponent.
- To use hardware switching, link the same instance of the Lan application (for example, la/0) to both ports on the FP. Otherwise, link a different instance of the Lan application to each port.
- See also “2-port 100BaseT Ethernet configuration parameters” (page 214)
- For the procedure steps, see “Example of configuring a 100BaseT Ethernet FP” (page 215).

Table 102
2-port 100BaseT Ethernet configuration parameters

Parameter	Values
Card type <cardtype>	2pEth100BaseT
Port type <port>	eth100
Port number <m>	0, 1

Example of configuring a 100BaseT Ethernet FP

1 After you set provisionable attributes for each port, add the Lan component.

```
add la/<m>
```

2 Link the Lan application to a port.

```
set la/<m> framer interfaceName lp/<n> eth100/<p>
```

Variable Definitions

Variable	Definition
<m>	is an instance value for the Lan component.
<n>	is the lp you link to the FP.
<p>	is the port number.

2-port 100BaseT Ethernet characteristics

This FP supports IP services on Nortel Networks Multiservice Switch 7400 nodes.

Supported features include:

- half duplex and full duplex networking
- layer 2 hardware switching between ports
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also “2-port 100BaseT Ethernet specifications” (page 215).

Table 103
2-port 100BaseT Ethernet specifications

Specification	Description
maximum line speed	100 Mbits/s
sparing supported	one-for-one
access mode	see IEEE 802.3u specification
(Sheet 1 of 2)	

Table 103 (continued)
2-port 100BaseT Ethernet specifications

Specification	Description
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	2 Mbyte
network clock synchronization supported	no
minimum software level required	not applicable
FP technologies	PM2, SBIC
(Sheet 2 of 2)	

4-port 10/100 BaseT Ethernet FP

The PEC for the 4-port 10/100BaseT Ethernet FP is NTNQ95. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port 10/100 BaseT Ethernet configuration considerations” (page 217).

For information about the physical characteristics of this FP, see “4-port 10/100 BaseT Ethernet characteristics” (page 218).

4-port 10/100 BaseT Ethernet configuration considerations

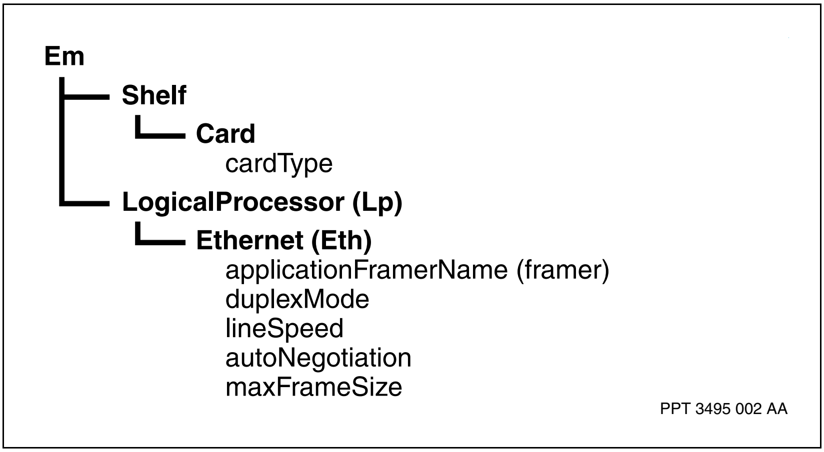
Before you begin configuring a 4-port 10/100BaseT Ethernet FP, consider the following:

- One or more virtual LANs (VLANs) can be mapped to a single virtual router (VR) or virtual router forwarder (VRF).
- This FP requires that a second generation control processor (CP2) be operational on the shelf, one of NTNQ01, NTNQ03, or NTFN33.
- For configuration parameters, see the table “4-port 10/100 BaseT Ethernet configuration parameters” (page 217).
- For component hierarchy, see the figure “Configuring traffic management on the 4-port 10/100BaseT Ethernet FP component hierarchy” (page 218).

Table 104
4-port 10/100 BaseT Ethernet configuration parameters

Parameter	Values
Card type <cartype>	4pEth100BaseT
Port type <port>	ethernet
Port number <m>	0 to 3
SFP configuration	not applicable

Figure 1
Configuring traffic management on the 4-port 10/100BaseT Ethernet FP component hierarchy



4-port 10/100 BaseT Ethernet characteristics

This FP supports the following software and hardware characteristics:

- Ethernet services on Nortel Networks Multiservice Switch 7400 nodes
- multiservices on each Ethernet interface
- full and half duplex networking
- each Ethernet interface can operate in port-mode or VLAN-mode
- Ethernet frame formats as follows:
  - an ingress frame as IEEE 802.3 or Ethernet v2.0
  - an egress frame as Ethernet v2.0
  - the capability to accept any combination of untagged and priority-tagged traffic on the same Ethernet interface in port-mode
  - the capability to accept untagged, priority-tagged, and VLAN-tagged traffic in VLAN-mode
- support of virtual router redundancy protocol (VRRP) for each Ethernet interface (RFC2338) in port-mode and each VLAN in VLAN-mode. One VRRP instance is supported per Ethernet VLAN.

- a standard frame size of up to 1518 bytes for port-mode and 1522 bytes for VLAN-mode
- Ethernet and IP statistics
- Ethernet port and VLAN access to VIPR and RFC2547 IP VPN
- denial of service (DoS) protection
- hitless software migration (HSM) and equipment protection are not supported
- when a redundant CP2 undergoes a switchover, the impact on each NTNQ95 is:
  - a cold standby
  - once the back-up CP2 is active, the Ethernet FP resets and services are re-established on the FP
  - the Ifstatistics are reset to zero
  - the OSI operational states are all reset to their default values

See also the tables “4-port 10/100BaseT Ethernet physical specifications” (page 219) and “4-port 10/100BaseT Ethernet traffic management specifications” (page 220).

Table 105
4-port 10/100BaseT Ethernet physical specifications

Specification	Description
maximum line speed	100 Mbits/s
effective data rate	not applicable
sparing supported	not applicable
network clock synchronization supported	no
minimum software level required	PCR 6.1
FP technologies	PPC, PQC12
(Sheet 1 of 2)	

Table 105 (continued)
4-port 10/100BaseT Ethernet physical specifications

Specification	Description
access mode	see IEEE 802.3 specification; Ethernet port mode or VLAN mode
fast RAM	not applicable
normal memory	128 Mbyte
shared memory	not applicable
(Sheet 2 of 2)	

Table 106
4-port 10/100BaseT Ethernet traffic management specifications

Traffic capability	Description
filtering, ingress	filter on IP SA or DA
	filter on MAC port DA
	filter on multicast addresses
classification and congestion control	based on layer 3 IP SA or DA
	based on layer 4 protocol type
	based on port
	based on port and VLAN
	based on DSCP
mapping, ingress	PHB mapped to four ATM quality of service (QoS) and three DPs when the Ethernet FP interworks with an ATM FP
queuing or discards, egress	one queue per port
IP configuration models	IP class of service (CoS) IP differentiated services (DiffServ)

4-port 10/100BaseT Ethernet FP MAC interface characteristics

The MAC portion of the Ethernet interface for the NTNQ95 FP does automatic retransmission of faulty packets and discarding packets received in error. The characteristics of the MAC include these capabilities:

- up to seven destination virtual MAC addresses per port
- independent 10 or 100 Mbit/s port operation
- full-duplex with standard flow-control functionality. This FP accepts and reacts to PAUSE frames but does not support the generation of PAUSE frames.
- programmable cyclic redundancy check (CRC) generation and removal
- full collision support, including jamming, back off, and automatic retransmission
- internal and external loopback
- programmable automatic discard of badly received packets such as runts, CRC errors, and too-long packets

4-port gigabit Ethernet FP

The PEC for the 4-port gigabit Ethernet FP is NTHW49. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

Information about this FP is as follows:

- “4-port gigabit Ethernet configuration considerations” (page 222)
- “4-port gigabit Ethernet characteristics” (page 223)
- “4-port gigabit Ethernet migration considerations” (page 225)
- “Traffic management on the 4-port gigabit Ethernet FP” (page 226)
- “Example of configuring traffic management on the 4-port gigabit Ethernet FP” (page 230)
- “IP differentiated services behavior on the 4-port gigabit Ethernet FP” (page 232)

4-port gigabit Ethernet configuration considerations

Before you begin configuring a 4-port gigabit Ethernet FP, consider the following:

- requires that a small form factor pluggable (SFP) optical module be plugged into each of its four optical module ports (referred to as sockets in hardware terms) in order for the card to be functional

  Note: For information about the SFP optical module, see NN10600-120 *Nortel Networks Multiservice Switch 15000/20000 Hardware Description*. For information about configuring an SFP module, see NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

- must connect to a device that supports auto-negotiation
- supports one virtual router (VR) per port up to four VRs per FP
- on a shelf of 4pGe FPs, supports a maximum of 28 VRs (that is, seven 4pGe FPs per shelf with a maximum of four VRs per FP)
- see also the table “4-port gigabit Ethernet configuration parameters” (page 222)
- for the configuration procedure steps, see “Configuring traffic management on the 4-port gigabit Ethernet FP component hierarchy” (page 231)
- for information about traffic management, see “Traffic management on the 4-port gigabit Ethernet FP” (page 226) and “Example of configuring traffic management on the 4-port gigabit Ethernet FP” (page 230)

Table 107
4-port gigabit Ethernet configuration parameters

Parameter	Values
Card type <cardtype>	4pGe
Port type <port>	ethernet
Port number <m>	0 to 3
SFP configuration	LX, SX, none

4-port gigabit Ethernet characteristics

Ethernet ports support either 1000BASE-SX or 1000BASE-LX fiber optic transceivers and function only in full duplex mode. The FP can interwork with the OAM Ethernet port of the CP and with selected VSP2, VSP3, VSP3-o, PSFP, and ATM PQC and GQM-based FPs that support ATM multi-protocol encapsulation (MPE) and are located within the same shelf.

> ***Note:*** The 4-port gigabit Ethernet FP card can interwork with voice services processor (VSP2, VSP3, VSP3-o) FP cards in the Media Gateway (MG) configuration.

This FP supports Ethernet virtual line service (EVLS) and IP solutions on Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes. It enables Multiservice Switch networks to serve Wireless Internet and Packet Voice markets that utilize IP and MPLS.

This FP transmits a packet size between 64 and 1518 bytes for IP traffic when the Ethernet interface is operating in port-mode, a packet size between 64 and 1522 bytes when the Ethernet interface is operating in VLAN-mode, and a packet size between 64 and 1600 bytes for Ethernet virtual line service (EVLS) traffic. It has an operating capability of full data line rate (1 Gbit/s) for each port. However, the aggregate backplane interface throughput of the four ports is 2.5 Gbit/s, depending on packet size and traffic characteristics.

For SNMP, currently only the 4-port Gigabit Ethernet (4pGe) FP supports 64-bit counters through a CAS command line interface. The SNMP standard MIB support for 64-bit counters is not supported. The 4pGe FP currently supports only four of the 64 counters.

When a 4pGe FP is configured to use link aggregation (LAG) and the FP or port is removed from service, the associated LAG links are automatically disabled. When a loss of service over a LAG link is due to the physical port going out of service, then a state change notification (SCN) is generated for the LAG link. The Ethernet port status LEDs do not change relative to LAG link status. When the FP is removed from service by other than a lock or a card reset, alarm 7012 0200 is generated to indicate the LP is disabled. When a reset occurs, alarm 7012 0101 is generated. When a 4pGe FP is configured to use link aggregation (LAG) and the FP is returned to service (unlocked), the LAG links are automatically enabled and traffic resumes. The typical FP enabling alarms occur (0000 1000, 7012 0100, and 0000 0000). For more information about LAG, see NN10600-580 *Nortel Networks Multiservice Switch 7400/15000/20000 Ethernet Service Operations*.

When a 4pGe is configured to use protected VR static routes, and one of the ports or an FP involved in the routes is removed from service (manually or due to a failure), each VR static route through the FP is dropped. The traffic on those routes is protected by being rerouted (maintained) according to the port or card protection configuration that was set up for the static routes. VR protected routes can be configured on the same 4pGe FP or between 4pGe FPs in the same shelf or in a shelf within one hop. When the port or FP is returned to service, its VR static routes automatically return to service and become available for traffic. To configure VR static routes, see NN10600-801 *Nortel Networks Multiservice Switch 7400/15000/20000 IP Configuration Management*.

Supported features include:

- IP traffic management, including weighted fair queueing
- IP encapsulation over Ethernet (RFC 894)
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)
- Ethernet virtual line service (EVLS) transports Ethernet frames across an ATM backbone
- IP differentiated services of the DiffServDomain and DiffServProfile components when configured for VIPR networks (Vr Dsd, Vr Ip DiffServProfile) and RFC2547 networks (Rtr Dsd, Rtr Vrf Dsd, Rtr Vrf DiffServProfile)
- Trunking into MPLS core for Provider provisioned VPN service based on RFC2547
- IP over gigabit Ethernet with up to four virtual routers per FP

See also “4-port gigabit Ethernet specifications” (page 225).

Table 108
4-port gigabit Ethernet specifications

Specification	Description
maximum line speed	1.25 Gbit/s
effective data rate	1.0 Gbit/s
maximum bandwidth per 4pGe FP card	2.5 Gbit/s

4-port gigabit Ethernet migration considerations

The 4pGe FP has numerous field programmable gate arrays (FPGAs) that store a specific version of software. When the version of the FPGAs in the running software is different than the version of FPGAs in the new migrating software, the FPGAs will need to be updated with the new version before the migration can complete. Updating the version for the FPGAs is handled automatically as part of the migration, but it may extend the migration up to 45 minutes to complete when one 4pGe FP is present in the shelf. When more than one 4pGe FP is present in the shelf, the migration may take slightly longer because it depends on when the other 4pGe FPs start getting loaded relative to the other FPs in the shelf. During the extended time frame, the FP faceplate shows a slow flashing red LED, the status of the FP may be shown as enabled, and the status of the LP may be shown as unlocked and disabled.

To successfully complete hitless software migration (HSM) to this release from previous releases, on a Multiservice Switch 15000 or Multiservice Switch 20000 node with a configured 4pGe FP, it is mandatory to apply a TAP patch to the previous release prior to initiating the migration. If this TAP patch is not applied prior to migration, HSM will not occur. As a result, it will require two nodal outages to successfully complete the migration.

Once the TAP patch is applied, the Ethernet application must be downloaded to the node and added to the software application version (sw avl) prior to initiating the migration.

Failure to follow this procedure to migrate to this release from previous releases will result in migration failure, or will require a two stage migration involving nodal outages.

Traffic management on the 4-port gigabit Ethernet FP

The 4pGe FP is an egress queueing FP with traffic management (TM) capabilities that improve network performance and congestion control. The prioritization of data delivery makes efficient use of bandwidth resources. Congestion is controlled by assigning discard priorities to different streams of traffic.

Emission priority queues

The 4pGe TM queueing strategy offers better delay and loss performance for higher EPs and starvation avoidance/minimum bandwidth guarantees for the lower EPs.

The 4pGe FP supports eight emission priorities (EPs), referencing each of the eight different queues provided on each of the four ports. EP0 and EP1 reference absolute priority queues (APQ) and EP2 to EP7 reference weighted fair queues (WFQ).

A percentage of the total bandwidth can be assigned on a per weighted fair queue basis by provisioning the *minimumBandwidthGuarantee* (minBw) attribute. By default, the higher priority weighted fair queues are assigned a larger proportion of the total bandwidth to favour the traffic of a higher QoS. See table "Default assignment of minimumBandwidthGuarantee" (page 226).

Table 109
Default assignment of minimumBandwidthGuarantee

EP value	Default minBw
0 (APQ)	n/a
1 (APQ)	n/a
2 (highest WFQ)	50
3	25
4	10
5	7
(Sheet 1 of 2)	

Table 109 (continued)
Default assignment of minimumBandwidthGuarantee

EP value	Default minBw
6	5
7 (lowest WFQ)	3
(Sheet 2 of 2)	

If you want to change the default minBw settings for specific weighted fair queues, it is recommended that the sum of the minBw for all active weighted fair queues be equal to 100% of the total bandwidth. The minBw range for each EP is 0 to 100. The following equation can be used to display the percentage of the total bandwidth used by a weighted fair queue based on the minBw assigned for that queue:

MBGx/minBwTotal

where:
MBGx is the minBw for EP/<x>
minBwTotal is the sum of the minBw for all active weighted fair queues

For example, if EP2, EP3, and EP5 are the only queues transmitting traffic, the queues will consume 100% of the bandwidth. In this example, EP2, EP3, and EP5 are configured with minBw 70, 20, and 10, respectively.

The actual bandwidth of each EP is as follows:

EP2=70 / (70 + 20 + 10) = 70% of link capacity
EP3=20 / (70 + 20 + 10) = 20% of link capacity
EP4=10 / (70 + 20 + 10) = 10% of link capacity

> ***Note:*** If a weighed fair queue no longer transmits traffic, its bandwidth is allocated among the remaining active weighted fair queues. This is due to the work conserving nature of the WFQ scheduler.

Buffer management

The 4pGe FP supports a maximum egress buffer space of 80M bytes which is divided equally among its four ports and allocated further among the eight queues of each port. Queues are set to a default size with the main objective being to absorb transient burstiness and minimize loss under overload. Queue sizes are user configurable under the *txQueueSize* attribute. See table “Default and maximum queue sizes” (page 228).

Table 110
Default and maximum queue sizes

txQueueSize	EP0	EP1	EP2	EP3	EP4	EP5	EP6	EP7
Default txQueueSize in payload bytes	100K	300K	300K	300K	7000K	4200K	3000K	2200K
Maximum txQueueSize in payload bytes	500K	500K	500K	500K	7000K	4200K	3000K	2200K

Congestion control

Congestion control on the 4pGe is based on packet discards using four drop precedence thresholds for each EP queue:

- DP3=35%
- DP2=75%
- DP1=90%
- DP0=100%

Changes in queue size automatically adjust the DP thresholds of the queue. The thresholds control the queue length and congestion of each EP. Four congestion control (CC) states are associated with the four DP thresholds. CC states are displayed by TM as the operational attribute *ccdpx* (with values from 0 to 3) and correspond to a queue fill region falling between two adjacent DP thresholds. For example, *ccpd0* refers to the region between DP0 and DP1 and indicates the queue is 90 to 100% full.

The decision to drop a packet before it is enqueued in an egress queue, is based on the DP of the packet and the fill level of the egress queue. A whole packet is dropped upon its arrival at the egress if the current queue fill exceeds the threshold of the packet’s assigned DP. For example, a packet with a DP3 will be dropped if the occupancy of the EP queue is in a congestion control state of ccdp0, ccdp1, or ccdp2, and not ccdp3. In this case, the queue length exceeds the DP3 threshold (35%) and congestion is alleviated by not allowing the packet to be queued. However, if the packet has a DP0, it will be queued in all congestion states of the queue.

When a port is congested with multiple oversubscribed WFQs (EP2 to EP7) competing for bandwidth, the queue assigned the higher minBw admits proportionately more packets than a queue assigned a lower minBw.

Example of configuring traffic management on the 4-port gigabit Ethernet FP

The traffic management (TM) component and its subcomponent are automatically added when an *Ethernet* component is provisioned. All the TM queues are automatically configured with default attribute values. All of these provisionable attributes can be changed for any of the four emission priority (EP) queues under a port.

Prerequisites

- The Ethernet port must be configured prior to performing this procedure.

Procedure steps

1 Set the maximum size of the queue associated with a port for traffic buffering.

```
set Lp/<n> Ethernet/<m> TM Ep/<o> txQueueSize <value>
```

Note: The txQueueSize can be changed for each of the 8 queues.

2 Set the amount of bandwidth to be allocated to Ep/2, Ep/3, Ep/5, and Ep/7.

```
set Lp/<n> Ethernet/<m> TM Ep/<o>
minimumBandwidthGuarantee <weight>
```

3 If transmitting Ethernet virtual line service (EVLS) traffic, set the maximum frame size allowed on the link.

```
set Lp/<n> Ethernet/<m> maxFrameSize <framesize>
```

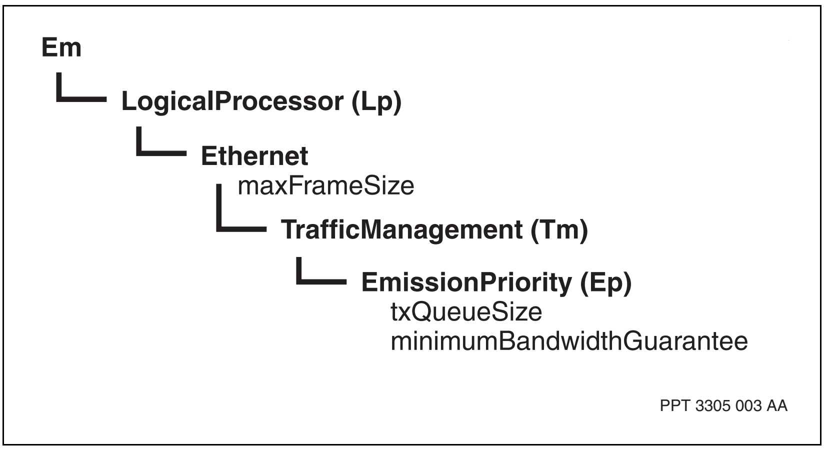
Variable Definitions

Variable	Definition
<framesize>	A value that should be provisioned only when using the Ethernet virtual line service (EVLS). Value ranges from 1518 to 1600 bytes.
<n>	An instance value for the logical processor.
<m>	An instance value for the port.
<o>	An instance value for the emission priorities EP2 to EP7.
(Sheet 1 of 2)	

Variable	Definition
<value>	Represents the maximum buffer size for a port-EP queue in bytes of payload data.
<weight>	A proportion of the total bandwidth to be allocated to the WFQ EPs (EP2 to EP7). When a WFQ EP is configured to carry traffic, it should be assigned a non-zero minimum bandwidth guarantee (MBG). However, regardless of traffic configuration, at least one WFQ EP must be configured with an MBG greater than zero or a semantic error will occur.
(Sheet 2 of 2)	

Procedure job aid

Figure 2
Configuring traffic management on the 4-port gigabit Ethernet FP component hierarchy



IP differentiated services behavior on the 4-port gigabit Ethernet FP

The scheduling class (SC) determines the relative importance of a packet and the transmit queue on which it is enqueued, and the packet inherits the scheduling characteristics of the queue.

The table “Scheduling behavior of 4pGe FP” (page 232) shows how the mapping is dependent on the ingress and egress media. Note that the 4pGe FP is the only Nortel Networks Multiservice Switch FP that supports IP queuing over eight queues. You can use all eight queues only with IP traffic where the ingress and egress FPs are both 4pGe.

Table 111
Scheduling behavior of 4pGe FP

Ingress FP	Egress FP	Scheduling behavior
4pGe	4pGe	Each of the eight available scheduling classes is directly mapped to one of eight transmit queues, where SC 7 is the highest priority and SC 0 is the lowest priority. For more information see the description of attribute *Vr Dsd TrafficClass schedulingClass8Queues* in NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*.
4pGe	PQC FP	The transmit queue in the PQC FP is selected based on the ATM service category of the egress ATM VCC. The egress ATM VCC is determined by the *ipcos* attribute value of the corresponding *AtmMpe AtmConnection* that matches the *sc4q* value in the PHB’s traffic class. For more information see the description of attribute *Vr Dsd TrafficClass schedulingClass4Queues* in NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*.
PQC FP	4pGe	The PQC FP can select one of 4 transmit queues on the 4pGe and is determined by the *sc4q* value in the PHB’s traffic class. For more information see the description of attribute *Vr Dsd TrafficClass schedulingClass4Queues* in NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*.

Table “Traffic class scheduling classes to 4pGe values” (page 233) shows the mapping between the scheduling classes defined in the traffic classes, and the service category and emission priority on the 4pGe FP. The mappings between the 4pGe service category and the 4pGe emission priority can be viewed in attribute *Lp Ethernet TrafficManagement ServiceCategory scToEpMappingOp*.

Table 112
Traffic class scheduling classes to 4pGe values

sc8q value 1	sc4q value 2	4pGe service category 3	4pGe emission priority 4
7		7	0 (highest)
6		6	1
5	3	5	2
4	2	4	3
3		3	4
2	1	2	5
1		1	6
0	0	0	7 (lowest)

1 attribute *schedulingClass8Queues* under the applicable *Vr Dsd TrafficClass* component (referenced for 4pGe to 4pGe IP traffic)

2 attribute *schedulingClass4Queues* under the applicable *Vr Dsd TrafficClass* component (referenced for PQC to 4pGe IP traffic)

3 component *Lp Ethernet TrafficManagement serviceCategory*

4 component *Lp Ethernet TrafficManagement emissionPriority*

For general information on IP differentiated services, see NN10600-800 *Nortel Networks Multiservice Switch 7400/15000/20000 IP Technology Fundamentals*. For information on configuring an Ethernet link for IP differentiated services, see NN10600-801 *Nortel Networks Multiservice Switch 7400/15000/20000 IP Configuration Management*.

6-port 10BaseT Ethernet FP

The PEC for the 6-port 10BaseT Ethernet FP is NTNQ36. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “6-port 10BaseT Ethernet configuration considerations” (page 234).

For information about the characteristics of this FP, see “6-port 10BaseT Ethernet characteristics” (page 235).

6-port 10BaseT Ethernet configuration considerations

Before you begin configuring a 6-port 10BaseT Ethernet FP, consider the following:

- This FP supports software-configurable media access control (MAC) addresses.
- See also “6-port 10BaseT Ethernet configuration parameters” (page 234).
- See also the figure “Configuring traffic management on the 6-port 10BaseT Ethernet FP component hierarchy” (page 235).

Table 113
6-port 10BaseT Ethernet configuration parameters

Parameter	Values
Card type <cardtype>	6pEth10BaseT
Port type <port>	Enet
Port number <m>	0 to 5

Figure 3
Configuring traffic management on the 6-port 10BaseT Ethernet FP component hierarchy

- **Em**
  - **Shelf**
    - **Card**
      - cardType
  - **LogicalProcessor (Lp)**
    - **Ethernet (Enet)**
      - heartbeatPacket
      - applicationFramerName (framer)
      - duplexMode
      - lineSpeed
      - autoNegotiation
      - maxFramerSize

PPT 3498 005 AA

6-port 10BaseT Ethernet characteristics

This FP supports IP services on Nortel Networks Multiservice Switch 7400 nodes.

Supported features include:

- frame filtering hardware
- large number of counters for statistics gathering
- comprehensive loopback capabilities for fault isolation
- fast packet processor (FPP) capability
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also “6-port 10BaseT Ethernet specifications” (page 236).

Table 114
6-port 10BaseT Ethernet specifications

Specification	Description
maximum line speed	10 Mbit/s
sparing supported	one-for-one
network clock synchronization supported	no
minimum software level required	not applicable
FP technologies	PM2, SBIC
access mode	see IEEE 802.3 specification
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	1 Mbyte

8-port 10/100BaseT Ethernet FP

The PEC for the 8-port 10/100BaseT Ethernet FP is NTNQ92. For a full list of PECs (including vintages) for supported FPs, see Nortel Networks Multiservice Switch Release Notes.

For information you need to configure this FP, see "8-port 10/100BaseT Ethernet FP configuration considerations" (page 237).

For information about the physical characteristics of this FP, see "8-port 10/100BaseT Ethernet FP characteristics" (page 239).

8-port 10/100BaseT Ethernet FP configuration considerations

Before you begin configuring an 8-port 10/100BaseT Ethernet FP, consider the following:

- One or more virtual LANs (VLANs) can be mapped to a single virtual router (VR) or virtual router forwarder (VRF).
- This FP requires that a second generation control processor (CP2) be operational on the shelf, one of NTNQ01, NTNQ03, or NTFN33.
- For configuration parameters, see the table "8-port 10/100BaseT Ethernet FP configuration parameters" (page 237).
- For component hierarchy, see the figure "Configuring traffic management on the 8-port 10/100BaseT Ethernet FP component hierarchy" (page 238).

Table 115
8-port 10/100BaseT Ethernet FP configuration parameters

Parameter	Values
Card type <cardtype>	8pEth100BaseT
Port type <port>	ethernet
Port number <m>	0 to 7
SFP configuration	not applicable

Figure 4
Configuring traffic management on the 8-port 10/100BaseT Ethernet FP component hierarchy

- **Em**
  - **Shelf**
    - **Card**
      - cardType
  - **LogicalProcessor (Lp)**
    - **Ethernet (Eth)**
      - applicationFramerName (framer)
      - duplexMode
      - lineSpeed
      - autoNegotiation
      - maxFrameSize

PPT 3495 002 AA

8-port 10/100BaseT Ethernet FP characteristics

This FP supports the following software and hardware characteristics:

- Ethernet services on Nortel Networks Multiservice Switch 7400 nodes
- multiservices on each Ethernet interface
- full and half duplex networking
- each Ethernet interface can operate in port-mode or VLAN-mode
- Ethernet frame formats as follows:
    - an ingress frame as IEEE 802.3 or Ethernet v2.0
    - an egress frame as Ethernet v2.0
    - the capability to accept any combination of untagged and priority-tagged traffic on the same Ethernet interface in port-mode and each VLAN in VLAN-mode
    - the capability to accept untagged, priority tagged, and VLAN-tagged traffic in VLAN-mode
- support of virtual router redundancy protocol (VRRP) for each Ethernet interface (RFC2338) in port-mode and VLAN-mode
- a standard frame size of up to 1518 bytes for port-mode and 1522 bytes for VLAN-mode
- Ethernet and IP statistics
- when a redundant CP2 undergoes a switchover, the impact on each NTNQ92 is:
    - a cold standby
    - once the back-up CP2 is active, the Ethernet FP resets and services are re-established on the FP
    - the Ifstatistics are reset to zero
    - the OSI operational states are all reset to their default values

See also the tables “8-port 10/100BaseT Ethernet physical specifications” (page 240) and “8-port 10/100BaseT Ethernet traffic management specifications” (page 241).

Table 116
8-port 10/100BaseT Ethernet physical specifications

Specification	Description
maximum line speed	100 Mbits/s
effective data rate	not applicable
sparing supported	not applicable
network clock synchronization supported	no
minimum software level required	PCR 6.1
FP technologies	PPC, PQC12
access mode	see IEEE 802.3 specification; Ethernet port mode or VLAN mode
fast RAM	not applicable
normal memory	128 Mbyte
shared memory	not applicable

Table 117
8-port 10/100BaseT Ethernet traffic management specifications

Traffic capability	Description
filtering, ingress	filter on IP SA or DA
	filter on MAC port DA
	filter on multicast addresses
classification and congestion control	based on layer 3 IP SA or DA
	based on layer 4 protocol type
	based on port
	based on port and VLAN
	based on DSCP
mapping, ingress	PHB mapped to four ATM quality of service (QoS) and three DPs when the Ethernet FP interworks with an ATM FP
queuing or discards, egress	one queue per port
IP configuration models	IP class of service (CoS) IP differentiated services (DiffServ)

8-port 10/100BaseT Ethernet FP MAC interface characteristics

The MAC portion of the Ethernet interface for the NTNQ92 FP does automatic retransmission of faulty packets and discarding packets received in error. The characteristics of the MAC include these capabilities:

- 500 MAC addresses per port or 1,000 per FP
- independent 10 or 100 Mbit/s port operation
- full-duplex with standard flow-control functionality. This FP accepts and reacts to PAUSE frames but does not support the generation of PAUSE frames.
- programmable cyclic redundancy check (CRC) generation and removal
- full collision support, including jamming, back off, and automatic retransmission

- internal and external loopback
- programmable automatic discard of badly received packets such as runts, CRC errors, and too-long packets

Ethernet FP OSI states

This section lists the following OSI state tables for Ethernet FPs:

- For the 2-port 100BaseT Ethernet FP, see “100BaseT Ethernet (En) component state combination” (page 243).
- For the 4-port 10/100BaseT Ethernet FP, see “Ethernet component state combination” (page 244) and “Vlan component state combination” (page 244).
- For the 4-port gigabit Ethernet FP, see “Ethernet component state combination” (page 244).
- For the 6-port 10BaseT Ethernet FP, see “Ethernet (En) 10BaseT component state combination” (page 242).
- For the 8-port 10/100BaseT Ethernet FP, see “Ethernet component state combination” (page 244) and “Vlan component state combination” (page 244).

Table 118
Ethernet (En) 10BaseT component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The component is disabled due to a broken physical disconnection or bad line state, etc.
Unlocked, Enabled, Idle	The component is not in use and is waiting to bind to the Framer component.
Unlocked, Enabled, Busy	The component is in use and can only service one Framer component at a time. No usage states are active.
Shutting Down, Enabled, Busy	The component is going from the unlocked to the locked state. The component is breaking the link to the Framer component.
(Sheet 1 of 2)	

Table 118 (continued)
Ethernet (En) 10BaseT component state combination

Combination (Administrative, Operational, Usage)	Details
Locked, Enabled, Idle	A lock command is in effect. You can test the component.
Locked, Disabled, Idle	A hardware test failed or a physical connection was broken while in the locked state.
(Sheet 2 of 2)	

Table 119
100BaseT Ethernet (En) component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The component is disabled due to a broken physical disconnection or bad line state. The LP associated with the component is down.
Unlocked, Enabled, Idle	The component is not in use and is ready to bind to the LAN application component.
Unlocked, Enabled, Busy	The component is in use.
Shutting Down, Enabled, Busy	The component is going from the unlocked to the locked state. The component is breaking the link to the Framer component.
Locked, Enabled, Idle	A lock command is in effect. You can test the component.
Locked, Disabled, Idle	A hardware test failed or a physical connection broke while the component was locked.

Table 120
Ethernet component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	External factors render the Ethernet interface inoperable through either the detection and declaration of port alarms or the parent component is disabled and/or locked.
Unlocked, Enabled, Idle	The Ethernet interface is not in use. The line input has been recognized as being in good working order.
Unlocked, Enabled, Busy	The Ethernet interface is in use by the application.
Shutting Down, Enabled, Busy	The component is going from the unlocked to the locked state. The component is breaking the link to the Framer component.
Locked, Disabled, Idle	A lock operator command is in effect. The line input has been recognized as being in poor working order.
Locked, Enabled, Idle	A lock operator command is in effect. The line input has been recognized as being in good working order. The Ethernet is operating in test mode (availabilityStatus: inTest).

Table 121
Vlan component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The *Vlan* component is not operational.
Unlocked, Enabled, Idle	The *Vlan* component is waiting for registration with the *Vr* or *Rtr Vrf*. The registration will complete when the *La* component is operational.
Unlocked, Enabled, Busy	The *Vlan* component is in use by the *La* component and has successfully registered with the *Vr* or *Rtf Vrf* to which it is associated.
(Sheet 1 of 2)	

Table 121 (continued)
Vlan component state combination

Combination (Administrative, Operational, Usage)	Details
Locked, Disabled, Idle	A lock operator command is in effect and renders the *Vlan* component not operational when the *La* component is not operational.
Locked, Enabled, Idle	A lock operator command is in effect and renders the *Vlan* component not operational when the *La* component is operational.
(Sheet 2 of 2)	

Ethernet FP standards compliance

This section lists the standards compliance for the Ethernet FPs:

- "2-port 100BaseT Ethernet compliance with standards" (page 245)
- "4-port 10/100BaseT Ethernet compliance with standards" (page 245)
- "4-port gigabit Ethernet compliance with standards" (page 246)
- "6-port 10BaseT Ethernet compliance with standards" (page 246)
- "8-port 10/100BaseT Ethernet compliance with standards" (page 246)

2-port 100BaseT Ethernet compliance with standards

The 2-port 100BaseT Ethernet FP complies with these standards and conventions:

- IEEE 802.3 and 802.3u

4-port 10/100BaseT Ethernet compliance with standards

The 4-port 10/100BaseT Ethernet FP complies with relevant sections of the following standards:

- Ethernet v2.0
- IEEE 802.3-2002 Ethernet CSMA/CD
- IEEE 802.1Q-1998 for frame format and VLAN tag treatment
- RFC894

- RFC1042
- RFC1213
- RFC2338
- RFC2684

4-port gigabit Ethernet compliance with standards

The 4pGe FP complies with relevant sections of the following standards:

- IEEE802.3-2002
- IETF RFC1213
- IETF RFC1643
- IETF RFC1042
- IETF RFC894

6-port 10BaseT Ethernet compliance with standards

The 6-port 10BaseT Ethernet FP complies with these standards and conventions:

- IEEE 802.3
- Digital/Intel/Xerox (DIX)

8-port 10/100BaseT Ethernet compliance with standards

The 8-port 10/100BaseT Ethernet FP complies with relevant sections of the following standards:

- Ethernet v2.0
- IEEE 802.3-2002 Ethernet CSMA/CD
- IEEE 802.1Q-1998 for frame format and VLAN tag treatment
- RFC894
- RFC1042
- RFC1213
- RFC2338
- RFC2684

See also the tables

- “Safety requirements” (page 247)
- “Electromagnetic compliance (EMC) requirements” (page 248)
- “Thermal requirements” (page 248)
- “Climatic requirements for weather-protected without temperature control” (page 249)
- “Climatic requirements for temperature controlled” (page 249)
- “Climatic requirements for an unattended telecommunications room” (page 250)

Table 122
Safety requirements

Requirement	Compliance specification, test method, or comment
EN600950 for European Union	Verband Deutscher Elektrotechniker (VDE) or Technischer berwachungs-Verein (TUV) assessed
national versions of IEC950, IEC60950	a CB report is available when the CSA C22.2 No. 950, UL 1950, or EN 60950 is not accepted
lightning protection, earthing, and grounding	EN60950, ETS 300 253
mounting apparatus (frame or cabinet) fire resistance criteria	EN60950
fire-resistant materials, components, wiring, and cables	EN60950
protection provided by enclosures	EN 60 529, 1992 [IP20]

Table 123
Electromagnetic compliance (EMC) requirements

Requirement	Compliance specification, test method, or comment
radiated emissions	EN 300-386-2 Sec. 5.1.1.3, (EN 55022, Class B)
conducted emissions	EN 300-386-2 Sec. 5.1.5.3, (ETS 300-386-1 subclause 7.2.3), EN55022
radiated radio frequency (RF) immunity	EN 300-386-2 Sec. 5.1.1.2, (EN 61000-4-3)
conducted RF immunity	EN 61000-6-2 (replaces EN50082-2)
electrical fast transient signal cables (with RJ-45s)	EN 300-386-2 Sec. 5.1.3.1, 5.1.5.1, (EN 61000-4-4), EN55024
surges	EN 300-386-2 Sec. 5.1.3.2, (EN 61000-4-5, ETS 300 386-1 subclause 6.4.2), EN55024
electrostatic discharge (ESD)	EN 300-386-2 Sec. 5.1.1.1, 5.1.1.4 (EN 6100-4-2), EN55024

Table 124
Thermal requirements

Requirement	Compliance specification, test method, or comment
heat dissipation (by office fluoroscope)	USA GR-63-CORE Iss. 1 Oct. 1995, R4-11, 04-12, 04-13
operational altitude -60 to 1800 m (-196.8 to 5905.5 ft.) above sea level	USA GR-63-CORE Iss. 1 Oct. 1995, R4-8
operational altitude 4000 m (13,123.36 ft.) above sea level	USA GR-63-CORE Iss. 1 Oct. 1995, R4-9

Table 125
Climatic requirements for weather-protected without temperature control

Requirement ETS 300 019 May 1994 (Storage Class 1.2)	Test method or comment
low temperature storage for 72 hours -25 degrees Celsius -13 degrees Fahrenheit	IEC 68-2-1 Ab: Cold
high temperature storage for 72 hours +55 degrees Celsius or +131 degrees Fahrenheit	IEC 68-2-2 Bb: Dry heat
high humidity storage for 4 days 93% at +30 degrees Celsius or 93% at +86 degrees Fahrenheit	IEC 68-2-56 Cb: Damp heat steady state
condensation humidity storage (relative) for 2 cycles 90 to 100% at +30 degrees Celsius or 90 to 100% at +86 degrees Fahrenheit	IEC 68-2-30 Db: Damp heat cyclic variant 1
storage vibration	IEC 68-2-6 Fc: Vibration sinusoidal

Table 126
Climatic requirements for temperature controlled

Requirement ETS 300 019 May 1994 (Operation Class 3.1)	Test method or comment
low temperature operation for 16 hours +5 degrees Celsius or +41 degrees Fahrenheit	IEC 68-2-1 Ab/Ad: Cold
high temperature operation for 16 hours +40 degrees Celsius or +104 degrees Fahrenheit	IEC 68-2-2 Bb/Bd: Dry heat
air temperature change for half cycles +25 or +40 degrees Celsius per minute +75.2 or +104 degrees Fahrenheit per minute	IEC 68-2-14 Nb: change of temperature
(Sheet 1 of 2)	

Table 126 (continued)
Climatic requirements for temperature controlled

Requirement ETS 300 019 May 1994 (Operation Class 3.1)	Test method or comment
high humidity (relative) for 4 days 85% at +30 degrees Celsius or 85% at +86 degrees Fahrenheit	IEC 68-2-56 Cb: Damp heat steady state
water (rain) at 6 mm (0.236 in.) per minute	IEC 68-2-18 Rb: Impacting water Method 2.2
shock, 3 in each direction	IEC 68-2-27 Ea: Shock
(Sheet 2 of 2)	

Table 127
Climatic requirements for an unattended telecommunications room

Requirement ETS 300 753 Oct. 1997 (Operation Class 3.1)	Test method or comment
acoustic noise is 60 dBA	ISO 7779(1)

Chapter 7
General processors

Nortel Networks Multiservice Switch 2-port general processor (GP) with disk supports asynchronous data transfer. The data transfer rate varies with the services being offered on this function processor (FP). The configuration reference information can help you when you configure and maintain the 2-port GP with disk.

For reference information about this FP, see “2-port GP with disk” (page 252).

For information about OSI states, see “2-port GP with disk OSI states” (page 258).

For information about standards compliance, see “2-port GP with disk compliance with standards” (page 258).

For information about applications and services for this FP, see “Applications and services supported by function processors” (page 39).

2-port GP with disk

The PEC for the 2-port GP with disk is NTHW10. For a full list of PECs (including vintages) for supported FPs, see Nortel Networks Multiservice Switch Release Notes.

For information you need to configure this FP, see “2-port GP with disk configuration considerations” (page 252).

For information about the characteristics of this FP, see “2-port GP with disk characteristics” (page 256).

2-port GP with disk configuration considerations

Before you begin configuring a 2-port GP with disk, consider the following:

- The one-for-one card sparing does not include the 20 GB disk
- See also “2-port GP with disk configuration parameters” (page 252)
- For the configuration procedure, see “Example of configuring a 2-port GP with disk” (page 253)
- For information about sparing this FP, see “2-port GP with disk sparing” (page 255).

Table 128
2-port GP with disk configuration parameters

Parameter	Values
Card type <cardtype>	2pGPDsk
Ethernet Port type <port>	ethernet100BaseT
Port number <m>	0, 1
Line sparing <swtichiveOnFailure>	enabled, disabled
no traffic wait <switchover Holdoff>	0 to 180 seconds
interfaceName	lp/<lp_number> ethernet100BaseT/ <port_number>

Example of configuring a 2-port GP with disk

Configure a 2pGpDsk to enable it to support services.

Prerequisites

- The 2pGpDsk must be installed according to FP installation procedures in the NN10600-130 *Nortel Networks Multiservice Switch 15000/20000 Hardware Installation, Maintenance, and Upgrade*.
- The software needed to support the services you are providing on the 2pGpDsk must be installed according to the procedures in the NN10600-270 *Nortel Networks Multiservice Switch 7400/15000/20000 Software Installation*.

Procedure steps

1 Configure the shelf slot with the appropriate card type.

```
set shelf card/<slot_number> cardType <cardtype>
```

2 Link the logical process or the shelf card.

```
set lp/<lp_number> maincard sh card/<slot_number>
```

3 Add a port to the logical processor.

```
add lp/<lp_number> ethernet100Baset/<port_number>
```

4 Turn auto-negotiation on or off for line speed and duplex mode.

```
set lp/<lp_number> ethernet100Baset/<port_number>
autoNegotiation <neg_setting>
```

5 Set the duplex mode for the port if auto-negotiation is disabled.

```
set lp/<lp_number> ethernet100Baset/<port_number>
duplexMode <duplex_setting>
```

6 Set the linespeed for the port if auto-negotiation is disabled.

```
set lp/<lp_number> ethernet100Baset/<port_number>
lineSpeed <speed_value>
```

7 Enable switchover if the port fails.

```
set lp/<lp_number> ethernet100Baset/<port_number>
switchoverOnFailure <line_sparing>
```

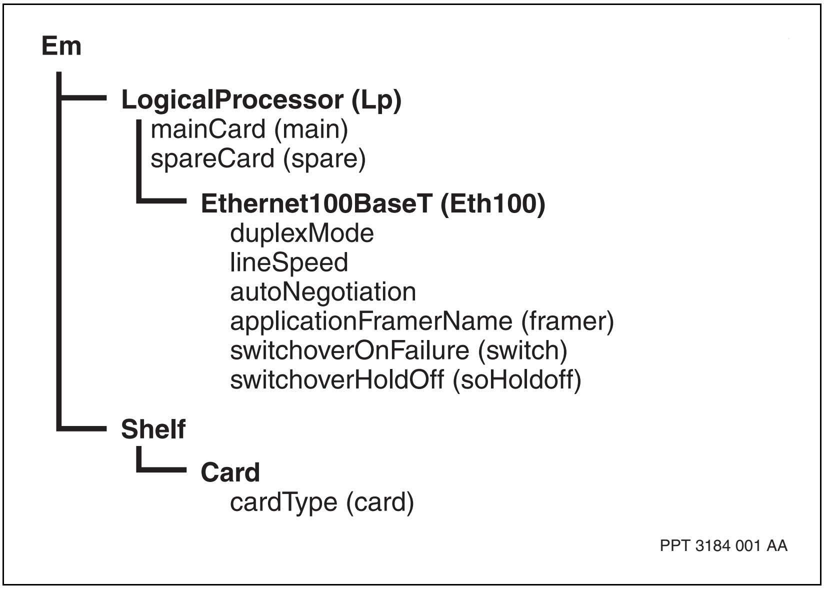
8 Set the switchover delay for the port.

```
set lp/<lp_number> ethernet100Baset/<port_number>
switchoverHoldoff <no_carrier_wait>
```

Variable values

Variable	Values
<slot_number>	The slot in the shelf the 2pGpDsk is inserted into.
<cardtype>	2pGPDsk for the 2pGPDsk.
<lp_number>	The number assigned to the logical processor you are configuring.
<port_number>	The port you are configuring on the 2pGpDsk.
<neg_setting>	Auto negotiation enabled or disabled for the port.
<duplex_setting>	The duplex mode you want to use on the port.
<speed_value>	The line speed you want the port to use.
<line_sparing>	Switchover enabled or disabled for the port.
<no_carrier_wait>	The amount of time in seconds you want the card to wait before switchover if there is no carrier.

Procedure job aid
Figure 5
Provisioning the 2pGpDsk component hierarchy



2-port GP with disk sparing

The 2pGpDsk supports line and card sparing. The redundant FPs do not need to be installed in adjacent slots. Packets are broadcast from the hub to both the active and spare FP simultaneously.

With the 2pGpDsk card sparing, if the active card fails then the spare FP will take over for all functions of the failed card.

> ***Note:*** Information stored on the disk of the active FP is not automatically stored on the spare FP.

The FP will switchover to the standby 2pGpDsk if an active port fails (with switchover enabled) and the spare FP can provide equal or better quality-of-service for all ports with switchover enabled. The FP will not switchover if the service quality is diminished for any operational port with switchover enabled. There will be no switchover if the line sparing is disabled when the port fails.

The table “2pGpDsk line sparing examples” (page 256) shows when switchover may occur as a result of a failed port on the 2pGpDsk.

Table 129
2pGpDsk line sparing examples

Failed port (other port ok)	Line sparing for active card		Port status for spare card		Switchover occurred
	Port 0	Port 1	Port 0	Port 1	
Port 0	enabled	enabled	ok	ok	YES
Port 0	enabled	enabled	ok	bad	NO
Port 0	enabled	disabled	bad	ok	NO
Port 0	enabled	disabled	ok	bad	YES
Port 0	disabled	enabled	ok	ok	NO
Port 1	disabled	enabled	ok	ok	YES
either port	disabled	disabled	ok	ok	NO
Port 0	enabled	disabled	ok	ok	YES

2-port GP with disk characteristics

The 2-port GP with disk may also be referred to as the 2-port GPDsk or the 2pGPDsk. This FP has two supported Ethernet 100BaseT ports and one unsupported Ethernet 10BaseT debug port. It has the capability of automatically spooling data from the applications running on it to the internal 20 gigabyte hard drive.

Wireless services will use the 2-port GP with disk to store call and user information. The uses of the 2-port GP can be expanded with the development of other services or applications.

Support features include:

- line sparing
- hitless software migration depending on the service you are running on the 2-port GP with disk

- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)
- IP DiffServ services of the DiffServ domain for the router (*Vr Dsd*) and the DiffServ profile for the interface (*Vr Ip DiffServ*)

See also "2-port GP with disk specifications" (page 257).

Table 130
2-port GP with disk specifications

Card characteristic	Description
maximum line speed	determined by service
effective data rate	determined by service
sparing supported	one-for-one (does not include the hard disk)
FLASH memory	1 Mbyte
DRAM memory	512 Mbyte
hard drive	20 Gbyte EIDE
minimum software level required	determined by service

2-port GP with disk OSI states

See “100BaseT Ethernet (En) component state combination” (page 243) for OSI state information for the 100BaseT Ethernet port. The 10BaseT debug port is not supported. See “Ethernet (En) 10BaseT component state combination” (page 242) for OSI state information for the 10BaseT debug port.

2-port GP with disk compliance with standards

The 100BaseT Ethernet ports comply with the following standards

- IEEE 802.3
- EN300 386-2, Performance Criterion A for shielded cable
- EN300 386-2, Performance Criterion B for unshielded cable
- Digital/Intel/Xerox (DIX)

The 2pGPDsk is compliant with ISO 8601 and Nortel Networks Corporate Standard 1805.00.

Chapter 8
HSSI function processor

The high speed serial interface (HSSI) function processor (FP) supports line speeds between 1 Mbit/s and 50 Mbit/s.

For reference information about this FP, see “1-port HSSI FP” (page 259).

For information about OSI states, see “1-port HSSI OSI states” (page 262).

For information about standards compliance, see “1-port HSSI compliance with standards” (page 264).

For information about applications and services for this FP, see “Applications and services supported by function processors” (page 39).

1-port HSSI FP

The PEC for the 1-port HSSI FP is NTNQ27. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For information you need to configure this FP, see “1-port HSSI configuration considerations” (page 260):

For information about the characteristics of this FP, see “1-port HSSI characteristics” (page 261).

1-port HSSI configuration considerations

Before you begin configuring a 1-port HSSI FP, consider the following:

- does not use a termination panel
- operates in DCE mode and can be configured to DTE through a DIP switch setting and the use of a null modem cable
- in DCE mode, you can achieve sourcing line rates slower than 50 Mbit/s by gapping a 50 Mbit/s clock stream
- the DCE mode port uses clocks generated by the gapped clock generator, with a provisional clock rate ranging from 1 Mbit/s to 50 Mbit/s

See also “1-port HSSI configuration parameters” (page 260).

Table 131
1-port HSSI configuration parameters

Parameter	Values
Card type <cardtype>	HSSI
Port type <port>	HSSI
Port number <m>	0
Port configuration	DCE or DTE (set using the DIP switch)

1-port HSSI characteristics

This FP supports for frame relay services on Nortel Networks Multiservice Switch 7400 nodes.

Supported features include:

- HSSI Local Digital Loopback (Loop A)
- interchange frame relay traffic to DTE devices such as routers, or DCE devices such as data/channel service units (DSU/CSUs)
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also “1-port HSSI specifications” (page 261).

Table 132
1-port HSSI specifications

Card characteristic	Description
effective data rate	50 Mbit/s
processor memory	128 Mbyte SDRAM
network clock synchronization supported	no
minimum software level required	not applicable
fast RAM	not applicable
normal memory	16 Mbyte
shared memory	2 Mbyte

1-port HSSI OSI states

These tables contain information about 1-port HSSI FP OSI states.

Table 133
1-port HSSI component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The HSSI port is inoperable due to at least one of the following alarms: • alarms related to actualLinkMode • incorrect link cable • input modem signal does not meet expected.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes. The line input has been recognized as good. Clocks are available.
Unlocked, Enabled, Busy	The HSSI component is in use. The HSSI component services only one user (a Framer component) at a time.
Locked, Enabled, Idle	A lock operator command is in effect and the HSSI component is operating in test mode (availabilityStatus: inTest).
Locked, Disabled, Idle	A lock operator command is in effect and the component is in one of the following conditions: • Left offline. (availabilityStatus: offline) • A hardware test failed. (availabilityStatus: failed) If running in test mode external factors cause errors (availabilityStatus: inTest). Bad line state and excessive line state changes are possible causes.

Table 134
HSSI Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. The system will reject Start test requests.
Unlocked, Enabled, Busy	The Test component is in use. A HSSI component creates a Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

1-port HSSI compliance with standards

The 1-port HSSI FP, in combination with the appropriate cable, complies to these ITU-T standards:

- ANSI TIA/EIA-612 (1993)
- ANSI TIA/EIA-613 (1993)
- In all modes, DTE and DCE, pin 46 of connector P0 on the faceplate of the HSSI FP has applied to it a soft pull-up voltage of +5 V through a high impedance value. This is used for proprietary cable identification. Pin 46 is defined as unused by the above standards. At the far-end of all Nortel Networks HSSI cables, pin 46 is unconnected.
- In DTE mode, the HSSI FP can slave to a maximum burst rate of 50 Mbit/s. Otherwise, compliance is met at the end of the proprietary null modem cable described later in this document.

Chapter 9
JT2 ATM function processor

The JT2 ATM function processor (FP) supports a maximum line speed of 6.312 Mbit/s. The configuration reference information can help you when you configure and maintain the JT2 ATM FP.

For reference information about this FP, see “2-port JT2 ATM FP” (page 266).

For information about OSI states, see “2-port JT2 ATM FP OSI states” (page 269).

For information about standards compliance, see “2-port JT2 ATM compliance with standards” (page 271).

For information about applications and services for this FP, see “Applications and services supported by function processors” (page 39).

2-port JT2 ATM FP

The PEC for the 1-port JT2 ATM FP is NTNQ53. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For information you need to configure this FP, see “2-port JT2 ATM FP configuration considerations” (page 266):

For information about the characteristics of this FP, see “2-port JT2 ATM characteristics” (page 267).

2-port JT2 ATM FP configuration considerations

Before you begin configuring a 2-port JT2 ATM FP, consider the following:

- You must link the ports to an ATM interface before they can provide any service. For more information, see the section on provisioning the AtmInterface component in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- Both ports are individually provisionable.
- The entire payload bandwidth is as a single clear channel.
- When you add a port, the system automatically creates an ATMCell subcomponent.
- The cell payload is scrambled by default, according to ITU-T Recommendation I.432. You can turn cell payload scrambling off for a port on an ATM card. However, when cell payload scrambling is turned off for ATM ports, there is a possibility of false cell header delineation errors.
- 98 timeslots (64-kbit/s each) plus framing bits
- The node synchronizes the transmit clock for both ports on the JT2 ATM FP from the same reference. Therefore, you must set the c*lockingSource* attribute for all the ports to local if you want to use the local clocking source.You must set the *clockingSource* attribute for all the ports to

module if you want to use the module clocking source. If you set the *clockingSource* attribute for one port to line, you must set the *clockingSource* attribute for the other port to *otherPort*.

If a CP reference clock is available, the default setting for the *clockingSource* attribute is module. Otherwise, the default setting is local, and you cannot select module.

If a fault condition exists for a JT2 FP that uses the line or module timing reference, and that reference is not present, the system uses the local oscillator to synchronize the transmit clock.

- See also “2-port JT2 ATM configuration parameters” (page 267).

Table 135
2-port JT2 ATM configuration parameters

Parameter	Values
Card type <cardtype>	2pJ6mAtm
Port type <port>	JT2
Port number <m>	0, 1
Clocking source	local, line, module, otherPort

2-port JT2 ATM characteristics

This FP supports ATM services on Nortel Networks Multiservice Switch 7400 nodes. It provides access both to and from the public network, and interfaces between Multiservice Switch nodes within a private network. It supports user-network-interfaces (UNIs) or ATM Multiservice Switch node-Multiservice Switch node-interfaces (MMIs).

The 2-port JT2 ATM FP also supports processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

See also “2-port JT2 ATM specifications” (page 268).

Table 136
2-port JT2 ATM specifications

Card characteristic	Description
effective data rate	6.144 Mbit/s
sparing supported	one-for-one
access mode	direct framing
fast RAM	512 kbyte
normal memory	16 Mbyte
shared memory	2 Mbyte (see Note)
network clock synchronization supported	yes
minimum software level required	not applicable
FP technologies	PDC1.0, CQC
Note: The value for shared memory on refers to the amount of cell queue memory (CQC) available. The value of 2 Mbytes is partitioned into 1.0 Mbyte blocks, one block is used in the ingress direction and the other for egress	

2-port JT2 ATM FP OSI states

The tables “JT2 component state combination” (page 269)and “JT2 ATM Test component state combination” (page 270) contain information about JT2 ATM FP OSI states.

Table 137
JT2 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The JT2 interface is inoperable due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisPhysicalAlarm • rxAisPayloadAlarm • rxRaiAlarm • lcdAlarm.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes. The line input is recognized as good. Clocks are available.
Unlocked, Enabled, Busy	The JT2 component is in use. The JT2 component services only one user (an ATM interface component) at a time.
ShuttingDown, Enabled, Busy	A lock command is in effect against the JT2 component. The JT2 component is waiting for the ATM interface component to go into a disabled mode before it completes the lock sequence and shuts down.
(Sheet 1 of 2)	

Table 137 (continued)
JT2 component state combination

Combination (Administrative, Operational, Usage)	Details
Locked, Enabled, Idle	A lock operator command is in effect. The JT2 component is operating in test mode (availabilityStatus: inTest).
Locked, Disabled, Idle	A lock operator command is in effect. The component is in one of the following conditions: • Left offline. (availabilityStatus: offline) • Some hardware test failed. (availabilityStatus: failed) • If running in test mode external factors cause errors (availabilityStatus: inTest). Bad line state and excessive line state changes are possible causes.
(Sheet 2 of 2)	

Table 138
JT2 ATM Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Idle	The hardware component is locked. You can perform a port and line test.
Unlocked, Enabled, Busy	The Test component is in use. A JT2 component creates a Test component. The Test component services only that particular component. A teststops either when the prescribed timer expires or you issue a stop test command.

2-port JT2 ATM compliance with standards

The 2-port JT2 ATM FP complies with the applicable sections of these standards:

- NTT, Technical Reference for High-Speed Digital Leased Circuit Services (General Specification)
- ATM Forum, ATM User-Network Interface Specification, 6,312 Kbit/s UNI (General Specification)
- ITU-T G.703 (Physical/Electrical Interface Specification)
- TTC JT-G.703-a (Jitter and Wander)
- ITU-T G.704 (Framing)
- ITU-T G.804 (Cell mapping)
- ITU-T G.706 (Frame Alignment and CRC Procedures)
- ITU-T G.775 (LOS and AIS detection and clearing)
- ITU-T I.361 (B-ISDN ATM Layer Specification)
- ITU-T I.432 (B-ISDN User-Network-Interfaces)

Chapter 10
OC-3/STM-1 function processors

Nortel Networks Multiservice Switch OC-3/STM-1 function processors (FPs support ATM services with a maximum line speed of 155.52 Mbit/s. The configuration reference information can help you when you configure and maintain these FPs.

Navigate to the reference information about each FP using the table "Multiservice Switch OC-3/STM-1 FPs" (page 274).

For information about OSI states, see "OC-3/STM-1 OSI states" (page 311).

For information about standards compliance, see "OC-3/STM-1 FP standards compliance" (page 315).

For information about the identified FP technologies, see "FP technology considerations" (page 433).

For information about applications and services for these FPs, see "Applications and services supported by function processors" (page 39).

Table 139
Multiservice Switch OC-3/STM-1 FPs

Type	Link to FP reference information
ATM	"Common non-channelized OC-3/STM-1 ATM FP configuration considerations" (page 274) "2-port OC-3/STM-1 ATM IP FP" (page 274) "3-port OC-3/STM-1 ATM FP" (page 279) "4-port OC-3/STM-1 ATM FP" (page 282) "4-port OC-3/STM-1Ch TDM/CES FP" (page 287) "16-port OC-3/STM-1 ATM FP" (page 294) "16-port OC-3/STM-1 ATM with OAM cell conversion" (page 297) "16-port OC-3/STM-1 POS and ATM FP" (page 299)

Common non-channelized OC-3/STM-1 ATM FP configuration considerations

- For all ATM FPs you must link the ports to an ATM interface before they can provide any service. For more information, see the section on provisioning the AtmInterface (*AtmIf*) component in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- The cell payload is scrambled by default, according to ITU-T Recommendation I.432. You can turn cell payload scrambling off for a port on an ATM card. However, when cell payload scrambling is turned off for ATM ports, there is a possibility of false cell header delineation errors.

2-port OC-3/STM-1 ATM IP FP

The PECs for the single-mode (SM) 2-port OC-3/STM-1 ATM IP FP for Nortel Networks Multiservice Switch 7400 nodes are:

- NTJS09BA
- NTJS09CA

- NTJS09DA
- NTNQ66AA

The PECs for the multimode (MM) 2-port OC-3/STM-1 ATM IP FP for Multiservice Switch 7400 nodes are:

- NTJS07BA
- NTJS07CA
- NTJS07DA
- NTNQ65AA

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “2-port OC-3/STM-1 ATM IP configuration considerations” (page 275).

For information about the characteristics of this FP, see “2-port OC-3/STM-1 ATM IP characteristics” (page 277).

2-port OC-3/STM-1 ATM IP configuration considerations

Before you begin configuring an OC-3/STM-1 ATM IP, consider the following.

- When you add a port, the system automatically creates a Path subcomponent. The system also creates an *ATMCell* component beneath the Path component.
- You must set three types of attributes:
  - Set the *Sonet* or *Sdh* provisionable attributes using the generic process
  - Set the *Sonet* or *Sdh Path* component attributes using the command

    set lp/<n> <port>/<m> path/0 <attribute> <attributevalue>
  - Set the *Sonet* or *Sdh Path AtmCell* component attributes using the command

```
set lp/<n> <port>/<m> path/0 cell <attribute>
<attributevalue>
```

- Automatic protection switching: *aps*. When an APS component is created, the *test* component is automatically created for it, replacing the *port test* component under Sonet/Sdh.
- APS attributes *workingLine* and *protectionLine* must be linked to the Sonet (or Sdh) ports that will function as such. For more information on working with APS, see NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.
- Up to seven 2-port OC-3/STM-1 ATM IP FPs can be configured in a Multiservice Switch 7480. It is recommended that no more than five active or Main FPs (with the attribute mainCard under the component Lp) occupy the same shelf assembly. The total of two excludes any spare FPs (with the attribute spareCard).
  — Deploying more than five active 2-port OC-3/STM-1 ATM IP FPs risks affecting the shelf's capability to provide services. The amount of risk and the extent of impact depends on the engineering limitations imposed by any Multiservice Switch 7400 node and depends on all of the FPs in a shelf simultaneously bursting up to their maximum line rates. Each active port sending AAL1 CES constantly sends more than its line rate onto the backplane. Calculate the total bandwidth of all active ports to ensure that the backplane capacity is not exceeded.
- See also "2-port OC-3/STM-1 ATM IP configuration parameters" (page 276).

Table 140
2-port OC-3/STM-1 ATM IP configuration parameters

Parameter	Values
Card type <cardtype>	• multimode - 2pOC3MmAtm2 • single mode - 2pOC3SmAtm2
Port type <port>	• Sonet (for OC-3) • Sdh (for STM-1)
(Sheet 1 of 2)	

Table 140 (continued)
2-port OC-3/STM-1 ATM IP configuration parameters

Parameter	Values
Port number <m>	0, 1
Port configuration	B-ISDN
Clocking	local, line, module
(Sheet 2 of 2)	

2-port OC-3/STM-1 ATM IP characteristics

The 2-port OC-3 ATM IP FP may also be referred to as the 2-port OC-3 multimode ATM2 SGAF, 2-port OC-3/STM-1 ATM IP, or the 2 P OC-3A. It supports ATM services on Nortel Networks Multiservice Switch 7400 nodes.

This FP supports ATM user-to-network-interface (UNI) or one ATM Multiservice Switch node-to-Multiservice Switch node-interface (PPI) for each port, from either side of the user/network boundary. It can provide access to and from a public network as well as provide an interface between Multiservice Switch nodes within a private network. It is available in single-mode and multimode formats.

Supported features include:

- ATM traffic management functions, including fair queuing and traffic shaping
- line automatic protection switching (line APS) between SONET interfaces on the same card (single-FP line APS)
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also “2-port OC-3/STM-1 ATM IP specifications” (page 278).

Table 141
2-port OC-3/STM-1 ATM IP specifications

Specification	Description
effective data rate	149.7 Mbit/s
access mode	STM-1, STS-3
normal memory	64 Mbyte
network clock synchronization supported	yes
synchronization status messages supported	yes
minimum software level required	not applicable
FP technologies, single-mode format	• PEC NTJS09BA - PPC, AQM1.0, PQC1.0 • PEC NTJS09CA - PPC, AQM1.1, PQC1.0 • PEC NTNQ66AA, NTJS09DA - PPC, AQM1.1, PQC2.0
FP technologies, multimode format	• PEC NTJS07BA - PPC, AQM1.0, PQC1.0 • PEC NTJS07CA - PPC, AQM1.1, PQC1.0 • PEC NTNQ65AA, NTJS07DA - PPC, AQM1.1, PQC2.0

3-port OC-3/STM-1 ATM FP

The PECs for the 3-port OC-3 ATM FP for Nortel Networks Multiservice Switch 7400 nodes are:

- NTNQ55 for single-mode format
- NTNQ54 for multimode format

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “3-port OC-3/STM-1 ATM configuration considerations” (page 279).

For information about the characteristics of this FP, see “3-port OC-3/STM-1 ATM characteristics” (page 281).

3-port OC-3/STM-1 ATM configuration considerations

Before you begin configuring an OC-3/STM-1 FP, consider the following.

- When you add a port, the system automatically creates a Path subcomponent. The system also creates an ATMCell component beneath the Path component.

  You must set three types of attributes:

  — Set the SONET or SDH provisionable attributes using the generic process.

  — Set the SONET or SDH Path component attributes using the command

  set lp/<n> <port>/<m> path/0 <attribute> <attributevalue>

  — Set the SONET or SDH Path AtmCell component attributes using the command

  set lp/<n> <port>/<m> path/0 cell <attribute> <attributevalue>

- An ILS Forwarder card is required for IP support on CQC-based FPs. The combination of a CQC-based FP and an ILS Forwarder card supports IP, but not IP VPN (tunneling with VCG). See NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description* for information on the ILS Forwarder card.
- Up to seven 3-port OC-3/STM-1 ATM FPs can be configured in a Multiservice Switch 7480. It is recommended that no more than five active or Main FPs (with the attribute mainCard under the component Lp) occupy the same shelf assembly. The total of two excludes any spare FPs (with the attribute spareCard).
  - — Deploying more than five active 3-port OC-3/STM-1 ATM FPs risks affecting the shelf's capability to provide services. The amount of risk and the extent of impact depends on the engineering limitations imposed by any Multiservice Switch 7400 node and depends on all of the FPs in a shelf simultaneously bursting up to their maximum line rates. Each active port sending AAL1 CES constantly sends more than its line rate onto the backplane. Calculate the total bandwidth of all active ports to ensure that the backplane capacity is not exceeded.
- See also "3-port OC-3/STM-1 ATM configuration parameters" (page 280).

Table 142
3-port OC-3/STM-1 ATM configuration parameters

Parameter	Values
Card type <cardtype>	• multimode - 3pOC3MmAtm
	• single mode - 3pOC3SmAtm
Port type <port>	• Sonet (for OC-3)
	• Sdh (for STM-1)
Port number <m>	0 to 2
Port configuration	B-ISDN
Clocking	local, line, module

3-port OC-3/STM-1 ATM characteristics

The 3-port OC-3/STM-1 ATM FP may also be referred to as the Three-port Single-mode OC-3/STM-1 ATM FP. This FP supports ATM services on Nortel Networks Multiservice Switch 7400 nodes.

The 3-port OC-3/STM-1 ATM FP supports either one OC-3 ATM user-to-network-interface (UNI) or one ATM Multiservice Switch node-to-Multiservice Switch node-interface (MMI) for each port. These can operate from either side of the user/network boundary, and can provide access to and from a public network. They can also to provide an interface between Multiservice Switch nodes within a private network. It is available in single-mode and multimode formats.

Supported features include:

- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)
- See also “3-port OC-3/STM-1 ATM specifications” (page 281).

Table 143
3-port OC-3/STM-1 ATM specifications

Specification	Description
effective data rate	149.7 Mbit/s
access mode	STM-1, STS-3
normal memory	16 Mbyte
shared memory	2 Mbyte
network clock synchronization supported	yes
minimum software level required	PCR1.0
FP technologies	PDC1.1, CQC

4-port OC-3/STM-1 ATM FP

The 4-port OC-3/STM-1 ATM FP in Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes has a number of product engineering codes (PECs), depending on the format and Multiservice Switch queue controller (PQC) version of the card. For a list of the PECs associated with Multiservice Switch queue controllers (PQC), see “4-port OC-3/STM-1 PECs” (page 282).

Table 144
4-port OC-3/STM-1 PECs

FP	PQC6v2 (also known as PQC2)	PQC12
4-port OC-3/STM-1 multimode	NTHR17	NTHW05
4-port OC-3/STM-1 single-mode	NTHR21	NTHW15

> ***Note:*** When a PEC is not mentioned specifically, you can assume the text applies to all 4-port OC-3 ATM FPs in general.

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port OC-3/STM-1 ATM configuration considerations” (page 282).

For information about the characteristics of this FP, see “4-port OC-3/STM-1 ATM characteristics” (page 284).

4-port OC-3/STM-1 ATM configuration considerations

Before you begin configuring a 4-port OC-3/STM-1 ATM FP, consider the following.

- The CA vintage or higher is required to support hitless software migration and equipment protection features.

- For NTNHR21CA, NTHR17CA, and later versions, you must load CA01S2A software before installing the FP. Inserting the FP into a system running an earlier load will damage the FP, requiring it to be returned to Nortel Networks for repair.
- For NTHR21BA and NTHR17BA, the maximum supported software level is PCR2.1.
- When you add a *Sonet* port, you must manually configure (provision) an *Sts* subcomponent. The system creates component *Cell* beneath component *Sts*.
- When you add an *Sdh* port, you must manually configure (provision) a *Vc4* subcomponent. The system creates component *Cell* beneath component *Vc4*.
- When configuring single-FP LAPS on the 4-port OC-3 ATM FP, the working and protection lines must be paired as follows: ports 0 and 1 must be paired on the same *Laps* component, and ports 2 and 3 must be paired on another *Laps* component.
- When configuring dual-FP line APS (LAPS) on the 4-port OC-3 ATM FP, configure a pair of ports on two adjacent FPs. For example, configure port 0 on the FP in slot 2, and port 0 on the adjacent FP in slot 3.
- Sparing, LAPS, and equipment protection are supported between FPs that have the same PQC base. For example, a PQC12-based FP to a PQC12-based FP or a PQC6-based FP to a PQC6-based FP is supported. However, a PCQ12-based FP to a PQC6-based FP is not supported.
- When using LAPS, the attribute *clockingSource* must be set to *module*.
- See also “4-port OC-3/STM-1 ATM configuration parameters” (page 284).

Table 145
4-port OC-3/STM-1 ATM configuration parameters

Parameter	Values
Card type <cardtype>	• 4pOC3MmAtm (for multimode) • 4pOC3SmIrAtm (for single-mode, intermediate reach)
Port type <port>	• Sonet (for OC-3) • Sdh (for STM-1)
Port number <m>	0 to 3
Port configuration	B-ISDN
Clocking source	local, line, module

4-port OC-3/STM-1 ATM characteristics

Each port has an OC-3 duplex SC fiber optic transceiver. This FP supports ATM services on Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes.

The 4-port OC-3/STM-1 ATM FP supports either one OC-3 ATM user-network-interface (UNI) or one ATM Multiservice Switch node-Multiservice Switch node-interface (MMI) for each port. These can operate from either side of the user/network boundary, and can provide access to and from a public network. They can also to provide an interface between Multiservice Switch nodes within a private network. It is available in single-mode intermediate reach and multimode formats.

Supported features include:

- SONET or SDH inter-card or intra-card line APS (LAPS) for a single-FP or dual-FP setup between pre-designated pairs of ports
- equipment sparing of optical FPs by using a sparing bus between adjacent pairs of optical FPs. The sparing bus connects FPs that are located in the following card slots: 2 and 3, 4 and 5, 6 and 7, 8 and 9, 10 and 11, 12 and 13, and 14 and 15. In equipment sparing of optical FPs, the traffic of a port on an active optical FP is switched to a spare FP if:
    - the active FP fails

- the port has been configured for dual-FP line APS (LAPS)
- the FP of the spare port is in service and operating normally

- when configured for dual-FP inter-card or intra-card LAPS, the FP supports:
  - hitless services
  - hitless software migration
  - port tests on the standby port provided the port is not also configured for Y-protection or port bridge group (PBG) -- the test types per FP type are identified in NN10600-520 *Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting*
- the complete set of Multiservice Switch ATM statistics
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)
- virtual router (VR) and IP (supported in the PVG using IP (VoIP) when VR interworking is used with a VR access point (AP) and the voice services processor 2 (VSP2) FP card on Multiservice Switch 15000 nodes)
- IP DiffServ services of the DiffServ domain for the router (*Vr Dsd*) and the DiffServ profile for the interface (*Vr Ip DiffServ*) on its PQC2 and PQC12 FPs

In addition, the PQC12-based 4-port OC-3 ATM FP has the following distinct characteristics:

- higher frame and cell processing capacity equivalent to OC-12 line rates
- greater IP capabilities
- fast hardware data path support for DPRS load-spreading

See also “4-port OC-3/STM-1 ATM specifications” (page 286).

Table 146
4-port OC-3/STM-1 ATM specifications

Specification	Description
total egress ATM buffer (cells) per port @ 3k connections per FP	51.4k
processor memory	128 Mbyte SDRAM
channelization	clear
network clock synchronization supported	yes
synchronization status messages supported	yes
minimum software level required - single-mode format	• PEC NTHR17FA - PCR3.1 • PEC NTHR21BA - PCR1.1.2 • PEC NTHR21CA - PCR1.1.2 (CA01S2A or later) • PEC NTHR21DA - PCR1.1.2 (CA01S2A or later) • PEC NTHR21FA - PCR3.1 • PEC NTHW15AA - PCR4.1
minimum software level required - multimode format	• PEC NTHR17BA - PCR1.1.2 • PEC NTHR17CA - PCR1.1.2 (CA01S2A or later) • PEC NTHR17DA - PCR1.1.2 (CA01S2A or later) • PEC NTHW05AA - PCR4.1
(Sheet 1 of 2)	

Table 146 (continued)
4-port OC-3/STM-1 ATM specifications

Specification	Description
FP technologies, single-mode format	• PEC NTHR21BA - PPC, AQM1.0, PQC1.0 • PEC NTHR21CA - PPC, AQM1.1, PQC1.0 • PEC NTHR21DA - PPC, AQM1.1, PQC2.0 • PEC NTHW15AA - PPC, AQM1.1, PQC12
FP technologies, multimode format	• PEC NTHR17BA - PPC, AQM1.0, PQC1.0 • PEC NTHR17CA - PPC, AQM1.1, PQC1.0 • PEC NTHR17DA - PPC, AQM1.1, PQC2.0 • PEC NTHW05AA - PPC, AQM 1.1, PQC12
(Sheet 2 of 2)	

4-port OC-3/STM-1Ch TDM/CES FP

The PEC for the 4-port OC-3/STM-1 Channelized time division multiplexed or circuit emulation service (TDM/CES) FP for Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes is NTHW70.

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port OC-3/STM-1Ch TDM/CES configuration considerations” (page 287).

For information about the characteristics of this FP, see “4-port OC-3/STM-1Ch TDM/CES characteristics” (page 291).

4-port OC-3/STM-1Ch TDM/CES configuration considerations

Before you begin configuring the 4-port OC-3/STM-1Ch TDM/CES FP as either SONET or SDH, consider the following:

- Ensure that the software running on the node meets the minimum software requirement for the FP. An incompatible software load can damage an FP beyond repair.

- The card operates as an ATM Forum standards compliant AAL1 CES card. When a CES remoteEndType is changed from its default value of ***ces*** to ***pvgExclusive*** or ***pvgShared*** it also operates in packet voice gateway (PVG) interworking mode. When configured for PVG interworking, the ports on the card can be used as PVG service interface streams (TDM streams) for carrying VoTDM bearer traffic. In this mode, there are semantic restrictions on the number of PVG interworking channels that can be provisioned on a per DS1 or E1 basis.
- *Chan* components must be linked to *Aal1Ces* before they can provide any service. For information on CES provisioning for PVG, see NN10600-781 *Nortel Networks Media Gateway 7480/15000 Non-switched Service Configuration Management* or NN10600-782 *Nortel Networks Media Gateway 7480/15000 Switched Service Configuration Management*. For information on CES configuration in general, see NN10600-720 *Nortel Networks Multiservice Switch 7400/15000/20000 AAL1 Circuit Emulation Operations*.
- When configuring LAPS on the 4-port OC-3/STM-1Ch TDM/CES FP, the working and protection FPs must occupy adjacent slots and the lower number must be an even number. For example, slots 2 and 3. For specifics on configuration see NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.
- When using LAPS, the attribute *clockingSource* must be set to *module*.
- When the port type is *sonet*, the FP supports 84 DS1 channels per port, each with 24 64-Kbits/s timeslots per DS1. When the port type is sdh, the FP supports 63 E1 channels per port, each with 31 64-Kbits/s timeslots per E1.
- Trunk conditioning <tc> is used to provision trunk conditioning options for a DS1/E1 channel. Trunk conditioning is applicable to both structured CES, and PVG TDM interworking function CES.
- Test component <test> controls tests on physical or logical interfaces. There is one instance per SONET/DS1 or SDH/E1 component.
- The override agent queue size for accounting, alarm, and scn record collection must be changed from the default values. Use the following FP and CP values:
    - accounting: 0 for the FP

— alarm: 1500 for the FP and 500 for the CP

— scn: 1000 for the FP and 1500 for the CP

- See also “4-port OC-3/STM-1Ch TDM/CES configuration parameters” (page 289).
- For additional configuration considerations specific to SONET, see “SONET configuration considerations” (page 289).
- For additional configuration considerations specific to SDH, see “SDH configuration considerations” (page 290).

Table 147
4-port OC-3/STM-1Ch TDM/CES configuration parameters

Parameter	Values
Card type <cardtype>	4pOC3ChSmIr
Port type <port>	• Sonet (for OC-3)
	• Sdh (for STM-1)
Port number <m>	0 to 3
Port configuration	TDM, CES
Clocking source	module, local

SONET configuration considerations

When configuring a 4-port OC-3/STM-1Ch TDM/CES FP port type as SONET, consider the following:

- Sts component <Sts>: represents an STS high-order path multiplexed into the OC-3. There are up to 3 instances of the STS component for an OC-3 interface <STS/n>: n=0-2.
- The concatNumber is an Sts provisionable attribute and should be set to 1.
- VT1dot5 low order path <VT1dot5/ l, m>: There are 28 instances of a VT1dot5 low order path multiplexed into the STS high order path. The 28 instances are distributed into virtual tributary groups 1-7. Each group has tributaries numbered 1-4 for mapping of DS1.

- VT1dot5 port numbers <l> <m>: When you add a VT1dot5 port, the system automatically creates a DS1 subcomponent.
- DS1 tributary component <DS1>: represents a DS1 tributary multiplexed into a virtual tributary VT1.5. There is one instance of this component per VT1.5.
- Channel on a DS1 tributary <chan>: 0-23 Controls the grouping of timeslots for CES service. There can be up to 24 chan components per DS1. For PVG, a maximum of 9 channels per DS1 is supported.
- Timeslot data rate for DS1 port <rate>: doNotOverride is the default. When DS1 zero coding is none, the user data rate is 64K; when it is bit7stuffing, the user data rate is 56K. The value of *timeslotDataRate* for a DS1 channel can only be "doNotOverride".
- Timeslots <timeslots>: 1-24. Each DS1 under the low order path is mapped into 24 timeslots. The channel component uses all timeslots by default. Timeslots can be deleted, for example, you can have 24 channel components each with one timeslot. There can be only one channel with 24 timeslots.
- When using the FP for CES, the value of the attribute *customerIdentifier* and its parent DS1 component *customerIdentfier* must be the same. The attribute *mapping* can only be set to "direct" mapping. The channel has no atmCell component.

SDH configuration considerations

When configuring a 4-port OC-3/STM-1Ch TDM/CES FP port type as SDH, consider the following:

- High order path <high_path>: *Vc4* (Adds a high order path to the port). There is only one Vc4 per STM-1.
- Low order path <low_path>: *Vc12* (Adds a low order path to the port)
- Path value <r>: *k, l, m,* (where *k=1-3, l=1-7, m=1-3,* for a possible total of 63 Vc12s)
- E1 component: represents an E1 tributary mapped into a VC-12 low-order path. There is only one instance of this component per VC-12.

- Channels on an E1 tributary <chan>: 0-31 Controls the grouping of timeslots for CES service. There can be up to 31 chan components per E1. For PVG, a maximum of 9 channels per E1 is supported.

4-port OC-3/STM-1Ch TDM/CES characteristics

This FP has four fully channelized OC-3/STM-1 ports. Each port has a duplex SC fiber optic transceiver. The FP can be configured for either OC-3 (with DS1 channels) or STM-1 (with E1 channels) but not both simultaneously.

The 4-port OC-3/STM-1Ch TDM/CES FP can either provide support for PVG applications or function as a standalone circuit emulation service (CES) card on Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes.

The 4-port OC-3/STM-1Ch TDM/CES FP does not support PORS routing.

When configured as either TDM or CES, supported features include:

- supports dual-FP, unidirectional, non-revertive line automatic protection switching (LAPS) of optical ports by using a sparing bus between adjacent pairs of optical FPs. One *Laps* component is provisioned and associated with the SONET component pair that will participate in the protection switch. A LAPS switch will affect only the failed fibre. The traffic that would be carried over the failed fibre will be routed via the protection card ports. All other traffic will continue to be routed through the active card ports.
- supports warm equipment protection. This relates to a complete failure of the active card. In this case the services on the ports that are provisioned for LAPS will be transferred to the protection card. With warm equipment protection of optical FPs the traffic of a port on an active optical FP is switched to the spare FP if:
  - the active FP fails
  - the port has been configured for dual-FP LAPS
  - the FP of the spare port is in service and operating normally
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also:

- "4-port OC-3/STM-1Ch TDM/CES specifications" (page 292)
- "TDM supported features" (page 292)
- "CES supported features" (page 293)

Table 148
4-port OC-3/STM-1Ch TDM/CES specifications

Specification	Description
total egress ATM buffer (cells) per port @ 3k connections per FP	51.4k
processor memory	128 Mbyte SDRAM
channelization	DS1 or E1
network clock synchronization	supported
synchronization status messages	supported
minimum software level required (see Note)	PCR 4.1
FP technologies	PQC12
Note: For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.	

TDM supported features

When configured as a TDM card, the 4-port OC-3/STM-1Ch TDM/CES FP:

- provides high density interface to PVG VSP FPs
- supports TDM to VSP intra-shelf connectivity
- provides 64 kbit/s ATM Forum compliant basic structured CES for signaling channel transport
- has up to 255 CES VCCs per STS1/TUG3
- supports up to 3024 CES/PVG connections per FP

- supports hot equipment protection (HEP) on the Nortel Networks Multiservice Switch 15000 Packet Voice Gateway (PVG) shelf using a 1 + 1 sparing configuration of the 4-port OC-3/STM-1Ch TDM/CES FP. In a 1 + 1 sparing configuration:
  - both cards are active but one card has active service and the other card has hot standby service
  - requires optical ports to be configured for inter-card linear automatic protection switching (LAPS)
- supports hitless software migration (HSM) on the Nortel Networks Multiservice Switch 15000 Packet Voice Gateway (PVG) shelf
- supports the processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

CES supported features

When configured as a circuit emulation services (CES) card, the 4-port OC-3/STM-1Ch TDM/CES FP:

- offers both basic structured and unstructured CES over DS1 or E1 circuits
- supports ATM Forum standards compliant CES over SVC, CES over PVC, and CES over SPVC
- has up to 255 CES VCCs per STS1/TUG3
- provides the capability of ATM adaptation layer 1 (AAL1) for CES over multiple DS1 or E1 channels through OC-3/STM-1 ports
- supports up to 3060 CES connections per FP

16-port OC-3/STM-1 ATM FP

The PECs for the 16-port OC-3/STM-1 ATM FPs for Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes depend on the faceplate connectors:

- NTHW31 with LC connectors
- NTHW24 (Japan 16p variant) with LC connectors
- NTHW21 with MT-RJ connectors

The software name is 16pOC3SmIrAtm for these FPs.

For the information you need to configure this FP, see “16-port OC-3/STM-1 ATM configuration considerations” (page 294).

For information about the characteristics of this FP, see “16-port OC-3/STM-1 ATM characteristics” (page 295).

For information about how cells are handled for in-service VPs or Vcs, see one of the following sections:

- “How cells are handled for an in-service VP” (page 298)
- “How cells are handled for an in-service VC” (page 298)

16-port OC-3/STM-1 ATM configuration considerations

Before you begin configuring a 16-port OC-3/STM-1 ATM FP, consider the following.

- When you add a *Sonet* port, you must manually configure (provision) an *Sts* subcomponent. The system creates component *Cell* beneath component *Sts*.
- When you add an *Sdh* port, you must manually configure (provision) a *Vc4* subcomponent. The system creates component *Cell* beneath component *Vc4*.
- Configure processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

- When configuring dual-FP line APS (LAPS) on the 16-port OC-3/STM-1 ATM FP, configure a pair of ports on two adjacent 16-port OC-3/STM-1 FPs. For example, configure port 0 on the FP in slot 2, and port 0 on the adjacent FP in slot 3.

  Note: An NTHW21 or NTHW31 cannot spare an NTHW44.

- When using LAPS, the attribute *clockingSource* must be set to *module*.
- See also the table “16-port OC-3/STM-1 ATM configuration parameters” (page 295).

Table 149
16-port OC-3/STM-1 ATM configuration parameters

Parameter	Values
Card type <cardtype>	16pOC3SmIrAtm
Port type <port>	• Sonet (for OC-3) • Sdh (for STM-1)
Port number <m>	0 to 15
Port configuration	B-ISDN
Clocking source	module, local
Protocol	g841AnnexB, standard, yProtection

16-port OC-3/STM-1 ATM characteristics

Depending on the faceplate connectors, the 16-port OC-3/STM-1 ATM FP has 16 OC-3 duplex LC fiber optic transceivers or 16 OC-3 MT-RJ fiber optic transceivers. The 16-port OC-3/STM-1 ATM FPs are available only in single-mode (SM) intermediate reach (IR). This FP supports:

- ATM services with user-to-network interfaces (UNI), which enable using the FP for network access
- ATM services with network-to-network interfaces (NNIs), which enable using the FP for trunking
- connection space and call setup rates at 16,000 connection endpoints per port with a maximum of 45,000 connection endpoints per FP

- SONET or SDH dual-FP inter-card line APS (LAPS) and equipment protection provided you configure a pair of ports on two adjacent 16-port OC-3/STM-1 FPs and the pair shares the same port number. For equipment protection of optical FPs, the traffic of a port on an active optical FP is switched to a spare FP provided:
  - the active FP fails or the active FP is locked when upgrading both FPs
  - the port has been configured for dual-FP LAPS
  - the FP of the spare port is in service and operating normally
- ITU-T G.841 Annex B MSP (APS) protection
- when configured for dual-FP inter-card LAPS, the FP supports:
  - ATM hitless services
  - hitless software migration
  - port tests on the standby port provided the port is not also configured for Y-protection or port bridge group (PBG) -- the test types per FP type are identified in NN10600-520 *Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting*
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)
- IP class of service (CoS)
- VR-to-VR and VCG-based IP VPNs
- IP DiffServ services of the DiffServ domain for the router (*Vr Dsd*) and the DiffServ profile for the interface (*Vr Ip DiffServ*)

See also “16-port OC-3/STM-1 ATM specifications” (page 297).

Table 150
16-port OC-3/STM-1 ATM specifications

Specification	Description
total egress ATM buffer (cells) per port @ 3k connections per FP	32k
processor memory	128 Mbyte SDRAM
channelization	concatenated
network clock synchronization supported	yes
synchronization status messages supported	yes
minimum software level required	PCR 2.1
FP technologies	APC, PPC, PQC2.0, QRD1.1

16-port OC-3/STM-1 ATM with OAM cell conversion

The PEC for the 16-port OC-3/STM-1 with OAM cell conversion is NTHW24. This FP is for use only with customers who need to interconnect with NTT (Nippon Telegraph and Telecommunications) equipment in the Japanese market. All other customers should use either NTHW21 or NTHW31. In addition to providing the same services as the 16-port OC-3/STM-1, this customized card accommodates the NTT O.151 loopback cells, which allows for loopback testing. See NN10600-520 *Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting* for more information on the O.151 OAM loopback test.

The firmware changes modify the O.151 OAM cell header to allow the cells to pass through the NTHW24 card and arrive at the fabric, where they can be looped back using the standard Nortel Networks Multiservice Switch looping capabilities. The firmware changes are always active, and will modify O.151 OAM cells whether or not the looping test is enabled.

The changes in card behavior are described in:

- “How cells are handled for an in-service VP” (page 298)
- “How cells are handled for an in-service VC” (page 298)

How cells are handled for an in-service VP

When the NTHW24 card is not being used to run the OAM loopback test, the card operates as a normal 16-port OC-3/STM-1 card that processes I.610 cells. When the VP is looping back the OAM test cells, the VP is out of service, and the rest of the card functions normally.

For all VPs, as the cells enter the card they are scanned for O.151 cells with VCI=3 and OAM Type = 3. When the O.151 cells are detected, then the VCI field is re-mapped to VCI = 19. Only these cells are affected. All other cells continue as normal.

The operator then configures the node to loop the VP under test back to the egress port by NRPing it onto itself. Once the loopback connection is configured in the software, all cells on VP = xxx are looped back, including the O.151 cells on VP = xxx and VCI = 3, which have been remapped to VP = xxx and VCI = 19. On the egress side of the card, the cells with VCI = 19 are reverse mapped back to VCI = 3. All the remapping is transparent to the user, who only sees that all cells are looped back.

VCI = 19 is not to be used for user traffic at any time.

How cells are handled for an in-service VC

When the NTHW24 card is not being used to run the OAM loopback test, the VC operates as a normal 16-port OC-3/STM-1 card connection that processes I.610 cells. When the VC is looping back the OAM test cells, the VC is out of service, and the rest of the card functions normally.

For all VCs, as the cells enter the card they are scanned for O.151 cells with OAM Type = 3 and PTI = 4. When the O.151 cells are detected, then the PTI field is re-mapped to PTI = 7. Only these cells are affected. All other cells continue as normal.

The operator then configures the VPI/VCI under test to loop back to the egress port. On the egress side of the card, the cells with PTI = 7 are mapped back to PTI = 4. The reversed mapping completes the loopback.

16-port OC-3/STM-1 POS and ATM FP

The PEC for the 16-port OC-3 POS and ATM FP for Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes is NTHW44 with software name 16pOC3PosAtm.

This FP can be used for both ATM bearer services and as a multiservice over ATM access FP. Typically the FP would be deployed to aggregate ATM traffic on the access side to ATM trunks on the core network side.

An NTHW44 operates only with CP3s in the same shelf.

For the information you need to configure this FP, see “16-port OC-3/STM-1 POS and ATM configuration considerations” (page 299).

For information about the characteristics of this FP, see “16-port OC-3/STM-1 POS and ATM characteristics” (page 302).

For migration information pertaining to this FP, see “16-port OC-3/STM-1 POS and ATM migration considerations” (page 309).

For information about NPU service bundles, see “16-port OC-3/STM-1 POS and ATM NPU service bundles” (page 309).

16-port OC-3/STM-1 POS and ATM configuration considerations

Before you begin configuring a 16-port OC-3/STM-1 POS and ATM FP (NTHW44) consider the following:

- In the current release, at layer 2, only ATM functionality is supported by the software.
- You must decide for each port whether it is to be cabled with single-mode or multimode fiber. The fiber cables must match the version of small-form pluggable (SFP) module that connects to each port of the FP, and each port must be configured in software to designate the SFP.

Note: For information about the SFP optical module, see NN10600-120 *Nortel Networks Multiservice Switch 15000/20000 Hardware Description*. For information about configuring an SFP module, see NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

- When you add a *Sonet* port, you must manually configure (provision) an *Sts* subcomponent. The system creates component *Cell* beneath component *Sts*, and component *OpticalModule*.
- When you add an *Sdh* port, you must manually configure (provision) a *Vc4* subcomponent. The system creates component *Cell* beneath component *Vc4*, and component *OpticalModule*.
- When configuring dual-FP (inter-card line automatic protection switching (line APS or LAPS) for SONET or SDH, configure each pair of ports on two adjacent NTHW44 FPs and use the same port numbers per pair. The first FP must be installed in an even-numbered slot, and its mate must be in the adjacent slot to the right of it. For example, configure port 0 on the FP in slot 2, and port 0 on the adjacent FP in slot 3. More configuration information is provided in NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*, the chapter on configuring line equipment protection for Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes.

  Note: An NTHW44 cannot spare an NTHW21, NTHW24, or NTHW31.

- When using LAPS, the attribute *clockingSource* must be set to *module*.
- When using LAPS, assigning the Y-protection capability to a pair of ports in a dual-FP configuration is optional. To enable Y-protection, the attribute *protocol* must be set to *yProtection* for each pair pf ports that are to be connected to the far end by fiber optical Y-splitter cables. After this attribute is set other LAPS settings are automatically changed. The

settings are identified in NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures* at the procedure for configuring Y-protection on dual FPs.

When using *yProtection*, only the SFP optical module (om) *OC3SmIr* is supported.

Y-protection does not support port tests, DPRS, or POS.

For the description of how Y-protection functions as a kind of equipment protection, see NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*, the section on understanding Y-protection.

- When replacing an NTHW21 or NTHW31 with an NTHW44, treat the decommissioning of the slot and the configuration of the NTHW44 as a new FP deployment in the slot. Consider that physical port locations are different.
- See also the table "16-port OC-3/STM-1 POS and ATM configuration parameters" (page 301).

Table 151
16-port OC-3/STM-1 POS and ATM configuration parameters

Parameter	Values
Card type <cardtype>	16pOC3PosAtm
Port type <port>	• Sonet (for OC-3)
	• Sdh (for STM-1)
Port number <m>	0 to 15
Port configuration	B-ISDN
Clocking source	module, local
SFP configuration	OC3MmSr, OC3SmIr, OC3SmLr, none (only OC3SmIr is supported with yProtection)
Protocol	g841AnnexB, standard, yProtection

16-port OC-3/STM-1 POS and ATM characteristics

The 16-port OC-3/STM-1 POS and ATM FP (NTHW44) supports the following characteristics:

- small-form pluggable (SFP) modules which connect multimode (MM), single-mode (SM) intermediate reach (IR), or SM long reach (LR) fiber cables to each port (socket) on the faceplate such that the FP can have a combination of SFPs, one type per port.
- confirmation that each inserted SFP matches the port configuration for it, and verifies operation (when the FP is powered from an installation or a replacement)
- ATM services with user-to-network interfaces (UNI), which enable using the FP for network access
- ATM services with network-to-network interfaces (NNIs), which enable using the FP for trunking
- IP differentiated services of the components *DiffServDomain* and *DiffServProfile* when configured for VIPR networks (Vr Dsd, Vr Ip DiffServProfile) and RFC2547 networks (Rtr Dsd, Rtr Vrf Dsd, Rtr Vrf DiffServProfile)
- RFC2547 MPLS IP VPN
- 32,000 per VC queues per FP
- basic virtual path terminations (VPTs)
- logical trunks over ATM or DPRS (the same as PQC12-based FPs)
- Nortel Networks Multiservice Switch networking (DPRS and PORS)
- supports ATM multi-protocol encapsulation (ATM MPE) over both PVC and SPVC connections
- supports virtual IP router (VIPR) functionality
- IP datapath media interworking with all PQC-based FPs
- DPRS logical trunk frame forwarding in hardware at OC-3 line rate on all 16 ports
- IP forwarding in hardware at near OC-3 line rate on all 16 ports
- supports all routing protocols

- hitless open shortest path first (OSPF) switchover
- hitless software migration (HSM) and hot equipment protection are supported for ATM services (layer-2) only
- when configured for dual-FP (inter-card) line automatic protection switching (LAPS) for SONET or SDH, the line and equipment protection for SONET and multiplex section protection (MSP) provide:

  Note: Only inter-card LAPS is supported.

  — ATM hitless services (hot standby)

  — loss of signal (LOS) detection within 10 milliseconds

  — line protection switchover for ATM services within 50 milliseconds upon a line or FP failure or being locked, and provided the mate port is in service and not degraded

  — hitless software migration support for ATM services

  — new ATM connections within 500 milliseconds from a switchover (only for Succession nodes)
- when configured for dual-FP (inter-card) LAPS and Y-protection, the equipment protection (EP) and hitless software migration (HSM) is the same as LAPS with the difference that one of the cards is service active while its mate is on hot standby, that is, there cannot be active ports on both cards simultaneously (as with standard LAPS), and other differences are identified in NN10600-520 *Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting*, the table about the status of Y-protection during maintenance actions or faults
- supports ITU-T G.841 Annex B MSP (APS) for ATM services running on SDH provisioned ports. Support for this protocol enables Nortel Networks Multiservice Switch nodes to interwork with networks that use the ITU-T G.841 Annex B protection scheme.
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)
- SONET and SDH fault and performance management for the FP includes:

- — alarm indication signal (AIS)
- — bit inter-leaved parity errors (BIP)
- — discard of ATM idle and unassigned cells
- — far end block errors (FEBE)
- — header error check sequence (HEC)
- — remote defect indicator (RDI)
- — loss of frame (LOF)
- — loss of pointer (LOP)
- — loss of signal (LOS)

- Handling operations, administration, and maintenance (OAM) ATM cells includes:
  - — supporting the standardized OAM cells for end-to-end AIS, end-to-end RDI, segment loopback, and end-to-end loopback
  - — not supporting the standard OAM cells for performance monitoring (FPM and BR), congestion control, segment AIS, and segment RDI by only transparently passing them through non-flow end points
  - — supporting the non-standardized OAM cells for the proprietary end of transmission (EOT) cell used by rerouting connections on flow end points and transparently passes this cell on the non-flow end points and trace
  - — not supporting the non-standardized OAM cells for the O.151 cell used by the NTHW24 FP (the 16-port OC-3/STM-1 FP with customized O.151 cells) by only transparently passing them through non-flow end points
  - — not supporting the non-standardized OAM cells for the proprietary cell discards used for performance monitoring of cell loss ratio (CLR) calculations by only transparently passing them through non-flow end points
- for AAL5 ATM connections, accurate layer 2 cell statistics up to and including the point of AAL5 frame reassembly and delivery to layer 3 on ingress, and from the point of AAL5 frame segmentation into cells on egress (but not while the cells are processed on layer 3)

- no need for the component *ConnMap*
- network processor units (NPUs) that enable new datapath capabilities when upgrading software

See also the table “16-port OC-3/STM-1 POS and ATM specifications” (page 306).

Table 152
16-port OC-3/STM-1 POS and ATM specifications

Specification	Description
processor memory	512 Mbytes
channelization	not supported
network clock synchronization supported	yes
synchronization status messages supported	yes
minimum software level required	PCR 5.2
egress ATM buffer (cells) per port @ 3k connections per FP	32,000
ATM adaptation layer 5 (AAL5) supported	yes
bandwidth management	same as all other Multiservice Switch ATM FPs
class scheduling	8 emission priorities (EPs), including: • absolute priority for EP0 and EP1 with minimum delay and cell delay variation (CDV) • EPs 2 to 7 with minimum bandwidth guarantees (MBGs) to avoid starvation • work-conserving allocation of unused bandwidth for high utilization
call latency (95th percentile)	• 25 milliseconds for a transit node or terminating node • 30 milliseconds for an originating node
(Sheet 1 of 3)	

Table 152 (continued)
16-port OC-3/STM-1 POS and ATM specifications

Specification	Description
connection admission control (CAC)	• CDV for CBR or VBR traffic types • overbooking resources per port based on QoS and basic VPT
connection space and call rate	16,000 connection end points per port with a maximum of 45,000 connection end points per FP (for this FP, there is no longer a restriction of 16,000 PVCs per card, which now can be any combination of PVCs, SPVCs, or SVCs)
ATM fault management	• alarm indication signal (AIS) • remote defect indication (RDI) • loopback
logical trunks	32 per FP
multicast connections per card	• 16,384 leaves per FP • 16 multicast leaf connections per root multicast connection
networking connections supported	PVCs, PVPs, SPVCs, SPVPs, SVCs, and SVPs, VPTs
packet congestion per VC	early packet discard (EPD) late packet discard (LPD) partial packet discard (PPD) weighted-random early discard (W-RED)
queuing disciplines	common and per VC
scheduling	link class connection
(Sheet 2 of 3)	

Table 152 (continued)
16-port OC-3/STM-1 POS and ATM specifications

Specification	Description
routing and signaling	AINI 1.0 IISP 1.0 ILMI 4.0 PNNI and H-PNNI 1.0 UNI 3.0, 3.1, and 4.0 local and global rerouting
call set-up rate	• 300 calls per second per FP (with accounting and carrier grade off) • 256 calls per second per FP (with accounting off and carrier grade on) • 150 calls per second per FP (with accounting and carrier grade on)
traffic management	TM 4.1 supporting: CBR nrt-VBR rt-VBR UBR UBR-MDCR (with definable CLR, CLP0/1, CDV, and CTD)
traffic shaping	• on any 4 emission priorities (EPs) • linear • dual-rate inverse usage parameter control (UPC) • variable rates with a minimum of 100 cells per second
Multiservice Switch ATM statistics	all supported with additional statistics for the NTHW44. For the list, see NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*.
FP technologies	GQM
(Sheet 3 of 3)	

16-port OC-3/STM-1 POS and ATM migration considerations

The 16pOC3PosAtm FP has numerous field programmable gate arrays (FPGAs) that store a specific version of software. When the version of the FPGAs in the running software is different than the version of FPGAs in the new migrating software, the FPGAs will need to be updated with the new version before the migration can complete. Updating the version for the FPGAs is handled automatically as part of the migration, but it may extend the migration up to 45 minutes to complete when at least one 16pOC3PosAtm FP is present in the shelf. When more than one 16pOC3PosAtm FP is present in the shelf, the migration may take slightly longer because it depends on when the other 16pOC3PosAtm FPs start getting loaded relative to the other FPs in the shelf. During the extended time frame, the FP faceplate shows a slow flashing red LED, the status of the FP may be shown as enabled, and the status of the LP may be shown as unlocked and disabled.

Enabling Y-protection on a dual FP configuration provides hitless software migration (HSM) when the far-end equipment does not support line automatic equipment protection (LAPS) or multiplex section protection (MSP).

When a PCR migration occurs from a PCR for which there is no NPU provisioning support, to a level that requires NPU provisioning support, the NPU (NetworkProcessingUnit) component is automatically added to the LP for a 16-port OC-3/STM-1 POS ATM FP. Also, the service bundle selection is automatically made to allow for a smooth software migration.

16-port OC-3/STM-1 POS and ATM NPU service bundles

A network processing unit (NPU) is a programmable device that specializes in the processing of data packets. NPUs are used in the ingress and egress datapaths of the 16-port OC-3/STM-1 POS ATM FP. The programmable nature of the NPUs gives flexibility to the GQM-based FPs in handling new and existing services as the behaviors of the NPUs can be altered by different service bundles. The NPU service bundle packages the application services offered by the NPUs into service bundles. The provisioning of the NPU component occurs under the LP component, and is required for this card.

Selection of a NPU service bundle is enabled by the addition of the NPU subcomponent to the LP component. The *serviceBundleName* attribute within the NPU component allows for the service bundle selection.

Software upgrade behavior

NPU service bundles have no effect on the outage impact or outage duration associated with the hitless software migration.

OC-3/STM-1 OSI states

This section lists the following OSI state tables for OC-3/STM-1 FPs.

- For all except the 16-port OC-3/STM-1 FPs, see:
  - "OC-3 Sonet/Sdh component state combination" (page 311)
  - "OC-3 Test component state combination" (page 312)
  - "OC-3 Path component state combination" (page 313)
- For the 16-port OC-3/STM-1 ATM (NTHW21 or NTHW31) and the 16-port OC-3/STM-1 POS and ATM (NTHW44) FPs, see:
  - "OC-3 Sonet/Sdh component state combination" (page 311)
  - "OC-3 Test component state combination" (page 312)
  - "OC-3/STM-1 STS component state combination" (page 314)

Table 153
OC-3 Sonet/Sdh component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The SONET/SDH interface is inoperable through due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisAlarm • rxRfiAlarm • lcdAlarm.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes. The line input is recognized as good. Clocks are available.
Unlocked, Enabled, Busy	The Sonet/Sdh component is in use. The Sonet/Sdh component has one Path component under it.
Unlocked, Enabled, Shutting Down	A lock command is in effect against the Sonet/Sdh component but the Path component under it is not yet suspended.
(Sheet 1 of 2)	

Table 153 (continued)
OC-3 Sonet/Sdh component state combination

Combination (Administrative, Operational, Usage)	Details
Locked, Enabled, Idle	A lock operator command is in effect. The SONET/SDH component is operating in test mode (availabilityStatus: inTest).
Locked, Disabled, Idle	A lock operator command is in effect. The component is in one of the following conditions: • Left offline. (availabilityStatus: offline) • Some hardware test failed. (availabilityStatus: failed) • If running in test mode external factors cause errors (availabilityStatus: inTest). Bad line state and excessive line state changes are possible causes.
(Sheet 2 of 2)	

Table 154
OC-3 Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Idle	The hardware component is locked. You can perform a port and line test.
Unlocked, Enabled, Busy	The Test component is in use. A Chan, DS1, E1, DS3, E3, V35, X21, Sonet, or Sdh component creates a Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

Table 155
OC-3 Path component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The Path component is inoperable due to at least one of the following alarms: • lopAlarm • rxAisAlarm • rxRfiAlarm • signalLabelMismatch Either a bad path state or the Sonet/Sdh is disabled. If the Sonet/Sdh is disabled either Sonet/Sdh is locked or there is a bad Sonet/Sdh signal.
Unlocked, Enabled, Idle	The component is not in use. The component is waiting for a binding to an ATM interface component.
Unlocked, Enabled, Busy	The Path component is in use. The Path component services only one user (an ATM interface component) at a time.
Unlocked, Enabled, Shutting Down	A lock command is in effect against the Path component. The Path component is waiting for the ATM interface component to go into a disabled mode before it completes the lock sequence and shuts down.
Locked, Disabled, Idle	A lock operator command is in effect.

Table 156
OC-3/STM-1 STS component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The *Sts* component is inoperable due to at least one of the following alarms: • lopAlarm • rxAisAlarm • rxRfiAlarm • signalLabelMismatch Either a bad path state or the *Sonet/Sdh* component is disabled. If the *Sonet/Sdh* component is disabled, either the component is locked or there is a bad SONET or SDH signal.
Unlocked, Enabled, Idle	The component is not in use. The component is waiting for a binding to an *ATM interface* component.
Unlocked, Enabled, Busy	The *Sts* component is in use. The *Sts* component services only one user (an *ATM interface* component) at a time.
Unlocked, Enabled, Shutting Down	A lock command is in effect against the *Sts* component. The *Sts* component is waiting for the *ATM interface* component to go into a disabled mode before it completes the lock sequence and shuts down.
Locked, Disabled, Idle	A lock operator command is in effect.

OC-3/STM-1 FP standards compliance

For the compliance of each FP, see:

- "2-port OC-3 ATM IP compliance with standards" (page 315)
- "3-port OC-3 ATM compliance with standards" (page 317)
- "4-port OC-3/STM-1 ATM FP compliance with standards" (page 318)
- "4-port OC-3/STM-1Ch TDM/CES FP compliance with standards" (page 319)
- "16-port OC-3/STM-1 ATM (with MT-RJ connectors) FP compliance with standards" (page 320)
- "16-port OC-3/STM-1 ATM (with LC connectors) FP compliance with standards" (page 321)
- "16-port OC-3/STM-1 POS and ATM FP compliance with standards" (page 323)

2-port OC-3 ATM IP compliance with standards

The 2-port OC-3 ATM IP FP complies with the applicable sections of the following standards:

- "SONET" (page 315)
- "SDH" (page 316)

SONET
ATM Forum

- AF-UNI-0010.002 (ref. [28])
  - — complies to section 2.1
- AF-TEST-0024.000 (ref. [31])

Telcordia

- GR-253-CORE (ref. [35]):
  - — complies to all required and applicable items for STS-3 ATM operation
  - — The following optional bytes are not supported by OC-3 ATM IPs:

- E1: Orderwire
- F1: Section User Channel
- D1-D3: Section Data Communication Channel
- J1: STS Path Trace
- F2: Path User Channel
- N1: Tandem Connection Maintenance/Path Data Channel
- TR-NWT-001112 (ref. [38])

ANSI

- T1.105-1995 (ref. [12]):
- T1.231-1993 (ref. [22]):
  — complies to section 8 for all SONET alarms and statistics listed in Section 3.2.3 on page 8
- T1.646-1995 (ref. [24], supersedes T1.624):
- T1E1.2/96-002 (ref. [25])
- 216 MD-1998.0041 - Version 01.05 - released - 1998-07-31 (PP504, P6.0)

SDH
ITU-T

- ETS 300 417 (previously ETS DE/TM-01015) (ref. [40])
- G.707 (ref. [45], replaces G.708. G.709) complies except for section 9.2.2.11 Table 5 which states that on receipt of an MS-AIS signal, line-timing should not be used

  Note: the following optional bytes are not supported by OC-3 ATM IPs:

  — E1: Orderwire

  — F1: Section User Channel

  — D1-D3: Section Data Communication Channel

  — J1: STS Path Trace

- F2: Path User Channel
- N1: Tandem Connection Maintenance/Path Data Channel

- G.782 (ref. [48])
- G.783 (ref. [49])
- G.813 (ref. [51])
- G.821
- G.825 (ref. [54])
  - complies, except may not meet wander requirements
- G.957 (ref. [56])

  Note: The OC-3 ATM IP single mode FP is classified as application code L-1.1.

- G.958 (ref. [57])
- I.432 (ref. [58])
  - complies to section 2 (Physical Medium at 155 520 kbit/s)
  - complies to section 4 (TC Sublayer) except:
  - Section 4.2.1.2: Physical layer cells are not guaranteed to be inserted in the cell
  - stream every 27 cells.
  - Section 4.2.1.3: Physical layer OAM cells are not implemented
- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios

3-port OC-3 ATM compliance with standards

The 3-port OC-3 ATM FP complies with the applicable sections of these standards:

- ANSI T1.105.1988. Sonet, with the exception that the STS path trace channel, is not user-programmable.
- ANSI T1.646

- ANSI T1.231 Partial compliance
- ATM UNI Forum Standard 3.1
- ITU-T I.432
- ITU-T G.707
- ITU-T G.708
- ITU-T G.709
- ITU-T G.783
- ITU-T G.821
- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios
- Telcordia TR-NWT-000253

4-port OC-3/STM-1 ATM FP compliance with standards

The 4-port OC-3/STM-1 ATM FP complies with the applicable sections of these standards

- ANSI T1.105.1995
- ANSI T1.646
- ANSI T1.231 Partial compliance
- ANSI T1E1.2/96-002
- Telcordia GR-253-CORE, except for the optical power ratings
- Class 1 IEC 825-1 (International) and Class 1 FDA (North America) for optical power requirements
- ATM UNI Forum Standard 3.1
- ITU-T I.432
- ITU-T G.707
- ITU-T G.708
- ITU-T G.709
- ITU-T G.782

- ITU-T G.783
- ITU-T G.813
- ITU-T G.825
- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios
- ITU-T G.957

  The OC-3 multimode FP is classified as having application code I-1, but is 6 to 7 dBm more sensitive in receive, and consequently provides up to 5 dBm less transmit power. The OC-3 single-mode FP is classified as having application code S-1.1.

- ITU-TG.958
- I.432, complies with section 2 (Physical Medium at 155 520 kbit/s), complies with section 4 with the exception of section 4.2.1.2 (physical layer cells are not guaranteed to be inserted in the cell stream every 27 cells) and section 4.2.1.3 (physical layer OAM cells are not implemented)
- Telcordia GR-253 R6-360 (for FPs with LAPS ports)
- TS026

4-port OC-3/STM-1Ch TDM/CES FP compliance with standards

The 4-port OC-3/STM-1 Ch TDM/CES FP complies with the applicable sections of these standards

- ANSI T1.107-1988
- ANSI T1.231-1993
- ANSI T1.106.06
- ATM Forum CES Interoperability Specifications
- ITU-T I.105
- ITU-T G.704.1995
- ITU-T G.706.1991

- ITU-T G.707
- ITU-T G.733
- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios
- ITU-T G.957
- Telcordia GR-253-CORE, except for the optical power ratings

16-port OC-3/STM-1 ATM (with MT-RJ connectors) FP compliance with standards

The 16-port OC-3/STM-1 with MT-RJ connectors (NTHW21) complies with the applicable sections of these standards

- ANSI T1.105.1995
- ANSI T1.105.01-1995
- ANSI T1.231-1997
- ANSI T1E1.2/96-002
- AF-UNI-0010.002
- AF-TM-0121.000
- ETS 300 417
- ETS 300 746
- ITU-T G.703
- ITU-T G.707
- ITU-T G.775
- ITU-T G.782
- ITU-T G.783
- ITU-T G.813
- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios

- ITU-T G.841 Annex-B MSP
- Telcordia GR-253-CORE, except for the optical power ratings
- Telcordia GR-253 R6-360 (for FPs with LAPS ports)

16-port OC-3/STM-1 ATM (with LC connectors) FP compliance with standards

The 16-port OC-3/STM-1 ATM FP with LC connectors (NTHW31 and NTHW24) complies with the applicable sections of these standards

- ANSI TI.640
- ANSI TI.646, SONET specification
- ETS 300 417, Generic Requirements of SDH Equipment
- ETS DE/TM-1015, Definition of Optical Interfaces
- FCC Part 15 class B, CISPR class B. CSA, UL, TUV
- IEC 825/CDRH Class 1, unconditionally eyesafe laser
- ITU-T G.703, Physical and Optical characteristics
- ITU-T G.707, SDH Characteristics, Overheads, Mapping
- ITU-T G.782, Characteristics
- ITU-T G.783, Characteristics
- ITU-T G.825, Jitter and Wander Specifications
- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios
- ITU-T G.841 SDH Network Protection Architectures (support 1+1 MSP)
- ITU-T G.841 Annex-B MSP
- ITU-T G.957, Optical Interfaces
- ITU-T G.958, Digital line systems for use with optical cables
- ITU-T I.432, Physical Layer Specification
- ITU-T I.610, fault management only
- NEBS Class 3 for A-48 Emulation Module: indoor office equipment

- Telcordia GR-253-CORE, except for the optical power ratings
- Telcordia GR-253 R6-360 (for FPs with LAPS ports)
- Telcordia GR-326, Optical Connectors
- Telcordia GR-1244, Clocking

16-port OC-3/STM-1 POS and ATM FP compliance with standards

The 16-port OC-3/STM-1 POS and ATM FP (NTHW44) complies with the applicable sections of these physical layer standards

- ANSI TI.640
- ANSI TI.646, SONET specification
- ETS 300 417, Generic Requirements of SDH Equipment
- ETS DE/TM-1015, Definition of Optical Interfaces
- FCC Part 15 class B, CISPR class B. CSA, UL, TUV
- IEC 825/CDRH Class 1, unconditionally eyesafe laser
- ITU-T I.432, Physical layer specification
- ITU-T G.707, SDH Characteristics, Overheads, Mapping
- ITU-T G.783, Characteristics of SDH equipment functional blocks, Jan 1994
- ITU-T G.813, Timing characteristics of SDH equipment slave clocks
- ITU-T G.825, Jitter and Wander Specifications
- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios
- ITU-T G.841 SDH Network Protection Architectures (support 1+1 MSP)
- ITU-T G.841, Annex B MSP
- ITU-T G.957, Optical Interfaces for Equipment and Systems Relating to SDH
- Telcordia GR-63-CORE, Network Equipment Building System (NEBS) Requirements: Physical Protection
- Telcordia GR-253-CORE, SONET Transport Systems
- Telcordia GR-326, Optical Connectors
- Telcordia GR-1244, Clocking

The NTHW44 complies with these ATM Forum standards:

- af-phy-0062.000, 155 Mbps over MMF Short wave length Lasers, Addendum to UNI 3.1, july 1996
- af-tm-0056.000, Traffic Management 4.0 (except ABR), Apr 1996
- af-tm-0121.000, Traffic Management 4.1 (except ABR and GFR), March 1999
- af-tm-0150.000, Addendum to Traffic Management v4.1 optional minimum desired cell rate indication for UBR, July 2000
- af-uni-0010.001, ATM User-Network Interface Specification V3.0, Sept 1993
- af-uni-0010.002, ATM User-Network Interface Specification V3.1, Sept 1994

The NTHW44 complies with these ITU-T ATM Telcordia standards:

- ITU-T I.150, B-ISDN ATM Functional Characteristics, Nov 1995 and Feb 1999
- ITU-T I.361, B-ISDN ATM Layer Specification, Nov 1995 and Feb 1999
- ITU-T I.363, B-ISDN ATM adaptation layer (AAL), March 1993
- ITU-T I.363.5, ATM adaptation layer-Type 5, July 1996
- ITU-T I.371, Traffic control and congestion control in B-ISDN, July 1996 and March 2000
- ITU-T I.372, Frame Relay Bearer Services on ATM, Feb 1998
- ITU-T I.610, B-ISDN operational and maintenance principles and functions, Nov 1995 and Feb 1999
- ITU-T I.731, Types and general characteristics of ATM equipment (except ABT and ABR), March 1996
- ITU-T I.732, Functional Characteristics of ATM equipment, March 1996

Chapter 11
OC-12/STM-4 function processors

Nortel Networks Multiservice Switch OC-12/STM-4 function processors (FPs) support ATM services with a maximum line speed of 622 Mbit/s. The configuration reference information can help you when you configure and maintain these FPs.

Navigate to the reference information about each FP using the table "Multiservice Switch OC-12/STM-4 FPs" (page 325).

For information about OSI states, see "OC-12/STM-4 FP OSI states" (page 343).

For information about standards compliance, see "OC-12/STM-4 FP standards compliance" (page 348).

For information about applications and services for these FPs, see "Applications and services supported by function processors" (page 39).

Table 157
Multiservice Switch OC-12/STM-4 FPs

Type	FPs
ATM	"Common OC-12/STM-4 ATM FPs configuration considerations" (page 326)
	"1-port OC-12/STM-4 ATM FP" (page 326)
	"4-port OC-12/STM-4 ATM FP" (page 337)
	"4-port MR POS and ATM FP" (page 330)

Common OC-12/STM-4 ATM FPs configuration considerations

- For all ATM FPs, you must link the ports to an ATM interface before they can provide any service. For more information see the section on provisioning an *AtmInterface* component in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- OC-12/STM-4 FPs are available only in single mode (SM) format.
- OC-12/STM-4 FPs, excluding the 4-port MR POS and ATM FP, support equipment sparing by using a sparing bus between adjacent pairs of optical FPs. The sparing bus connects FPs that are located in the following card slots: 2 and 3, 4 and 5, 6 and 7, 8 and 9, 10 and 11, 12 and 13, and 14 and 15.

1-port OC-12/STM-4 ATM FP

The PECs for the 1-port OC-12/STM-4 FP are:

- NTHR29BA
- NTHR29DA

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “1-port OC-12/STM-4 ATM configuration considerations” (page 326).

For information about the characteristics of this FP, see “1-port OC-12/STM-4 ATM characteristics” (page 327).

1-port OC-12/STM-4 ATM configuration considerations

Before you begin configuring a 1-port OC-12/STM-4 ATM FP, consider the following.

- Loading the PEC NTHR29DA FP with loads that are earlier vintage than PCR1.1 CA01S2A may result in damage requiring the FP to be returned to Nortel Networks for repairs.

- The 1-port OC-12/STM-4 ATM FP has a single port for carrying traffic, along with an internal port for sparing.

  When configuring APS on the 1-port OC-12/STM-4 ATM FP, ports 0 and 1 must be paired on the same *Aps* component.

- When you add a *Sonet* port, you must manually configure (provision) an *Sts* subcomponent. The system creates component *Cell* beneath component *Sts*.
- When you add an *Sdh* port, you must manually configure (provision) a *Vc4* subcomponent. The system creates component *Cell* beneath component *Vc4*.
- The cell payload is scrambled by default, according to ITU-T Recommendation I.432. Cell payload scrambling can be turned off for a port on an ATM card. However, when cell payload scrambling is turned off for ATM ports, there is an increased risk of false cell header delineation errors.
- See also “1-port OC-12/STM-4 ATM configuration parameters” (page 327).

Table 158
1-port OC-12/STM-4 ATM configuration parameters

Parameter	Values
Card type <cardtype>	1pOC12SmLrAtm
Port type <port>	• Sonet (for OC-12) • Sdh (for STM-4)
Port number <m>	0, 1
Port configuration	B-ISDN
Clocking source	local, line, module

1-port OC-12/STM-4 ATM characteristics

The 1-port OC12c/STM4 FP may also be referred to as the One-port OC12C TURBO FP. It has a single external OC12c port with two OC12c duplex SC fiber optic transceivers.

Supported features include:

- network-to-network interfaces (NNIs)
- loopback monitoring
- SONET or SDH line APS between pre-designated pairs of ports.
  - single-FP line APS on the 1-port OC12c/STM4 FP APS is implemented with one optic transceiver representing the active port and the second optic transceiver representing the spare port.
  - dual-FP line APS has the original active port on the active FP and the spare port on an adjacent spare FP.
- hitless services when configured for dual-FP line APS
- hitless software migration when configured for dual-FP line APS
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

Table 159
1-port OC-12/STM-4 ATM specifications

Specification	Description
total egress ATM buffer (cells)/port @ 3k connections/FP	32k
sparing supported	equipment sparing of optical FPs by using a sparing bus between adjacent pairs of optical FPs
processor memory	128 Mbyte SDRAM
channelization supported	clear
network clock synchronization supported	yes
network clock synchronization synchronization status messages	yes
(Sheet 1 of 2)	

Table 159 (continued)
1-port OC-12/STM-4 ATM specifications

Specification	Description
minimum software level required	• PEC NTHR29BA - PCR1.1 • PEC NTHR29DA - PCR1.1, load CA01S2A or later
FP technologies	• PEC NTHR29BA - PPC, PQC1.0, AQS • PEC NTHR29DA - PPC, PQC2.0, AQS
(Sheet 2 of 2)	

4-port MR POS and ATM FP

The 4-port multi-rate (MR) packet over SONET (POS) and asynchronous transfer mode (ATM) function processor (FP) has software name 4pMRPosAtm and the product engineering code (PEC) NTHW46. This FP is supported by Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes.

The 4pMRPosAtm FP can be used for both ATM bearer services and as a multiservice over ATM access FP. Typically the FP would be deployed to aggregate ATM traffic on the access side to ATM trunks on the core network side.

An NTHW46 operates only with CP3s in the same shelf.

This FP type has the following sections:

- “4-port MR POS and ATM configuration considerations” (page 330)
- “4-port MR POS and ATM characteristics” (page 331)
- “4-port MR POS and ATM migration considerations” (page 337)

4-port MR POS and ATM configuration considerations

Before you begin configuring a 4-port MR POS and ATM FP (NTHW46) consider the following.

- You must decide whether the FP functions for ATM or for packet over SONET (POS). Only ATM functionality is currently supported by the software.
- Each port is cabled with single-mode fiber. The fiber cables must match the version of small-form pluggable (SFP) module that connects to each port of the FP, and you must set the *opticalModule* type to match each inserted SFP module after adding the component *Sonet* or *Sdh*.

  Note: For information about the SFP optical module, see NN10600-120 *Nortel Networks Multiservice Switch 15000/20000 Hardware Description*. For information about configuring an SFP module, see NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

- When you add a *Sonet* port, you must manually add an *Sts* subcomponent. The system creates component *Cell* beneath component *Sts*, and component *OpticalModule*.
- When you add an *Sdh* port, you must manually add a *Vc4* subcomponent. The system creates component *Cell* beneath component *Vc4*, and component *OpticalModule*.
- When replacing an NTHW11 or NTHW86 with an NTHW46, treat the decommissioning of the slot and the configuration of the NTHW46 as a new FP deployment in the slot. Consider that physical port locations are different.
- There is no need to select a service bundle.
- See also the table “4-port MR POS and ATM configuration parameters” (page 331).

Table 160
4-port MR POS and ATM configuration parameters

Parameter	Values
Card type <cardtype>	4pMRPosAtm
Port type <port>	• Sonet (for OC-12)
	• Sdh (for STM-4)
Port number <m>	0 to 3
Port configuration	B-ISDN
Clocking source	module, local, line
SFP configuration	OC12SmIr, OC12SmLr

4-port MR POS and ATM characteristics

The 4-port MR POS and ATM FP supports the following characteristics:

- small-form pluggable (SFP) modules which connect single-mode (SM) intermediate reach (IR), or SM long reach (LR) fiber cables to each port (socket) on the faceplate such that the FP can have a combination of SFPs, one type per port

- provides a single reference clock to be used as a network synchronization source
- confirmation that each inserted SFP matches the port configuration for it, and verifies operation
- ATM services which enable using the FP for network access or trunking
- 32,000 per VC queues
- basic virtual path terminations (VPTs)
- logical trunks over ATM or DPRS (the same as PQC12-based FPs)
- Multiservice Switch networking (DPRS and PORS)
- full line rate of 2.5 Gbit/s for DPRS logical trunk frame forwarding
- when configured for dual-FP (inter-card) line automatic protection switching (LAPS) for SONET or SDH, the line protection for SONET and multiplex section protection (MSP) provide:
  - ATM hitless services (hot standby)
  - line protection switchover within 50 milliseconds upon a line or FP failure or being locked, and provided the mate port is in service and not degraded
  - new ATM connections within 500 milliseconds from a switchover (only for Succession nodes)
- ATM traffic management features including:
  - traffic policing
  - congestion control
  - packet-wise discards
  - perVc queuing and common queuing
  - traffic shaping
  - weighted fair queue connection scheduling
  - prioritized class scheduling with minimum bandwidth guarantees
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

- SONET and SDH fault and performance management for the FP
- Handling operations, administration, and maintenance (OAM) ATM cells includes:
  - — supporting the standardized OAM cells for end-to-end AIS, end-to-end RDI, segment loopback, and end-to-end loopback
  - — not supporting the standard OAM cells for performance monitoring (FPM and BR), congestion control, segment AIS, and segment RDI by only transparently passing them through non-flow end points
  - — supporting the non-standardized OAM cells for the proprietary end of transmission (EOT) cell used by local/global routing and/or edge-based rerouting (EBR) connections on flow end points and transparently passes this cell on the non-flow end points
  - — not supporting the non-standardized OAM cells for the O.151 cell used by the NTHW24 FP (the 16-port OC-3/STM-1 FP with customized O.151 cells) by only transparently passing them through non-flow end points
  - — not supporting the non-standardized OAM cells for the proprietary cell discards used for performance monitoring of cell loss ratio (CLR) calculations by only transparently passing them through non-flow end points
- for AAL5 ATM connections, accurate layer 2 cell statistics up to and including the point of AAL5 frame reassembly and delivery to layer 3 on ingress, and from the point of AAL5 frame segmentation into cells on egress (but not while the cells are processed on layer 3)
- component *ConnMap* is not required

See also the table “4-port MR POS and ATM specifications” (page 333).

Table 161
4-port MR POS and ATM specifications

Specification	Description
processor memory	256 Mbytes
channelization	not supported
network clock synchronization supported	yes
synchronization status messages supported	yes
minimum software level required	PCR 6.1
egress ATM per VC queues per FP	32,000
total egress ATM buffer (cells) per FP	1000k
ATM adaptation layer 5 (AAL5) supported	yes
bandwidth management	same as all other Multiservice Switch ATM FPs
class scheduling	8 emission priorities (EPs), including: • absolute priority for EP0 and EP1 with minimum delay and cell delay variation (CDV) • EPs 2 to 7 with minimum bandwidth guarantees (MBGs) to avoid starvation • work-conserving allocation of unused bandwidth for high utilization
call latency (95th percentile)	• 25 milliseconds for a transit node or terminating node • 30 milliseconds for an originating node
(Sheet 1 of 4)	

Table 161 (continued)
4-port MR POS and ATM specifications

Specification	Description
connection admission control (CAC)	• CDV for CBR or VBR traffic types • overbooking resources per port based on QoS and basic VPT
connection space and call rate	16,000 connection end points per port with a maximum of 45,000 connection end points per FP (for this FP, there is no longer a restriction of 16,000 PVCs per card, which now can be any combination of PVCs, SPVCs, or SVCs)
ATM fault management	• alarm indication signal (AIS) • remote defect indication (RDI) • loopback
logical trunks	32 per FP
multicast connections per card	• 16,384 leaves per FP • up to 16 multicast leaf connections per root multicast connection
networking connections supported	PVCs, PVPs, SPVCs, SPVPs, SVCs, and SVPs, VPTs
packet congestion per VC	early packet discard (EPD) late packet discard (LPD) partial packet discard (PPD) weighted-random early discard (W-RED)
queuing disciplines	common and per VC
scheduling	link class connection
(Sheet 2 of 4)	

Table 161 (continued)
4-port MR POS and ATM specifications

Specification	Description
routing and signaling	AINI 1.0 IISP 1.0 ILMI 4.0 PNNI and H-PNNI 1.0 UNI 3.0, 3.1, and 4.0 local and global rerouting
call set-up rate	• 300 calls per second per FP (with accounting and carrier grade off) • 265 calls per second per FP (with accounting off and carrier grade on) • 150 calls per second per FP (with accounting and carrier grade on)
traffic management	TM 4.1 supporting: CBR nrt-VBR rt-VBR UBR UBR-MDCR (with definable CLR, CLP0/1, CDV, and CTD)
traffic shaping	• on any 4 emission priorities (EPs) • linear • dual-rate inverse usage parameter control (UPC) • variable rates with a minimum of 100 cells per second
traffic policing	dual usage parameter control (UPC) policers that support policing of all traffic descriptor types.
(Sheet 3 of 4)	

Table 161 (continued)
4-port MR POS and ATM specifications

Specification	Description
Multiservice Switch ATM statistics	all supported with additional statistics for the NTHW46. For the list, see NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference.*
FP technologies	GQM
(Sheet 4 of 4)	

4-port MR POS and ATM migration considerations

The 4pMRPosAtm FP has numerous field programmable gate arrays (FPGAs) that store a specific version of software. When the version of the FPGAs in the running software is different than the version of FPGAs in the new migrating software, the FPGAs will need to be updated with the new version before the migration can complete. Updating the version for the FPGAs is handled automatically as part of the migration, but it may extend the migration up to 45 minutes to complete when one 4pMRPosAtm FP is present in the shelf. When more than one 4pMRPosAtm FP is present in the shelf, the migration may take slightly longer because it depends on when the other 4pMRPosAtm FPs start getting loaded relative to the other FPs in the shelf.

4-port OC-12/STM-4 ATM FP

The PECs for the 4-port OC-12/STM-4 ATM FP are:

- NTHW11 for PQC6v2-based (also knows as PQC2-based)
- NTHW86 for PQC12-based

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “4-port OC-12/STM-4 ATM configuration considerations” (page 338).

For information about the characteristics of this FP, see “4-port OC-12/STM-4 ATM characteristics” (page 340).

4-port OC-12/STM-4 ATM configuration considerations

Before you begin configuring a 4-port OC-12/STM-4 ATM FP, consider the following.

- The four ports are used for carrying traffic. Each STS, VC-4 component has to be provisioned explicitly. The system automatically creates an AtmCell beneath them.
- The cell payload is scrambled by default, according to ITU-T Recommendation I.432. Cell payload scrambling can be turned off for a port on an ATM card. However, when cell payload scrambling is turned off for ATM ports, there is an increased risk of false cell header delineation errors.
- For the PQC12-based version of the OC-12/STM-4 FP:
  - to take advantage of the enhanced frame relay and DPRS performance capabilities, the loadspreadfast algorithm must be used. For more information about this forwarding policy, see NN10600-425 *Nortel Networks Multiservice Switch 7400/15000/20000 Operations: Dynamic Packet Routing System*.
  - Sparing, LAPS, and equipment protection are supported between FPs that have the same PQC base. For example, a PQC12-based FP to a PQC12-based FP or a PQC6-based FP to a PQC6-based FP is supported. However, a PCQ12-based FP to a PQC6-based FP is not supported.
- See also “4-port OC-12/STM-4 ATM configuration parameters” (page 339).
- For the OC-12 configuration procedure steps, see “Example of configuring the 4-port OC-12 ATM” (page 339).
- For the STM-4 configuration procedure steps, see “Example of configuring the 4-port STM-4 ATM” (page 339).

Table 162
4-port OC-12/STM-4 ATM configuration parameters

Parameter	Values
Card type <cardtype>	4pOC12SmIrAtm
Port type <port>	• Sonet (for OC-12) • Sdh (for STM-4)
Port number <m>	0 to 3
Clocking source	module, local

Example of configuring the 4-port OC-12 ATM

1 Set the *cardType* attribute.

```
set shelf card/x cardType 4pOC12SmIrATM
```

2 Add a SONET port.

```
add lp/x sonet/y
```

3 Set *expectedSectionTrace*.

```
set lp/x sonet/y expectedSectionTrace "<alpha, up to n
character>"
```

4 Add the *sts* component to the SONET port.

```
add lp/x sonet/y sts/m
```

where, m=0 for concatenation level STS-12c

5 Set the concatenation level for the sts component.

```
set lp/x sonet/y sts/1 concatenationLevel n
```

Variable Definitions

Variable	Definition
<n>	is 12 for STS-12 concatenation.

Example of configuring the 4-port STM-4 ATM

1 Set the *cardType* attribute.

```
set shelf card/x cardType 4pOC12SmIrAtm
```

2 Add an SDH port.

```
add lp/x sdh/y
```

3 Set expectedSectiontrace.

```
set lp/x sdh/y expectedSectionTrace “<alpha, up to 15
chars>”
```

4 Add a VC4 component.

a. Add a VC4 component.

```
add lp/x sdh/y vc4/0
```

```
set lp/x sdh/y vc4/0 expectedSectionTrace “<alpha,
up to 15 chars>” where the vc4 instance number may
only be “0”
```

5 Set the concatenation level for VC4.

```
set lp/x sdh/y vc4/m concatenaionLevel n
```

Variable Definitions

Variable	Definition
<n>	n is equal to: • 4 for STM4 concatenation. • 1 for vc4 concatenation. • X for vc3 concatenation.
<m>	m is equal to: • 0 for concatenation level STM4 • 0,1,2,3 for concatenation level VC4 • 0,1,2,...,11, for concatenation level VC3

4-port OC-12/STM-4 ATM characteristics

The 4-port OC12/STM4 ATM FP may also be referred to as the 4pOC12SmIrAtm FP. It supports network-to-network and user-to-network interfaces (NNIs and UNIs) as well as a variety of services on Nortel

Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes, including the following service classes: ATM, FR (DPRS), IP and MPLS. Each port has duplex SC fiber transceivers.

Supported features include:

- loopback monitoring
- SONET or SDH dual-FP inter-card line APS between pre-designated pairs of ports on adjacent 4-port OC-12/STM-4 FPs. All ports must be provisioned as SONET or SDH. You cannot mix SONET and SDH on the same FP.
- when configured for dual-FP inter-card LAPS, the FP supports:
  - hitless services
  - hitless software migration
  - port tests on the standby port provided the port is not also configured for Y-protection or port bridge group (PBG) -- the test types per FP type are identified in NN10600-520 *Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting*
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)
- virtual router (VR) and IP (supported in the PVG using IP (VoIP) when VR interworking is used with a VR access point (AP) and the voice services processor 2 (VSP2) FP or VSP3 FP card on Multiservice Switch 15000 nodes)
- VR-to-VR and VCG-based IP VPNs on its PQC12 FPs
- IP DiffServ services of the DiffServ domain for the router (*Vr Dsd*) and the DiffServ profile for the interface (*Vr Ip DiffServ*) on its PQC12 FPs

In addition, the PQC12-based version has the following distinct characteristics:

- higher frame and cell processing capacity equivalent to OC-12 line rates
- greater IP capabilities

- fast hardware data path support for DPRS loadspreading and frame relay access

See also the table “4-port OC-12/STM-4 ATM specifications” (page 342).

Table 163
4-port OC-12/STM-4 ATM specifications

Specification	Description
total egress ATM buffer (cells)/port @ 3k connections/FP	512k
sparing supported	equipment sparing of optical FPs by using a sparing bus between adjacent pairs of optical FPs
processor memory	256 Mbyte SDRAM
channelization supported	no
network clock synchronization supported	yes
network clock synchronization synchronization status messages	yes
minimum software level required	• PEC NTHW11 - PCR2.2 • PEC NTHW86 - PCR3.0
FP technologies	• PEC NTHW11 - PPC, PQC2.0, QRD1.1, APC • PEC NTHW86 - PPC, PQC12, QRD1.1, QRD1.2, APC

OC-12/STM-4 FP OSI states

The following tables contain information about OC-12/STM-4 FP OSI states.

- "OC-12/STM-4 Sonet/Sdh component state combination" (page 343)
- "OC-12/STM-4 Test component state combination" (page 344)
- "OC-12/STM-4 Sts component state combination" (page 345)

Table 164
OC-12/STM-4 Sonet/Sdh component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The SONET/SDH interface is inoperable due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisAlarm • rxRfiAlarm • lcdAlarm
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes. The line input is recognized as good. Clocks are available.
Unlocked, Enabled, Busy	The *Sonet/Sdh* component is in use. The *Sonet/Sdh* component has one Sts component under it.
Unlocked, Enabled, Shutting Down	A lock command is in effect against the *Sonet/Sdh* component but the *Sts* component under it is not yet suspended.
(Sheet 1 of 2)	

Table 164 (continued)
OC-12/STM-4 Sonet/Sdh component state combination

Combination (Administrative, Operational, Usage)	Details
Locked, Enabled, Idle	A lock operator command is in effect. The *Sonet/Sdh* component is operating in test mode (availabilityStatus: inTest).
Locked, Disabled, Idle	A lock operator command is in effect. The component is in one of the following conditions: • Left offline (availabilityStatus: offline) • Some hardware test failed (availabilityStatus: failed) • If running in test mode external factors cause errors (availabilityStatus: inTest). Bad line state and excessive line state changes are possible causes.
(Sheet 2 of 2)	

Table 165
OC-12/STM-4 Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the *Test* component. Start test requests will be rejected.
Unlocked, Enabled, Idle	The hardware component is locked. You can perform a port and line test.
Unlocked, Enabled, Busy	The *Test* component is in use. A *Chan*, *DS1*, *E1*, *DS3*, *E3*, *V35*, *X21*, *Sonet*, or *Sdh* component creates a *Test* component. The *Test* component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

Table 166
OC-12/STM-4 Sts component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The *Sts* component is inoperable due to at least one of the following alarms: • lopAlarm • rxAisAlarm • rxRfiAlarm • signalLabelMismatch Either a bad path state or the *Sonet/Sdh* is disabled. If the *Sonet/Sdh* is disabled either *Sonet/Sdh* is locked or there is a bad *Sonet/Sdh* signal.
Unlocked, Enabled, Idle	The component is not in use. The component is waiting for a binding to an *ATM interface* component.
Unlocked, Enabled, Busy	The *Sts* component is in use. The Sts component services only one user (an *ATM interface* component) at a time.
Unlocked, Enabled, Shutting Down	A lock command is in effect against the *Sts* component. The *Sts* component is waiting for the *ATM interface* component to go into a disabled mode before it completes the lock sequence and shuts down.
Locked, Disabled, Idle	A lock operator command is in effect.

Table 167
DS3 channelized component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The DS3 interface is inoperable due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisAlarm • rxRaiAlarm • lcdAlarm • rxIdle Or the far-end DS3 interface sends a request to the local end to loop back the incoming signal. When the PLCP option is turned on, PLCP lofAlarm and PLCP rxRaiAlarm also disable the component.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes. The line input is recognized as good. Clocks are available.
Unlocked, Enabled, Busy	The *DS3* component is in use. The *DS3* component services only one user (an ATM interface or *ATMIf* component) at a time.
Shutting Down, Enabled, Busy	A lock command is in effect against the *DS3* component. The *DS3* component is waiting for the *AtmIf* component to go into a disabled mode before it completes the lock sequence and shuts down.
(Sheet 1 of 2)	

Table 167 (continued)
DS3 channelized component state combination

Combination (Administrative, Operational, Usage)	Details
Locked, Enabled, Idle	A lock operator command is in effect. The *DS3* component is operating in test mode (availabilityStatus: inTest).
Locked, Disabled, Idle	A lock operator command is in effect. The component is in one of the following states: • Left offline (availabilityStatus: offline) • Some hardware test failed (availabilityStatus: failed) • If running in test mode external factors cause errors (availabilityStatus: inTest). Bad line state and excessive line state changes are possible causes.
(Sheet 2 of 2)	

Table 168
DS3 channelized ATM Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the *Test* component. Start test requests will be rejected.
Locked, Disabled, Idle	The hardware component is locked. You can perform a port and line test.
Locked, Enabled, Idle	The *Test* component is in use. A *DS3 or VC3* component creates a Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

OC-12/STM-4 FP standards compliance

This section lists the standards compliance for the OC-12/STM-4 FPs:

- “1-port OC-12/STM-4 ATM FP compliance with standards” (page 348)
- “4-port OC-12/STM-4 ATM FP compliance with standards” (page 349)
- “4-port MR POS and ATM FP compliance with standards” (page 350)

1-port OC-12/STM-4 ATM FP compliance with standards

The 1-port OC-12/STM-4 ATM FP complies with the applicable sections of these standards

- ANSI T1.105.1995
- ANSI T1.646
- ANSI T1.231 Partial compliance
- ANSI T1E1.2/96-002
- ATM UNI Forum Standard 3.1
- I.432.2, complies with section 3 (Physical Medium at 622 080 kbit/s), complies with section 4 with the exception of section 4.2.1.2 (physical layer cells are not guaranteed to be inserted in the cell stream every 27 cells) and section 4.2.1.3 (physical layer OAM cells are not implemented).
- ITU-T I.432
- ITU-T G.707
- ITU-T G.708
- ITU-T G.709
- ITU-T G.782
- ITU-T G.783
- ITU-T G.813
- ITU-T G.825 with the exception of wander requirements
- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios

- ITU-T G.957
- ITU-T G.958
- Telcordia GR-253-CORE, except for the optical power ratings
- TS026

4-port OC-12/STM-4 ATM FP compliance with standards

The 4-port OC-12/STM-4 ATM FP complies with the applicable sections of these standards

- ANSI T1.105.1995
- ANSI T1.646
- ANSI T1.231 Partial compliance
- ATM UNI Forum Standard 3.1 and 4.0
- ATM Forum Traffic Management Specification 4.1
- ETS 300 417
- GR-253 R6-360 (for FPs with LAPS ports)
- I.432.2, complies with section 2 (Physical Medium at 155 520 kbit/s), complies with section 4 with the exception of section 4.2.1.2 (physical layer cells are not guaranteed to be inserted in the cell stream every 27 cells) and section 4.2.1.3 (physical layer OAM cells are not implemented).
- ITU-T I.432
- ITU-T G.707
- ITU-T G.708
- ITU-T G.782
- ITU-T G.783
- ITU-T G.825 with the exception of wander requirements
- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios
- ITU-T G.957

- ITU-T G.958
- Telcordia GR-253-CORE, except for the optical power ratings
- Telcordia GR-1110-CORE
- Telcordia GR-1113-CORE
- Telcordia GR-1248-CORE

4-port MR POS and ATM FP compliance with standards

The 4-port MR POS and ATM FP complies with the applicable sections of these standards:

- ANSI T1.105.1995
- ANSI T1.646
- ANSI T1.231 Partial compliance
- ATM UNI Forum Standard 3.1 and 4.0
- ETS 300 417
- GR-253 R6-360 (for FPs with LAPS ports)
- ITU-T I.150
- ITU-T I.361
- ITU-T I.363
- ITU-T I.363.5
- ITU-T I.371
- ITU-T I.372
- ITU-T I.432
- ITU-T I.610
- ITU-T I.731
- ITU-T I.732
- ITU-T G.783

- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios
- ITU-T G.957
- Telcordia GR-63-CORE
- Telcordia GR-253-CORE
- Telcordia GR-1110-CORE

Chapter 12
OC-48/STM-16 function processors

Nortel Networks Multiservice Switch OC-48/STM-16 FPs support ATM and packet over SONET (POS) services with a maximum line speed of 2.48832 Gbit/s. The configuration reference information can help you when you configure and maintain these FPs.

Navigate to the reference information about the FP using the table “Multiservice Switch OC-48/STM-16 FPs” (page 354).

For information about OSI states, see “OC-48/STM-16 OSI states” (page 358).

For information about problem resolution see, “Troubleshooting” (page 361).

For information about standards compliance, see “OC-48/STM-16 FP standards compliance” (page 362).

For information about applications and services for these FPs, see “Applications and services supported by function processors” (page 39).

Table 169
Multiservice Switch OC-48/STM-16 FPs

Type	FPs
	“Common OC-48/STM-16 FP configuration considerations” (page 354)
ATM	“1-port OC-48/STM-16 ATM with APS FP” (page 354)

Common OC-48/STM-16 FP configuration considerations

- For both OC-48/STM-16 FP types, you must link the port to an ATM interface before it can provide any ATM service. For the 1-port OC-48/STM-16 POS FP, the ATM service is ATM PVC/PVP over MPLS service. For more information see the section on provisioning an *AtmInterface* component in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- The cell payload is scrambled by default, according to ITU-T Recommendation I.432. For the APS FP, cell payload scrambling can be turned off for a port on an ATM card; be aware that this will result in an increased risk of false cell header delineation errors and as such it is recommended that cell payload scrambling be left turned on. For the POS FP, cell payload scrambling cannot be turned off for a port on the 1-port OC-48/STM-16 POS FP.

1-port OC-48/STM-16 ATM with APS FP

The PEC for the 1-port OC-48/STM-16 with APS FP is NTHW01EA. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “1-port OC-48/STM-16 ATM with APS configuration considerations” (page 355).

For information about the characteristics of this FP, see “1-port OC-48/STM-16 ATM with APS characteristics” (page 356).

1-port OC-48/STM-16 ATM with APS configuration considerations

Before you begin configuring a 1-port OC-48/STM-16 ATM with APS, consider the following.

- When you add a *Sonet* port, you must manually configure (provision) an *Sts* subcomponent. The system creates component *Cell* beneath component *Sts*.
- When you add an *Sdh* port, you must manually configure (provision) a *Vc4* subcomponent. The system creates component *Cell* beneath component *Vc4*.
- You can define a maximum of four Sts components. You do not need to define all four if they are not all needed.
- See also “1-port OC-48/STM-16 ATM with APS configuration parameters” (page 355).

Table 170
1-port OC-48/STM-16 ATM with APS configuration parameters

Parameter	Values
Card type <cardtype>	1pOC48ChSmIrAtm (Note: the software capability for channelization is not available for the hardware.)
Port type <port>	• Sonet (for OC-48) • Sdh (for STM-16)
Port number <m>	0
Port configuration	B-ISDN
Sts component type <path>	Sts, Vc4
Sts component instance <r>	0, 12, 24, 36
Concatenation level <c>	• 48 when configuring a single Sts component • 12 when configuring multiple Sts components
Clocking source	module, local

1-port OC-48/STM-16 ATM with APS characteristics

The 1-port OC-48/STM-16 ATM with APS FP provides support for ATM services with automatic protection switching (APS) for network-to-network interfaces (NNI) on Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes. The port has an OC-48/STM-16 duplex SC fiber optic transceiver.

This FP is available only in single-mode format in intermediate reach.

Supported features include:

- loopback monitoring
- dual-FP line APS and equipment protection (unidirectional and bidirectional, revertive and non-revertive)
- hitless software migration when configured for one-for-one equipment protection using inter-FP LAPS
- line and module timing
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)
- PVC, SVC, SPVC, and SPVP connection types
- one path at OC-48/STM-16 payload capacity and four paths at STS-12/STM-4 capacity
- Multiservice Switch networking (DPRS and PORS)
- ATM classes of service: rt-VBR, nrt-VBR, UBR and CBR
- IP class of service (CoS)
- VR-to-VR and VCG-based IP VPNs

See also:

- “1-port OC-48/STM-16 ATM with APS specifications” (page 357)

Table 171
1-port OC-48/STM-16 ATM with APS specifications

Specification	Description
usable data rate	2.3 Gbit/s
usable cell rate	5.37 million cells per second
PHY devices	TDAT
processor memory	128Mb SDRAM
channelization	not applicable
network clock synchronization supported	yes
synchronization status messages supported	yes
minimum software level required	PCR 2.1
FP technologies	PPC, PQC2.0, QRD1.1

OC-48/STM-16 OSI states

These tables contain information about OC-48/STM-16 OSI states.

- "1-port OC-48/STM-16 Sonet component state combination" (page 358)
- "1-port OC-48/STM-16 Test component state combination" (page 359)
- "1-port OC-48/STM-16 Sts component state combination" (page 360)

Table 172
1-port OC-48/STM-16 *Sonet* component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The *Sonet* interface is inoperable due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisAlarm • rxRfiAlarm • lcdAlarm.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes. The line input is recognized as good. Clocks are available.
Unlocked, Enabled, Busy	The *Sonet* component is in use. The *Sonet/Sdh* component has one *Sts* component under it.
Unlocked, Enabled, Shutting Down	A lock command is in effect against the *Sonet* component but the *Sts* component under it is not yet suspended.
(Sheet 1 of 2)	

Table 172 (continued)
1-port OC-48/STM-16 *Sonet* component state combination

Combination (Administrative, Operational, Usage)	Details
Locked, Enabled, Idle	A lock operator command is in effect. The *Sonet* component is operating in test mode (*availabilityStatus:* inTest).
Locked, Disabled, Idle	A lock operator command is in effect. The component is in one of the following states: • Left offline (*availabilityStatus:* offline) • Some hardware test failed. (*availabilityStatus:* failed) • If running in test mode external factors cause errors (*availabilityStatus:* inTest). Bad line state and excessive line state changes are possible causes.
(Sheet 2 of 2)	

Table 173
1-port OC-48/STM-16 *Test* component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the *Test* component. Start test requests will be rejected.
Unlocked, Enabled, Idle	The hardware component is locked. You can perform a port and line test.
Unlocked, Enabled, Busy	The *Test* component is in use. A *Chan, DS1, E1, DS3, E3, V35, X21, Sonet*, or *Sdh* component creates a *Test* component. The *Test* component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

Table 174
1-port OC-48/STM-16 *Sts* component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The *Sts* component is inoperable due to at least one of the following alarms: • lopAlarm • rxAisAlarm • rxRfiAlarm • signalLabelMismatch Either a bad path state or the *Sonet* component is disabled. If the *Sonet* component is disabled either the component is locked or there is a bad SONET signal.
Unlocked, Enabled, Idle	The component is not in use. The component is waiting for a binding to an *ATM interface* component.
Unlocked, Enabled, Busy	The *Sts* component is in use. The *Sts* component services only one user (an *ATM interface* component) at a time.
Unlocked, Enabled, Shutting Down	A lock command is in effect against the *Sts* component. The *Sts* component is waiting for the *ATM interface* component to go into a disabled mode before it completes the lock sequence and shuts down.
Locked, Disabled, Idle	A lock operator command is in effect.

Troubleshooting

The following table “Handling symptoms” (page 361) describes some symptoms that may occur with the OC-48/STM-16 channelized ATM FP with APS.

Table 175
Handling symptoms

Symptoms that may occur	Probable causes	Corrective measures
Lp Sonet component is enabled and in a busy state and the *Path component is in a disabled state.*	An OC-48/STM-16 card is transmitting a power level to another OC-48/STM-16 card on another node that is not within the recommended range.	You need to check the power level coming into the OC-48/ STM-16 card to ensure it is within the recommended range.
Lp Sonet and Lp Sonet Path components are in a disabled state.	An OC-48/STM-16 card is not properly connected to another OC-48/STM-16 card.	You need to ensure the physical path between the OC-48/STM-16 cards is properly set up and uninterrupted.
A P-AIS alarm is raised.	An OC-48/STM-16 concatenated card is connected to an OC-48/ STM-16 non-concatenated card.	You need to ensure an OC-48/ STM-16 concatenated card is connected to a card of the same type.

OC-48/STM-16 FP standards compliance

This section lists the standards compliance for the OC-48/STM-16 FPs:

- "1-port OC-48/STM-16 ATM FP with APS compliance with standards" (page 362)
- "1-port OC-48/STM-16 POS FP compliance with standards" (page 363)

1-port OC-48/STM-16 ATM FP with APS compliance with standards

The 1-port OC-48/STM-16 ATM FP with APS complies with the applicable sections of these standards

- ANSI T1.105.1995, complies with SONET with the exception of the following bytes:
  - E1: Orderwire
  - F1: Section user channel
  - D1-D3: Section data communication
  - J1: STS path trace
  - F2: Path user channel
  - N1: Tandem connection maintenance/path data channel
- ANSI T1.646
- ANSI T1.231-1993, complies with section 8 for all SONET alarms and statistics with the exception of the following bytes:
  - E1: Orderwire
  - F1: Section user channel
  - D1-D3: Section data communication
  - J1: STS path trace
  - F2: Path user channel
  - N1: Tandem connection maintenance/path data channel
- ANSI T1E1.2/96-002
- Telcordia GR-253-CORE, except for the optical power ratings

- tested against CENELEC EN50 081 parts 1 and 2, FCC 15, Class B limits for emissions
- tested against CENELEC EN50 082 part 1 immunity requirements
- CFR 1040.10 Class I laser safety requirements
- Class I to IEC 825-1:1993
- ITU-T I.432
- ITU-T G.707
- ITU-T G.708
- ITU-T G.709
- ITU-T G.782
- ITU-T G.783
- ITU-T G.813
- ITU-T G.825
- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios
- ITU-T G.957
- ITU-T G.958

1-port OC-48/STM-16 POS FP compliance with standards

The 1-port OC-48/STM-16 POS FP complies with the applicable sections of these standards

- ANSI T1.105.1995, complies with SONET with the exception of the following bytes
  - E1: Orderwire
  - F1: Section user channel
  - D1-D3: Section data communication
  - J1: STS path trace
  - F2: Path user channel

- N1: Tandem connection maintenance/path data channel
- M1 Byte: Line REI is not generated or checked
- K1 and K2: APS is not supported on the 1-port OC-48/STM-16 POS FP

- ANSI T1.646
- ANSI T1.231-1993, complies with section 8 for all SONET alarms and statistics with the exception of the following bytes
  - E1: Orderwire
  - F1: Section user channel
  - D1-D3: Section data communication
  - J1: STS path trace
  - F2: Path user channel
  - N1: Tandem connection maintenance/path data channel
  - M1 Byte: Line REI is not generated or checked
  - K1 and K2: APS is not supported on the 1-port OC-48/STM-16 POS FP
- ANSI T1E1.2/96-002
- Telcordia GR-253-CORE, except for the optical power ratings
- tested against Class A FCC Part 15b
- tested against Class A CISPR22
- tested against Class A CENELEC EN 300 386-2
- tested against Class A Telcordia GR-1089-CORE
- CFR 1040.10 Class I laser safety requirements
- Class I to IEC 825-1:1993
- FB-AIC-0178.000, “ATM-MPLS Network Interworking”
- ITU-T G.707
- ITU-T G.709
- ITU-T G.782

- ITU-T G.783
- ITU-T G.813
- ITU-T G.825
- ITU-T G.826 partial compliance by supporting ES and SES measurements for transmission performance, but not ESR, SESR, and BBER ratios
- ITU-T G.957
- ITU-T G.958
- the 1-port OC-48/STM-16 POS FP supports the following PPP encapsulation methods
- RFC 1662 PPP in HDLC framing
  - — RFC 1619 PPP over SONET/SDH prior to insertion into SPE
  - — RFC 2615

Chapter 13
STM-1 function processors

Nortel Networks Multiservice Switch STM-1 function processors (FPs) support a maximum line speed of 155.52 Mbit/s. The configuration reference information can help you when you configure and maintain these FPs.

Navigate to the reference information about each FP using the table "Multiservice Switch STM-1 FPs" (page 367).

For information about OSI states, see "STM-1 OSI States" (page 377).

For information about standards compliance, see "STM-1 FPs standards compliance" (page 382).

For information about applications and services for these FPs, see "Applications and services supported by function processors" (page 39).

Table 176
Multiservice Switch STM-1 FPs

Type	FPs
Frame Relay	"1-port STM-1Ch FP" (page 368)
ATM	"2-port STM-1 electrical ATM IP FP" (page 371)
multiservice	"2-port STM-1 electrical channelized CES/ATM/IMA FP" (page 374)

1-port STM-1Ch FP

The PEC for the 1-port STM-1Ch FP is NTHR83. For a full list of PECs (including vintages) for supported FPs, see Nortel Networks Multiservice Switch Release Notes.

For the information you need to configure this FP, see "1-port STM-1Ch configuration considerations" (page 368).

For information about the characteristics of this FP, see "1-port STM-1Ch characteristics" (page 370).

1-port STM-1Ch configuration considerations

Before you begin configuring a 1-port STM-1Ch FP, consider the following:

- An E1 channel can support full or partial usage of the total available timeslots.
- A maximum of 768 channels can be configured within an STM-1 with the limitation that an STM-1 has 3 groups of 21 E1s. Each group of 21 E1s is divided into two banks of 11 and 10 E1s. A maximum of 128 channels can be configured for each bank of E1s. The channels may be DS0 to the full E1 bandwidth consuming all the time slots of the E1. See table "1-port STM-1Ch channel configuration" (page 368).
- See also "1-port STM-1Ch configuration parameters" (page 369).

Table 177
1-port STM-1Ch channel configuration

Number of E1s		E1 numbers	maximum number of channels	Provision to maximize per-FP throughput
21	11	0 to 10	128	one-third of connections here
	10	11 to 20	128	
21	11	21 to 31	128	one-third of connections here
	10	32 to 41	128	
(Sheet 1 of 2)				

Table 177 (continued)
1-port STM-1Ch channel configuration

Number of E1s		E1 numbers	maximum number of channels	Provision to maximize per-FP throughput
21	11	42 to 52	128	one third of connections here
	10	53 to 62	128	
63	63	63	768	
(Sheet 2 of 2)				

Table 178
1-port STM-1Ch configuration parameters

Parameter	Values
Card type <cardtype>	1pSTM1ChSmIr
Port type <port>	Sdh
Port number <m>	0
Port configuration	B-ISDN
High order path <high_path>	Vc4 (Adds a high order path to the port.)
Path value <q>	0
Low order path <low_path>	Vc12 (Adds a low order path to the port, with 63 Vc12s multiplexed into a Vc4 high order path.)
Path value <r>	k,l,m; k=1..3, l=1..7, m=1..3
Tributary <trib_port>	E1 (An E1 superchannel is mapped into a Vc12.)
Channel number <s>	c; c is 0 to 31 (31 (64 kbit/s) channels are multiplexed into an E)
Attribute <attribute>	timeslots !1 2 ... etc. (Specifies the 64 k/bits timeslots within E1)
Clocking source	module, line

1-port STM-1Ch characteristics

The 1-port STM-1Ch FP supports frame relay and IP services on Multiservice Switch and Nortel Networks Multiservice Switch 15000 nodes. It is only available in single-mode (SM) intermediate reach (IR). The port has one single-mode SC fiber optic transceiver.

This FP supports either one user-to-network interface (UNI) or one network-to-network interface (NNI). These can operate from either side of the user/network boundary, and can provide access to and from a public network. They can also provide an interface between Multiservice Switch nodes within a private network.

Supported features include:

- frame relay to ATM interworking applications, as follows:
  - Network interworking allows two frame networks to connect over an ATM backbone network.
  - Service interworking allows ATM and frame relay users to interwork transparently.
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)
- IP packet forwarding in hardware, access to Multiservice Switch virtual routers (VRs), and IP tunneling
- IP encapsulation over PPP (RFC 1661) and over Frame Relay (RFC 1490)
- VR-to-VR and VCG-based IP VPNs on its PQC2.0 FPs
- virtual framers with both ends on a single FP
- up to 250 virtual frames per FP

See also “1-port STM-1Ch specifications” (page 371).

Table 179
1-port STM-1Ch specifications

Specification	Description
processor memory	128 Mbyte SDRAM
channelization	768 channels/card
network clock synchronization supported	yes
synchronization status messages supported	yes
minimum software level required	PCR2.0
FP technologies	PPC, PQC2.0

2-port STM-1 electrical ATM IP FP

The PEC for the 2-port STM-1 electrical ATM IP FP is NTNQ90. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “2-port STM-1 electrical ATM IP configuration considerations” (page 371).

For information about the characteristics of this FP, see “2-port STM-1 electrical ATM IP characteristics” (page 373).

2-port STM-1 electrical ATM IP configuration considerations

Before you begin configuring the 2-port STM-1 electrical ATM IP FP, consider the following:

- For all ATM FPs, you must link the ports to an ATM interface before they can provide any service. For more information, see the section on provisioning the AtmInterface component in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- When you add an SDH port, the system automatically creates a Path subcomponent. The system also creates an *ATMCell* component beneath the Path component.

- The 2-slot 2-port STM-1e ATM IP FP can be plugged into any pair of adjacent slots except slot 0 (zero), which must be occupied by a CP; a second CP would require slot 15 in a Multiservice Switch 7480. When configuring a 2-slot FP, only set the *cardtype* attribute of the lowest slot number of the pair.
- Up to seven 2-port STM-1e ATM IP FPs can be configured in a Multiservice Switch 7480. It is recommended that no more than five active or Main FPs (with the attribute mainCard under the component Lp) occupy the same shelf assembly. The total of two excludes any spare FPs (with the attribute spareCard).
  - — Deploying more than five active 2-port STM-1e ATM IP FPs risks affecting the shelf's capability to provide services. The amount of risk and the extent of impact depends on the engineering limitations imposed by any Multiservice Switch 7400 node and depends on all of the FPs in a shelf simultaneously bursting up to their maximum line rates. Each active port sending AAL1 CES constantly sends more than its line rate onto the backplane. Calculate the total bandwidth of all active ports to ensure that the backplane capacity is not exceeded.
- See also "2-port STM-1 electrical ATM configuration parameters" (page 372).

Table 180
2-port STM-1 electrical ATM configuration parameters

Parameter	Values
Card type <cardtype>	2pSTM1eAtm
Port type <port>	Sdh
Port number <m>	0, 1
Port configuration	B-ISDN
Clocking	local, module, line

2-port STM-1 electrical ATM IP characteristics

The 2-port STM-1 electrical ATM IP FP provides support for ATM services on Nortel Networks Multiservice Switch 7400 nodes. This FP has interoperability with the Multiservice Switch 7400 2-port STM-1 electrical 1:1 sparing panel (NTPS92AA), providing one-to-one hitless equipment protection (hot standby).

The 2-port STM-1 electrical ATM IP FP can connect to:

- STM-1 electrical customer premises network equipment
- another 2-port STM-1 electrical ATM IP FP card

Supported features include:

- ATM traffic management functions, including fair queuing and traffic shaping
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)
- VR-to-VR and VCG-based IP VPNs on its PQC 2.0 FPs

See also “2-port STM-1 electrical ATM specifications” (page 373).

Table 181
2-port STM-1 electrical ATM specifications

Specification	Description
effective data rate	149.7 Mbits/s
access mode	STM-1e
normal memory	64 Mbyte
network clock synchronization supported	yes
synchronization status messages supported	yes
minimum software level required	PCR4.2
FP technologies	PPC, AQM1.1, PQC2.0

2-port STM-1 electrical channelized CES/ATM/IMA FP

The PEC for the 2-port STM-1 electrical channelized CES/ATM/IMA FP is NTNQ91. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “2-port STM-1 electrical channelized CES/ATM/IMA configuration considerations” (page 374).

For information about the characteristics of this FP, see “2-port STM-1 electrical channelized CES/ATM/IMA characteristics” (page 375).

2-port STM-1 electrical channelized CES/ATM/IMA configuration considerations

Before you begin configuring the 2-port STM-1 electrical channelized CES/ATM/IMA FP, consider the following.

- For this FP, you must link the port to an ATM, CES, or IMA interface before they can provide any service. For more information, see the section on provisioning the AtmInterface component in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- When you add an SDH port, the system automatically creates a Vc4 subcomponent.
- Up to 57 ATMIFs can be configured per port. The ATMIF cannot be used on E1 57 to 62 (or k=3, l = 2 to 7, and m=3).
- The 2-slot 2-port STM-1e Channelized FP can be plugged into any pair of adjacent slots except slot 0 (zero), which must be occupied by a CP; a second CP would require slot 15 in a Multiservice Switch 7480. When configuring a 2-slot FP, only set the *cardtype* attribute of the lowest slot number of the pair.
- Up to seven 2-port STM-1e Channelized FPs can be configured in a Multiservice Switch 7480. It is recommended that no more than two active or Main FPs (with the attribute mainCard under the component Lp) occupy the same shelf assembly. The total of two excludes any spare FPs (with the attribute spareCard).

— Deploying more than two active 2-port STM-1e Channelized FPs risks affecting the shelf's capability to provide services. The amount of risk and the extent of impact depends on the engineering limitations imposed by any Multiservice Switch 7400 node. Calculate the total bandwidth of all active ports to ensure that the backplane capacity is not exceeded.

- The version of field programmable gate arrays (FPGAs) in the FP must match the version in the software, so an automatic check occurs whenever the CP is reloaded or the FP is reset. If a higher FPGA version is found, the FP automatically downloads it to its flash memory. It is normal for the download to take up to 15 minutes per card. The download can occur concurrently on other STM-1e Channelized FPs within the same shelf assembly, but start times and endings may vary slightly.
- See also "2-port STM-1 electrical channelized CES/ATM/IMA configuration parameters" (page 375).

Table 182
2-port STM-1 electrical channelized CES/ATM/IMA configuration parameters

Parameter	Values
Card type <cardtype>	2pSTM1eCh
Port type <port>	Sdh
Port number <m>	0, 1
Port configuration	B-ISDN
Clocking	local, module

2-port STM-1 electrical channelized CES/ATM/IMA characteristics

The 2-port STM-1 electrical channelized CES/ATM/IMA FP provides support for ATM services on Nortel Networks Multiservice Switch 7400 nodes. This FP has interoperability with the Multiservice Switch 7400 2-port STM-1 electrical 1:1 sparing panel (NTPS92AA), providing one-to-one hitless equipment protection (hot standby) for ATM, in addition to warm standby for CES and IMA.

The 2-port STM-1 electrical channelized ATM FP can connect to:

- STM-1 electrical channelized customer premise network equipment
- another 2-port STM-1 electrical channelized CES/ATM/IMA card

Supported features include:

- ATM traffic management functions, including fair queuing and traffic shaping
- Simultaneous support of multiple service types on the same FP (CES, IMA, ATM)
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also “2-port STM-1 electrical channelized CES/ATM/IMA specifications” (page 376).

Table 183
2-port STM-1 electrical channelized CES/ATM/IMA specifications

Specification	Description
effective data rate	149.7 Mbits/s
access mode	STM-1e channelized to E1
normal memory	256 Mbyte
network clock synchronization supported	yes
synchronization status messages supported	yes
minimum software level required	PCR5.2
FP technologies	PPC, AQM1.1, PQC2.0

STM-1 OSI States

The following tables contain information about STM-1 FP OSI states.

- For the 1-port STM-1Ch FP, see:
  - “STM-1 FP Sdh component state combination” (page 377)
  - “STM-1 FP Test component state combination” (page 378)
  - “STM-1 FP Vc4 component state combination” (page 380)
  - “STM-1 FP Vc12 component state combination” (page 380)
- For the 2-port STM-1 electrical ATM and 2-port STM-1 electrical channelized CES/ATM/IMA FPs, see:
  - “STM-1 FP Sdh component state combination” (page 377)
  - “STM-1 FP Test component state combination” (page 378)
  - “STM-1 Path component state combination” (page 379)

Table 184
STM-1 FP Sdh component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The *Sdh* interface is inoperable due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisAlarm • rxRfiAlarm • lcdAlarm
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes. The line input is recognized as good. Clocks are available.
Unlocked, Enabled, Busy	The *Sdh* component is in use. The *Sdh* component has one *Sts* component under it.
(Sheet 1 of 2)	

Table 184 (continued)
STM-1 FP Sdh component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Enabled, Shutting Down	A lock command is in effect against the *Sdh* component but the *Vc4* component under it is not yet suspended.
Locked, Enabled, Idle	A lock operator command is in effect. The *Sdh* component is operating in test mode (availabilityStatus: inTest).
Locked, Disabled, Idle	A lock operator command is in effect. The component is in one of the following conditions: • Left offline (availabilityStatus: offline) • Some hardware test failed (availabilityStatus: failed) • If running in test mode external factors cause errors (availabilityStatus: inTest). Bad line state and excessive line state changes are possible causes.
(Sheet 2 of 2)	

Table 185
STM-1 FP Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the *Test* component. Start test requests will be rejected.
Unlocked, Enabled, Idle	The hardware component is locked. You can perform a port and line test.
Unlocked, Enabled, Busy	The *Test* component is in use. A *Chan*, *DS1*, *E1*, *DS3*, *E3*, *V35*, *X21*, or *Sdh* component creates a *Test* component. The *Test* component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

Table 186
STM-1 Path component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The Path component is inoperable due to at least one of the following alarms: • lopAlarm • rxAisAlarm • rxRfiAlarm • signalLabelMismatch Either a bad path state or the Sonet/Sdh is disabled. If the Sonet/Sdh is disabled either Sonet/Sdh is locked or there is a bad Sonet/Sdh signal.
Unlocked, Enabled, Idle	The component is not in use. The component is waiting for a binding to an ATM interface component.
Unlocked, Enabled, Busy	The Path component is in use. The Path component services only one user (an ATM interface component) at a time.
Unlocked, Enabled, Shutting Down	A lock command is in effect against the Path component. The Path component is waiting for the ATM interface component to go into a disabled mode before it completes the lock sequence and shuts down.
Locked, Disabled, Idle	A lock operator command is in effect.

Table 187
STM-1 FP Vc4 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The *Vc4* component is inoperable due to at least one of the following alarms: • lopAlarm • rxAisAlarm • rxRfiAlarm • signalLabelMismatch Either a bad path state or the *Sdh* component is disabled. If the *Sdh* component is disabled, either the component is locked or there is a bad SDH signal.
Unlocked, Enabled, Idle	The component is not in use.
Unlocked, Enabled, Busy	The *Vc4* component is in use. The *Vc4* component services only one user at a time.
Unlocked, Enabled, Shutting Down	A lock command is in effect against the *Vc4* component. The *Vc4* component is waiting for a component to go into a disabled mode before it completes the lock sequence and shuts down.
Locked, Disabled, Idle	A lock operator command is in effect.

Table 188
STM-1 FP Vc12 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	External factors render the Vc12 component inoperable. Bad Vc12 state or one of the parent components is disabled.
Unlocked, Enabled, Idle	Not in use. Waiting for a binding to an application layer component to this component or one of the child components.
Unlocked, Enabled, Busy	The Vc*12* component is in use. The Vc12 component services only one user at a time.
(Sheet 1 of 2)	

Table 188 (continued)
STM-1 FP Vc12 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Enabled, Shutting Down	A lock command has been issued against a parent component but there is still an application layer component bound to it of to one of the child components.
Locked, Disabled, Idle	A lock or lock -force operator command is in effect. Some hardware test may have failed while trying to unlock the parent component. If running in test mode, external factors render this component inoperable.
Locked, Enabled, Idle	A lock or lock -force operator command is in effect and one of the parent components is operating in test mode.
(Sheet 2 of 2)	

STM-1 FPs standards compliance

This section lists the standards compliance for the STM-1 FPs:

- “1-port STM-1Ch FP compliance with standards” (page 382)
- “2-port STM-1 electrical FPs compliance with standards” (page 383)
- “2-port STM-1 electrical channelized CES/ATM/IMA specific compliance” (page 384)

1-port STM-1Ch FP compliance with standards

The 1-port STM-1Ch FP complies with the applicable sections of these standards

- ANSI T1.105.1995
- ANSI T1.646
- ANSI T1.231 Partial compliance
- ANSI T1E1.2/96-002
- ATM UNI Forum Standard 3.1
- BABT/TC/139
- I.432, complies with section 2 (Physical Medium at 155 520 kbit/s), complies with section 4 with the exception of section 4.2.1.2 (physical layer cells are not guaranteed to be inserted in the cell stream every 27 cells) and section 4.2.1.3 (physical layer OAM cells are not implemented)
- ITU-T G.707
- ITU-T G.708
- ITU-T G.709
- ITU-T G.782
- ITU-T G.783
- ITU-T G.813
- ITU-T G.825 with the exception of wander requirements

- ITU-T G.957

  The STM-1 single-mode FP is classified as having application code S-1.1.

- ITU-TG.958
- Telcordia GR-253-CORE, except for the optical power ratings
- TS026

2-port STM-1 electrical FPs compliance with standards

The 2-port STM-1 electrical FPs comply with the applicable sections of the following standards (exceptions where noted):

SDH
ITU-T

- G.703 (ref. [12])
- G.707 (ref. [13], replaces G.708, G.709)
  complies except for clause 9.2.2.11 Table 5 when clockingSource is set to line. This clause specifies: On receipt of MS-AIS signal "Do not use for synchronization". Because the port is disabled on receipt of an AIS signal, there is no added customer value to make this comply for line timing.

  The following optional bytes are not supported:
  E1: Orderwire
  F1: Section User Channel
  D1-D3: Section Data Communication Channel
  J1: STS Path Trace
  F2: Path User Channel
  N1: Tandem Connection Maintenance/Path Data Channel
- G.825 (ref. [17])
- I.432 ([18]):
  complies to section 2 (Physical Medium at 155 520 kbit/s)
  complies to section 4 (TC Sublayer) except:
  Section 4.2.1.2: Physical layer cells are not guaranteed to be inserted in the cell stream every 27 cells
  Section 4.2.1.3: Physical layer OAM cells are not implemented.

ATM
ATM Forum

- af-pnni-0081.000 - PNNI v1.0 Errata and PICs
- af-uni-0010.002 - ATM User-Network Interface Specification V3.1

ITU-T

- I.361 (02/99) - B-ISDN ATM layer specification
- I.363 (03/93) - B-ISDN ATM adaptation layer (AAL) specification

2-port STM-1 electrical channelized CES/ATM/IMA specific compliance

CES

- af-vfoa-0078.000 - Circuit Emulation Service Interoperability Specification Version 2

IMA 1.1

- af-phy-0086.000 - Inverse Multiplexing for ATM Specification Version 1.0
- af-phy-0086.001 - Inverse Multiplexing for ATM Specification Version 1.1

Chapter 14
TTC2M MVP-E function processor

Nortel Networks Multiservice Switch TTC2M MVP-E FP supports voice services with a maximum line speed of 2.048 Mbit/s. The configuration reference information can help you when you configure and maintain TTC2M MVP-E FPs.

For reference information about the FP, see “1-port TTC2M MVP-E FP” (page 386).

For information about OSI states, see “TTC2M MVP-E FP OSI states” (page 389).

For information about standards compliance, see “TTC2M MVP-E compliance with standards” (page 391).

For information about applications and services for this FP, see “Applications and services supported by function processors” (page 39).

1-port TTC2M MVP-E FP

The PEC for TTC2M MVP-E FP is NTNQ87.

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For information you need to configure this FP, see “1-port TTC2M MVP-E configuration considerations” (page 386).

For information about the characteristics of this FP, see “1-port TTC2M MVP-E characteristics” (page 386).

1-port TTC2M MVP-E configuration considerations

Before you begin configuring a TTC2M MVP-E FP, see “1-port TTC2M MVP-E configuration parameters” (page 386).

Table 189
1-port TTC2M MVP-E configuration parameters

Parameter	Values
Card type <cardtype>	1pTTC2mMvpe (for TTC2M MVP-E)
Port type <port>	E1
Port number <m>	0
Number of channels <p>	0 to 30
Timeslots	1 to 31
Clocking source	local, line, module

1-port TTC2M MVP-E characteristics

The TTC2M MVP-E FP may also be referred to as the One-port TTC2M Multipurpose Voice Platform enhanced on-Board ECAN or 1 P TTC2M MVP-E FP. It provides access to Nortel Networks Multiservice Switch 7400 nodes from customer equipment such as a private branch exchange (PBX), using either switched or permanent virtual circuit (SVC or PVC) connections according to the service.

The TTC2M MVP-E has one port that can process 30 channels for voice and bit transparent data services. The FP supports channel associated signaling (CAS) protocols.

The TTC2M MVP-E does not support data calls.

Supported features include a number of audio handling capabilities for both ingress and egress traffic to conserve bandwidth and ensure quality:

- internal echo cancellation. The TTC2M MVP-E FP contains a daughter card that supports internal echo cancellation according to ITU-T G.165 and G.168
- compression of voice, modem and facsimile calls using standards-based encoding algorithms
- congestion management
- suppression of idle frames during speech calls and facsimile transmissions
- detection of 2100 Hz tones (identifying modem and facsimile transmissions) and DTMF digits
- control of cell delay variation and network loss planning
- bidirectional µ-Law (North American) to A-Law (international) conversion of 64 kbit/s voice data according to ITU-T G.711
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also “1-port TTC2M MVP-E specifications” (page 387).

Table 190
1-port TTC2M MVP-E specifications

Specification	Description
effective data rate	1.920 Mbit/s
sparing supported	no
access mode	TTC2M
(Sheet 1 of 2)	

Table 190 (continued)
1-port TTC2M MVP-E specifications

Specification	Description
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC
normal memory	PEC NTNQ87, 16 Mbyte
shared memory	0.5 Mbyte
(Sheet 2 of 2)	

TTC2M MVP-E FP OSI states

The tables “E1 component state combination” (page 389), “E1 Channel (Chan) component state combination” (page 390), and “E1 Test component state combination” (page 390) contain information about TTC2M MVP-E FP OSI states.

Table 191
E1 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The E1 port is inoperable due to at least one of the following alarms: • losAlarm • lofAlarm • rxAisAlarm • multifrmLofAlarm • rxMultifrmRaiAlarm • txMultifrmRaiAlarm.
Unlocked, Enabled, Busy	The E1 component is in use.
Locked, Enabled, Idle	A lock/lock operator command is in effect. The E1 component is ready to service a user. A test is running.
Locked, Disabled, Idle	• Some hardware test failed. • The E1 component is in the locked state. • External factors render the E1 port inoperable.

Table 192
E1 Channel (Chan) component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	External factors render the Chan component inoperable because of E1 alarms.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes.
Unlocked, Enabled, Busy	The Chan component is in use. The Chan component can only service one user at a time.
Locked, Enabled, Idle	A lock operator command is in effect. The Chan component is otherwise ready to service a user. A test is running.
Locked, Disabled, Idle	Some hardware test failed or the Chan component is in the locked state.

Table 193
E1 Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Busy	The Test component is in use. An E1, or Chan component creates a Test component. The Test component services only that particular component. A test stops either when the prescribed timer expires or you issue a stop test command.

TTC2M MVP-E compliance with standards

The TTC2M MVP-E FPs comply with the applicable sections of these Japanese TTC standards:

- JJ-20-10
- JJ-20-11
- JJ-20-12

Chapter 15
V.11 function processor

Nortel Networks Multiservice Switch V.11 function processor (FP) supports frame-relay services. The V.11 supports line rates from 9.6 kbit/s to 7.68 Mbit/s for data circuit equipment (DCE) mode and from 9.6 Kbit/s to 8.4 Mbit/s for data termination equipment (DTE) mode. The configuration reference information can help you when you configure and maintain V.11 FPs.

For reference information about this FP, see “8-port V.11 FP” (page 394).

For information about OSI states, see “8-port V.11 FP OSI states” (page 398).

For information about standards compliance, see “8-port V.11 compliance with standards” (page 399).

For information about applications and services for this FP, see “Applications and services supported by function processors” (page 39).

8-port V.11 FP

The PECs for the 8-port V.11 FP are:

- NTNQ12
- NTNQ13

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For information you need to configure this FP, see “8-port V.11 configuration considerations” (page 394).

For information about the characteristics of this FP, see “8-port V.11 characteristics” (page 396).

8-port V.11 configuration considerations

Before beginning to configure an 8-port V.11 FP, consider the following:

- Port configuration is DCE or DTE in groups of four; that is, ports 0 to 3 and ports 4 to 7. The configuration is determined by the type of connection at the termination panel port
- The speed of all ports in use must add up to less than (not equal to) 20Mbit/s. See “V.11 high speed configuration considerations” (page 396).
- The 8-port V.11 FP supports V-port robustness speeds of 1 024 000 and 2 048 000 in addition to the common speeds within the configurable ranges. In some configurations where common speeds are combined with robustness speeds for ports on the same FP, there may be conflicts for the following speeds:
  - 1 920 000
  - 1 280 000
  - 960 000
  - 768 000
  - 640 000
  - 512 000

  - 384 000
  - 320 000
  - 256 000
  - 128 000
  - 64 000

- Configuration of ports for lines speeds and link mode must follow these rules. If you do not follow these configuration rules, the check prov fails and the system lists the conflicting speeds:
  - all ports within a group (ports 0 to 3 for group 1 and ports 4 to 7 for group 2) are configured as either DCE (that is, DCE is supplying the line clock) or DTE through the *linkMode* attribute; one group can be DCE and the other DTE, or both groups can be of the same link mode
  - if the ports in a group are DTE, you can configure any common or robustness line speed with no conflicts occurring
  - if the ports in a group are DCE, the ports can be any speed except one of the conflicting speeds noted above
- A group of ports in DCE mode can be configured to:
  - use clocks generated by one of two phase-locked loops (PLLs), with a configurable clock rate of exactly 9600, 19200, 32000, 48000, 56000, 64000, 112000, 128000, 168000, 192000, 224000, 256000, 320000, 336000, 384000, 448000, 512000, 640000, 672000, 768000, 960000, 1024000, 1280000, 1344000, 1536000, 1920000, 2048000, 2560000, 3840000, 7680000. If the entered value is different from the values listed above, the next highest value in the list is selected.
- See also “8-port V.11 configuration parameters” (page 396).

Table 194
8-port V.11 configuration parameters

Parameter	Values
Card type <cardtype>	V11
Port type <port>	X21
Port number <m>	0-7

V.11 high speed configuration considerations

The maximum supported speed for each port is 7.68 Mbit/s. If you use all eight ports, calculate the upper speed limitation by summing all the speeds for the ports and ensure this sum is less than 20 Mbit/s. This characterization is at the interface level, not the protocol level. The speeds for each protocol have not been altered.

At speeds above 1.92 Mbit/s, the network sync mechanism does not synchronize to the clock provided. Without the network clock sync capacity, clocking for network sync must be received on a different interface to the module, or services requiring network clock sync cannot be used.

There are cabling constraints at high speeds. Refer to NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description* if you are making V.11 cables.

8-port V.11 characteristics

The 8-port V.11 may also be referred to as the 8 P V11 or the Eight-port V.11 FP. It supports frame relay services on Nortel Networks Multiservice Switch 7400 nodes for Multiservice Switch-to-Multiservice Switch trunking. Each port can support data circuit (DCE) or data terminal (DTE) equipment. This FP is available in standard or premium format. Use the premium format for high capacity frame relay applications.

Supported features include:

- high-level data link control (HDLC)-framed protocols such as frame relay, DPN-100 trunks, or network lines

- transparent data requirements, such as bit and HDLC transparent data services\
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also "8-port V.11 specifications" (page 397).

Table 195
8-port V.11 specifications

Specification	Description
effective data rate	8.0 DTE 7.68 DCE
sparing supported	no
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC
fast RAM	not applicable
normal memory	• PEC NTNQ12 -16 Mbyte • PEC NTNQ13 - 32 Mbyte
shared memory	0.5 Mbyte

8-port V.11 FP OSI states

The tables “X21 component state combination” (page 398) and “V.11 Test component state combination” (page 398) contain information about 8-port V.11 FP OSI states.

Table 196
X21 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The X21 interface is inoperable. Bad line state and excessive line state changes are possible causes. Lack of clocks will also disable the port.
Unlocked, Enabled, Idle	The component is not in use. Provisioning or binding processes are possible causes. The line input is good. Clocks are available.
Unlocked, Enabled, Busy	The X21 component is in use. The X21 component services only one user (a Framer component) at a time.
Locked, Enabled, Idle	A port and line test is in progress.
Locked, Disabled, Idle	Some hardware test failed or the X21 component is in the locked state. A lock operator command is in effect.

Table 197
V.11 Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Busy	The Test component is in use. A V35, X21, DS1, E1, CHAN, DS3, or E3 component creates a Test component. The test component services only the component that created it. A test stops either when the prescribed timer expires or you issue a stop test command.

8-port V.11 compliance with standards

The V.11 FP conforms to ITU-T V.11 recommendations.

Chapter 16
V.35 function processor

Nortel Networks Multiservice Switch V.35 function processor (FP) supports frame-relay services. The V.35 supports line rates from 9.6 kbit/s to 3.84 Mbit/s for data circuit equipment (DCE) mode and from 9.6 kbit/s to 4.0 Mbit/s for data termination equipment (DTE) mode. The configuration reference information can help you when you configure and maintain V.35 FPs.

For reference information about this FP, see “8-port V.35 FP” (page 402).

For information about OSI states, see “8-port V.35 OSI states” (page 406).

For information about standards compliance, see “8-port V.35 compliance with standards” (page 407).

For information about applications and services for this FP, see “Applications and services supported by function processors” (page 39).

8-port V.35 FP

The PECs for the 8-port V.35 FP are:

- NTNQ10
- NTNQ11

For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For information you need to configure this FP, see “8-port V.35 FP configuration considerations” (page 402).

For information about the characteristics of this FP, see “8-port V.35 characteristics” (page 404).

8-port V.35 FP configuration considerations

Before beginning to configure an 8-port V.35 FP, consider the following:

- Port configuration is DCE or DTE in groups of four; that is, ports 0 to 3 and ports 4 to 7. The configuration is determined by the type of connection at the termination panel port
- Each port supports a maximum speed of 3.84 Mbit/s. At speeds above 1.92 Mbit/s, the network sync mechanism does not sync to the clock provided. Without the network clock sync capacity, clocking for network sync must be received on a different interface to the module, or services requiring network clock sync cannot be used.
- There are cabling constraints at high speeds. See NN10600-170 *Nortel Networks Multiservice Switch 7400 Hardware Description* if you are making V.35 cables.
- The 8-port V.35 FP supports V-port robustness speeds of 1 024 000 and 2 048 000 in addition to the common speeds within the configurable ranges. In some configurations where common speeds are combined with robustness speeds for ports on the same FP, there may be conflicts for the following speeds:
  - 1 920 000
  - 1 280 000

- 960 000
- 768 000
- 640 000
- 512 000
- 384 000
- 320 000
- 256 000
- 128 000
- 64 000

- Configuration of ports for lines speeds and link mode must follow these rules. If you do not follow these configuration rules, the check prov fails and the system lists the conflicting speeds:
  - all ports within a group (ports 0 to 3 for group 1 and ports 4 to 7 for group 2) are configured as either DCE (that is, DCE is supplying the line clock) or DTE through the *linkMode* attribute; one group can be DCE and the other DTE, or both groups can be of the same link mode
  - if the ports in a group are DTE, you can configure any common or robustness line speed with no conflicts occurring
  - if the ports in a group are DCE, the ports can be any speed except one of the conflicting speeds noted above
- A group of ports in DCE mode can be configured to:
  - use clocks generated by one of two phase-locked loops (PLLs), with a provisionable clock rate of exactly 9600, 19200, 32000, 48000, 56000, 64000, 112000, 128000, 168000, 192000, 224000, 256000, 320000, 336000, 384000, 448000, 512000, 640000, 672000, 768000, 960000, 1024000, 1280000,1344000, 1536000, 1920000, 2048000, 2560000, 3840000. If the entered value is different from the values listed above, the next highest value in the list is selected.
- See also “8-port V.35 configuration parameters” (page 404).

Table 198
8-port V.35 configuration parameters

Parameter	Values
Card type <cardtype>	V35
Port type <port>	V35
Port number <m>	0-7

8-port V.35 characteristics

The 8-port V.35 FP may also be referred to as the may also be referred to as the 8 P V35 or the eight-port V.35 FP. It supports frame relay services on Nortel Networks Multiservice Switch 7400 nodes for Multiservice Switch-to-Multiservice Switch trunking. Each port can support data circuit (DCE) or data terminal (DTE) equipment. This FP is available in standard or premium format. Use the premium format for high capacity frame relay applications.

Supported features include:

- high-level data link control (HDLC)-framed protocols such as frame relay, DPN-100 trunks, or network lines
- transparent data requirements, such as bit and HDLC transparent data services
- processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS)

See also “8-port V.35 specifications” (page 404).

Table 199
8-port V.35 specifications

Specification	Description
effective data rate	4.0 DTE 3.84 DCE
sparing supported	no
(Sheet 1 of 2)	

Table 199 (continued)
8-port V.35 specifications

Specification	Description
network clock synchronization supported	yes. Reversion enhancement is not supported.
minimum software level required	not applicable
FP technologies	PM2, SBIC
fast RAM	not applicable
normal memory	• PEC NTNQ10 -16 Mbyte • PEC NTNQ11 - 32 Mbyte
shared memory	0.5 Mbyte
(Sheet 2 of 2)	

8-port V.35 OSI states

The tables "V35 component state combination" (page 406) and "V.35 Test component state combination" (page 406) contain information about the 8-port V.35 FP OSI states.

Table 200
V35 component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The V.35 port is inoperable. Bad line state and excessive line state changes are possible causes. Lack of clocks will also disable the port.
Unlocked, Enabled, Idle	The component is not in use. Waiting for a binding to a Framer component is a possible cause. The line input is good. Clocks are available.
Unlocked, Enabled, Busy	The V35 component is in use. The V35 component services only one user (a FRAMER component) at a time.
Locked, Enabled, Idle	A port and line test is in progress.
Locked, Disabled, Idle	Some hardware test failed or the V35 component is in the locked state. A lock operator command is in effect.

Table 201
V.35 Test component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	The hardware component is unlocked. No resource is available to the Test component. Start test requests will be rejected.
Unlocked, Enabled, Busy	The Test component is in use. A V35, X21, DS1, E1, CHAN, DS3, or E3 component creates a Test component. The Test component services only the component that created it. A test stops either when the prescribed timer expires or you issue a stop test command.

8-port V.35 compliance with standards

The V.35 FP conforms to ITU-T V.35 Recommendations.

Chapter 17
Voice services processors

Nortel Networks Multiservice Switch voice services processors (VSPs) support Media Gateway services. The configuration reference information can help you when you configure and maintain VSPs.

Navigate to the reference information about each VSP using the table “Multiservice Switch voice services processors” (page 410).

For information about OSI states, see “Voice services processor OSI states” (page 428).

For information about standards compliance, see “Voice services processors standards compliance” (page 429).

For information about applications and services for these FPs, see “Applications and services supported by function processors” (page 39).

Table 202
Multiservice Switch voice services processors

Type	FPs
Media Gateway	

Common VSP characteristics

The VSP FP card (also known as VSP1) supports non-switched voice gateway services only and does not support switched voice gateway services. The VSP2 FP card supports both switched or non-switched voice gateway services. The VSP3 and VSP3-o FP cards support switched voice gateway services only and do not support non-switched voice gateway services.Voice services include support for pulse code modulation (PCM) voice, adaptive differential pulse code modulation (ADPCM) voice compression, echo cancellation, and silence suppression.

For non-switched Media Gateway over ATM, the VSP1 FP card provides voice and voice band data processing functionality between an ATM and a TDM data path. For switched and non-switched Media Gateway over ATM and switched Media Gateway over IP, the VSP2 FP card provides voice and voice band data processing functionality between a TDM data path and an ATM or IP network. For switched Media Gateway over ATM or IP, the VSP3 FP card provide voice and voice band data processing functionality between a TDM data path and an ATM or IP network.

For switched Media Gateway over ATM, the VSP3-o FP card provide voice and voice band data processing functionality between a TDM data path and an ATM network.

All VSP-type FPs support processing and transmission of synchronization status messages (SSM) within the network clock synchronization system (NCS).

The VSPs contain modules to handle the voice and voice band data and modules to handle signalling.

- For the VSP and VSP2, one or more voice processing modules (VPM) handle the voice and voice band data.
- For the VSP3, a single digital signal processor (DSP) handles the voice and voice band data. The VSP3-o also uses DSPs to handle the voice and voice band data.
- Signalling for all VSPs is handled by a signal processing module (SPM). The SPM processes CAS and CCS information (support for signaling types depends on the software capabilities) and provides the capability for supporting supplementary services.

All VSPs use virtual ports. In addition, the VSP3 can be configured to use the two gigabit Ethernet ports on its faceplate to interface with the IP network. The VSP, VSP2, and VSP3-o have no gigabit Ethernet ports on the faceplate to interface with the IP network.

Voice services processor (VSP)

The VSP FP card is supported in Media Gateway shelves in Nortel Networks Multiservice Switch 7400 nodes. The VSP FP card only supports non-switched voice gateway services and does not support switched voice gateway services. There are three product engineering codes (PEC) for the VSP depending on the number of voice processing modules (VPM). The PEC of the VSP FP card can be NTFN87 (with 9 VPMs), NT0494 (with 6 VPMs), or NT0492 (with 3 VPMs). The VSP FP card has a software description of *12mVspAal*. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “VSP configuration considerations” (page 412).

For information about the characteristics of this FP, see “VSP characteristics” (page 413).

VSP configuration considerations

Before you begin configuring the VSP, consider the following:

- There are three versions of the VSP, based on the number of VPMs in the hardware. All versions use the same PEC and card type.
- To spare all of the connections for a given VSP, you must always spare it with the same version VSP. To verify that the number of VPMs on the spare FP matches the active FP, you can display and compare the values for the *insertedModuleType* attributes. To determine the number of VPMs on the VSP, display the operational attributes of the *PModule* component:

  `display lp/<n> Vsp PModule/*`

  where <n> is the LP number associated with the FP.

  The value of the *insertedModuleType* attribute for each PModule component specifies the actual hardware on the VSP and can be vpm, spm, or none. To ensure successful sparing, the settings for both FPs must match.

- The maximum number of timeslots you can configure when the VSP is used for non-switched Media Gateway is 192/240, 384/480, or 576/720 timeslots.
- To configure a VSP, set the *cardType* attribute first and then link an logical processor (LP) to the slot on the shelf before you add a port. When you add a port, the system automatically provisions all of the *PModule* subcomponents. The system also sets the *moduleType* attribute for each *PModule* component.
- On the version of the FP that supports 576/720 timeslots and contains nine VPMs and one SPM, the setting for each *moduleType* attribute matches the placement of hardware modules. If you are configuring a VSP that contains fewer VPMs, you must change the configuration to correctly reflect the number of VPMs and their positions on the FP. For the appropriate values for each version, see “Settings for PModule components” (page 413).
- See also “VSP configuration parameters” (page 413).

Table 203
Settings for PModule components

moduleType attribute setting	PModule components 3 VPM version	PModule components 6 VPM version	PModule components 9 VPM version
none	1, 2, 7 to 12	1, 2, 10 to 12	1, 2
spm	3	3	3
vpm	4 to 6	4 to 9	4 to 12

Table 204
VSP configuration parameters

Parameter	Values
Card type <cardtype>	12mVspAal
Port type <port>	VSP

VSP characteristics

The VSP supports Media Gateway services for Nortel Networks Multiservice Switch 7400 nodes. It is a 2-slot FP that may also be referred to as the ATM Voice Services FP. The VSP transports bearer traffic using AAL2. Transport media for signaling traffic depends on the type of voice gateway service.

See also “VSP specifications” (page 413).

Table 205
VSP specifications

Specification	Description
sparing supported	• one-for-one • one-for-n (where n is 1 to 4) • one-for-n sparing behavior enhancement
minimum software level required	not applicable

Voice services processor 2 (VSP2)

The VSP2 FP card is supported in Media Gateway shelves in Nortel Networks Multiservice Switch 7400, Multiservice Switch 15000, and Multiservice Switch 20000 nodes.

The PECs for the VSP2 are:

- NT0482 for Multiservice Switch 7400 nodes
- NTHW87 for Multiservice Switch 15000 and Multiservice Switch 20000 nodes

The VSP2 FP card has a software description of *Vsp2*. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “VSP2 configuration considerations” (page 414).

For information about the characteristics of this FP, see “VSP2 characteristics” (page 415).

VSP2 configuration considerations

Before you begin configuring a VSP2, consider the following:

- The maximum number of timeslots that can be configured for non-switched Media Gateway over ATM and for switched Media Gateway over ATM without digit collection (feature vgsATM) is:
  - Nortel Networks Multiservice Switch 7400 - 1008 timeslots
  - Multiservice Switch 15000 or Multiservice Switch 20000 - 1120 timeslots
- The maximum number of timeslots that can be configured for switched Media Gateway over ATM with digit collection (feature vgsATMDC) is:
  - Multiservice Switch 7400 - 864 timeslots
  - for Multiservice Switch 15000 or Multiservice Switch 20000 - 960 timeslots

- The maximum number of timeslots that can be configured for switched voice over IP is:
  - Multiservice Switch 7400 - 1008 timeslots
  - Multiservice Switch 15000 or Multiservice Switch 20000 - 1120 timeslots
- To configure a VSP2, set the *cardType* attribute first and then link an LP to the slot on the shelf before you add a port. When you add a port, the system automatically provisions all of the *PModule* subcomponents. The system also sets the *moduleType* attribute for each *PModule* component.

  The setting for each *moduleType* attribute matches the placement of hardware modules.

- See also “VSP2 configuration parameters” (page 415).

Table 206
VSP2 configuration parameters

Parameter	Values
Card type <cardtype>	VSP2
Port type <port>	VSP

VSP2 characteristics

The VSP2 supports Media Gateway services on Nortel Networks Multiservice Switch 7400, Multiservice Switch 15000, and Multiservice Switch 20000 nodes. The VSP2 is a 2-slot FP on Multiservice Switch 7400, but is only a single slot FP on Multiservice Switch 15000 and Multiservice Switch 20000 nodes

For switched voice over ATM, the VSP2 provides voice and voice band data processing functionality between an ATM and a TDM data path. For switched voice over IP, the VSP2 provides connections between a TDM network and an IP network.

For switched VoATM (*VgsAtm* and *VgsAtmG729* feature packages), the VSP2 FP transports bearer traffic using AAL2. The transport media for signaling traffic in VoATM depends on the type of voice gateway service.

For VoIp (*VgsIp* and *VgsIpG729* feature packages), the VSP2 FP transports bearer traffic using AAL5 unless virtual router (VR) is used. Transport media for signaling traffic depends on the type of voice gateway service.

Supported features include:

- virtual router (VR) interworking using an VR access point (AP) for switched Media Gateway using IP (VoIP) on Multiservice Switch 15000 nodes
- one or two VRs on a single VSP2 FP card
- hardware-assisted IP forwarding
- interworking with ATM IP FP cards
- hot equipment protection (HEP) on Multiservice Switch 15000 and Multiservice Switch 20000 Media Gateway shelf using a 1:1 sparing configuration of the VSP2 FP. In a 1:1 sparing configuration:
    - one card is active and the other card is standby
- hitless software migration (HSM) and hot equipment protection (HEP) on Multiservice Switch 15000 Media Gateway shelf when used with the 4-port OC-3/STM-1Ch TDM/CES FP (software description of *4pOC3ChSmIr*) and ATM FPs that are carrier grade compliant
- ASPEN version 2.1 protocol or H.248 version 1.0 protocol for connection control between the Media Gateway and the media gateway controller (MGC)
- interworking with the 4-port gigabit Ethernet FP card (4pGe, NTHW49)
- VSP HEP when used with VR access point (VrAp) and the 4-port gigabit Ethernet FP card (4pGe, NTHW49)

See also “VSP2 specifications” (page 417).

Table 207
VSP2 specifications

Specification	Description
sparing supported	• one-for-one (supports HEP) • one-for-n (where n is 1 to 4 for Multiservice Switch 7400 nodes, and n is 1 to 13 for Multiservice Switch 15000 and Multiservice Switch 20000 nodes) (does not support HEP) • one-for-n sparing behavior enhancement (does not support HEP)
minimum software level required	not applicable

Voice services processor 3 (VSP3)

The voice services processor 3 (VSP3) FP card is supported in Media Gateway shelves in Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes. The VSP3 FP card has a PEC of NTHW84 and a software description of *2pGeMmSrVsp3*. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “VSP3 configuration considerations” (page 417).

For information about the characteristics of this FP, see “VSP3 characteristics” (page 418).

VSP3 configuration considerations

Before you begin configuring a VSP3, consider the following:

- When configured to use the two gigabit Ethernet ports on its faceplate, the VSP3 FP requires external cabling
- To configure a VSP3, set the *cardType* attribute first, add the *logicalProcessorType* and set the feature list, add the *logicalProcessor*, and then link an LP to the slot on the shelf before you add a port. When

you add a port, the system automatically provisions all of the *PModule* subcomponents. The system also sets the *moduleType* attribute for each *PModule* component.

The setting for each *moduleType* attribute matches the placement of hardware modules.

- The VSP3 supports 2016 timeslots of G.711 voice call compression and 1512 timeslots of G.729 Annex A and B voice call compression on Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes.
- See also “VSP3 configuration parameters” (page 418).

Table 208
VSP3 configuration parameters

Parameter	Values
Card type <cardtype>	2pGeMmSrVsp3
Port type <port>	VSP

VSP3 characteristics

The VSP3 supports switched Media Gateway services for Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes. It is a single slot FP.

The VSP3 FP supports voice processing (voice, voice band data (VBD), and facsimile/modem) and call control processing. For switched voice services, the VSP3 provides connections between a TDM network and a packet network.

Supported features include:

- switched Media Gateway voice services such as pulse code modulation (PCM) voice, echo cancellation, and silence suppression
- dual tone multifrequency (DTMF) relay for switched Media Gateway using IP functionality

- fax relay via ITU-T recommendation T.38 for switched Media Gateway using IP functionality
- voice band data (VBD) terminals for switched Media Gateway using IP functionality
- virtual router (VR) interworking using an VR access point (AP) for switched Media Gateway using IP (VoIP) on Multiservice Switch 15000 nodes
- supports all existing VSP1 and VSP2 switched VoAAL2 features
- support of state change signaling in accordance with ITU-T recommendation I.366.2
- voice-band connection admission control (VCAC)
- 128 ms echo cancellation
- DTMF Relay support as per I.366.2 Annex K
- one or two VRs on a single VSP3 FP card
- hardware-assisted IP forwarding
- interworking with ATM IP FP cards
- hot equipment protection (HEP) on Multiservice Switch 15000 Media Gateway shelf using a 1:1 sparing configuration of the VSP3 FP
- hitless software migration (HSM) and hot equipment protection (HEP) on Multiservice Switch 15000 Media Gateway shelf when used with the 4-port OC-3/STM-1Ch TDM/CES FP (software description of *4pOC3ChSmIr*) and ATM FP that are carrier grade compliant
- ASPEN version 2.1 protocol or H.248 version 1.0 protocol for connection control between the Media Gateway and the MGC
- interworking with the 4-port gigabit Ethernet FP card (4pGe, NTHW49)
- VSP HEP when used with VR access point (VrAp) and the 4-port gigabit Ethernet FP card (4pGe, NTHW49)
- 5 and 30-Minute performance measurement

See also:

- “VSP3 support of text telephony terminals” (page 420)

- “VSP3 specifications” (page 420)

VSP3 support of text telephony terminals

The following text telephony terminals are supported on the VSP3 FP for Media Gateway using switched ATM or IP functionality when the peer gateway supports the G.711 voice compression. Media Gateway processes the call as voice band data (VBD).

- V.18 text telephones
- V.21 text telephones
- Bell 103 text telephones
- DTMF text telephones

Baudot and European deaf telephone (EDT) text telephony terminals are also supported on the VSP3 FP for Media Gateway using IP functionality when the peer gateway supports the G.711 voice compression and if the current voice codec is not G.711 voice compression. Calls are processed as voice band data (VBD) for these conditions. If these conditions are not present, Media Gateway processes the call as a voice call.

V.23 text telephony terminals are not fully supported on the VSP3 FP for Media Gateway using IP functionality.

Table 209
VSP3 specifications

Specification	Description
sparing supported	• one-for-one (supports HEP) • one-for-n (where n is 1 to 13) (does not support HEP) • one-for-n sparing behavior enhancement (does not support HEP)

Voice services processor 3 with optical TDM interface (VSP3-o)

The voice services processor 3 with optical TDM interface (VSP3-o) FP card is supported in Media Gateway (MG) shelves in Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes. The VSP3-o FP card has a product engineering code (PEC) of NTHW77 and a software description of *2pOc3ChSmIrVsp3*. For a full list of PECs (including vintages) for supported FPs, see *Nortel Networks Multiservice Switch Release Notes*.

For the information you need to configure this FP, see “VSP3-o configuration considerations” (page 421).

For information about the characteristics of this FP, see “VSP3-o characteristics” (page 422).

VSP3-o configuration considerations

Before you begin configuring a VSP3-o FP card, consider the following:

- Only one of the two OC-3/STM-1 TDM ports (ports 0 and 1) on the faceplate of the VSP3-o FP card is an active port. Port 0 is the active port. This active port 0 on the faceplate requires external cabling. TDM FP cards cannot connect internally over the backplane to the VSP3-o FP card. Other VSP2, VSP3, or VSP3-o FP cards cannot connect internally over the backplane to the active port 0 of the VSP3-o FP card.
- The VSP3-o FP card supports a maximum of 2016 timeslots of G.711, G.726 or G.729 Annex A and B voice call compression on Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes. Codec types can be mixed on a single VSP3-o (note that there are restrictions on which codecs can be used for VoAAL2 and VoIP in this release of VSP3-o. The VSP3-o FP card supports G.711 and G.729 Annex A and B for switched VoIP. The VSP3-o FP card supports G.711, G.726, and G.729 Annex A and B for switched VoATM.
- See also “VSP3-o configuration parameters” (page 422).

Table 210
VSP3-o configuration parameters

Parameter	Values
Card type <cardtype>	2pOc3ChSmIrVsp3
Port type <port>	SDH or SONET

VSP3-o characteristics

The VSP3-o FP supports switched Media Gateway (MG) services for Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes. Non-switched MG services are not supported. The VSP3-o FP is not supported on Multiservice Switch 7400 nodes. The VSP3-o FP is a single slot FP.

The VSP3-o FP supports voice processing (voice, voice band data (VBD), and facsimile/modem) and call control processing. For switched voice services, the VSP3-o provides connections between a TDM network and a packet network.

Only one of the two OC-3/STM-1 optical TDM ports (ports 0 and 1) on the faceplate of the VSP3-o FP card is supported. Port 0 is the supported port. This optical port 0 of the VSP3-o FP behaves the same as the 4-port OC-3/STM-1Ch TDM/CES FP card (configured as a TDM card for Media Gateway) except where noted in this chapter. See “4-port OC-3/STM-1Ch TDM/CES FP” (page 287).

For VoIP (*VgsIp* feature package), the VSP3-o FP card can use virtual router (VR) interworking functionality by provisioning component *VrAp*. The VR interworking functionality supports the routing of traffic from a VSP3-o FP card to an Internet Protocol (IP) network through an ATM FP card and/or a 4-port gigabit Ethernet FP card that is on the same Multiservice Switch shelf as the VSP3-o FP card. If VR interworking functionality is not used, the VSP3-o FP card only needs an ATM FP card in the same Multiservice Switch shelf. When VR interworking functionality is not provisioned, the following connections are supported by the VSP3-o FP card:

- soft permanent virtual circuits (SPVC) connections by provisioning component SpvcAp

- endpoint-provisioned switched virtual circuits (SVC) connections by provisioning components Aap or Pap

For VoATM (*VgsAtm* feature package), the following media path connections are supported by the VSP3-o FP card:

- SPVC connections by provisioning component SpvcAp
- endpoint-provisioned SVC connections by provisioning components Aap or Pap
- dynamic SVC connections by provisioning component Aal2SvcService

Supported features of the VSP3-o FP card include:

- switched MG using IP functionality and switched MG using ATM functionality
- non-switched MG is not supported
- switched MG voice services such as pulse code modulation (PCM), G.711 call compression, voice, echo cancellation, and silence suppression
- dual tone multifrequency (DTMF) relay for switched MG using IP functionality per document RFC 2833 of the Internet Engineering Task Force (IETF)
- dual tone multifrequency (DTMF) relay for switched MG using ATM functionality (VoAAL2)
- tone generation for the TDM side (packet-side tone generation is not supported)
- continuity testing with the public switched telephone network (PSTN)
- fax relay via ITU-T recommendation T.38 for switched MG using IP functionality (fax relay is not supported for switched VoAAL2)
- per-trunk signaling (PTS)
- timeslot relay (exception: timeslot relay is not supported for trunks that are PTS provisioned)
- voice band data (VBD) terminals for switched MG using ATM or IP functionality

- call compression per G.711, G.726, and G.729 annex A and B standards (G.726 is not supported for switched VoIP)
- 128 ms echo cancellation
- voice activity detector (VAD)
- G.711 packet loss concealment (PLC)
- DTMF Relay support as per I.366.2 Annex K
- text telephony terminals for switched MG using ATM or IP functionality
- virtual router (VR) interworking using component *VirtualRouterAccessPoint (VrAp)* for the bearer path and control path in switched MG using IP functionality on Multiservice Switch 15000 and Multiservice Switch 20000 nodes
- VR interworking using component *VirtualRouterAccessPoint (VrAp)* for the control path in switched MG using ATM functionality (VoAAL2) on Multiservice Switch 15000 and Multiservice Switch 20000 nodes
- interworking with VSP2 FP and VSP3 FP cards on Multiservice Switch 15000 and Multiservice Switch 20000 nodes
- primary rate interface (PRI) backhaul
- supports all existing switched VoAAL2 features of the VSP/VSP2/VSP3 FPs
- support of state change signaling in accordance with ITU-T recommendation I.366.2
- supports one or two VRs on a single VSP3-o FP card
- hardware-assisted IP forwarding
- interworking with ATM FP cards
- adjacent card automatic protection configuration (note: the lower slot number of the adjacent VSP3-o FP cards must be an even number)
- H.248 version 1.0 protocol for connection control between the MG and the MGC

- hot equipment protection (HEP) on a Multiservice Switch 15000 or Multiservice Switch 20000 Media Gateway shelf using a 1 + 1 sparing configuration for the TDM ports and using dual LP equipment protection (DLEP) sparing through the *Vsp* subcomponent of component *DualLpEquipmenyProtection (Dlep)*
- hitless software migration (HSM) and hot equipment protection (HEP) on the Multiservice Switch 15000 or Multiservice Switch 20000 Media Gateway shelf when used with ATM FP cards that are carrier grade compliant
- supports only one of the two OC-3/STM-1 TDM ports (port 0) on the faceplate of the VSP3-o FP card
- supports all the detection functionality for TDM fault conditions of the 4-port OC-3/STM-1Ch TDM/CES FP
- supports all the TDM data collection system (DCS) alarms that the 4-port OC-3/STM-1Ch TDM/CES FP card also supports
- supports the TDM DCS alarms at virtual container/virtual tributary (VC/VT) levels
- shelf synchronization based on clock signal extracted from the OC-3/STM-1 TDM port (synchronous optical network (SONET) uses clock signals at the OC-3 level and synchronous digital hierarchy (SDH) uses clock signals at the STM-1 level)
- interworking with the 4-port gigabit Ethernet FP card (4pGe, NTHW49)
- VSP HEP when used with VR access point (VrAp) and the 4-port gigabit Ethernet FP card (4pGe, NTHW49)
- 5 and 30-Minute performance measurement

See also:

- “VSP3-o support of text telephony terminals” (page 426).
- “VSP3-o specifications” (page 426)

VSP3-o support of text telephony terminals

The following text telephony terminals are supported on the VSP3-o FP for Media Gateway using switched ATM or IP functionality when the peer gateway supports the G.711 voice compression. Media Gateway processes the call as voice band data (VBD).

- V.18 text telephones
- V.21 text telephones
- Bell 103 text telephones
- DTMF text telephones

Baudot and European deaf telephone (EDT) text telephony terminals are also supported on the VSP3 FP for Media Gateway using IP functionality when the peer gateway supports the G.711 voice compression and if the current voice codec is not G.711 voice compression. Calls are processed as voice band data (VBD) for these conditions. If these conditions are not present, Media Gateway processes the call as a voice call.

V.23 text telephony terminals are not fully supported on the VSP3-o FP for Media Gateway using IP functionality.

Table 211
VSP3-o specifications

Specification	Description
sparing supported	• one-plus-one (where cards are in adjacent even/odd-numbered slots)
network clock synchronization supported	• OC-3 level clock • STM-1 level clock • external building-integrated timing supply (BITS) • free-running
(Sheet 1 of 2)	

Table 211 (continued)
VSP3-o specifications

Specification	Description
switched VoIP TDM-to-packet using G.711 packets	2016 connections
switched VoAAL2 TDM-to-packet using G.711, G726, and/or G.729 Annex A and B packets	2016 connections (switched VoIP and switched VoAAL2 are mutually exclusive)
switched VoAAL2 packet-to-packet	not supported
virtual circuits (VC)	4096 VCs maximum
backhaul channels	• 84 channels of primary rate interface (PRI) when provisioned for OC-3/DS1 • 63 channels of PRI when provisioned for STM-1/E1
tones for TDM side	2016 connections
tones for packet side	not supported
time slot relay	84 connections
echo cancellation	128 ms nominal tail length
(Sheet 2 of 2)	

Voice services processor OSI states

This section lists the following OSI state tables for all VSP FPs:

- "Vsp component state combination" (page 428)
- "PModule component state combination" (page 428)

Table 212
Vsp component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	There has been a hardware failure on the processor card.
Unlocked, Enabled, Idle	This transitional state occurs before the component becomes active.
Unlocked, Enabled, Active	The component is operational. The processor card can carry traffic.
Locked, Enabled, Idle	This transitional state occurs when an operator locks the component. This state precedes the Locked, Disabled, Idle state.
Locked, Disabled, Idle	The component has been locked by an operator.

Table 213
PModule component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Disabled, Idle	There has been a hardware failure on the processor card.
Unlocked, Enabled, Idle	No services have been allocated to the component.
Unlocked, Enabled, Active	At least one service has been allocated to the component.

Voice services processors standards compliance

This section lists the standards compliance for the VSP FPs:

- "VSP compliance with standards" (page 429)
- "VSP2 compliance with standards" (page 429)
- "VSP3 compliance with standards" (page 430)
- "VSP3-o compliance with standards" (page 431)

VSP compliance with standards

The VSP complies with the following standards:

- ITU-T G.711
- ITU-T G.164
- ITU-T G.165
- ITU-T G.168
- ITU-T G.726; 40 kbit/s and 16 kbit/s compression modes are not implemented
- ITU-T G.729 Annex A and B. Compliant with voice activity detection (VAD) and voice compression only.
- ITU-T Recommendation T.30
- ITU-T Recommendation 1.363.2
- BTD-VTOA LLTAAL2-0.01 (ATM Forum Draft)
- AT&T Technical Report 41459
- AT&T Technical Report 41458

Note: Either the ITU-T G.726 standard or G.729 Annex A and B standard can be used with non-switched Media Gateway.

VSP2 compliance with standards

The VSP2 complies with the following standards:

- ITU-T G.711
- ITU-T G.164

- ITU-T G.165
- ITU-T G.168
- ITU-T G.726; 40 kbit/s and 16 kbit/s compression modes are not implemented
- ITU-T G.729 Annex A and B. Compliant with voice activity detection (VAD) and voice compression only.
- ITU-T Recommendation T.30
- ITU-T Recommendation 1.363.2
- BTD-VTOA LLTAAL2-0.01 (ATM Forum Draft)
- AT&T Technical Report 41459
- AT&T Technical Report 41458

VSP3 compliance with standards

The VSP3 complies with the following standards

- ITU-T G.711 Appendix I (packet loss concealment)
- ITU-T G.165
- ITU-T G.168
- ITU-T G.726
- ITU-T G.729 Annex A and B.
- ITU-T Recommendation T.30
- ITU-T Recommendation I.363.2
- ITU-T Recommendation I.366.2 Annex K
- IEEE RFC 826
- IEEE RFC 894
- IETF RFC 2833 interoperability
- ITU-T T.38
- ITU-T V.17
- ITU-T V.21

- ITU-T V.27
- ITU-T V.29
- ITU-T V.33

VSP3-o compliance with standards

The VSP3-o FP card complies with the following standards

- ITU-T G.165
- ITU-T G.168
- ITU-T G.726 (40 kbit/s, 24 kbit/s, and 16 kbit/s compression modes are not implemented)
- ITU-T G.729 Annex A and B.
- ITU-T Recommendation T.30
- ITU-T Recommendation I.366.2 Annex K
- IEEE RFC 826
- IEEE RFC 894
- IETF RFC 2833 interoperability
- ITU-T T.38
- ITU-T V.17
- ITU-T V.21
- ITU-T V.27
- ITU-T V.29
- ITU-T V.33

Appendix
FP technology considerations

Nortel Networks Multiservice Switch series products continue to introduce new, service-enhancing technologies to its function processors (FPs). Examples of these technologies are processors, application-specific integrated circuits (ASICs), field-programmable gate arrays (FPGAs), and modules that combine multiple technology components.

Some technologies have an impact on the way you configure an FP. The description of each FP type in this document includes a specifications table that indicates the distinguishing technology of the FP type. The FP technologies that are listed in the tables are described as follows:

- "APC" (page 434)
- "AQM" (page 434)
- "Atlas" (page 435)
- "ATM IP" (page 435)
- "CQC" (page 435)
- "GQM" (page 436)
- "NCS" (page 436)
- "PDC" (page 436)
- "PM" (page 437)
- "PPC" (page 438)
- "PQC" (page 438)
- "QRD" (page 438)

- "RSP2" (page 439)
- "SBIC" (page 439)

APC

The ATM port controller (APC) ASIC provides ATM traffic management and related functions on some second-generation ATM function processors (which also include PPC and PQC technologies).

The APC ASIC allows for higher port densities than the AQM ASIC. FPs with the APC differ from FPs with AQM in the following ways: smaller set of ATM statistics, no OAM performance monitoring hardware support, virtual path termination (VPT) support is for basic VPT only, limited traffic shaping rates, different virtual circuit provisioning, and support for per-VCC queuing only.

Configuring an APC-based FP for ATM connections includes APC-specific procedures for resource management controls, configured mapping of connection instance values, and various APC-specific traffic management settings.

AQM

The ATM queue manager (AQM) ASIC provides feature-rich ATM traffic management and shaping capabilities on some second-generation Nortel Networks Multiservice Switch ATM function processors (which also include PPC and PQC technologies). The AQM supports data rates up to OC-3.

Nortel Networks Multiservice Switch systems support more than one version of the AQM ASIC. Refer to the specifications table for a specific FP; the PEC suffix will help you identify which version you have. The following versions are supported:

- AQM1.0
- AQM1.1, which provides improved policing and shaping functionality.

Before installing an AQM-based FP, ensure that the node is running the appropriate software version. The software version requirements, if applicable, are indicated in the specifications table for each FP.

Configuring an AQM-based FP for ATM connections includes AQM-specific procedures for resource management controls and various AQM-specific traffic management settings.

AQS

The ATM queue scheduler (AQS) ASIC provides ATM traffic management and related functions on the 1-port OC-12/STM-4 ATM FP (which also includes PPC and PQC technologies).

The AQS ASIC allows supports up to OC-12 data rates and higher port densities than the AQM ASIC, but does not provide the following features: per-connection queueing, traffic shaping, ABR VS/VD and ER, I.610 performance measurements, EPD/LPD congestion thresholds, WRED, virtual link VPT, standard VPT, or floating point.

Configuring the 1-port OC-12/STM-4 ATM FP for ATM connections is similar to configuring AQM-based FPs. Exceptions are noted in the NTPs, as necessary.

Atlas

The Atlas-3200 processor ASIC implements ATM layer functions that include header translation, cell rate policing, per-connection cell counting and I.610 compliance of OAM requirements for up to 64K virtual connections. The Atlas-3200 operates between the physical layer devices and the traffic manager to send or receive cells or packets. The Atlas-3200 supports the fixed-length cells of ATM traffic or the variable-length cells of packet over SONET (POS) traffic at the OC-48 line rate.

ATM IP

The term “ATM IP” is used to refer to the second generation of Nortel Networks Multiservice Switch ATM FPs. These FPs include the PowerPC processor, PQC ASIC, and at least one additional traffic management ASIC.

CQC

The cell queue controller (CQC) ASIC is a component on the first generation of Nortel Networks Multiservice Switch ATM FPs. CQC functionality includes connection identification, queueing and shaping, and as well as frame and cell forwarding.

Configuring a CQC-based FP for ATM connections includes CQC-specific procedures for resource management controls, configured mapping of connection instance values, and various CQC-specific traffic management settings.

> ***Note:*** A combination of ATM networking and core networking on the same 8Mbyte CQC ATM FP is not supported. Also, 8Mbyte CQC ATM FPs are not supported in PCR4.1 and up.

GQM

The generic queue manager (GQM) is a traffic management device (ASIC) which resides on the multiservice function processor (FP) cards. The GQM descends from other traffic management devices such as the AQM and QRD, and is capable of OC-48. It differs considerably from the other traffic management devices in that:

- it will schedule up to a single OC-48 channel
- its scheduling algorithms are frame or cell agnostic
- it can shape four emission priorities (EPs)
- it does not have a usage parameter control (UPC) function because that is done by a different ASIC called ATLAS (on the same card)

NCS

Network clock synchronization (NCS) allows the use of a port as a reference to the *NS* component. In each function processor specification table, the item "network clock synchronization supported" is set to *yes* or *no*. *Yes* means that network clock synchronization is supported on the card. If it is supported, but the reversion enhancement is not supported (based on the NS attributes *useableReferences* and *reversionDelay*), the message "Reversion enhancement is not supported" appears.

PDC

The processor daughter card (PDC) is an FP component which contains the i960 processor and associated circuitry for first-generation ATM cards (those with CQC technology).

Nortel Networks Multiservice Switch systems support more than one version of the PDC. Refer to the specifications table for a specific FP; the PEC suffix will help you identify which version you have. The following versions are supported:

- PDC1.0 offers 8 Mbyte of processor memory. FPs with PDC1.0 support core networking services (such as PORS, DPRS, and VNS) only.

  Note: A combination of ATM networking and core networking on the same 8 Mbyte ATM FP is not supported.

- PDC1.1 provides up to 32 Mbyte of processor memory. FPs with PDC1.1 support ATM networking, core networking, and combinations of these services.

When installing FPs in a spared configuration, ensure that you use FPs with equivalent amounts of memory.

> ***Note:*** A combination of ATM networking and core networking on the same 8Mbyte CQC ATM FP is not supported. Also, 8Mbyte CQC ATM FPs are not supported in PCR4.1 and up.

PM

The processor module (PM) is a component of many Nortel Networks Multiservice Switch 7400 series non-ATM FPs. It contains the processor, memory, service-providing components, and backplane connectivity on Multiservice Switch FPs.

Multiservice Switch systems support more than one version of the processor module. Refer to the specifications table for a specific FP; the PEC suffix will help you identify which version you have. The following versions are supported:

- PM1 offers 8 Mbyte of processor memory.

  Note: PM1 FPs are not supported in PCR5.2 and up.

- standard PM2 offers 16 Mbyte of processor memory.
- premium PM2 offers 32 Mbyte of processor memory.

The amount of processor memory on an FP is a factor when engineering services (particular combinations of services).

When installing FPs in a spared configuration, ensure that you use FPs with equivalent amounts of memory.

PPC

The powerPC (PPC) processor is supplied on second-generation ATM FPs, some CPs, and most of the FPs used with Multiservice Switch 15000 nodes. These FPs offer more processor memory than the first-generation FPs and allow for increased flexibility when engineering combinations of services.

PQC

Nortel Networks Multiservice Switch queue controller (PQC) ASIC performs base layer functions, such as ATM cell forwarding and frame forwarding for frame relay and IP traffic. The PQC ASIC is a key component on second-generation ATM FPs, along with the PowerPC processor and additional traffic management ASICs.

Multiservice Switch systems support more than one version of the PQC. Refer to the specifications table for a specific FP; the PEC will help you identify which version you have. The following versions are supported:

- PQC1 (also known as PQC6v1 and PQC1.0)
- PQC2 (also known as PQC6v2 and PQC2.0) provides greater frame forwarding throughput over PQC1.
- PQC12 (also known as PQC12.0, and PQC12a) provides higher frame and cell processing capacity, and fast hardware data path support for DPRS load spreading, frame relay access, and MPLS.

  Note: PCR3.0 software release must be running on a Multiservice Switch 15000 or Multiservice Switch 20000 before PQC12 based FP.

QRD

The queue relay device (QRD) is a high-capacity cell queuing ASIC that bypasses the usual PQC cell relay datapath. The QRD appears on high-speed FPs where the benefits of fast forwarding rates (up to OC-48) outweigh the need for traffic management features.

RSP2

The route switch processor II (RSP2) is a second generation multi-layer packet processor ASIC that runs field upgradable firmware. The firmware performs packet or cell forwarding at the line rate. As the family of cards evolves, the RSP2 is key to providing the capability to upgrade cards of the same type in the field.

SBIC

The shared bus interface controller (SBIC) is an FP component that provides control of data movement between the shared memory and the bus and link controllers. The SBIC appears on first-generation frame-based FPs that provide voice and frame relay services.

Nortel Networks Multiservice Switch 7400/15000/20000

FP Configuration Reference

Release 6.1

Publication: NN10600-551
Document status: Standard
Document version: 6.1S2
Document date: November 2004
Printed in Canada

NORTEL NETWORKS