



Nortel Networks Multiservice Switch

7400/15000/20000

ATM Fault and Performance Management

NN10600-715

Nortel Networks Multiservice Switch 7400/15000/20000

ATM Fault and Performance Management

Publication: NN10600-715

Document status: Standard

Document version: 6.1S2

Document date: November 2004

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Printed in Canada

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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 describes the procedures used to monitor and troubleshoot Nortel Networks Multiservice Switch ATM services for function processors, interfaces, and connections.

The following topics are discussed in this section:

- “Who should read this document and why” (page 17)
- “What you need to know” (page 17)
- “What’s new in this document” (page 18)
- “Text conventions” (page 20)
- “Related documents” (page 21)
- “How to get more help” (page 22)

Who should read this document and why

This guide is for persons who operate and maintain ATM services for their Nortel Networks Multiservice Switch networks.

What you need to know

This guide requires that you understand Nortel Networks Multiservice Switch network architecture and operation. Also, you should understand ATM technology and the open systems interconnection (OSI) model.

Use the following documents to help you understand Nortel Networks Multiservice Switch networks, and ATM concepts before you use the information in this guide:

- NN10600-700 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Technology Fundamentals*
- NN10600-702 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*
- NN10600-705 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Management Fundamentals*
- NN10600-706 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals*
- NN10600-707 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Queuing and Scheduling Fundamentals*
- NN10600-708 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM CAC and Bandwidth Fundamentals*

Refer to NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* for information about Multiservice Switch ATM network configuration.

What's new in this document

The following features were added to this document:

- “Global rerouting for specified paths” (page 19)
- “PNNI local and global rerouting” (page 19)

Other changes made to this document include the following:

- The table “Interpreting the status of the ATM connection” (page 59) was updated to indicate dynamic ATM connection behavior when a loopback status goes from a value of good to bad.
- 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 Q00987930, the section “Initiating a path trace filter” (page 134) was updated to include accurate commands.
- For CR Q00857358, the table “Interpreting the display of the callRedirection component” (page 66) was updated to include the following attributes: *lastFailureCauseCode* and *lastFailureDiagCode*.
- The section “CLR calculation” (page 199) was updated with information about activation requests.
- The tables “Cause code definitions for ATM UNI version 3.0” (page 282) and “Cause code definitions for ATM UNI version 3.1” (page 287) were updated with an additional definition for cause code 73.
- Updated the following tables with the removal of cause code 58 as it no longer exists:
 - “Handling problems in ATM routing and signaling” (page 258)
 - “Summary of cause codes for ATM UNI version 3.0” (page 266)
 - “Summary of cause codes for ATM UNI version 3.1” (page 269)
 - “Cause code definitions for ATM UNI version 3.0” (page 282)
 - “Cause code definitions for ATM UNI version 3.1” (page 287)

Global rerouting for specified paths

The following section was updated for this feature:

- “Monitoring connections on an ATM interface” (page 126)

PNNI local and global rerouting

The following section was updated for this feature:

- “SPVC scenarios” (page 224)

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 node 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

In addition to the documents listed in “What you need to know” (page 17), see the following documents for related information:

- NN10600-030 *Nortel Networks Multiservice Switch 7400/15000/20000 Overview*
- NN10600-720 *Nortel Networks Multiservice Switch 7400/15000/20000 AAL1 Circuit Emulation Operations*
- NN10600-730 *Nortel Networks Multiservice Switch 7400/15000/20000 Inverse Multiplexing for ATM Operations*
- NN10600-920 *Nortel Networks Multiservice Switch 7400/15000/20000 Operations: Frame Relay to ATM Interworking*
- NN10600-800 *Nortel Networks Multiservice Switch 7400/15000/20000 IP Technology Fundamentals*
- NN10600-801 *Nortel Networks Multiservice Switch 7400/15000/20000 IP Configuration Management*
- NN10600-581 *Nortel Networks Multiservice Switch 7400/15000/20000 VPN Technology Fundamentals*
- NN10600-582 *Nortel Networks Multiservice Switch 7400/15000/20000 VPN Configuration Management*
- NN10600-420 *Nortel Networks Multiservice Switch 7400/15000/20000 Operations: Trunking*
- NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*

- *NN10600-500 Nortel Networks Multiservice Switch 6400/7400/15000/20000 Alarms Reference*
- *NN10600-560 Nortel Networks Multiservice Switch 7400/15000/20000 Accounting*
- *Nortel Networks Multiservice Switch Release Notes*

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

ATM function processor monitoring

Examine the overall status of the ATM function processor (FP) to get a high-level view of how the FP is operating before examining its individual components. This step will help you avoid trying to troubleshoot problems with connections and interfaces when there are problems at the FP level.

ATM function processor monitoring tasks

- “Checking the OSI status of the FP” (page 24)
- “Examining the software status of the FP” (page 25)
- “Examining the buffer usage of ATM FPs” (page 26)
- “Displaying the overall connection usage of ATM FPs” (page 28)
- “Displaying specialized connection usage of ATM FPs” (page 30)
- “Monitoring FPs providing hitless services” (page 32)

Checking the OSI status of the FP

Examine the OSI state of the FP to determine whether the card itself is in place and operating correctly.

Procedure steps

- 1 Determine the OSI states of the FP.

```
display Shelf Card/<n> OsiState
```

Variable values

Variable	Value
<n>	The slot number of the FP. If adminState is unlocked, operationalState is enabled, and usageState is active, the FP is operational. If any other states are displayed, see NN10600-520 <i>Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting</i> for a description of all OSI states and list of troubleshooting procedures for FPs.

Examining the software status of the FP

See NN10600-520 *Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting* for procedures on displaying the memory utilization and CPU utilization of a processor card. These values can be compared to the limits configured for the card by your system administrator or network engineer.

Examining the buffer usage of ATM FPs

Examine the FP buffer usage to determine how ATM cells and frames are being handled and whether memory buffers on the ATM FP are becoming congested with frames and cells.

The AQM is the component in ATM IP FPs where most queuing of ATM cells occurs.

Prerequisites

- For more information about the *Aqm* component, see NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*

Procedure steps

- 1 Display all the information associated with the *Arc* component operational attributes for the LP associated with the FP.

```
display Lp/<n> Eng Arc
```

Note: For ATM IP FPs, the attributes described in this step apply to PQC memory.

- 2 From the list displayed, examine the attributes listed below to determine the status and availability of cell memory. These attributes apply to both CQC and ATM-IP function processors.
 - txCellMemoryCongestionState
 - txCellMemoryUsage
 - txCellMemoryMaxUsage
 - rxCellMemoryCongestionState
 - rxCellMemoryUsage
 - rxCellMemoryMaxUsage
- 3 If any of these values indicate an unacceptable behavior (such as a high level of congestion), see “Troubleshooting ATM function processors” (page 279) or consult your network engineer.
- 4 If you are using an ATM-IP FP, display information associated with the *Aqm* component operational attributes.

```
display Lp/<n> Eng Arc Aqm/<m>
```

- 5 From the list displayed, examine the attributes listed below to determine the status and availability of AQM cell memory.

- txCellMemoryCongestionState
- txCellMemoryUsage
- txCellMemoryMaxUsage

Note: The AQM component of ATM-IP FPs does not use receive buffers.

- 6 If any of these values indicate a problem, see “Troubleshooting ATM function processors” (page 279) or consult your network engineer.
- 7 Examine frame memory usage by displaying all the information associated with the *Fcrc* component operational attributes for the LP associated with the interface.

```
display Lp/<n> Eng Fcrc
```

- 8 From the list displayed, examine the attributes listed below to determine the status and availability of frame memory. These attributes apply to both CQC and ATM-IP function processors.
- txFrameMemoryCongestionState
 - txFrameMemoryUsage
 - txFrameMemoryMaxUsage
 - rxFrameMemoryCongestionState
 - rxFrameMemoryUsage
 - rxFrameMemoryMaxUsage
- 9 If any of these values indicate unacceptable behavior, see “Troubleshooting ATM function processors” (page 279) or consult your network engineer.

Variable values

Variable	Value
<m>	The instance number of the AQM.
<n>	The instance number of the LP you want to monitor.

Displaying the overall connection usage of ATM FPs

Determine how overall connection usage is effecting FPs. A connection is used for each VCC or VPC which is active on the FP. If there are no free connections in the connection pool, new switched connections (SVCs) cannot be set up, and additional provisioning of PVC connections may fail.

Procedure steps

- 1 Display all the information associated with the *Arc* component operational attributes for the LP associated with the FP.

```
display Lp/<n> Eng Arc
```

- 2 From the list displayed, examine the attributes listed below to determine how connections are being processed.

- connectionPoolAvailable
- connectionPoolUsage
- protectedConnectionPoolAvailable
- protectedConnectionPoolUsage

- 3 Compare the values displayed for these attributes. If the amount used is excessively high, or if the amount available is close to 0, you may need to consult your network engineer to determine whether the FP is adequately provisioned.

- 4 If you are using an ATM-IP FP, display information associated with the *Aqm* component operational attributes.

```
display Lp/<n> Eng Arc Aqm/<m>
```

- 5 From the list displayed, examine the attributes listed below to determine the status and availability of AQM cell memory.

- connectionPoolAvailable
- connectionPoolUsage

- 6 Compare the values displayed for these attributes. If the amount used is excessively high, or if the amount available is close to 0, you may need to consult your network engineer to determine whether the FP is adequately provisioned.

Variable values

Variable	Value
<m>	The instance number of the AQM you want to monitor.
<n>	The instance number of the LP you want to monitor.

Displaying specialized connection usage of ATM FPs

Use this procedure to determine how multicast connections are being handled by the FP.

Procedure steps

- 1 Display all the information associated with the *Arc* component operational attributes for the LP associated with the FP.

```
display Lp/<n> Eng Arc
```

- 2 From the list displayed, examine the attributes listed below to determine how connections are being processed.

- multicastBranchesAvailable
- multicastBranchesUsage
- perVcQueueAvailable
- perVcQueueUsage
- protectedMcastBranchesAvailable
- protectedMcastBranchesUsage

- 3 Compare the values displayed for these attributes. If the amount used is excessively high, or if the amount available is close to 0 (zero), you may need to consult your network engineer to determine whether the FP is adequately provisioned.

- 4 Examine frame-related connection usage by displaying information associated with the *Fcrc* component operational attributes.

```
display Lp/<n2> Eng Fcrc
```

- 5 From the list displayed, first examine the attributes listed below to determine the status and availability of the frame memory subconnection pool.

- subConnectionPoolAvailable
- subConnectionPoolUsage

- 6 If the number of used sub connections is high or the number of available subconnections is near zero, consult your network engineer to determine whether the FP is adequately provisioned.

- 7 Examine the attributes listed below to determine the status and availability of the LNN connection pool.

- InnConnectionPoolAvailable
 - InnConnectionPoolUsage
- 8** If the number of used connections is high or the number of available connections is near 0 (zero), consult your network engineer to determine whether the FP is adequately provisioned.
- 9** Examine frame-related connection usage of PQC-based FPs by displaying operational attributes under the *Fcrc Pqc* component.
- ```
display Lp/ <n3> Eng Fcrc Pqc
```
- 10** From the list displayed, first examine the attributes listed below to determine the status and availability of the frame memory IP routing entries pool.
- *ipRoutesPoolSize* - this attribute displays the number of IP routing entries permitted on the LP.
  - *ipRoutesPoolUsage* - this attribute displays the total number of IP routing entries currently in use by the FP.
  - *ipRoutesPoolAvailableEst* - this attribute displays the estimated number of IP routing entries available on the LP. This is determined from the number of IP routing resources available on the card (each IP routing resource can hold between 1 and 3 IP routing entries). The number of IP routing entries for each IP routing resource is obtained from the current IP routing resource usage on the card.
- 11** If the number of available IP routing entries is near zero, increase the maximum number of IP routing entries permitted on the LP.

## Variable values

| Variable | Value                                                        |
|----------|--------------------------------------------------------------|
| <n>      | The instance number of the LP you want to monitor.           |
| <n2>     | The instance number of the LP you want to monitor.           |
| <n3>     | The instance number of the PQC-based LP you want to monitor. |
|          |                                                              |

## Monitoring FPs providing hitless services

Hitless services apply only to Nortel Networks Multiservice Switch 15000 and Multiservice Switch 20000 nodes. See NN10600-702 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals* for a description of how hitless services apply to ATM.

For the connections to be hitless, the ATM interface must be provisioned for equipment protection with either:

- one-for-one sparing for FPs with electrical interfaces
- dual-FP line APS and equipment protection for FPs with optical interfaces

See NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures* for a description of the operational behavior of hitless services and the *Shelf Card SparedServices* component.

---

## Chapter 2

# ATM interface monitoring

---

Monitor ATM interfaces to determine whether the ATM interfaces on a specific function processor (FP) are operating correctly.

### Prerequisites to ATM interface monitoring

- Determine whether ATM FPs are operating properly, see “ATM function processor monitoring” (page 23).

### ATM interface monitoring tasks

- “Displaying the OSI state of the ATM interface” (page 34)
- “Identifying troubled connections” (page 35)
- “Examining connection admission” (page 36)
- “Displaying ATM interface traffic statistics” (page 37)
- “Displaying ATM interface operational attributes” (page 44)
- “Displaying the last alarmed peak transmit utilization of an ATM link” (page 46)
- “Displaying the ConnectionMapping attributes” (page 48)

## Displaying the OSI state of the ATM interface

Examine the OSI state of the interface to determine its overall status.

### Procedure steps

- 1 Display the OSI state attributes of the *AtmIf* component.

```
display AtmIf/<n> osiState
```

### Variable values

| Variable | Value                                                                                                                                                                                           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <n>      | The instance number of the ATM interface.<br><br>The table "OSI states for the ATM interface" (page 34) shows the possible OSI state outputs that may appear as a result of using this command. |
|          |                                                                                                                                                                                                 |

### Procedure job aid

**Table 1**  
**OSI states for the ATM interface**

| State                                                                      | Meaning                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| adminState = unlocked<br>operationalState = enabled<br>usageState = idle   | The <i>AtmIf</i> component is unlocked and the port to which it is linked is unlocked and enabled; no <i>Vcc</i> , <i>Vpt</i> , or <i>Vpc</i> subcomponents configured.                                                                                                                                                                                                                                               |
| adminState = unlocked<br>operationalState = enabled<br>usageState = active | Some <i>Vcc</i> , <i>Vpt</i> , or <i>Vpc</i> components have been configured, but the number of connections has not reached the limit that the <i>AtmIf</i> component can support.                                                                                                                                                                                                                                    |
| adminState = unlocked<br>operationalState = enabled<br>usageState = busy   | The number of <i>Vcc</i> , <i>Vpc</i> or <i>Vpt</i> components that are configured has reached the limit that the <i>AtmIf</i> component can support. If the limit is reached for any of the <i>Vcc</i> , <i>Vpt</i> , or <i>Vpc</i> components, then the <i>usageState</i> attribute becomes busy. This condition can also occur when an <i>AtmIf</i> component that is linked to a port has no bandwidth available. |
| adminState = unlocked<br>operationalState = disabled<br>usageState = idle  | The port to which the <i>AtmIf</i> component is linked is either locked or disabled.                                                                                                                                                                                                                                                                                                                                  |
|                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                       |

## Identifying troubled connections

Use the following procedure to determine whether there are any troubled connections associated with the ATM interface.

### Procedure steps

- 1 Display status information about the *ConnectionAdministrator (Ca)* component belonging to the interface.

```
display AtmIf/<n> Ca
```

- 2 Examine the following attributes from the list displayed to determine whether any trouble connection exist:

- troubledVpcs
- troubledVpts
- troubledVccs

- 3 If any value greater than 0 is displayed for any of the attributes listed above, see “Troubleshooting ATM interfaces” (page 251).

## Examining connection admission

Examine connection admission to monitor how connections are being admitted, based on bandwidth demands, usage, and availability per bandwidth pool.

*Note:* To determine the current bandwidth usage and availability on the receive side, monitor the same attributes on the transmitting node at the other end of the link.

### Procedure steps

- 1 Display status information about the *ConnectionAdministrator (Ca)* component belonging to the interface.  
  
`display AtmIf/<n> Ca`
- 2 Examine the attributes listed below in the following order to determine the connection resources of the interface:
  - poolWaitAdmitConnections
  - poolAdmittedConnections
- 3 If any connections are waiting for admission, you may need to consult your network engineer to determine whether the interface has been adequately provisioned. You should also see “Troubleshooting ATM interfaces” (page 251).
- 4 Examine the attributes listed below in the following order to determine how connections are being admitted on the interface:
  - poolRequestedBandwidth
  - poolAdmittedBandwidth
  - poolAvailable Bandwidth
  - poolProvisionedBandwidth
- 5 The values for requested bandwidth should be equal to those for admitted bandwidth. If there is a discrepancy between these values, see “Troubleshooting ATM interfaces” (page 251).
- 6 If the pool of available bandwidth is small, you may need to consult your network engineer to determine if additional bandwidth should be provisioned for the interface. The amount of provision bandwidth will indicate how much bandwidth is reserved for PVCs.

## Displaying ATM interface traffic statistics

The ATM interface provides several statistics to monitor performance. Display ATM interface traffic statistics to monitor traffic flow through the interface as a whole, rather than on a per-connection (VCC, VPC) basis.

### Prerequisites

- The counters for these statistics are reset only when the card is reset. After a reset, users should be aware that during connection establishment, OAM cells are generated to determine connection status. Regardless of the intermediate state of a connection, these cells are transmitted and recorded in the appropriate operational attributes for statistics at various levels in the ATM component hierarchy. Therefore, on card rest the statistics for the *AtmIf* and associated connections may not be zero.

### Procedure steps

- 1 Display information about a specific ATM interface component.

```
display AtmIf/<n> Statistics
```

This command displays the operational attributes in the Statistics group under the *AtmIf* component as shown in the figure “Summary of *AtmIf* statistics collection” (page 41). For the APC-based FPs, see the table “*AtmIf* statistics available on APC-based FPs” (page 42) for a listing of supported statistics.

- 2 For AQM-based FPs, display statistics specific to cell and frame discards.

```
display AtmIf/<n> txCellEfci, txCellDiscard,
txCellDiscardClp
```

```
display AtmIf/<n> txFrameDiscard, txFrameDiscardClp
```

```
display AtmIf/<n> rxCellEfci, rxCellDiscard
rxCellDiscardClp
```

```
display AtmIf/<n> rxFrameDiscard, rxFrameDiscardClp
```

The values for these attributes typically do not increase over time in a well engineered network. Changing values indicates traffic discard on one or more connections under this interface. A connection that experiences cell or frame discard is likely to be over-subscribed in either the transmit or receive directions. Re-engineering the network for better balance is indicated. The problem may also be associated with a connection that the node expects to be configured but is not.

**Note:** These attributes do not apply to APC and CQC-based FPs, which do not display frame discard statistics.

- 3 Display statistics specific to discarded received cells.

**display AtmIf/<n> droppedRxCells**

The *droppedRxCells* attribute is supported on both AQM-based and CQC-based FPs. It is not supported on APC-based FPs.

The *droppedRxCells* attribute indicates an invalid VPI.VCI, which is typically caused when a VCC or VPC is configured to transmit at one end of a link but there is no VCC or VPC configured at the other end. See the table “Handling problems” (page 230) for more information about dropped cells.

For the 1pOC48ChSmlrAtm card, the *droppedRxCells* attribute may not reset to zero. To obtain an accurate reading, subtract the initial value from the attribute value.

- 4 For AQM-based FPs, display statistics on dropped cells for the connection:

**display AtmIf/<n> lastDroppedRxCellConnection**

The *lastDroppedRxCellConnection* attribute is supported on AQM-based and CQC-based FPs. This attribute is not supported on APC-based FPs.

When the ATM interface includes a frame-forwarding connection that was disabled or enabled while transmitting user traffic, the *lastDroppedRxCellConnection* attribute may display a VPI.VCI value that is out of range.

For the 1pOC48ChSmlrAtm card, the *lastDroppedRxCellConnection* attribute may not reset to zero during card resets or provisioning changes. The attribute may initially indicate that a connection does not exist.

- 5 For AQM and APC-based FPs, display statistics on the number of AAL5 frame assembly errors and aborts.

**display AtmIf/<n> aal5RxErrors, aal5RxAborts**

These attributes count the number of frames that could not be re-assembled. Cell loss indicates

- congestion on previous nodes in the connection
- physical link errors
- LRC errors at the source node

The *aal5RxAborts* attribute counts AAL5 frame aborts. An AAL5 aborted frame is one in which the AAL5 frame length has been set to zero. This count is included in *aal5RxErrors*.

- 6 For AQM and APC-based FPs, if there are lost cells, display statistics on the connection:

```
display AtmIf /<n> lastAal5RxErrorConnection
```

The *lastAal5RxAbortConnection* attribute indicates the VPI and VCI of the last connection that exhibited AAL5 aborts. These errors are counted in the attribute *aal5RxAborts*. These attributes are not available for CQC-based FPs.

- 7 For AQM and APC-based FPs, display statistics on the number of LRC frame errors received across the bus.

```
display AtmIf /<n> lrcFrameErrors
```

LRC frame errors may indicate a hardware fault on either the transmitting or receiving FP. See “Troubleshooting LRC errors at the ATM interface level” (page 253) for more information about fault management for LRC errors.

- 8 For AQM and APC-based FPs, determine if there are errors on a connection.

```
display AtmIf /<n> lastLrcFrameErrorConnection
```

The *lrcFrameErrorConnections* attribute indicates the VPI.VCI of the last connection that had LRC frame errors on frames received across the bus. These errors are counted in the *lrcFrameErrors* attribute.

- 9 Examine the following attributes from the displayed information to determine how many cells have been transmitted and received over the ATM interface:

- *txCell*
- *txCellClp*
- *txCellEfci*
- *rxCell*
- *rxCellClp*
- *rxCellEfci*

- 10 If the volume of traffic seems either too high or too low, consult your network engineer to determine whether the interface has been properly provisioned.

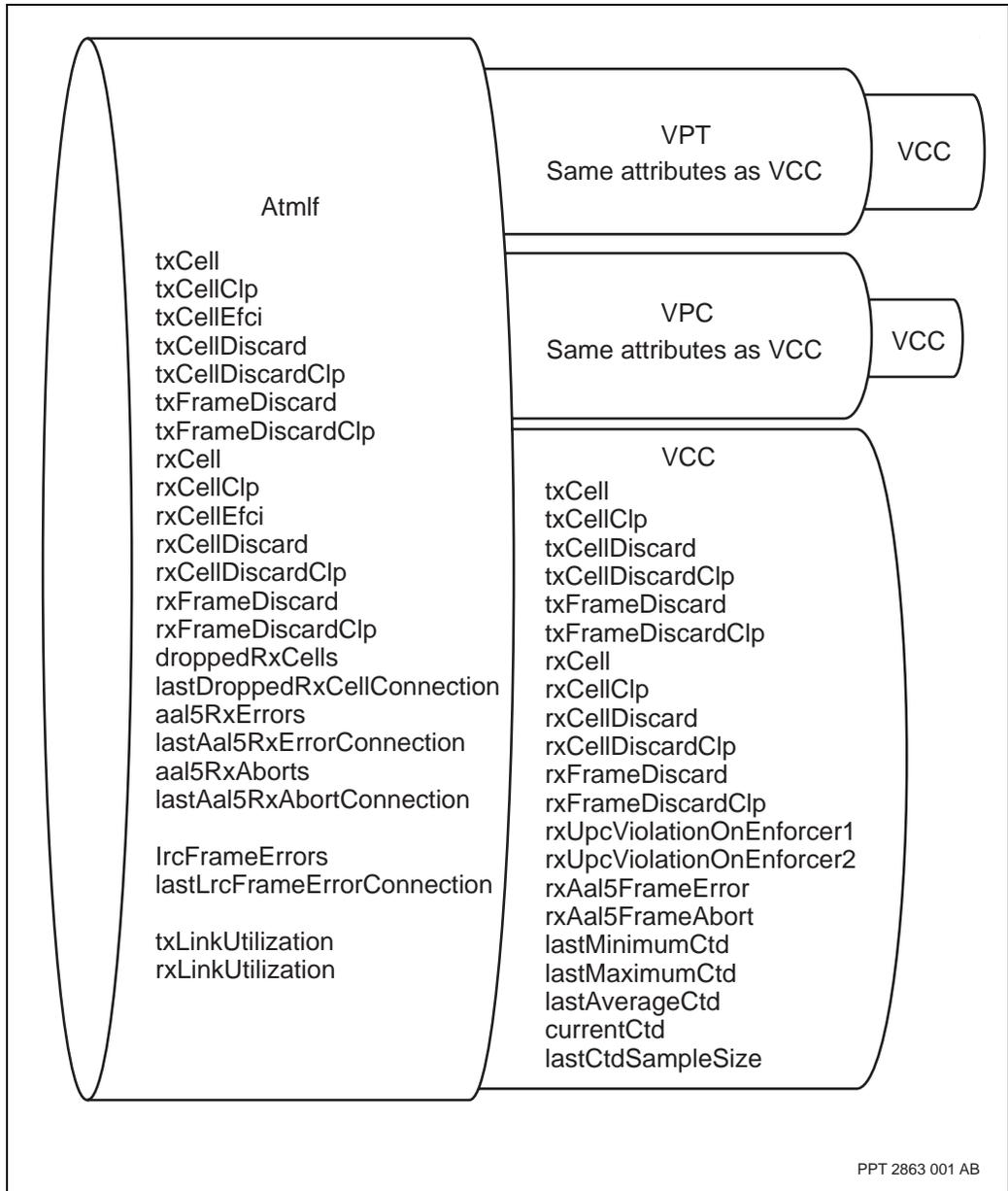
### Variable values

| Variable | Value                                                             |
|----------|-------------------------------------------------------------------|
| <n>      | The instance number of the <i>AtmIf</i> component being monitored |
|          |                                                                   |

### Procedure job aid

The figure “Summary of AtmIf statistics collection” (page 41) illustrates how the statistics discussed in this section are inter-related. Note that statistics are available on a limited basis on APC-based FPs. For a listing showing these statistics on a per port and a per connection basis for APC-based FPs, see the table “AtmIf statistics available on APC-based FPs” (page 42).

**Figure 1**  
**Summary of Atmlf statistics collection**



**Table 2**  
**Atmlf statistics available on APC-based FPs**

| Statistics                                                                                                                               | 16-port OC-3/STM-1 FP |                              | 4-port OC-12/STM-4 FP                 |                              |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------------|---------------------------------------|------------------------------|
|                                                                                                                                          | per port<br>(Atmlf)   | per connection<br>(VCC, VPC) | per port,<br>unchannelized<br>(Atmlf) | per connection<br>(VCC, VPC) |
| txCellCLP0+1                                                                                                                             | yes                   | yes                          | yes                                   | yes                          |
| txCellCLP1                                                                                                                               | yes                   | yes                          | no                                    | yes                          |
| txCellDiscardCLP0+1                                                                                                                      | no                    | yes*                         | yes                                   | yes*                         |
| txCellDiscardCLP1                                                                                                                        | no                    | no                           | no                                    | no                           |
| rxCellCLP0+1                                                                                                                             | yes**                 | yes**                        | yes**                                 | yes**                        |
| rxCellCLP1                                                                                                                               | yes                   | no                           | no                                    | no                           |
| rxCellDiscardCLP0+1                                                                                                                      | no                    | yes**                        | yes**                                 | yes**                        |
| rxCellDiscardCLP1                                                                                                                        | no                    | no                           | no                                    | no                           |
| rxAal5FrameError                                                                                                                         | yes                   | yes                          | yes                                   | yes                          |
| rxAal5FrameAbort                                                                                                                         | yes                   | yes                          | yes                                   | yes                          |
| *It is provided through a calculation.                                                                                                   |                       |                              |                                       |                              |
| ** Per-connection rxCellDiscardCLP0+1 on the 4pOC12SmIrAtm and 16pOC3SmIrAtm FPs is counted after traffic policing by UPC at the ingress |                       |                              |                                       |                              |
|                                                                                                                                          |                       |                              |                                       |                              |

**Note:** The per-connection TxCellDiscard CLP0+1 statistics on 4pOC12SmIrAtm and 16pOC3SmIrAtm FPs may move up and down by 1 cell if read in subsequent displays. The same can happen to RxCellDiscard CLP0+1 as well. This behavior is caused by a hardware limitation. On 4pOC12SmIrAtm and 16pOC3SmIrAtm FPs, the per-connection TxCellDiscard CLP0+1 and RxCellDiscard CLP0+1 statistics are derived from a number of counters including buffer occupancy counters. Depending on the timing between when a cell is entering a buffer and when the buffer occupancy counter is accessed for an operational display, a cell in transit may be counted in one instance but may not be counted in another instance. This results in the statistics

moving up and down by a difference of one cell. When that happens, the smaller value of the two values in subsequent readings should be deemed as the true value of the counter.

## Displaying ATM interface operational attributes

Display operational information on transmit cell memory for a specific ATM interface. These attributes do not apply to CQC-based FPs.

### Prerequisites

- see “Summary of AtmIf statistics collection” (page 41) and “AtmIf statistics available on APC-based FPs” (page 42).

### Procedure steps

- 1 For the AQM-based FPs, display information about transmit cell memory usage for a specific ATM interface.

```
display AtmIf /<n> txCellMemoryUsage
```

The *txCellMemoryUsage* attribute indicates the amount of memory used, in transmit cells, for the ATM interface. This attribute does not apply to the CQC-based, AQS-based, APC-based, and QRD-based FPs.

- 2 For the AQM-based FPs, display information about the congestion state of a specific interface.

```
display AtmIf /<n> txCellMemoryCongestionState
```

The *txCellMemoryCongestionState* attribute indicates the congestion state of the transmit cell memory for the ATM interface. This attribute does not apply to the CQC-based, AQS-based, APC-based, and QRD-based FPs.

- 3 For the APC-based FPs, display the values in cells/s, of the 31 shaping rates currently in use at the interface.

```
display AtmIf /<n> opShapingRates
```

The *opShapingRates* attribute is a vector of 31 elements, each of which represents a shaping rate value. A shaping rate value of zero means that the entry is empty and can be used.

- 4 For the APC-based FPs, display the number of VCCs that currently use the 31 shaping rates.

```
display AtmIf /<n> shapeUsage
```

The *shapeUsage* attribute is a vector of 31 elements, each representing the number of VCCs using the particular rate which is displayed with the same element index in the *opShapingRates* attribute.

- 5 Display all operational information for a specific ATM interface component.

**display AtmIf/<n> operational**

This command displays the information described in the above steps relevant to the FP in use.

### Variable values

| Variable | Value                                                              |
|----------|--------------------------------------------------------------------|
| <n>      | The instance number of the <i>AtmIf</i> component being monitored. |
|          |                                                                    |

## Displaying the last alarmed peak transmit utilization of an ATM link

The peak transmit utilization of an ATM link while the last SET alarm is or was in effect can be displayed in operational mode at any time. When the link transmit utilization stays above the provisioned threshold for three consecutive minutes, an alarm (with alarm ID 7039 5000) is set. When the utilization drops down to or below the threshold for three consecutive minutes, the alarm is cleared.

*Note:* If the alarm was raised prior to a CP switchover, it is still present after the CP switchover. Nortel Networks Multiservice Data Manager (MDM) clears all alarms from its active alarm display on loss of connectivity to the CP. When connectivity is re-established, Multiservice Data Manager does not generate proxy alarms for threshold alarms, such as the ATM utilization alarm, that do not impact the operational or administrative state of a CAS component. When the system clears the alarm, the Multiservice Data Manager active alarm display is current.

### Prerequisites

- The link transmit utilization of ATM links can be monitored by provisioning the *criticalTxUtilAlarmThreshold* (*critThresh*) attribute of the *LinkTxUtilization* (*Ltu*) component under *AtmIf*. The threshold can be provisioned as a percentage between 1 to 99. See NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* for details on adding the ATM link transmit utilization alarm for the ATM interface.

### Procedure steps

- 1 Display the last alarmed peak transmit utilization of an ATM link.

```
display AtmIf/<n> lastAlarmPeakTxUtilization
```

The *lastAlarmPeakTxUtilization* attribute indicates the peak sample of the ATM link transmit utilization while the last SET alarm is or was in effect. While alarm is SET, the above attribute holds the highest value of the last three utilization samples taken.

---

## Variable values

| Variable | Value                                     |
|----------|-------------------------------------------|
| <n>      | The instance number of the ATM interface. |
|          |                                           |

## Displaying the ConnectionMapping attributes

View the optional VCC space supported by the ATM interface. The VCC space consists of an VPI Zero VCC Space and a Programmable VCC Space. The VPI Zero VCC Space is used to support VCCs with a VPI of zero and the Programmable VCC Space is used to support VCCs with a VPI other than zero. The *ConnectionMapping* (*ConnMap*) component is used to view the VCC space supported by an ATM interface on the CQC- and APC-based FPs listed in the table “Function processors supporting the ConnMap component” (page 49).

### Procedure steps

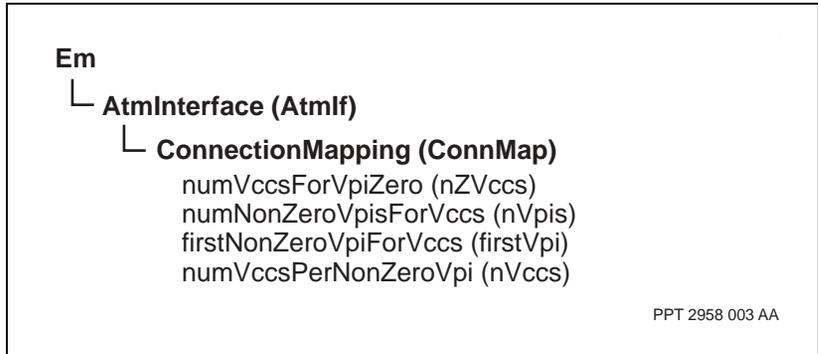
- 1 Display the number of VCCs supported for the VPI zero VCC Space.  
`display AtmIf/<n> ConnMap nZVccs`
- 2 Display the number of contiguous VPIs supported in the Programmable VCC Space.  
`display AtmIf/<n> ConnMap nVpis`
- 3 Display the initial VPI of the Programmable VCC Space.  
`display AtmIf/<n> ConnMap firstVpi`
- 4 Display the number of VCCs supported for each VPI in the Programmable VCC Space.  
`display AtmIf/<n> ConnMap nVccs`

### Variable values

| Variable | Value                                     |
|----------|-------------------------------------------|
| <n>      | The instance number of the ATM interface. |
|          |                                           |

## Procedure job aid

**Figure 2**  
**ConnectionMapping component hierarchy**



**Table 3**  
**Function processors supporting the *ConnMap* component**

| Function processor                                        | ASIC |
|-----------------------------------------------------------|------|
| 2-port J6                                                 | CQC  |
| 3-port DS1                                                | CQC  |
| 3-port DS3                                                | CQC  |
| 3-port E1                                                 | CQC  |
| 3-port E3                                                 | CQC  |
| 3-port OC-3                                               | CQC  |
| 4-port OC-12/STM-4<br>(4pOC12SmlrAtm or<br>4pOC12SmLrAtm) | APC  |
| 16-port OC-3/STM-1<br>(16pOC3Smlr)                        | APC  |



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## Chapter 3

# Connection monitoring

---

Monitor connections to determine if any or all the connections on an ATM interface are operating correctly.

### Prerequisites to connection monitoring

- Verify that the ATM interface is operating correctly. See “ATM interface monitoring” (page 33).

### Connection monitoring tasks

- “Determining the OSI state of virtual connections” (page 52)
- “Determining the OSI state of the source and destination SPVCs and SPVPs” (page 54)
- “Determining the status of a virtual connection” (page 58)
- “Displaying the status of call redirection” (page 65)
- “Monitoring an ATM multicast connection” (page 67)
- “Examining VPT connection admission” (page 69)
- “Viewing ATM connection statistics” (page 71)
- “Viewing ATM traffic descriptor parameters” (page 78)
- “Viewing congestion control activity for connections” (page 75)
- “Viewing CTD calculations” (page 73)
- “Considerations for monitoring queue length” (page 83)
- “Monitoring a point-to-multipoint SPVC connection” (page 80)

## Determining the OSI state of virtual connections

Determine the OSI state of the virtual connections (VPCs, VCCs, and VPTs) provisioned on a specific ATM interface.

### Procedure steps

- 1 Display the OSI attributes of all *Vpc* components under an *AtmIf* component.  

```
display AtmIf/<n> Vpc/* osiState
```
- 2 Display the OSI state attributes of all VCCs under an *AtmIf* component.  

```
display AtmIf/<n> Vcc/* osiState
```
- 3 Display the OSI state attributes of all VCCs associated with all virtual path terminator.  

```
display AtmIf/<n> Vpt/* Vcc/* osiState
```
- 4 Refer to the table “Interpreting OSI states for an ATM connection” (page 53) for an explanation of the result displayed with this procedure.

### Variable values

| Variable | Value                                     |
|----------|-------------------------------------------|
| <n>      | The instance number of the ATM interface. |
|          |                                           |

## Procedure job aid

**Table 4**  
**Interpreting OSI states for an ATM connection**

| State                                                                     | Meaning                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| adminState = unlocked<br>operationalState = enabled<br>usageState = idle  | <p>The <i>Vcc</i> or <i>Vpc</i> is available to send and receive traffic over the local physical link, but has not been activated by the application.</p> <p>For a <i>Vpt</i>, this state indicates that the <i>Vpt</i> is unable to allocate its VPI channel resource.</p>                                                                                       |
| adminState = unlocked<br>operationalState = enabled<br>usageState = busy  | <p>The <i>Vcc</i> or <i>Vpc</i> has been activated by the application to send and receive traffic over the local physical link.</p> <p>A <i>Vpt</i> is not controlled by an application, so it is activated when it is provisioned.</p> <p><b>Note:</b> The <i>Vcc</i> or <i>Vpc</i> may be troubled if traffic loss is occurring.</p>                            |
| adminState = unlocked<br>operationalState = disabled<br>usageState = idle | <p>The <i>Vcc</i>, <i>Vpt</i>, or <i>Vpc</i> is unable to send and receive traffic over the local physical link because the link is down, the associated port has been locked, the connection is not admitted, or the connection's bandwidth has been released (due to an IMA group link loss). The application may or may not have activated the connection.</p> |

## Determining the OSI state of the source and destination SPVCs and SPVPs

Determine the OSI state of the source and destination VPCs, VCCs, and VPTs provisioned on a specific ATM interface. The results verify if the source or destination SPVC or SPVP is currently being used.

*Note:* A provisioned destination SPVC or SPVP is used primarily for AIS generation. See NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* for details on AIS generation.

### Prerequisites

- Configure an ATM interface (see NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* for details).
- Configure a *Vcc*, *Vpc*, and *Vpt* component (see NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* for details).

### Procedure steps

- 1 Display the OSI state of all source or destination components under an *AtmIf* component.

For SPVCs:

```
display AtmIf/<n> Vcc/* Src OsiState
display AtmIf/<n> Vcc/* Dst OsiState
display AtmIf/<n> Vcc/* Msrc OsiState
```

For SPVPs:

```
display AtmIf/<n> Vpc/* Src OsiState
display AtmIf/<n> Vpc/* Dst OsiState
```

For VPT SPVCs:

```
display AtmIf/<n> Vpt/* Vcc/* Src OsiState
display AtmIf/<n> Vpt/* Vcc/* Dst OsiState
```

- 2 Refer to the table “Interpreting OSI states of the Src and Dst component state combinations” (page 55) for an explanation of the results displayed by this procedure.

## Variable values

| Variable | Value                                                      |
|----------|------------------------------------------------------------|
|          | The instance value of the ATM interface. No default value. |
|          |                                                            |

## Procedure job aid

**Table 5**  
Interpreting OSI states of the *Src* and *Dst* component state combinations

| State                                                                                                                                                                           | Meaning                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| src/dst adminState = unlocked<br>src/dst operationalState = enabled<br>src/dst usageState = idle<br>vcc/vpc usageState = idle                                                   | The SPVC or SPVP is not connected and the bandwidth is not allocated on the permanent portion of the source or destination SPVC or SPVP. AIS cells are not being generated.                                                                                            |
| src/dst adminState = unlocked<br>src/dst operationalState = enabled<br>src/dst usageState = idle<br>vcc/vpc usageState = busy                                                   | The SPVC or SPVP is not connected and the bandwidth is allocated on the permanent portion of the source or destination SPVC or SPVP. AIS cell are being generated (assuming that the <i>aisGeneration</i> attribute is set to <i>enabled</i> ).                        |
| src/dst adminState = unlocked<br>src/dst operationalState = enabled<br>src/dst usageState = idle<br>vcc/vpc usageState = idle<br>(Rx is down, Tx is up, not <i>permLocked</i> ) | When the Rx port is down, and the Tx port is up, the ATM interface is down. The vcc/vpc usageState is set to idle automatically, independent of whether AIS cells are being generated. The <i>txCell</i> attribute is used to verify if AIS cells are being generated. |
| (Sheet 1 of 2)                                                                                                                                                                  |                                                                                                                                                                                                                                                                        |

**Table 5 (continued)**  
**Interpreting OSI states of the *Src* and *Dst* component state combinations**

| State                                                                                                                                         | Meaning                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| src/dst adminState = unlocked<br>src/dst operationalState = enabled<br>src/dst usageState = idle<br>vcc/vpc usageState = idle<br>(permLocked) | The SPVC or SPVP is provisioned with permLocked. Though the SPVC or SPVP is disconnected, AIS cells cannot be generated. |
| src/dst adminState = unlocked<br>src/dst operationalState = enabled<br>src/dst usageState = active<br>vcc/vpc usageState = active             | The SPVC or SPVP is connected. AIS cells are not being generated.                                                        |
| (Sheet 2 of 2)                                                                                                                                |                                                                                                                          |

**Table 6**  
**Interpreting OSI states of the *Msrc* and *Party* component state combinations**

| State                                                                                                      | Meaning                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| msrc/party adminState = unlocked<br>msrc/party operationalState = disabled<br>msrc/party usageState = idle | msrc and party: The PMP SPVC is not capable of attempting party establishment. This can occur when parent components or other dependencies (for example, a port supporting the PMP SPVC or party) are not enabled.                                        |
| msrc/party adminState = unlocked<br>msrc/party operationalState = enabled<br>msrc/party usageState = idle  | msrc: This is valid when all dependencies are enabled and the PMP SPVC is capable and attempting party establishment. However, no parties have been established yet.<br><br>party: This is valid when the party is in the process of trying to establish. |
| (Sheet 1 of 2)                                                                                             |                                                                                                                                                                                                                                                           |

**Table 6 (continued)**  
**Interpreting OSI states of the *Msrc* and *Party* component state combinations**

| State                                                                                                       | Meaning                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| msrc/party adminState = unlocked<br>msrc/party operationalState = enabled<br>msrc/party usageState = active | msrc: This is valid when all dependencies are enabled and the PMP SPVC is capable and attempting party establishment. At least one, but not all parties are established.<br><br>party: This is valid when all dependencies are enabled and the party is established. |
| msrc/party adminState = unlocked<br>msrc/party operationalState = enabled<br>msrc/party usageState = busy   | msrc: This is valid when all dependencies are enabled and the PMP SPVC has established all parties.<br><br>party: This is never reported. It is an invalid state.                                                                                                    |
| (Sheet 2 of 2)                                                                                              |                                                                                                                                                                                                                                                                      |

## Determining the status of a virtual connection

Determine the status of a virtual connection (VPC, VCC, and VPT) to monitor these connections.

### Procedure steps

- 1 Display the status attributes of the *Vpc* component.  
`display AtmIf/<n> Vpc/<Vpi> status`
- 2 Display the status attributes of the *Vcc* component.  
`display AtmIf/<n> Vcc/* status`
- 3 Display the status attributes of the *Vpt* component.  
`display AtmIf/<n> Vpt/<Vpi> status`
- 4 Display the status attributes of any VCCs that are associated with a *Vpt* component.  
`display AtmIf/<n> Vpt/* Vcc/* status`
- 5 Display the status attributes of any VCCs associated with a specific *Vpt* component.  
`display AtmIf/<n> Vpt/<Vpi> Vcc/* status`
- 6 See “Interpreting the status of the ATM connection” (page 59) for an explanation of the results of this procedure.

### Variable values

| Variable  | Value                                                  |
|-----------|--------------------------------------------------------|
| <n>       | The instance number of the ATM interface               |
| <Vpi>     | Defines the instance value of the <i>Vpc</i> component |
| Vpt/<Vpi> | The instance value of the <i>Vpt</i> component         |
|           |                                                        |

## Procedure job aid

**Table 7**  
**Interpreting the status of the ATM connection**

| Attribute         | Value            | Meaning                                                                                                                                                                        |
|-------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| localFailureCause | noFailure        | There is currently no bandwidth failure related to this connection                                                                                                             |
|                   | portDown         | The port corresponding to the ATM interface for this connection is down                                                                                                        |
|                   | localBwLoss      | The <i>Ima</i> group corresponding to this connection has lost some bandwidth and as a result this connection has been released.                                               |
|                   | notAdmitted      | This connection has not been admitted by the connection admission control algorithm.                                                                                           |
|                   | appNotRegistered | There is no application registered to use this connection                                                                                                                      |
|                   | disabledByApp    | The application using this connection has requested that the connection be disabled.                                                                                           |
|                   | vpDown           | The Vpt Vcc is down due to its associated Vpt experiencing a fault. This includes VPT not admitted, VP-layer fault detected, or VPT released due to an IMA group link failure. |
|                   | bwReduced        | The connection is operating in a reduced bandwidth state. This connection may be a bandwidth elastic connection that has been allocated less than the requested bandwidth.     |
| aisState          | good             | The connection end-point has not detected any failures on the receive direction of the connection.                                                                             |
| (Sheet 1 of 6)    |                  |                                                                                                                                                                                |

**Table 7 (continued)**  
**Interpreting the status of the ATM connection**

| Attribute      | Value | Meaning                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | bad   | <p>A failure has been detected that affects the ATM layer in the receive direction of the connection. The reasons for the value <i>bad</i> include:</p> <ul style="list-style-type: none"><li>• ATM layer OAM AIS cells are being received (for example, due to an upstream layer physical problem).</li><li>• The parent VPT is receiving OAM VP AIS cells (this condition applies only to VPT VCCs).</li></ul> |
| (Sheet 2 of 6) |       |                                                                                                                                                                                                                                                                                                                                                                                                                  |

**Table 7 (continued)**  
**Interpreting the status of the ATM connection**

| Attribute | Value         | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           |               | <ul style="list-style-type: none"> <li>• A local failure is detected because the port associated with the connection point has failed or is locked. (In this case, the <i>localFailureCause</i> attribute has the value <i>portdown</i>.)</li> <li>• A problem related to bandwidth is detected. For example, the connection was not admitted due to insufficient bandwidth, or was released due to a reduction in bandwidth. (If the connection was not admitted, <i>localFailureCause</i> would have the value <i>notAdmitted</i>. If the connection was released, <i>localFailureCause</i> would have the value <i>localBwLoss</i>.)</li> </ul> <p>For interworking with non-ATM service (for example, frame relay), this may mean that a fault at the far-end, non-ATM portion of the connection has been detected by the remote interworking function. In this case, the remote interworking function initiates AIS cell insertion at the far-end ATM connection end-point towards this connection end-point. For more information, see NN10600-920 <i>Nortel Networks Multiservice Switch 7400/15000/20000 Operations: Frame Relay to ATM Interworking</i></p> |
|           | notApplicable | The <i>Vcc</i> or <i>Vpc</i> component is not a connection end-point and, as a result, AIS termination is not performed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|           | unknown       | The connection has not been activated by the end-point application and is in enabled-idle OSI state.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

(Sheet 3 of 6)

**Table 7 (continued)**  
**Interpreting the status of the ATM connection**

| Attribute      | Value         | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rdiState       | good          | The connection end-point has not detected any failures in the transmit direction of the connection. That is, the end-point is not receiving any ATM layer OAM RDI cells.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                | bad           | <p>A failure has been detected that affects the ATM layer in the receive direction of the connection. The value <i>bad</i> occurs if the connection end-point is receiving ATM layer OAM RDI cells. These cells are inserted by the remote connection end-point when it is in the AIS state.</p> <p>For interworking with non-ATM service (for example, frame relay), this may mean that a fault within the non-ATM portion of the connection has been detected. The interworking function using this connection end-point has detected a fault, has initiated AIS cell insertion downstream, and the AIS cells have reached the far-end connection end-point resulting in RDI cells being transmitted towards this connection end-point. For more information, see NN10600-920 <i>Nortel Networks Multiservice Switch 7400/15000/20000 Operations: Frame Relay to ATM Interworking</i>.</p> |
|                | notApplicable | The <i>Vcc</i> or <i>Vpc</i> component is not a connection end-point and, as a result, RDI termination is not performed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                | unknown       | The connection has not been activated by the end-point application and is in enabled-idle OSI state.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| (Sheet 4 of 6) |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

**Table 7 (continued)**  
**Interpreting the status of the ATM connection**

| Attribute                | Value   | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rxOamCellCongestionState | good    | The rate of OAM cells received at the connection point is less than the maximum permitted threshold.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                          | bad     | The rate of received OAM cells exceeds the maximum permitted threshold of three cell/s for each type of OAM cell (These include AIS RDI, segment link-side loopback, segment device-side loopback, end-to-end loopback, unknown, and corrupted cells). When using trace command OAM cells, the permitted threshold is 250 cell/s. The state indicator remains <i>bad</i> for a time-out period of one minute before returning to <i>good</i> again. During this time-out, OAM cell extraction or monitoring is disabled for the connection point. As a result, other OAM failure conditions may occur (such as failure of running loopbacks). |
|                          | unknown | The connection is not activated (as is the case before a VCC test is started).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

(Sheet 5 of 6)

**Table 7 (continued)**  
**Interpreting the status of the ATM connection**

| Attribute                                                                               | Value         | Meaning                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| endToEndLoopbackState<br>segmentLinkSideLoopbackState<br>segmentSwitchSideLoopbackState | good          | Loopback insertion and termination is enabled and ATM-layer continuity exists; as expected, inserted cells are returning and are being terminated.                                                                                                                                                                                                                                              |
|                                                                                         | bad           | <p>Loopback insertion and termination is enabled and ATM-layer continuity does not exist; inserted cells are not returning.</p> <p>A VCC to VPC link shows the VPC as a segment boundary and the value of segLinkSideLoopback is on, then the value of segLinkSideLoopbackState is bad.</p> <p>Dynamic ATM connections are torn down when loopback status goes from a value of good to bad.</p> |
|                                                                                         | unknown       | No loopback insertion and termination is being performed either because the loopback is provisioned off or because the connection is not activated by the application.                                                                                                                                                                                                                          |
|                                                                                         | notApplicable | Loopback insertion and termination is not being performed because the specific type of loopback is not applicable to the particular connection point. This is true for end-to-end loopbacks at segment end-points and connecting points, for segment device-side loopbacks at connection end-points and connecting points, and for segment link-side loopbacks at connecting points.            |

(Sheet 6 of 6)

## Displaying the status of call redirection

Display the status of call redirection to monitor the connection.

### Prerequisites

- You must be in operational mode to perform this procedure.
- See the NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference* for additional information about operational attributes.

### Procedure steps

- 1 Display operational attributes for Vcc Src component for SPVCs:  
`display Atmif vcc/<vpi.vci> src`
- 2 Display operational attributes for Vpc Src component for SPVPs:  
`display Atmif vpc/<vpi> src`
- 3 Display operational attributes for Vpt Vcc Src component for SPVCs:  
`display Atmif vpt/<vpi> vcc/<vci> src`

### Variable definitions

| Variable  | Value                                 |
|-----------|---------------------------------------|
| <vci>     | The instance value of the vpt vcc.    |
| <vpi>     | The instance value of the vpc or vpt. |
| <vpi.vci> | The instance value of the vcc.        |
|           |                                       |

## Procedure job aid

**Table 8**  
**Interpreting the display of the callRedirection component**

| Attribute                     | Values                            | Meaning                                                                                                                                                                       |
|-------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| currentDestination            | primary, secondary, not Connected | This attribute indicates the active destination address.                                                                                                                      |
| primaryAdminState             | locked, unlocked                  | This attribute indicates the OSI administrative state of the primary destination.                                                                                             |
| secondaryAdminState           | locked, unlocked                  | This attribute indicates the OSI administrative state of the secondary destination.                                                                                           |
| lastFailureCauseCode          | Unsigned32 (0..255)               | This attribute contains the cause code in the last transmitted signaling message to the primary destination that contained the cause information element.                     |
| lastFailureDiagCode           | AsciiString (0..8)                | This attribute contains the diagnostic code, if present, in the last transmitted signaling message to the primary destination that contained the cause information element.   |
| lastSecondaryFailureCauseCode | Unsigned32 (0..255)               | This attribute contains the cause code in the last transmitted signaling message to the secondary destination that contained the cause information element.                   |
| lastSecondaryFailureDiagCode  | AsciiString (0..8)                | This attribute contains the diagnostic code, if present, in the last transmitted signaling message to the secondary destination that contained the cause information element. |

## Monitoring an ATM multicast connection

Monitor any ATM multicast connection by displaying the branches, leaves and relay points to determine how many are in use.

*Note 1:* The maximum number of relay points that can be displayed is 60.

*Note 2:* On GQM-based FPs, the maximum number of branches for a multicast connection is 16.

### Prerequisites

- You need any configured and in-service ATM FP.

### Procedure steps

- Display the multicast connection information for a VPC.  

```
display AtmIf/<n> Vpc/<Vpi> connectionInfo
```
- Display the multicast connection information for a VCC.  

```
display AtmIf/<n> Vpt/<Vpt> Vcc/<Vpi.Vci> connectionInfo
```
- Query the status of multicast branch resources using step 4 through step 6.
- Display the number of switched multicast branch resources used by all PMP SVCs on the port.  

```
display Atmif/<n> ca switchedMulticastBranches
```
- Display the number of permanent multicast branch resources used by all PMP SPVCs and PMP PVCs on the port  

```
display Atmif/<n> ca permanentMulticastBranches
```
- Display the number of multicast branch resources currently available to PMP connections on the lp and the number of multicast branch resources currently in use by all connections (switched and permanent) on the lp.  

```
display Lp/<lp> eng arc multicastBranchesAvailable, multicastBranchesUsage
```
- Display all the relay points (branches) of this connection.  

```
display Atmif/<n> Vpc/<Vpi> RP
```

```
display Atmif/<n> Vpt/<Vpt> Vcc/<Vpi.Vci> RP
```

## Variable values

| Variable  | Value                                           |
|-----------|-------------------------------------------------|
| <n>       | The instance number of the ATM interface.       |
| <Vci>     | The instance value of the <i>Vpi</i> component. |
| <Vpi>     | The instance value of the <i>Vpc</i> component. |
| <Vpi.Vci> | The instance value of the <i>Vcc</i> component. |
| <Vpt>     | The instance value of the <i>Vpt</i> component. |

## Procedure job aid

**Table 9**  
Interpreting the display of the ATM connectionInfo

| Attribute               | Value             | Meaning                                                                                                                                                                                                                                      |
|-------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>distributionType</i> | pointToMultipoint | The attribute indicates the way data is distributed in the connection. The value indicates this connection point is part of a multicast connection.                                                                                          |
| <i>numLeaves</i>        | 0 to 64K          | The attribute indicates the number of leaves of the multicast connection.<br><br><b>Note:</b> For PMP SPVCs, the number of leaves is 0 to 300. For PMP PVCs, the number of leaves is limited by the number of multicast connection branches. |

---

## Examining VPT connection admission

Examine VPT connection admission to monitor how connections associated with virtual path terminators are being admitted, based on bandwidth demands, usage, and availability per bandwidth pool.

### Procedure steps

- 1 Display status information about the *ConnectionAdministrator (Ca)* component belonging to the VPT.  

```
display AtmIf/<n> Vpt/<Vpi> Ca
```
- 2 Examine the attributes listed below in the following order to determine the connection resources of the VPT:
  - poolWaitAdmitConnections
  - poolAdmittedConnection
- 3 If a high number of connections are waiting for admission, you may need to consult your network engineer to determine whether the VPT has been adequately provisioned.
- 4 Examine the attributes listed below in the following order to determine how connections are being admitted on the VPT:
  - poolRequestedBandwidth - examine this attribute first
  - poolAdmittedBandwidth - compare this attribute to the values displayed above.
  - poolAvailableBandwidth
  - poolProvisionedBandwidth

The values for requested bandwidth should be similar to those for admitted bandwidth.
- 5 If the pool of available bandwidth is small, you may need to consult your network engineer to determine whether additional bandwidth should be provisioned for the VPT. The amount of provisioned bandwidth will indicate how much bandwidth is reserved for PVCs.

### Variable values

| Variable | Value                                                    |
|----------|----------------------------------------------------------|
| <n>      | The instance value of the <i>AtmInterface</i> component. |
| <Vpi>    | The instance value of the <i>Vpt</i> component.          |
|          |                                                          |

## Viewing ATM connection statistics

View ATM connection statistics for VPC, VCC, and VPT traffic flow to monitor the performance of a connection. The inter-relationship between the statistics described in this section is shown in the figure “Summary of AtmIf statistics collection” (page 41). Note that statistics are available on a limited basis on APC-based function processors. See the table “AtmIf statistics available on APC-based FPs” (page 42) for a listing of supported per-connection statistics.

### Procedure steps

- 1 Display information for a VPC.
 

```
display AtmIf/<n> Vpc/<Vpi> Statistics
```
- 2 Display information for a VCC.
 

```
display AtmIf/<n> Vcc/<Vpi.Vci> Statistics
```
- 3 Display information for all VCCs associated with all VPTs.
 

```
display AtmIf/<n> Vpt/* Vcc/* Statistics
```
- 4 Display information for all VCCs associated with a specific VPT.
 

```
display AtmIf/<n> Vpt/<Vpt> Vcc/* Statistics
```
- 5 Examine the following statistics to determine how much traffic is flowing across the connection
  - txCell, rxCell
  - txCellClp, rxCellClp
- 6 Examine the following connections to determine how much traffic is being discarded.
  - txCellDiscard, rxCellDiscard, txFrameDiscard, rxFrameDiscard
  - txCellDiscardClp, rxCellDiscardClp, txFrameDiscardClp, rxFrameDiscardClp

**Note:** The counters for these statistics are reset only when the connection is reset. After a reset, users should be aware that during connection establishment, OAM cells are generated to determine cell status. Regardless of the intermediate state of a connection, these cells are transmitted and recorded in the appropriate operational attributes for statistics at various levels in the ATM component hierarchy. Therefore, on card rest the statistics for the *AtmIf* and associated connections may not be zero.

- 7 If the values displayed seem high, see “Troubleshooting connections” (page 229).

### Variable values

| Variable  | Value                                                              |
|-----------|--------------------------------------------------------------------|
| <n>       | The instance number of the <i>AtmIf</i> component being monitored. |
| <Vpi>     | Defines the instance value of the <i>Vpc</i> component.            |
| <Vpi.Vci> | The instance number of the <i>Vcc</i> component.                   |
| <Vpt>     | The instance number of the <i>Vpt</i> component.                   |
|           |                                                                    |

## Viewing CTD calculations

View cell transfer delay (CTD) calculations if the interface is configured for CTD calculations on SPVCs and SPVPs. You can display the collected measurements under the VCC and VPC components of the associated connections. The CTD statistics are displayed as operational attributes of the VCC and VPC components of every associated source SPVC or SPVP on the interface. Nortel Networks Multiservice Switch systems calculate the CTD by dividing the round trip delay (RTD) in half. CTD is measured with microsecond precision.

### Prerequisites

- The inter-relationship between the statistics described in this section is shown in the figure “Summary of AtmIf statistics collection” (page 41). Note that statistics are available on a limited basis on APC-based function processors. See the table “AtmIf statistics available on APC-based FPs” (page 42) for a listing of supported per-connection statistics.

### Procedure steps

- 1 Display CTD measurements for a VPC.  

```
display AtmIf/<n> Vpc/<Vpi> performance
```
- 2 Display CTD measurements for a VCC.  

```
display AtmIf/<n> Vcc/<Vpi.Vci> performance
```
- 3 Examine the attributes listed below to determine the CTD for the connection:
  - lastMinimumCtd
  - lastMaximumCtd
  - lastAverageCtd
  - currentCtd
  - lastCtdSampleSize
- 4 If the statistics display noMeasurement, there is a configuration error or a loopback error. To ensure that CTD monitoring is configured correctly, see NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*. To ensure that the loopback state is good, check the operational attribute segSwitchSideLoopbackState for the VCC or VPC.

### Variable values

| Variable  | Value                                                       |
|-----------|-------------------------------------------------------------|
| <n>       | The instance number of the Atmlf component being monitored. |
| <Vpi>     | The instance number of the Vpc component.                   |
| <Vpi.Vci> | The instance number of the Vcc component.                   |
|           |                                                             |

## Viewing congestion control activity for connections

View congestion control activity for connections (VPCs and VCCs). This procedure is also an extension of viewing errors through the interface statistics. In each of the following steps, the wildcard for VCC or VPC in each command can be replaced with a specific VCI.VPI or VPI address to see the operating characteristics for a particular connection. For more information about the attributes in this procedure, see NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*.

Congestion at the connection level may result from either cells arriving over the backplane in excess of the shaping rate for the connection or congestion of all connections in the corresponding emission priority. A connection which is exceeding its shaping rate appears as discards on that connection only. In most cases, congestion on the link or in the queues associated with the emission priority appears as discards for all connections of that emission priority or lower. For more information, see the following documents:

- NN10600-705 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Management Fundamentals*
- NN10600-706 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals*
- NN10600-707 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Queuing and Scheduling Fundamentals*
- NN10600-708 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM CAC and Bandwidth Fundamentals*

### Prerequisites

- The inter-relationship between the statistics described in this section is shown in the figure “Summary of AtmIf statistics collection” (page 41). Note that statistics are available on a limited basis on APC-based function processors. See the table “AtmIf statistics available on APC-based FPs” (page 42) for a listing of supported per-connection statistics.
- For more information concerning the txCellDiscard and txFrameDiscard attributes as they apply to the AQM and CQC-based function processors, see NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*.

## Procedure steps

- 1 Display the connection's traffic shaping state.

```
display Atmif/<n> Vcc/<Vpi.Vci> Tm trafficShaping
```

- 2 EFCI marking may have occurred at the remote end or at the current interface. (On AQM-based function processors, calls with EFCI marking are counted through the *txCellEfc* attribute. EFCI-related statistics are not available on the CQC and APC-based function processors.) Determine queue congestion for all connections on the interface.

```
display Atmif/<n> Vcc/* Tm txQueueLength,
txQueueCongestionState,txQueueThreshold
```

```
display Atmif/<n> Vpc/* Tm txQueueLength,
txQueueCongestionState,txQueueThreshold
```

```
display Atmif/<n> vpt/* Vcc/* Tm txQueueLength,
txQueueCongestionState,txQueueThreshold
```

```
display Atmif/<n> vpt/<vpi> Vcc/* Tm txQueueLength,
txQueueCongestionState,txQueueThreshold
```

**Note:** Received cells with EFCI marking are counted through the *rxCellEfc* attribute. This attribute indicates congestion at one or more nodes along the path toward the source end of the connection.

- 3 Discarded calls or frames that are counted through the *txDiscard* and *txDiscardClp* attributes are discarded on transmission to the link. For AQM and CQC-based function processors, determine which connections are discarding cells and frames.

```
display Atmif/<n> Vcc/* txCellDiscard, txFrameDiscard
```

```
display Atmif/<n> Vpc/* txCellDiscard, txFrameDiscard
```

**Note:** These attributes are not available on the APC-based function processors.

- 4 For AQM and CQC-based function processors, determine cell and frame discard for the receive direction.

```
display Atmif/<n> Vcc/* rxCellDiscard, rxFrameDiscard
```

```
display Atmif/<n> Vpc/* rxCellDiscard, rxFrameDiscard
```

**Note:** These attributes are not available on the APC-based function processors.

- 5 Determine which connections are experiencing UPC violations or partial pack discard (PPD) in the ingress direction.

For AQM, APC, and CQC-based function processors, use the following commands:

```
display Atmif/<n> Vcc/* tm rxTdt
```

```
display Atmif/<n> Vpc/* tm rxTdt
```

**Note:** The *rxUpcViolationOnEnforcer1* and *rxUpcViolationOnEnforcer2* attributes show whether the violations are on enforcer 1 (PCR0+1, CDVT or DGCRA) or on enforcer 2 (PCR0, SCR, MBS or CDVT).

For AQM and CQC-based function processors, use the following commands:

```
display Atmif/<n> Vcc/* rxCellDiscard
```

```
display Atmif/<n> Vpc/* rxCellDiscard
```

For AQM-based function processors, use the following commands:

```
display Atmif/<n> Vcc/* rxUpcViolationOnEnforcer1,
rxUpcViolationOnEnforcer2
```

```
display Atmif/<n> Vpc/* rxUpcViolationOnEnforcer1,
rxUpcViolationOnEnforcer2
```

## Variable values

| Variable | Value                                                                |
|----------|----------------------------------------------------------------------|
| <n>      | The instance number of the <i>AtmIf</i> component under examination. |
| <vpi>    | The instance value of the <i>Vpt</i> component.                      |
|          |                                                                      |

## Viewing ATM traffic descriptor parameters

View ATM traffic descriptor parameters to monitor additional connection statistics.

### Prerequisites

Traffic descriptors determine how the UPC and CAC traffic management controls apply to cells. For information, see the following documents:

- NN10600-705 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Management Fundamentals*
- NN10600-706 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals*
- NN10600-707 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Queuing and Scheduling Fundamentals*
- NN10600-708 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM CAC and Bandwidth Fundamentals*

### Procedure steps

- 1 List the parameters for the transmit direction.

```
display Atmif/<n> Vcc/<Vpi.Vci> Tm txTrafficDescParm
```

```
display Atmif/<n> Vpc/<Vpi> Tm txTrafficDescParm
```

```
display Atmif/<n> Vpt/<Vpi> Tm txTrafficDescParm
```

- 2 List the parameters for the receive direction.

```
display Atmif/<n> vcc/<Vpi.Vci> Tm rxTrafficDescParm
```

```
display Atmif/<n> Vpc/<Vpi> Tm rxTrafficDescParm
```

```
display Atmif/<n> Vpt/<Vpi> Tm rxTrafficDescParm
```

---

## Variable values

| Variable  | Value                                                                |
|-----------|----------------------------------------------------------------------|
| <n>       | The instance number of the <i>Atmlf</i> component under examination. |
| <Vpi>     | The instance value of the <i>Vpc</i> and <i>Vpt</i> components.      |
| <Vpi.vci> | The instance value of the <i>Vcc</i> component.                      |
|           |                                                                      |

## Monitoring a point-to-multipoint SPVC connection

Monitor a point-to-multipoint SPVC connection to determine its overall status.

### Prerequisites

- For more information on interpreting the OSI states, see “Interpreting OSI states of the Msrc and Party component state combinations” (page 56).

### Procedure steps

- 1 Query the status of the VCC component, using the procedure “Monitoring an ATM multicast connection” (page 67).
- 2 Query the status of an entire PMP SPVC connection.  

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc
```
- 3 Query the OSI states of the entire point-to-multipoint connection using step 4 through step 6.
- 4 Display the OSI administrative state.  

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc adminState
```
- 5 Display the OSI operational state.  

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc operationalState
```
- 6 Display the OSI usage state.  

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc usageState
```
- 7 Query the parties of the entire point-to-multipoint connection using step 8 through step 10.
- 8 Display the number of parties currently established for the PMP SPVC.  

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc establishedParties
```
- 9 Display the number of parties expected to be established for the PMP SPVC.  

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc expectedParties
```
- 10 Display the number of parties provisioned for the PMP SPVC.  

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc totalParties
```

**Note:** The number of *expectedParties* is always equal to the *totalParties* or 0 if the *msrc* is disabled.

- 11 Query the status of an individual party.

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc Party/<party>
```

- 12 Query the OSI states of a single party of the point-to-multipoint connection using step 13 through step 15.

- 13 Display the OSI administrative state.

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc Party/<party>
adminState
```

- 14 Display the OSI operational state.

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc Party/<party>
operationalState
```

- 15 Display the OSI usage state

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc Party/<party>
usageState
```

- 16 Display the number of failed attempts to set up the party since the first time the connection tried to establish.

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc Party/<party>
retryCount
```

- 17 Display the cause code in the last received signaling message that contained the cause code information element.

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc Party/<party>
lastFailureCauseCode
```

- 18 Display the diagnostic code in the last received signaling message that contained the cause code information element.

```
display Atmif/<n> Vcc/<Vpi.Vci> Msrc Party/<party>
lastFailureDiagCode
```

**Note:** The diagnostic code is present only if a procedural error is detected by the signaling protocol. The diagnostic code, if present, is always accompanied by the cause code.

- 19 Identify failed parties or failed PMP SPVCs using step 20 and step 21.

- 20 Display all PMP SPVCs that have at least one party that is not established.

```
display Atmif/* Vcc/* Msrc/(usageState != busy)
```

21 Display which parties are not established.

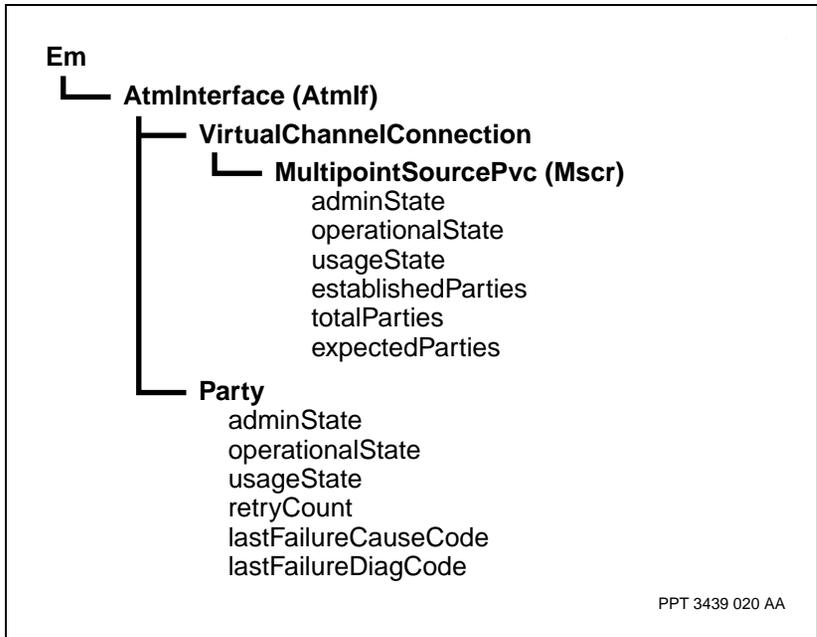
```
display Atmif/* Vcc/* Msrc Party/(usageState !=
active)
```

### Variable definitions

| Variable  | Value                                                                                          |
|-----------|------------------------------------------------------------------------------------------------|
| <lp>      | The number of the LP associated with the ATM function processor.                               |
| <n>       | The instance value of the <i>AtmIf</i> component, and can be any unique value from 1 to 4 095. |
| <party>   | The number of the party.                                                                       |
| <vpi.vci> | The instance value of the <i>VCC</i> component.                                                |

### Procedure job aid

Figure 3  
Point-to-multipoint SPVC connection component hierarchy



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## Considerations for monitoring queue length

Interpreting common queuing lengths on ATM IP function processors differs from this interpretation for CQC-based function processors.

On ATM IP function processors, common queuing is achieved through a virtual queue. Two types are used. The *txQueueLength* operational attribute under a *Vcc* component shows the number of cells for that particular VCC and not for the entire contents of the virtual queue. For this reason, the queue lengths differ for VCCs for a particular service category under an ATM interface. The queue length of the entire virtual common queue is not visible under the *Vcc* component.

For rtVBR and CBR, queuing is handled in an identical manner to those for CQC-based function processors. The *unshapedTransmitQueuing* attribute reads common for connections under these service categories. For nrtVBR and UBR, cells for different VCCs are arranged in order of first-in first-out (FIFO). The *unshapedTransmitQueuing* attribute reads *fifo* for connections under these service categories.

On CQC-based function processors, there is a physical queue which functions in a FIFO manner. The *txQueueLength* operational attribute under a *Vcc* component (where common queuing is enabled) shows the length for the entire queue. The number of cells occupied by a specific VCC is not visible.



## Chapter 4

# Signal monitoring

---

Monitor signaling to determine whether the settings are appropriate. The signaling OSI state is either enabled or disabled. If signaling is disabled, the node cannot route SVC and SPVC calls across the interface. Disabling the integrated local management interface (ILMI) operational state, however, will not disable signaling. For more information, refer to the *Integrated Local Management Interface (ILMI) Specification Version 4.0* (af-ilmi-0065.000), ATM Forum Technical Committee, 1996.

### Prerequisites to monitoring signaling

- See “Connection monitoring” (page 51) for information and procedures that are common to monitoring for all connection types.

### Monitoring signaling tasks

This task flow shows you the sequence of procedures you perform to monitor signaling:

- “Displaying information on the signaling channel” (page 86)
- “Displaying information on ILMI PDUs” (page 88)

## Displaying information on the signaling channel

Display information on the signaling channel to monitor its attributes.

The meanings of the statistics attributes are listed in the table “Switched connection statistics under the Signalling component” (page 86).

### Procedure steps

- 1 Display the attributes for the *Signalling* subcomponent under the interface.

```
display AtmIf/<n> <ifType> Signalling
```

The cause codes are listed under the *lastTxCauseCode* and *lastRxCauseCode* attributes. The code returned applies to the last failed SPVC, SVC, or SPVP call request. The diagnostic codes are listed under the *lastTxDiagCode* and *lastRxDiagCode* attributes.

### Variable values

| Variable | Value                                     |
|----------|-------------------------------------------|
| <ifType> | Uni, Lisp, Aini, or Pnni.                 |
| <n>      | The instance number of the ATM interface. |
|          |                                           |

### Procedure job aid

**Table 10**  
Switched connection statistics under the *Signalling* component

| Attribute                    | Meaning                                                                        |
|------------------------------|--------------------------------------------------------------------------------|
| <i>peakConnections</i>       | high water mark of connections                                                 |
| <i>successfulConnections</i> | the number of switched connections that have been successfully established     |
| <i>failedConnections</i>     | the number of switched connections that have not been successfully established |
|                              |                                                                                |

The attribute *txPdus* lists the number of transmitted signaling protocol data units (PDU). The attribute *rxPdus* lists the number of received signaling PDUs.

## Displaying information on ILMI PDUs

Display information on ILMI PDUs to determine if connections can be routed across the interface. If the integrated local management interface (ILMI) operational state is disabled, then signaling is not disabled. If signaling is disabled, SVC and SPVC connections cannot be routed across the interface, although SPVCs and SPVPs can still originate and terminate on the interface.

### Procedure steps

- 1 Display the attributes for the subcomponent under the interface.

```
display AtmIf/<AtmIf> Uni Ilmi
```

**Note:** The attribute *txPdus* lists the number of transmitted ILMI PDUs. The attribute *rxPdus* lists the number of received ILMI PDUs.

### Variable values

| Variable | Value                                       |
|----------|---------------------------------------------|
| <AtmIf>  | is the instance number of the ATM interface |
|          |                                             |

---

## Chapter 5

# Routing monitoring

---

Monitor routing to determine if switched connections are operating properly within your networking environment.

### Prerequisites to monitoring routing

- See “Connection monitoring” (page 51) for information and procedures that are common to monitoring for all connection types.

### Monitoring routing tasks

- “Displaying information on the number of calls routed” (page 94)
- “Displaying a physical link or a virtual path connection” (page 95)
- “Monitoring PNNI networking operational measurements” (page 96)
- “Displaying OSI state information for SVCC RCC operational information” (page 100)
- “Displaying SVCC RCC operational attributes” (page 101)
- “Displaying SVCC-based statistics” (page 103)
- “Displaying the exit Vcc used by the SVCC-based RCC” (page 105)
- “Displaying logical link relationships in the PNNI networking hierarchy” (page 106)
- “Displaying the physical links making up a logical linking the PNNI networking hierarchy” (page 109)
- “Displaying the physical nodes reachable from a logical node in the PNNI networking hierarchy” (page 111)

- “Optimizing connections and monitoring rerouting” (page 113)
- “Optimize command” (page 114)
- “Activating a module optimization pass on a PNNI node” (page 115)
- “Optimizing connections on an ATM interface” (page 116)
- “Monitoring path optimization on an ATM interface” (page 117)
- “Optimizing an individual connection” (page 123)
- “Listing the signaling interfaces that have rerouting capabilities” (page 125)
- “Monitoring connections on an ATM interface” (page 126)
- “Troubleshooting scenarios” (page 126)
- “Rerouting alarm” (page 127)
- “Monitoring PNNI path load balancing” (page 129)
- “Clearing PNNI load balancing” (page 131)
- “Setting up atmPathTrace override configuration” (page 132)
- “Initiating a path trace filter” (page 134)
- “Initiating a PathTrace Test connection” (page 136)
- “Initiating a connection trace” (page 151)
- “Using the RouteFinder component” (page 152)
- “Setting the RouteFinder’s destination address and the number of computed routes” (page 153)
- “Setting the RouteFinder’s ATM traffic requirements” (page 154)
- “Setting RouteFinder component attributes supporting PNNI load balancing and route caching” (page 167)
- “Using the RouteFinder to set the highest PNNI level used for route computation” (page 170)
- “Monitoring PNNI route caching” (page 172)
- “Clearing the PNNI route cache” (page 175)
- “Monitoring PNNI node reachability” (page 176)

- “Monitoring the topology database using the active parent node” (page 177)
- “Monitoring the topology database using the upnode” (page 178)
- “Monitoring the topology database using horizontal link ATM service metrics” (page 180)
- “Monitoring the topology database using uplink ATM service category metrics” (page 183)
- “Monitoring the topology database using the dynamically created PNNI network hierarchy” (page 188)

### **Port ID information**

This section contains information on port ID to interface ID conversions and procedures on displaying port ID information. See the following sections:

- “Converting port IDs to interface IDs for ATM ports” (page 93)
- “Converting port IDs to interface IDs for non-ATM ports” (page 93)

Nortel Networks Multiservice Switch node port IDs can be converted to interface IDs. Refer to the figure “Example of RouteFinder (Rf) output” (page 92) to understand how this conversion can be performed.

**Figure 4**  
**Example of RouteFinder (Rf) output**

```
ARtg Pnni Rf
Route 1:
node id = 60A0390012345678123456780000F900201B35900060
port id = 720897
node id = 60A0390012345678123456780000F900201B35900060
ok 1998-12-10 03:18:09.84
```

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```
ARtg Pnni Rf
Route 1:
node id = 60A03900123456780000F900201B35900060
node name@level = EM/CHICAGO@96
port id = 720897
interfaceName = AtmIf/60
ok 1998-12-10 03:18:09.84
```

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In this example, the port ID of 720897 equals a hexadecimal value of 0x000B0001. The least significant 4 bits of the port ID represents the port type of either 1 or 2.

How you convert the port ID to a interface ID depends on the port type. Every port ID in a Nortel Networks Multiservice Switch network is one of two types:

- type 1, for ATM ports
- type 2, for non-ATM ports

**Converting port IDs to interface IDs for ATM ports**

For the port ID of 720897 illustrated in the figure “Example of RouteFinder (Rf) output” (page 92), you interpret the equivalent hexadecimal value as follows:

- The least significant 4 bits (in this example 1) indicate that this is a type 1 port (an ATM port).
- The next 12 bits (in this example 000) represent the VPI number. Currently this value is always 0. For Nortel Networks Multiservice Switch networks, this value is reserved for future use.
- The most significant 16 bits (in this example 000B) represent the ATM interface value. In this example, 000B maps to AtmIf/11.

**Converting port IDs to interface IDs for non-ATM ports**

For this example, consider port ID 284210 which has a hexadecimal equivalent of 0x00045632. You interpret the equivalent hexadecimal value as follows:

- The least significant 4 bits (in this example 2) indicate that this is a type 2 port (a non-ATM card).
- The next 4 bits represent the card number (in this example card 3). For type 2 ports, you cannot determine which ports on the card.
- The most significant 24 bits (in this example 000456) represent an internal counter, in this example 456.

## Displaying information on the number of calls routed

Display information on the number of calls routed. Nortel Networks Multiservice Switch nodes maintain information for ATM calls such as the number of calls the node tries to route, the number of failed routing attempts, and the addresses associated with the node.

### Procedure steps

- 1 Display the ATM routing operational attributes.

```
display ARtg
```

The *routingAttempts* attribute lists the total number of calls that the node tried to route. The *callsFailed* attribute lists the total number of calls that the node did not route successfully. The counter for both attributes wraps when it exceeds the maximum value.

## Displaying a physical link or a virtual path connection

Display a physical link or virtual path connection. Nortel Networks Multiservice Switch nodes maintain information for ATM calls such as the number of calls the node tries to route, the number of failed routing attempts, and the addresses associated with the node.

### Procedure steps

- 1 Display the port or virtual path connection associated with a port ID.

```
display ARtg Port/<Port>
```

- 2 Display the component name associated with a physical port.

```
display ARtg Port/<Port> componentName
```

### Variable values

| Variable | Value                                                                      |
|----------|----------------------------------------------------------------------------|
| <Port>   | The instance number of the port on the node within the ATM routing domain. |
|          |                                                                            |

### Procedure job aid

**Figure 5**  
**Physical link or virtual path connection component hierarchy**



## Monitoring PNNI networking operational measurements

Monitor PNNI networking operational measurements involving:

- neighbor nodes
- horizontal links
- uplinks

For procedures displaying SVCC RCC operational information, see “Displaying SVCC RCC operational attributes” (page 101)

### Procedure steps

- 1 Display statistics on the routing control channel.  

```
display AtmIf/<AtmIf> Pnni Rcc
```
- 2 Display the routing status of an LGN at a specified level of the PNNI hierarchy.  

```
display ARtg Pnni CfgNode/<CfgNode_level>
```
- 3 Display the operational state of the CfgNode.  

```
display ARtg Pnni CfgNode/* IgnState
```
- 4 Display the leadership priority advertised by the peer group leader (PGL) node.  

```
display ARtg Pnni CfgNode/<CfgNode_level>
opLeadershipPriority
```
- 5 Display the node ID of the node that is currently advertised as the preferred PGL.  

```
display ARtg Pnni CfgNode/<CfgNode_level>
preferredPglNodeId
```

**Note:** If a preferred PGL has not been chosen, this attribute's value will be set to zero.
- 6 Display the version of the PNNI routing protocol used to exchange information over the link.  

```
display ARtg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> negotiatedVersion
```
- 7 Display the derived aggregation token value used on a link by using one of the options listed below.

Display via the *AtmIf* or *AtmIf Vpt* components.

```
display AtmIf/<AtmIf> Pnni Rcc/<remote_LGN_address>
derivedAggregationToken
```

or use:

```
display AtmIf/<AtmIf> Vpt/<Vpt> Pnni
Rcc/<remote_LGN_address> derivedAggregationToken
```

For a horizontal link, display the aggregation token value.

```
display ARTg Pnni CfgNode/<CfgNode_level> Nbr/
<Nbr_nodeID> HLnk/<HLnk_portID> aggregationToken
```

For an uplink, display the aggregation token value.

```
display ARTg Pnni CfgNode/<CfgNode_level> ULnk/
<ULnk_portID> aggregationToken
```

- 8 Display the state of a horizontal link.

```
display ARTg Pnni CfgNode/<CfgNode_level> Nbr/
<Nbr_nodeID> HLnk/<HLnk_portID> state
```

- 9 Display the port identifier of the port at the remote end of the link as assigned by the remote node.

```
display ARTg Pnni CfgNode/<CfgNode_level> Nbr/
<Nbr_nodeID> HLnk/<HLnk_portID> remotePortId
```

- 10 Display the list of inducing uplinks forming a horizontal link.

```
display ARTg Pnni CfgNode/<CfgNode_level> Nbr/
<Nbr_nodeID> HLnk/<HLnk_portID> InducingUpLink/*
```

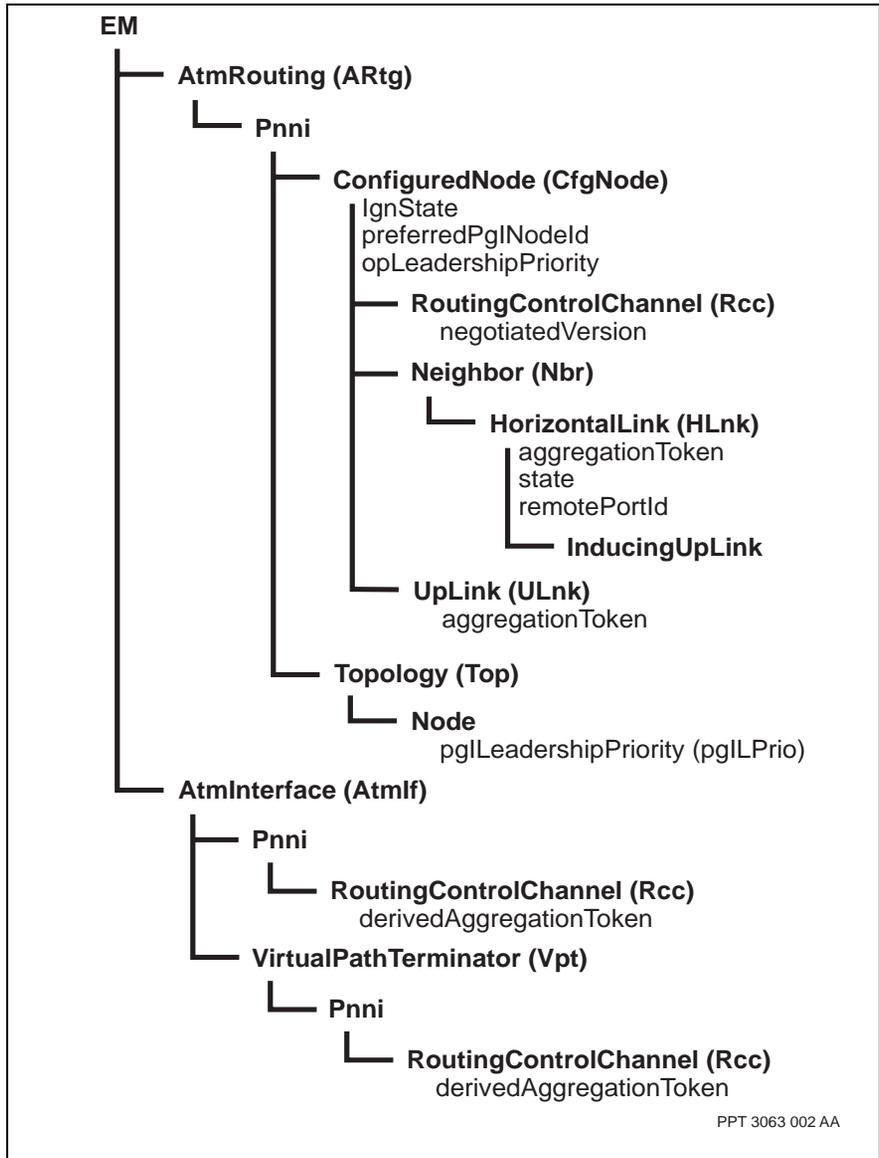
## Variable values

| Variable        | Value                                                                                                                   |
|-----------------|-------------------------------------------------------------------------------------------------------------------------|
| <AtmIf>         | The instance number of the ATM interface.                                                                               |
| <CfgNode_level> | The level of the node in the PNNI networking hierarchy having a value of between 0 and 104, inclusive.                  |
| <HLnk_portID>   | The port ID identifying the logical connection between the ancestor ( <i>CfgNode</i> ) and its neighbor ( <i>Nbr</i> ). |
| (Sheet 1 of 2)  |                                                                                                                         |

| <b>Variable</b>      | <b>Value</b>                                                                               |
|----------------------|--------------------------------------------------------------------------------------------|
| <remote_LGN_address> | The address of the node that is acting as the LGN at the specified level in the hierarchy. |
| <UpLink_portID>      | The port ID representing the logical uplink associated with the <i>CfgNode</i> .           |
| (Sheet 2 of 2)       |                                                                                            |

## Procedure job aid

Figure 6  
Component tree for querying PNNI networking operational measurements



## Displaying OSI state information for SVCC RCC operational information

Display OSI state information for SVCC RCC for use in route computation.

### Procedure steps

- 1 Display the OSI state information level that will be used in route computation.

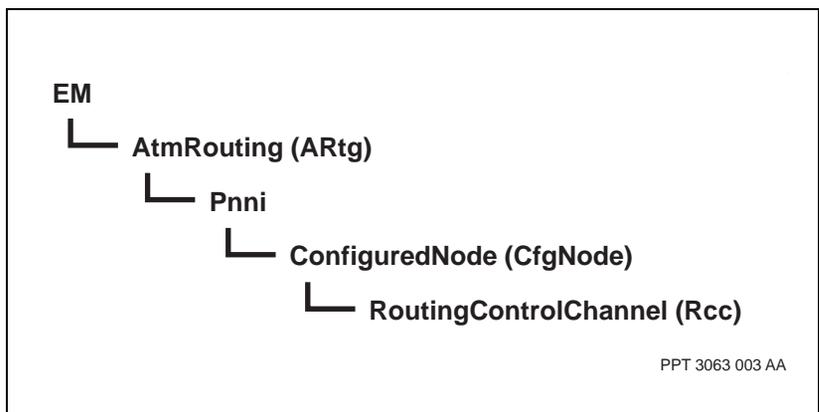
```
display ARtg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> state
```

### Variable values

| Variable             | Value                                                                                                  |
|----------------------|--------------------------------------------------------------------------------------------------------|
| <CfgNode_level>      | is the level of the node in the PNNI networking hierarchy having a value between 0 and 104, inclusive. |
| <remote_LGN_address> | is the address of the node that is acting as the LGN at the specified level in the hierarchy.          |
|                      |                                                                                                        |

### Procedure job aid

**Figure 7**  
OSI state information for SVCC RCC operational information component hierarchy



## Displaying SVCC RCC operational attributes

Display SVCC RCC operational attributes as part of monitoring SVCC RCCs.

### Procedure steps

- 1 Display the state of the Hello protocol exchange over a specified link.

```
display ARTg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> helloState
```

- 2 Display the ATM end system address to which SVCC establishment is attempted.

```
display ARTg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> remoteAddress
```

- 3 Display the number of failed attempts to set up the SVCC RCC.

```
display ARTg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> retryCount
```

- 4 Display the cause code in the last transmitted signaling message containing the CAUSE information element.

```
display ARTg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> lastFailureCauseCode
```

- 5 Display the diagnostic code in the last transmitted signaling message.

```
display ARTg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> lastFailureDiagCode
```

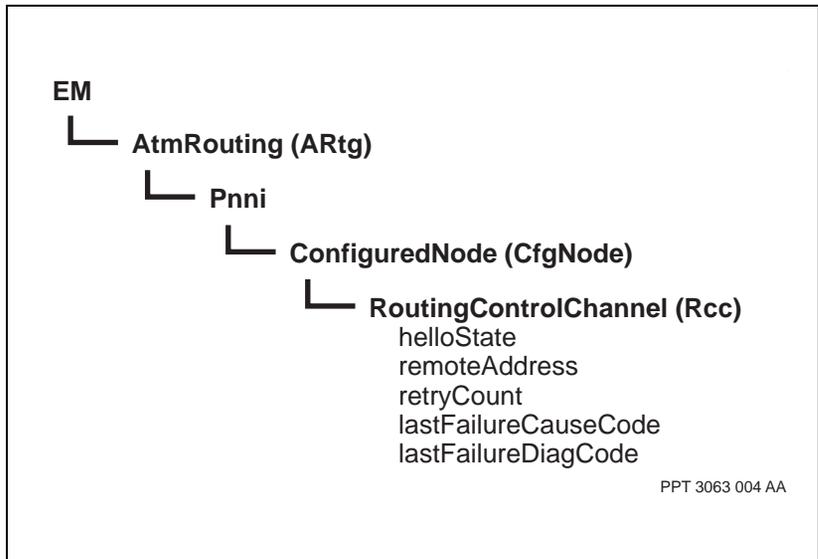
**Note:** The diagnostic code is present only if a procedural error is detected by the signaling protocol. The diagnostic code, if present, is always accompanied by the cause code.

### Variable values

| Variable             | Value                                                                                                  |
|----------------------|--------------------------------------------------------------------------------------------------------|
| <CfgNode_level>      | is the level of the node in the PNNI networking hierarchy having a value between 0 and 104, inclusive. |
| <remote_LGN_address> | is the address of the node that is acting as the LGN at the specified level in the hierarchy.          |
|                      |                                                                                                        |

## Procedure job aid

**Figure 8**  
**SVCC RCC operational attributes component hierarchy**



## Displaying SVCC-based statistics

Display SVCC-based statistics as part of monitoring SVCC RCCs.

### Procedure steps

- 1 Display the total number of Hello packets received across the RCC, including bad and mismatched packets.

```
display ARtg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> helloPacketsRx
```

- 2 Display the total number of mismatched Hello packets received across the RCC.

```
display ARtg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> helloPacketsTx
```

- 3 Display the total number of Hello packets received across the RCC.

```
display ARtg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> mismatchedhelloPacketsRx
```

- 4 Display the total number of bad Hello packets received across the RCC.

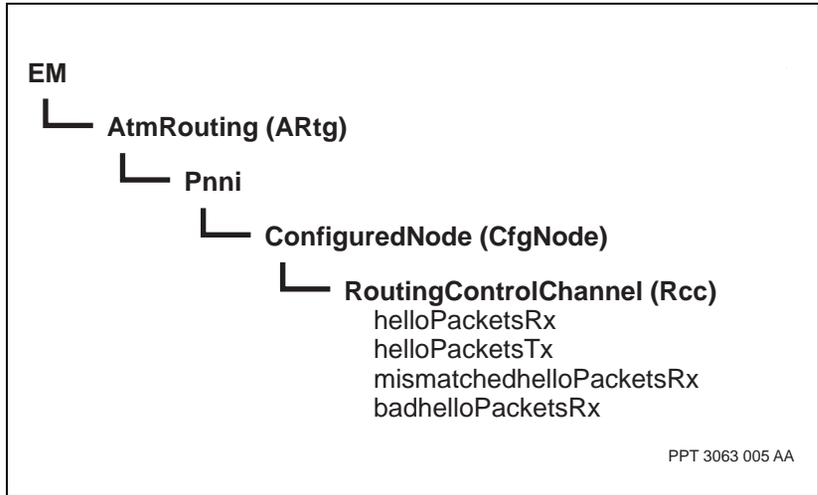
```
display ARtg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> badhelloPacketsRx
```

### Variable values

| Variable             | Value                                                                                               |
|----------------------|-----------------------------------------------------------------------------------------------------|
| <CfgNode_level>      | The level of the node in the PNNI networking hierarchy having a value between 0 and 104, inclusive. |
| <remote_LGN_address> | The address of the node that is acting as the LGN at the specified level in the hierarchy.          |
|                      |                                                                                                     |

## Procedure job aid

**Figure 9**  
**SVCC-based statistics component hierarchy**



## Displaying the exit Vcc used by the SVCC-based RCC

Display the exit Vcc used by the SVCC-based RCC as part of monitoring SVCC RCCs.

### Procedure steps

- 1 Display the exit Vcc used by the SVCC-based RCC.

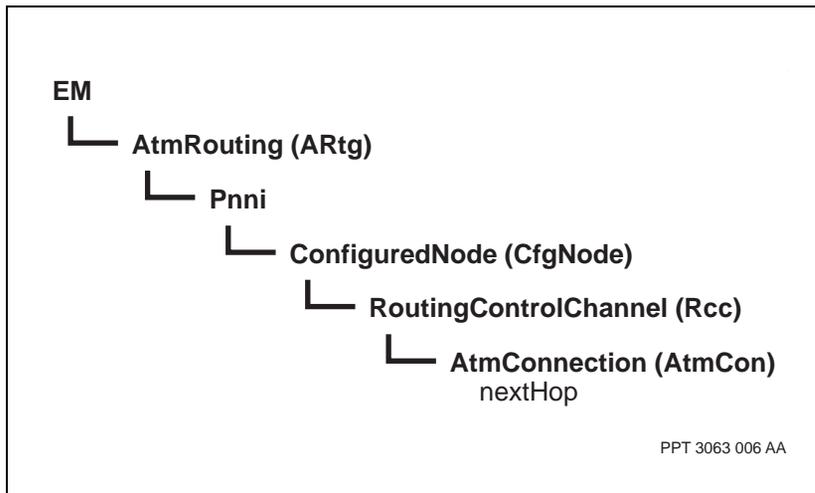
```
display ARtg Pnni CfgNode/<CfgNode_level>
Rcc/<remote_LGN_address> AtmCon nextHop
```

### Variable values

| Variable             | Value                                                                                               |
|----------------------|-----------------------------------------------------------------------------------------------------|
| <CfgNode_level>      | The level of the node in the PNNI networking hierarchy having a value between 0 and 104, inclusive. |
| <remote_LGN_address> | The address of the node that is acting as the LGN at the specified level in the hierarchy.          |
|                      |                                                                                                     |

### Procedure job aid

Figure 10  
Exit Vcc component hierarchy



## Displaying logical link relationships in the PNNI networking hierarchy

Display logical link relationships in the PNNI hierarchy as part of monitoring nodal relationships.

### Procedure steps

- 1 Display link information for neighboring nodes in the same peer group at the lowest level.

```
display ARTg Pnni CfgNode/<CfgNode_level> Nbr rccList
```

- 2 Display a horizontal link.

```
display ARTg Pnni CfgNode/<CfgNode_level> Nbr/
<Nbr_nodeID> HLnk/*
```

**Note:** A horizontal link is a link between two LGNs and is formed by one or more uplinks. Also, a horizontal link can be formed directly from physical links having the same aggregation token.

- 3 Display the inducing uplink to the node that forms an horizontal link with an ancestor's neighbor.

```
display ARTg Pnni CfgNode/<CfgNode_level> Nbr/
<Nbr_nodeID> HLnk/<HLnk_portID> InducingUpLink/*
```

- 4 Display an uplink formed by a physical node (by one physical link) or by a logical node (by one or more uplinks).

```
display ARTg Pnni CfgNode/<CfgNode_level> ULnk/
<ULnk_portID>
```

- 5 Display the physical link that is the inducing uplink between two nodes that are not neighbors but have common ancestors (share the common peer group ID).

```
display ARTg Pnni CfgNode/<CfgNode_level> ULnk/
<ULnk_portID> InducingUpLink/
<InducingUpLink_nodeID>,<InducingUpLink_portID>
```

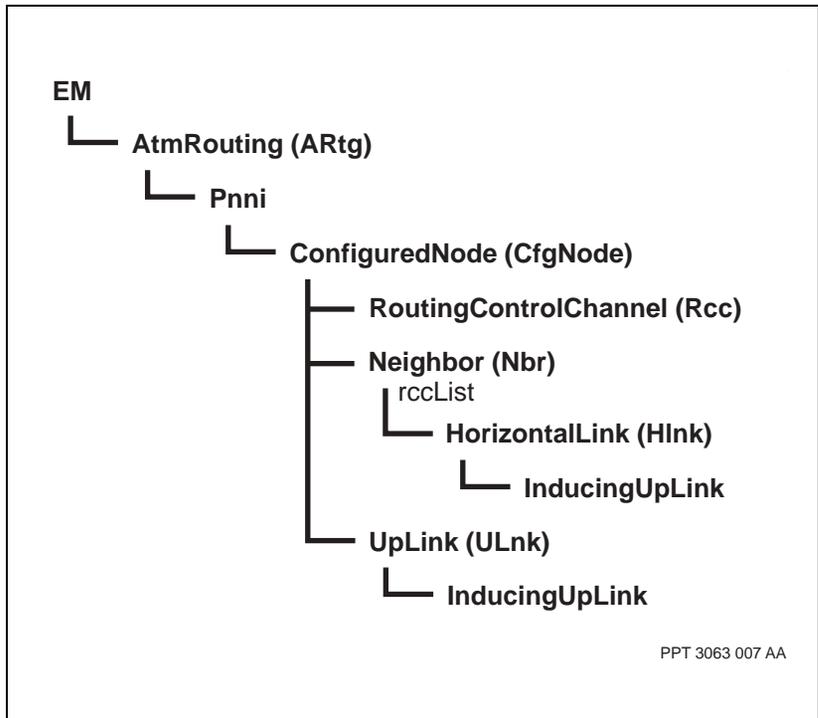
## Variable values

| Variable                                           | Value                                                                                                                                                                                                                                |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <CfgNode_level>                                    | The level of the node in the PNNI networking hierarchy having a value between 0 and 104, inclusive.                                                                                                                                  |
| <HLnk_portID>                                      | The port ID identifying the logical connection between the ancestor ( <i>CfgNode</i> ) and its neighbor ( <i>Nbr</i> ).                                                                                                              |
| <InducingUpLink_nodeID><br><InducingUpLink_portID> | The underlying link that induces the uplink and is uniquely specified by the node ID and the port ID. The node ID is one of the <i>CfgNodes</i> , and the port ID is the ID representing an <i>UpLink</i> from that <i>CfgNode</i> . |
| <Nbr_nodeID>                                       | The node ID representing the neighbor node.                                                                                                                                                                                          |
| <UpLink_portID>                                    | The port ID representing the logical uplink associated with the <i>CfgNode</i> .                                                                                                                                                     |

## Procedure job aid

Figure 11

Logical link relationships in the PNNI network component hierarchy



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## Displaying the physical links making up a logical linking the PNNI networking hierarchy

Determine which physical links make up a logical link as part of monitoring nodal relationships. The logical link maps to a node ID and a port ID.

### Procedure steps

- 1 Find the node corresponding to the logical link's node ID by going to each physical node and displaying the node IDs to find a match.

```
display ARTg Pnni CfgNode/<CfgNode_level> opNodeId
```

- 2 Once you find the matching node ID, find the port ID by one of the following cases:

For an uplink, list all uplinks to see if a match exists:

```
list ARTg Pnni CfgNode/<CfgNode_level> ULnk/*
```

If you have a match, list all the inducing uplinks.

```
list ARTg Pnni CfgNode/<CfgNode_level> ULnk/
<ULnk_portID> InducingUpLink/*
```

For a physical link, list all the physical links:

```
list ARTg Port/*
```

If you have a match, display the physical component of the port.

```
display ARTg Port/* componentName
```

For a horizontal link, go to each neighbor and list the links to find a matching port ID:

```
list ARTg Pnni CfgNode/<CfgNode_level> Nbr/
<Nbr_nodeID> HLnk/*
```

If you have a match, list the inducing uplinks.

```
list ARTg Pnni CfgNode/<CfgNode_level> Nbr/
<Nbr_nodeID> HLnk/<HLnk_portID> InducingUpLink*
```

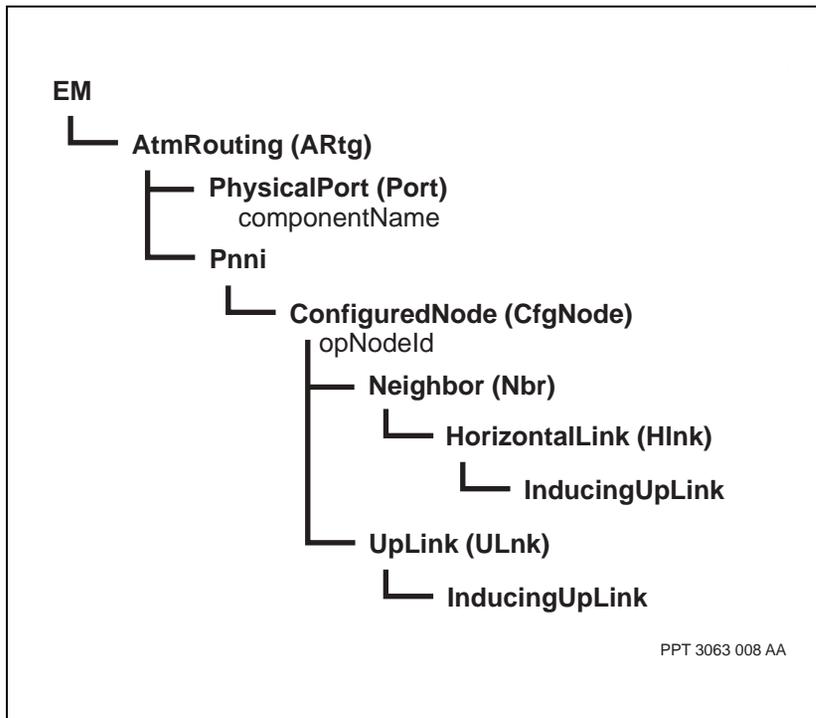
- 3 Repeat step 1 and step 2 for all links that you find until only the physical links remain.

## Variable values

| Variable        | Value                                                                                                                   |
|-----------------|-------------------------------------------------------------------------------------------------------------------------|
| <CfgNode_level> | The level of the node in the PNNI networking hierarchy having a value between 0 and 104, inclusive.                     |
| <HLink_portID>  | The port ID identifying the logical connection between the ancestor ( <i>CfgNode</i> ) and its neighbor ( <i>Nbr</i> ). |
| <Nbr_nodeID>    | The node ID representing the neighbor node.                                                                             |
| <UpLink_portID> | The port ID representing the logical uplink associated with the <i>CfgNode</i> .                                        |

## Procedure job aid

**Figure 12**  
Physical links making up a logical link component hierarchy



## Displaying the physical nodes reachable from a logical node in the PNNI networking hierarchy

Display the physical nodes reachable from a specified logical node as part of monitoring nodal relationships.

### Procedure steps

- 1 Check to see if the node is a physical node by seeing if it appears as the lowest level in the CfgNode listing.

```
display ARtg Pnni CfgNode/*
```

If the node is not at the lowest level, this command displays all levels.

**Note:** For any level (except the lowest level where no LGNs exist) in the PNNI networking hierarchy where the lgnState is active, you can display all the nodes on that level and all the associated information.

- 2 By specifying the level immediately below the node in question, display all the children of the node.

```
display ARtg Pnni Topology/<Topology_level> Node/*
```

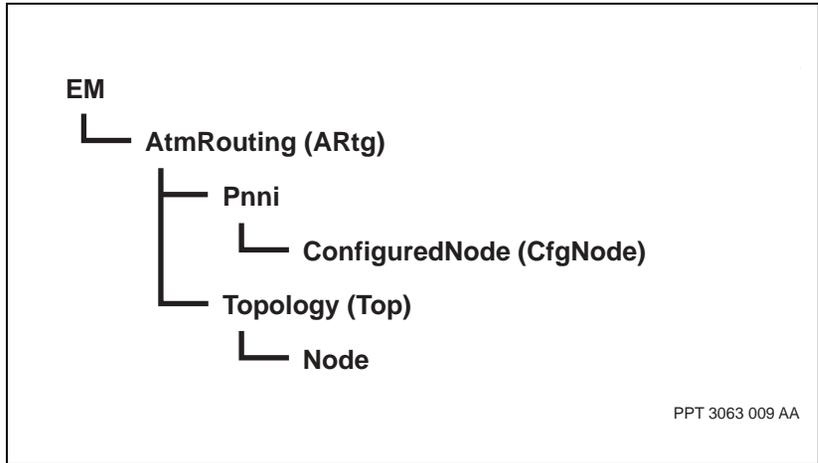
### Variable values

| Variable         | Value                                                                                 |
|------------------|---------------------------------------------------------------------------------------|
| <Topology_level> | is the level in the PNNI networking hierarchy immediately below the node in question. |
|                  |                                                                                       |

## Procedure job aid

Figure 13

Physical nodes reachable from a logical node component hierarchy



## Optimizing connections and monitoring rerouting

For PNNI networks, rerouting provides the following capabilities:

- connection recovery (hard rerouting)
- path optimization (soft rerouting)

The operational procedures in this section enable you to monitor the rerouting capability and manually optimize connections on a nodal, interface, and per-connection basis.

*Note:* When there is a local connection recovery in a downstream rerouting domain, you can only issue the `optimize artg pnni` command or the `optimize [-all] atmif/x UNI/IISP/AINI/PNNI reroute` command. Also, if there is a local connection recovery in a downstream rerouting domain, the `optimize` command at the connection level is not applicable.

### Navigation links

For more information, see the following sections:

- “Optimize command” (page 114)
- “Activating a module optimization pass on a PNNI node” (page 115)
- “Optimizing connections on an ATM interface” (page 116)
- “Monitoring path optimization on an ATM interface” (page 117)
- “Optimizing an individual connection” (page 123)
- “Listing the signaling interfaces that have rerouting capabilities” (page 125)
- “Monitoring connections on an ATM interface” (page 126)
- “Troubleshooting scenarios” (page 126)

## Optimize command

The reroute feature uses the *optimize* command to manually activate path optimization (soft rerouting) for connections managed by a *Reroute* subcomponent under *AtmIf* or to manually activate a module-wide optimization on a PNNI node. This command attempts to move an active connection from an existing PNNI path to an improved path. You can only use the *-all* option for the *AtmIf* interface. For example, *Optimize -all atmif/n pnni/uni/aini/iisp reroute*. *Optimize -all* optimizes all the subscribed connections whether they are recovered or not. For optimization on a PNNI node (*optimize artg pnni reroute*), for example, *artg pnni reroute moduleOptimizationConnections* can be provisioned to *allSubscribed*.

The *optimize* command can also request path optimization for an individual connection (soft PVC or soft PVP). If found, a better path will be established. If a better path is not found, there is no change and the current path is not interrupted.

**Note:** Use the *optimize* command with care as service disruptions will occur when a connection is moved to a better path. To minimize the impact of service disruptions, use the *optimize* commands during network maintenance windows.

## Activating a module optimization pass on a PNNI node

Activate a module optimization pass on a PNNI node manually.

### Procedure steps

- 1 Use the *optimize* command to activate a module (nodal) optimization pass.

```
optimize ARtg Pnni Reroute
```

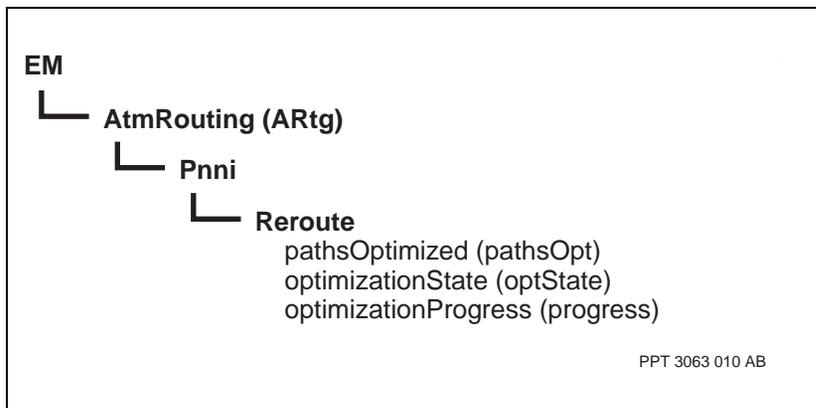
- 2 You can cancel a module optimization pass.

```
optimize -cancel ARtg Pnni Reroute
```

### Procedure job aid

Figure 14

Module optimization pass on a PNNI node component hierarchy



## Optimizing connections on an ATM interface

Optimize connections on an ATM interface manually.

### Procedure steps

- 1 Reroute the recovered (hard routed) connections on an ATM interface.

```
optimize AtmIf/<AtmIf> <IfType> Reroute
```

- 2 Reroute all the connections on an interface.

```
optimize -all AtmIf/<AtmIf> <IfType> Reroute
```

### Variable values

| Variable | Value                                     |
|----------|-------------------------------------------|
| <AtmIf>  | The instance number of the ATM interface. |
| <ifType> | Uni, lisp, Aini, or Pnni.                 |
|          |                                           |

## Monitoring path optimization on an ATM interface

Monitor path optimization on an ATM interface if required.

Use the table “Rerouting cause codes” (page 121) to obtain a list of the possible rerouting cause codes and their description.

### Procedure steps

- 1 Display the number of connections that are subscribed to the local rerouting protocol
 

```
display AtmIf/<AtmIf> <IfType> Reroute
localSubscribedConnections
```
- 2 Display the number of connections that have been recovered and are subscribed to local path optimization.
 

```
display AtmIf/<AtmIf> <IfType> Reroute
localEligibleRecoveredCon
```
- 3 Display the number of connections that have been recovered but are not subscribed to local path optimization.
 

```
display AtmIf/<AtmIf> <IfType> Reroute
localIneligibleRecoveredCon
```
- 4 Display the value of the last local Reroute Cause information element received at the interface.
 

```
display AtmIf/<AtmIf> <IfType> Reroute
localLastRrCauseCode
```
- 5 Display how many local connection segments were successfully optimized during the last optimization pass at this interface.
 

```
display AtmIf/<AtmIf> <IfType> Reroute
localPathsOptimized
```
- 6 Display the number of connections that are subscribed to the global rerouting protocol (global connection recovery or global path optimization or both).
 

```
display AtmIf/<AtmIf> <IfType> Reroute
globalSubscribedConnections
```
- 7 Display the number of connections that have been recovered and are subscribed to global path optimization.

- `display AtmIf/<AtmIf> <IfType> Reroute globalEligibleRecoveredCon`
- 8 Display the number of connections that have been recovered but are not subscribed to global path optimization.
- `display AtmIf/<AtmIf> <IfType> Reroute globalIneligibleRecoveredCon`
- 9 Display the value of the last global Reroute Cause information element received at the interface.
- `display AtmIf/<AtmIf> <IfType> Reroute globalLastRrCauseCode`
- 10 Display how many global connection segments were successfully optimized during the last optimization pass at this interface.
- `display AtmIf/<AtmIf> <IfType> Reroute globalPathsOptimized`
- 11 Display the number of successful local connection recoveries that were performed over the lifetime of the interface.
- `display AtmIf/<AtmIf> <IfType> Reroute totalLocalConnectionRecoveries`
- 12 Display the number of successful local path optimizations that were performed over the lifetime of the interface.
- `display AtmIf/<AtmIf> <IfType> Reroute totalLocalPathOptimizations`
- 13 Display the number of local connection recovery subscribed connections that could not be recovered.
- `display AtmIf/<AtmIf> <IfType> Reroute totalLocalFailedRecoveries`
- 14 Display the number of optimization at the interface.
- `display AtmIf/<AtmIf> <IfType> Reroute totalOptimizationPasses`
- 15 Display the number of successful global connection recoveries that were performed over the lifetime of the interface.
- `display AtmIf/<AtmIf> <IfType> Reroute totalGlobalConnectionRecoveries`

- 16** Display the number of global connection recovery subscribed connections that could not be globally recovered.

```
display AtmIf/<AtmIf> <IfType> Reroute
totalGlobalFailedRecoveries
```

- 17** Display the number of successful global path optimizations that were performed over the lifetime of the interface.

```
display AtmIf/<AtmIf> <IfType> Reroute
totalGlobalPathOptimizations
```

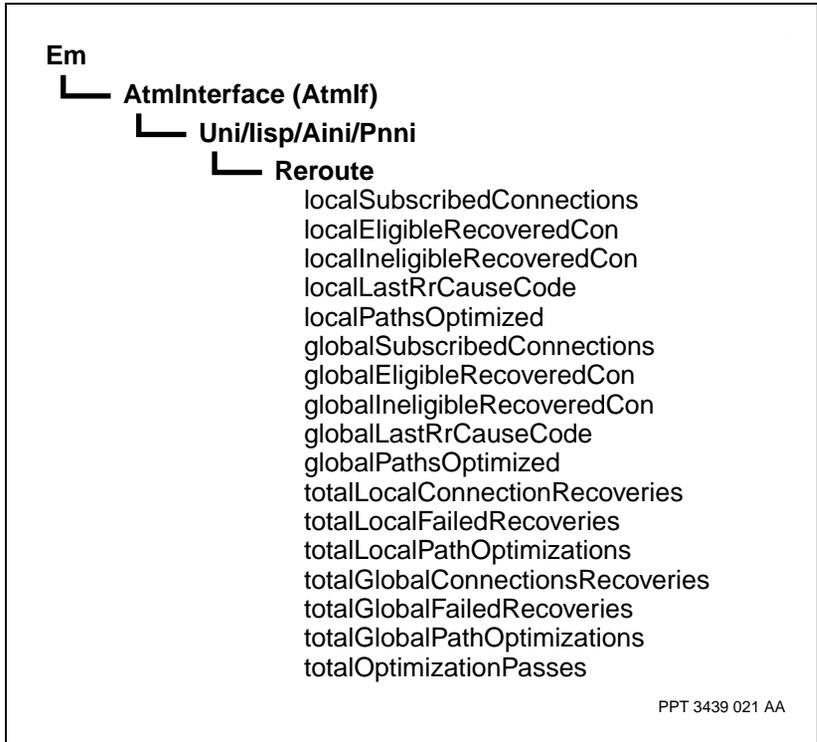
### Variable values

| Variable | Value                                     |
|----------|-------------------------------------------|
| <AtmIf>  | The instance number of the ATM interface. |
| <IfType> | Uni, lisp, Aini, or Pnni.                 |
|          |                                           |

## Procedure job aid

Figure 15

Path optimization on an ATM interface component hierarchy



**Table 11**  
**Rerouting cause codes**

| Value | Description                                                   | Details                                                                                                                                                                                                                                                                                                     |
|-------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Release received from outside any rerouting domain            | A release has been received from outside the rerouting domain. The expected behavior at the rerouting node is to prevent the connection recovery. A rendezvous node adds this rerouting cause value when the egress side receives a release without any rerouting cause IE.                                 |
| 2     | Failed to recover the connection using domain-based rerouting | A failure has occurred inside the rerouting domain, but the connection recovery mechanism was unsuccessful at connection recovery.                                                                                                                                                                          |
| 3     | Unrecognized endpoint key for rerouting                       | The endpoint key uniquely identifies the rerouting node at the rendezvous node. This identifier is provided during initial call setup. The rendezvous node only responds to that identifier. If a rerouting request is made with another identifier (i.e. another rerouting node), the request is rejected. |
| 4     | Rerouting operation complete                                  | This rerouting cause code is used to terminate a successful path optimization. It's always generated at the rerouting node on the incumbent path. The Rendezvous node uses this cause code to change the data path from the incumbent connection to the rerouting connection.                               |
| 5     | Old incarnation number                                        | The incarnation number is used to validate incoming rerouting requests at the rendezvous node. If the rendezvous node receives multiple requests, only the request with a valid incarnation number is respected.                                                                                            |
| 6     | Rerouting operation already in progress                       | A rendezvous node generates this cause code value if it receives multiple path optimization requests.                                                                                                                                                                                                       |

(Sheet 1 of 2)

**Table 11 (continued)**  
**Rerouting cause codes**

| <b>Value</b>   | <b>Description</b>                     | <b>Details</b>                                                                                                                                                                                     |
|----------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7              | Violation of rerouting domain boundary | A rerouting connection segment from a path optimization or a connection recovery attempts to traverse an inter-domain interface or an AINI/IISP/UNI interface before reaching the rendezvous node. |
| 8              | Unsupported switchover behavior        | The switchover mechanism specified in the rerouting IE is set to an unrecognized value (neither standard nor RCL)                                                                                  |
| (Sheet 2 of 2) |                                        |                                                                                                                                                                                                    |

## Optimizing an individual connection

If required, manually optimize an individual connection.

### Procedure steps

- 1 Use the reroute command to optimize an individual connection.

```
optimize AtmIf/<AtmIf> Vcc/*|Vpc/*|Vpt/*Vcc/* Src
RerouteOv
```

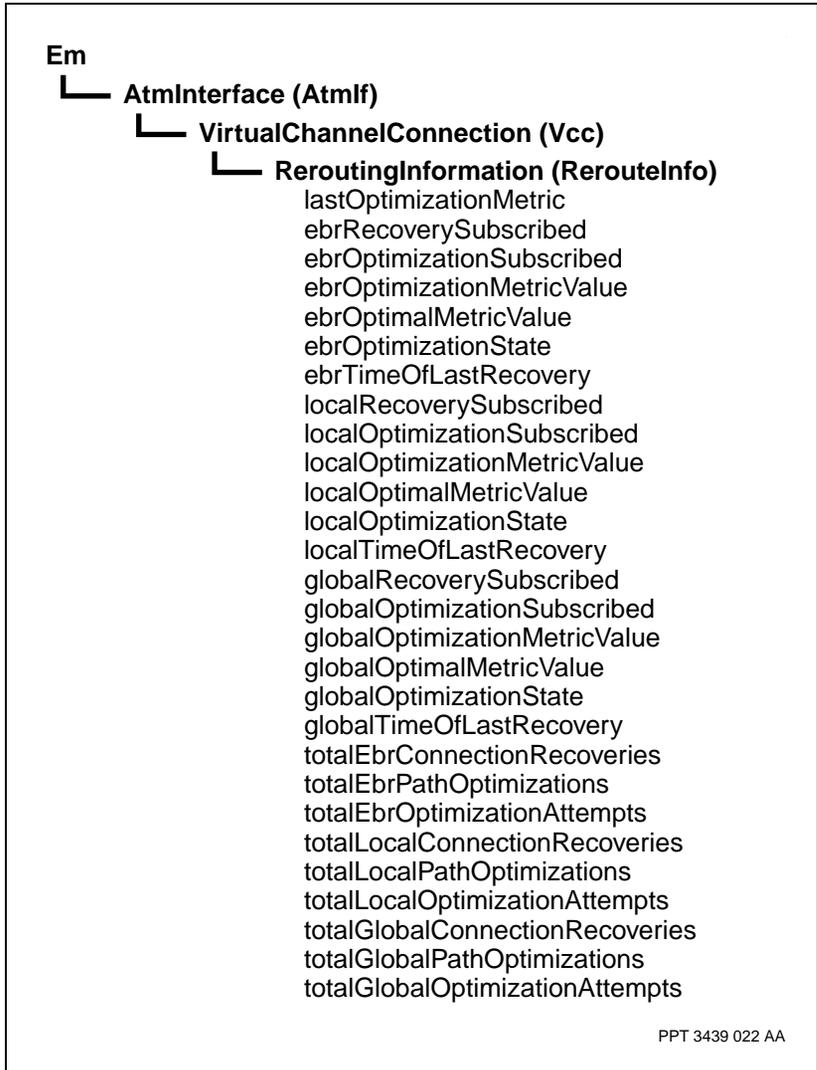
**Note:** A successful completion of the command indicates only that the path optimization is finished and does not indicate whether or not the connection was actually moved to a better path.

### Variable values

| Variable | Value                                        |
|----------|----------------------------------------------|
| <AtmIf>  | is the instance number of the ATM interface. |
|          |                                              |

## Procedure job aid

Figure 16  
Individual connection component hierarchy



## Listing the signaling interfaces that have rerouting capabilities

List the signaling interfaces that have rerouting capabilities.

### Procedure steps

- 1 List the signaling interfaces that have rerouting capabilities.

```
list AtmIf/* [Vpt/*] <IfType> Reroute
```

### Variable values

| Variable | Value                     |
|----------|---------------------------|
| <IfType> | Uni, lisp, Aini, or Pnni. |
|          |                           |

## Monitoring connections on an ATM interface

Monitor connections on an ATM interface, if required.

### Procedure steps

- 1 List the soft PVCs and soft PVPs that have an *RerouteOv* component configured.  

```
list -p AtmIf/* Vcc/*|Vpc/*|Vpt/*Vcc/* Src RerouteOv
```
- 2 List the connections that subscribe to rerouting.  

```
list AtmIf/* Vcc/*|Vpc/*|Vpt/*Vcc/* RerouteInfo
```
- 3 Display the rerouting parameters of a connection.  

```
d AtmIf/* Vcc/*|Vpc/*|Vpt/*Vcc/* RerouteInfo
```
- 4 Display the connections subscribed to connection recovery or path optimization.  

```
display AtmIf/* Vcc/*|Vpc/*|Vpt/*Vcc/* RerouteInfo
lRecSub, lOptSub, gRecSub, gOptSub, eRecSub, eOptSub
```
- 5 Display the number of times connections have been recovered (hard routed).  

```
display AtmIf/* Vcc/*|Vpc/*|Vpt/*Vcc/* RerouteInfo
ttlConRec, ttlgConRec, tteConRec
```
- 6 Display the number of times connections have been optimized.  

```
display AtmIf/* Vcc/*|Vpc/*|Vpt/*Vcc/* RerouteInfo
ttlPathOpt, ttgPathOpt, ttePathOpt
```
- 7 Display the number of times attempts have been made to optimize a connection.  

```
display AtmIf/<AtmIf> Vcc/*|Vpc/*|Vpt/*Vcc/*
RerouteInfo ttlOptAtt, ttgOptAtt, tteOptAtt
```

## Troubleshooting scenarios

The following table contains troubleshooting scenarios for optimizing connections and monitoring rerouting.

**Table 12**  
**Troubleshooting scenarios**

| Troubleshooting scenario                                                                                                                         | Verify the following items:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The connection tried to subscribe to rerouting, but was unable to subscribe to rerouting.                                                        | <p>Verify that the connection is active.</p> <p>Verify that at least one rerouting capability is active.</p> <p>Verify that the routing protocol is ATM.</p> <p>Verify that the rendezvous node supports a rerouting connection.</p> <p>Verify that the rendezvous node supports the requested rerouting protocol.</p> <p>Verify that the connection is not a one node domain. A one node domain is a node that acts as the rerouting node and the rendezvous node. Use the TRACE -v -s command to identify the nodes that the connection is traversing.</p> |
| The connection has a <i>rerouteInfo</i> component, but the requested rerouting protocol is localGlobal but only global attributes are displayed. | <p>Verify that the global rendezvous node is the same as the local rendezvous node. If they are the same, it is not an issue.</p> <p>Verify your local domain border node.</p> <p>Verify that locally, the node does act as a one node domain.</p>                                                                                                                                                                                                                                                                                                           |
| The connection has a <i>rerouteInfo</i> component, but the requested rerouting protocol is localGlobal but only local attributes are displayed.  | <p>Verify that the global destination supports a global rerouting connection.</p> <p>Verify that the connection is the DTL originator. Only the DTL originator can display local and global attributes</p>                                                                                                                                                                                                                                                                                                                                                   |

## Rerouting alarm

PNNI rerouting uses an alarm to indicate to the network operator which ATM signaling interfaces manage connections that have been recovered by rerouting procedures. The alarm is set for each ATM signaling interface that manages one or more recovered connections also subscribed to path optimization. Due to the impact on scalability and performance, the information in the alarm is minimal and the alarm is only issued for the interface and not for each connection. This alarm type can either be SET or CLEAR.

To indicate that there is one or more connections eligible for optimization at the given ATM signaling interface or application, a SET alarm is issued when:

- a connection is successfully recovered and is marked operationally as recovered
- the recovered connection is subscribed to path optimization

To indicate that there are no connections eligible for optimization at this ATM signaling interface, a CLEAR alarm is generated after:

- a path optimization is attempted on all eligible recovered connections
- all of the eligible recovered connections are released

This alarm functionality enables the alarm to be cleared when all connections on the ATM signaling interface are routed back on their optimal paths, or if all of the eligible recovered connections on that ATM signaling interface are released. In the context of this alarm, the optimal path of a connection is considered a path with a better or equal optimization metric as the incumbent path, or the best path taken after a chosen number of successive optimization attempts. This prevents the alarm from being set permanently and providing no information.

## Monitoring PNNI path load balancing

Monitor PNNI path load balancing information for call set up requests.

### Prerequisites

- For information on changing load balancing variance attributes, see NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- For information on changing the load balancing method, see NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

### Procedure steps

- 1 Display the average number of computed paths.

```
display ARtg Pnni Lb/* avgPaths
```

If the average number of computed paths is much smaller than the number of alternate paths for load balancing, this indicates that the load balancing variance factors are too small.

- 2 Display the distribution of acceptable paths relative to their configured optimization metrics.

```
display ARtg Pnni Lb/* optMLd
```

If sub-optimal paths are chosen at an unsatisfactory rate, you should consider using an alternate load balancing method.

- 3 Display the distribution of acceptable routing paths by available cell rate.

```
display ARtg Pnni Lb/* avCrLd
```

If you have specified the widest path load balancing method, the widest path category should be chosen 100% of the time.

- 4 Display the available bandwidth on the PNNI links of the node under the *ConnectionAdministrator (CA)* subcomponent of the *AtmInterface (AtmIf)* component.

```
display AtmIf/n> CA poolAvailableBandwidth
```

- 5 Display the available bandwidth on the PNNI links admitted on the *VirtualPathTerminator (Vpt)*.

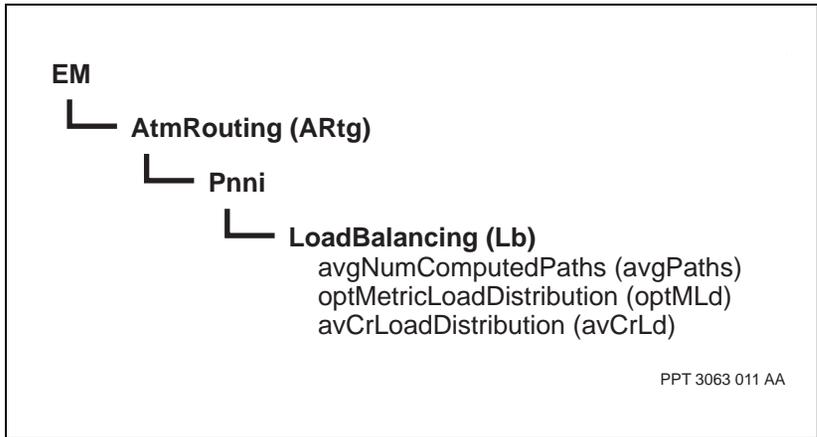
```
display AtmIf/n> Vpt/<m> CA poolAvailableBandwidth
```

## Variable values

| Variable | Value                                     |
|----------|-------------------------------------------|
| <n>      | The instance number of the ATM interface. |
|          |                                           |

## Procedure job aid

Figure 17  
PNNI path load balancing component hierarchy



## Clearing PNNI load balancing

Clear PNNI load balancing to reset all the *LoadBalancing* statistics back to zero.

### Procedure steps

- 1 Clear all *LoadBalancing* operational attributes.

```
clear ARtg Pnni Lb/n
```

### Variable values

| Variable | Value                             |
|----------|-----------------------------------|
| <n>      | One of cbr, rtvbr, ntvbr, or ubr. |
|          |                                   |

## Setting up atmPathTrace override configuration

Set up atmPathTrace override configuration.



### WARNING

**This procedure resets the function processor**

Configure the *AtmPathTrace* component before you activate any ATM service to prevent service interruption.

### Prerequisites

- Prior to configuring the path trace filter, you need to add the override component and configure its *maxTraceRecords* and *maxConcurrentTraceRequests* attributes using the path trace filter configuration procedure in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- By default, once the atmUni, atmLisp, atmAini and/or atmPnni features are included in the feature list, the *AtmPathTrace* component dynamically appears under the *Lp Eng* component. The *maxTraceRecords* attribute which specifies the maximum number of records allowed to be stored on this LP has a default value of 0, which means that no filter is allowed to be added below the signaling component, unless *maxTraceRecords* is set to a value between 0 and 200. The *maxConcurrentTraceRequests* attribute which specifies the maximum number of concurrent trace requests on this LP has a default value of 20. Once the maximum number of concurrent trace requests has been reached, the trace transit list information element in the connection setup request is dropped and the setup request proceeds.

### Procedure steps

- 1 Add an ATM path trace override component:  

```
add Lp/<lp> Eng AtmPathTrace Ov
```
- 2 Set the maximum trace record attribute or maximum concurrent trace requests.  

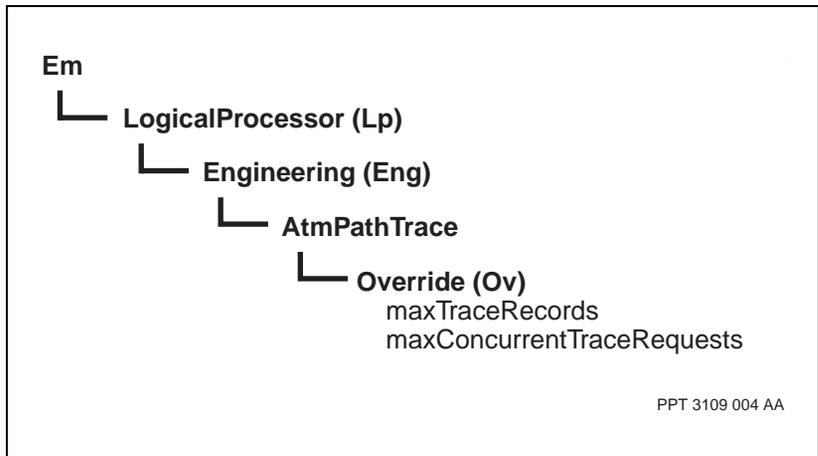
```
set Lp/<lp> Eng AtmPathTrace Ov
<atmPathTraceOverrideAttributes>
```

## Variable values

| Variable                         | Value                                                            |
|----------------------------------|------------------------------------------------------------------|
| <atmPathTraceOverrideAttributes> | maxTraceRecords or maxConcurrentTraceRequests.                   |
| <lp>                             | The number of the LP associated with the ATM function processor. |
|                                  |                                                                  |

## Procedure job aid

**Figure 18**  
**atmPathTrace override configuration component hierarchy**



## Initiating a path trace filter

Initiate a path trace filter and define the criteria for which a point-to-point connection will be traced.

### Prerequisites

- Prior to configuring the path trace filter, you need to add the override component and configure its *maxTraceRecords* and *maxConcurrentTraceRequests* attributes using the procedure “Setting up atmPathTrace override configuration” (page 132).

### Procedure steps

- 1 Use one of the following procedures to define the ATM interface on the source node (the node that originates the call setup request):
  - Configure a UNI in *NN10600-710 Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* to define a UNI.
  - Configure an IISP interface in *NN10600-710 Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* to define an IISP.
  - Configure an AINI interface in *NN10600-710 Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* to define an AINI.
  - Configure a PNNI in *NN10600-710 Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* to define a PNNI.
- 2 Add the *PathTraceFilter* component under the ATM signaling interface component.

```
add AtmIf/<n> <IfType> PathTraceFilter
```

- 3 Start the path trace filter.

```
start AtmIf/<n> <IfType> PathTraceFilter
```

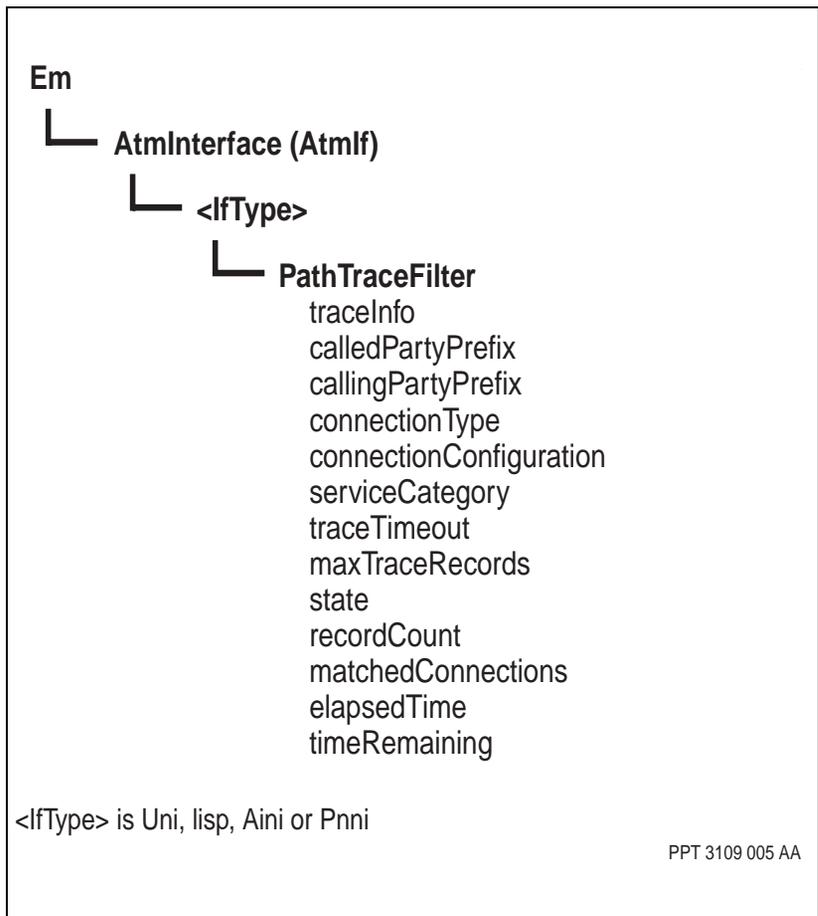
## Variable values

| Variable | Value                            |
|----------|----------------------------------|
| <IfType> | Uni, lisp, Aini, or Pnni.        |
| <n>      | The number of the ATM interface. |
|          |                                  |

## Procedure job aid

Figure 19

### Path trace filter component hierarchy



## Initiating a PathTrace Test connection

You can use the *PathTraceTestConnection* component to manage the path trace test connection.

### Procedure steps

- 1 Set the test called vpi.vci value for the connection.

```
set AtmIf/n <IfType> PathTraceTestConnection
testCalledVpiVci <testCalledVpiVci>
```

- 2 Set the test called address for the connection.

```
set AtmIf/n <IfType> PathTraceTestConnection
testCalledAddress <testCalledAddress>
```

- 3 Set the specified path for the connection.

```
set AtmIf/n <IfType> PathTraceTestConnection
testSpecifiedPath <specifiedPath>
```

- 4 Optionally, set the traffic descriptor type for the transmit direction of a connection.

```
set AtmIf/n <IfType> PathTraceTestConnection
txTrafficDescType <txTdt>
```

- 5 If you set the *txTrafficDescType* in step 1, set the *txTrafficDescParm* attribute. See “Additional information about the *txTrafficDescType* attribute” (page 145).

```
set AtmIf/n <IfType> PathTraceTestConnection
txTrafficDescParm <txTdp_parm1> <txTdp_parm2>
<txTdp_parm3> <txTdp_parm4> <txTdp_parm5>
```

- 6 Optionally, set the traffic descriptor type for the receive direction. See “Additional information about the *rxTrafficDescType* attribute” (page 148)

```
set AtmIf/n <IfType> PathTraceTestConnection
rxTrafficDescType <rxTdt>
```

- 7 If you set the *rxTrafficDescType*, set the *rxTrafficDescParm*.

```
set AtmIf/n <IfType> PathTraceTestConnection
rxTrafficDescParm <rxTdp_parm1> <rxTdp_parm2>
<rxTdp_parm3> <rxTdp_parm4>
```

- 8 Optionally, set the ATM service category for both directions of a connection.

- 
- ```

set AtmIf/n <IfType> PathTraceTestConnection
atmServiceCategory <service>

```
- 9 Optionally, set the QoS class for the forward direction of a connection.
- ```

set AtmIf/n <IfType> PathTraceTestConnection
fwdQosClass <fwdQos>

```
- 10 Optionally, set the QoS class for the backward direction of a connection.
- ```

set AtmIf/n <IfType> PathTraceTestConnection
bwdQosClass <bwdQos>

```
- 11 Optionally, set the bearer capability for a connection.
- ```

set AtmIf/n <IfType> PathTraceTestConnection
bearerClassBbc <bcBbc>

```
- 12 Optionally, set the transfer capability for a connection.
- ```

set AtmIf/n <IfType> PathTraceTestConnection
transferCapabilityBbc <tcBbc>

```
- 13 Optionally, set the clipping susceptibility for a connection.
- ```

set AtmIf/n <IfType> PathTraceTestConnection
clippingBbc <cBbc>

```
- 14 Optionally, set the best effort parameter for the ATM traffic descriptor information element (TD-IE) for a connection.
- ```

set AtmIf/n <IfType> PathTraceTestConnection
bestEffort <bestEffort>

```
- 15 Set the flags.
- ```

set AtmIf/n <IfType> PathTraceTestConnection
tracecrankback <tracecrankback>

```

## Variable values

| Variable       | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <bcBbc>        | <p>One of <i>a</i>, <i>c</i>, <i>x</i>, and <i>derivedFromServiceCategory</i>. The default is <i>derivedFromServiceCategory</i>.</p> <p>Class <i>a</i> service is a connection-oriented, constant bit rate ATM transport service. Class <i>a</i> service has end-to-end timing requirements and may require stringent cell loss, cell delay, and cell delay variation performance. When <i>bearerClassBbc</i> is defined as Class <i>a</i>, the user is requesting more than an ATM-only service. The network looks at the AAL to provide interworking based upon its contents.</p> <p>Class <i>c</i> service is a connection-oriented, variable bit rate ATM transport service. Class <i>c</i> service has no end-to-end timing requirements. When <i>bearerClassBbc</i> is defined as Class <i>c</i>, the user is requesting more than an ATM-only service. The network interworking function looks at the AAL and provide service based on it.</p> <p>Class <i>x</i> service is a connection-oriented ATM transport service where the AAL, <i>trafficType</i> (<i>vbr</i> or <i>cbr</i>) and timing requirements are user-defined (that is, transparent to the network). When <i>bearerClassBbc</i> is defined as Class <i>x</i>, the user is requesting an ATM-only service from the network. In this case, the network does not process higher layer protocols.</p> <p>The value <i>derivedFromServiceCategory</i> specifies that the nodes derive the actual value for this connection from the value of the <i>atmServiceCategory</i> attribute. Either this attribute has the value <i>derivedFromServiceCategory</i> or the <i>atmServiceCategory</i> attribute has the value <i>derivedFromBBC</i>, but not both.</p> |
| (Sheet 1 of 7) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

| Variable       | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <bestEffort>   | <p data-bbox="476 211 1133 300">One of <i>indicated</i>, <i>notIndicated</i>, <i>derivedFromServiceCategory</i>. The default is <i>derivedFromServiceCategory</i>. This attribute is one of the broadband bearer capability attributes.</p> <p data-bbox="476 316 1133 373"><i>Indicated</i> means that the quality of service for this connection is not guaranteed.</p> <p data-bbox="476 389 1133 446"><i>NotIndicated</i> means that the quality of service for this connection is guaranteed.</p> <p data-bbox="476 462 1133 633">The value <i>derivedFromServiceCategory</i> specifies that the actual value which is used for this connection is derived from the value of the <i>atmServiceCategory</i>. This attribute must either be set to <i>derivedFromServiceCategory</i>, or the <i>atmServiceCategory</i> attribute must be set to <i>derivedFromBBC</i>, but not both.</p>                                                                                                                                                                                               |
| <bwdQos>       | <p data-bbox="476 657 1133 682">One of 0, 1, 2, 3, 4, or <i>sameAsFwd</i>. The default is <i>sameAsFwd</i>.</p> <p data-bbox="476 698 1133 787">Class 1 supports a QoS that meets service class A performance requirements (for example, circuit emulation, constant bit rate video).</p> <p data-bbox="476 803 1133 893">Class 2 supports a QoS that meets service class B performance requirements (for example, variable bit rate audio and video).</p> <p data-bbox="476 909 1133 998">Class 3 supports a QoS that meets service class C performance requirements (for example, connection-oriented data transfer).</p> <p data-bbox="476 1015 1133 1104">Class 4 supports a QoS that meets service class D performance requirements (for example, connectionless data transfer).</p> <p data-bbox="476 1120 1133 1177">Class 0 is the unspecified bit rate QoS class, with no objective for performance parameters.</p> <p data-bbox="476 1193 1133 1250">If the <i>bwdQosClass</i> attribute is <i>sameAsFwd</i>, the nodes use the values in the <i>fwdQosClass</i> attribute.</p> |
| (Sheet 2 of 7) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| Variable          | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <cBbc>            | <p>Yes or <i>no</i>. The default value is <i>no</i>.</p> <p>This attribute specifies the value for the clipping susceptibility parameter in the BBC IE. The nodes use this attribute for SPVC connections only. It is one of the broadband bearer capability attributes.</p> <p>Clipping is an impairment in which the first fraction of a second of information to be transferred is lost. It occurs after a call is answered and before an associated connection is switched through.</p>                                                                                                                                                                                                                         |
| <fwdQos>          | <p>One of is one of 0, 1, 2, 3, or 4. The default is 0.</p> <p>Class 1 supports a QoS that meets service class A performance requirements (for example, circuit emulation, constant bit rate video).</p> <p>Class 2 supports a QoS that meets service class B performance requirements (for example, variable bit rate audio and video).</p> <p>Class 3 supports a QoS that meets service class C performance requirements (for example, connection-oriented data transfer).</p> <p>Class 4 supports a QoS that meets service class D performance requirements (for example, connectionless data transfer).</p> <p>Class 0 is the unspecified bit rate QoS class, with no objective for performance parameters.</p> |
| <IfType>          | Uni, lisp, Aini, or Pnni                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <rxTdp_parm1 - 4> | <p>A vector of four decimal entries with values between 0 and 2147483647. The nodes associate these parameters with the <i>rxtrafficDescType</i> attribute. The default vector is 0 0 0 0.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| (Sheet 3 of 7)    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

| Variable       | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <rxtdt>        | One of 1, 2, 3, 4, 5, 6, 7, 8, 9 or <i>sameAsTx</i> . The default is <i>sameAsTx</i> . This attribute defines the type of traffic management the node applies to the receive direction of a connection as defined in the ATM Forum standards. The <i>rxtrafficDescType</i> attribute determine the number and meaning of the parameters in the <i>rxTrafficDescParm</i> attribute. When you select <i>sameAsTx</i> , the nodes use the values for the <i>txTrafficDescType</i> and <i>txTrafficDescParm</i> attributes for the <i>rxTrafficDescType</i> and <i>rxTrafficDescParm</i> attributes. |
| (Sheet 4 of 7) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

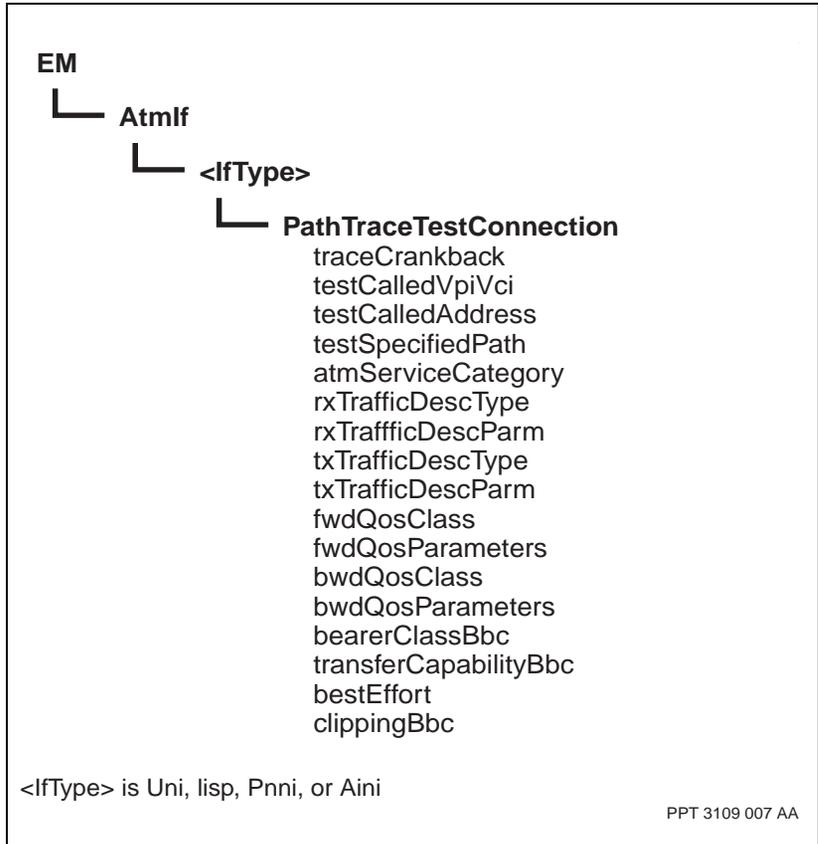
| Variable       | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <service>      | <p data-bbox="476 211 1133 292">One of <i>unspecifiedBitRate</i>, <i>constantBitRate</i>, <i>rtVariableBitRate</i>, <i>nrtVariableBitRate</i>, or <i>derivedFromBBC</i>. The default is <i>unspecifiedBitRate</i>.</p> <p data-bbox="476 316 1081 365">This attribute specifies the ATM service category for both directions of the connection.</p> <p data-bbox="476 389 1133 560">If this attribute is <i>derivedFromBBC</i>, the nodes use the BBC and <i>bestEffort</i> attributes to determine the <i>atmServiceCategory</i> for a connection. If this attribute is not <i>derivedFromBBC</i>, the nodes use the value of this attribute to override the provisioned BBC IE parameters. In those cases, the nodes do not use the BBC attributes.</p> <p data-bbox="476 576 1114 779">The <i>constantBitRate</i> service category is for real time applications (those requiring tightly constrained delay and delay variation), such as voice and video applications. The consistent availability of a fixed quantity of bandwidth is appropriate for CBR service. Cells that are delayed past the value for CTD are of significantly reduced value to the application.</p> <p data-bbox="476 803 1133 1031">The <i>rtVariableBitRate</i> service category is for real time applications (those requiring tightly constrained delay and delay variation), such as voice and video applications. Sources transmit at a rate that varies with time (the source is bursty). Cells that are delayed past the value specified by CTD are of significantly reduced value to the application. VBR real time service may support statistical multiplexing of real time sources.</p> <p data-bbox="476 1047 1133 1274">The <i>nrtVariableBitRate</i> service category is for non-real time applications that have bursty traffic characteristics and that you can characterize in terms of a PCR, SCR, and MBS. For cells that the network transfers within the traffic contract, the application expects a low cell loss ratio. For all connections, the application expects a bound on the mean cell transfer delay. VBR non-real time service may support statistical multiplexing of connections.</p> |
| (Sheet 5 of 7) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

| Variable            | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | <p>The <i>unspecifiedBitRate</i> service is for non-real time applications (those that do not require tightly constrained delay and delay variation). UBR sources are bursty. UBR service supports a high degree of statistical multiplexing among sources. UBR service does not specify traffic-related service guarantees. The nodes make no numerical commitments on cell loss ratio experienced by a UBR connection or on the cell transfer delay experienced by cells on the connection.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <specifiedPath>     | <p>An ASCII string containing up to 32 characters. There is no default value. This attribute specifies the path that will be used to get to the destination of this test connection.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <tcBbc>             | <p>One of <i>0</i>, <i>1</i>, <i>2</i>, <i>5</i>, <i>8</i>, <i>9</i>, <i>10</i>, <i>notApplicable</i>, or <i>derivedFromServiceCategory</i>. The default is <i>derivedFromServiceCategory</i>.</p> <p>The value <i>derivedFromServiceCategory</i> specifies that the nodes derive the actual value which for this connection from the value of the <i>atmServiceCategory</i>. Either this attribute has the value <i>derivedFromServiceCategory</i> or the <i>atmServiceCategory</i> attribute has the value <i>derivedFromBBC</i>, but not both.</p> <p>For more information, see the following documents:</p> <ul style="list-style-type: none"> <li>• NN10600-705 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Management Fundamentals</i></li> <li>• NN10600-706 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals</i></li> <li>• NN10600-707 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Queuing and Scheduling Fundamentals</i></li> <li>• NN10600-708 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM CAC and Bandwidth Fundamentals</i></li> </ul> |
| <testCalledAddress> | <p>This value specifies the destination address of the test connection. The default value is a 0 to 40 hexadecimal string.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| (Sheet 6 of 7)      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

| Variable           | Value                                                                                                                                                                                                                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <testCalledVpiVci> | This value specifies the called VPI and VCI values for this test connection on the destination interface. The default value is 0.1.                                                                                                                                                                                                                |
| <tracecrankback>   | Yes or no. The default value is no.                                                                                                                                                                                                                                                                                                                |
| <txTdp_parm1 - 5>  | A vector of five decimal entries with values between 0 and 2147483647. The nodes associate these parameters with the <i>txtrafficDescType</i> attribute. The default vector is 0 0 0 0 0.                                                                                                                                                          |
| <txTdt>            | One of 1, 2, 3, 4, 5, 6, 7, 8, or 9. The default is 1. This attribute defines the type of traffic management the nodes apply to the transmit direction of a connection as defined in the ATM Forum standards. The <i>txtrafficDescType</i> attribute determine the number and meaning of the parameters in the <i>txTrafficDescParm</i> attribute. |
| (Sheet 7 of 7)     |                                                                                                                                                                                                                                                                                                                                                    |

## Procedure job aid

**Figure 20**  
**PathTraceTest connection component hierarchy**



### Additional information about the *txTrafficDescType* attribute

The *txTrafficDescType* attribute defines the meaning of each parameter.

Parameters express values as follows:

- peak cell rate (PCR), sustained cell rate (SCR) and requested shaping rate are in cell/s
- maximum burst size (MBS) is in cells
- CDVT is in microseconds

Nortel Networks Multiservice Switch nodes use the values of PCR, SCR, MBS and CDVT for connection admission control (CAC). The nodes use CDVT for CAC only when the *atmServiceCategory* attribute is set to *constantBitRate*. For all other values of *atmServiceCategory*, Multiservice Switch CAC ignores CDVT. The values of PCR, SCR and requested shaping rate determine the actual shaping rate on connections with traffic shaping enabled.

Configure parameters by traffic descriptor type as follows:

- When *txTrafficDescType* is 1 or 2, all parameters must be zero.
- When *txTrafficDescType* is 3, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameter 1 must be greater than zero. Parameters 2 and 3 must be zero.
- When *txTrafficDescType* is 4, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic with cell discard, parameter 2 represents the PCR for CLP equal to 0 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameter 1 must be greater than or equal to parameter 2. Parameters 1 and 2 must be greater than zero. Parameter 3 must be zero.
- When *txTrafficDescType* is 5, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic with cell tagging, parameter 2 represents the PCR for CLP equal to 0 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameter 1 must be greater than or equal to parameter 2. Parameters 1 and 2 must be greater than zero. Parameter 3 must be zero.
- When *txTrafficDescType* is 6, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 and 1 traffic, parameter 3 represents the MBS for CLP equal to 0 and 1 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any

value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameters 1, 2 and 3 must be greater than zero. Parameter 1 must be greater than or equal to parameter 2. Parameter 5 must either be zero (unused) or greater than or equal to parameter 2.

- When *txTrafficDescType* is 7, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 with cell discard, parameter 3 represents the MBS for CLP equal to 0 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameters 1, 2 and 3 must be greater than zero. Parameter 1 must be greater than or equal to parameter 2. Parameter 5 must either be zero (unused) or greater than or equal to parameter 2.
- When *txTrafficDescType* is 8, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 traffic with cell tagging, parameter 3 represents the MBS for CLP equal to 0 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameters 1, 2 and 3 must be greater than zero. Parameter 1 must be greater than or equal to parameter 2. Parameter 5 must either be zero (unused) or greater than or equal to parameter 2.
- When *txTrafficDescType* is 9, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the CDVT, parameter 3 represents the MCR, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameter 1 must either be zero or be greater than or equal to parameter 3.
- Whenever it is valid to specify PCR, use parameter 5 to specify a requested shaping rate. A non-zero value in parameter 5 overrides the value in parameter 1 and Multiservice Switch nodes use parameter 5 as the PCR in calculations of CAC and shaping rate.
- For *txTrafficDescType* 3, 4, 5, and 9 Multiservice Switch nodes shape transmit traffic at the next rate less than the PCR.

- For *txTrafficDescType* 6, 7 and 8, Multiservice Switch nodes shape transmit traffic at the highest available rate that is between PCR and SCR. However, if there is no available shaping rate between PCR and SCR, the nodes shape traffic at the next rate above the PCR.

### **Additional information about the *rx TrafficDesc Type* attribute**

If the *rxTrafficDescType* attribute is *sameAsTx*, Nortel Networks Multiservice Switch nodes use the values in the *txTrafficDescParm* attribute.

The *rxtrafficDescType* attribute defines the meaning of each parameter. Parameters express values as follows:

- peak cell rate (PCR), sustained cell rate (SCR) and requested shaping rate are in cell/s
- maximum burst size (MBS) is in cells
- CDVT is in microseconds

Multiservice Switch nodes use the rx values of PCR, SCR, MBS and CDVT for usage parameter control (UPC).

- When *rxTrafficDescType* is 1 or 2, all parameters must be zero.
- When *rxTrafficDescType* is 3, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic. Parameter 1 must be non-zero. Parameters 2 and 3 must be zero (unused).
- When *rxTrafficDescType* is 4, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, and parameter 2 represents the PCR for CLP equal to 0 traffic with cell discard. Parameters 1 and 2 must be non-zero. Parameter 3 must be zero (unused). Parameter 1 must be greater than or equal to parameter 2.
- When *rxTrafficDescType* is 5, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, and parameter 2 represents the PCR for CLP equal to 0 traffic with cell tagging. Parameters 1 and 2 must be non-zero. Parameter 3 must be zero (unused). Parameter 1 must be greater than or equal to parameter 2.

- When *rxTrafficDescType* is a 6, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 and 1 traffic, and parameter 3 represents the MBS for CLP equal to 0 and 1 traffic. Parameters 1, 2 and 3 must be non-zero. Parameter 1 must be greater than or equal to Parameter 2.
- When *rxTrafficDescType* is 7, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 traffic with cell discard, and parameter 3 represents the MBS for CLP equal to 0 traffic. Parameters 1, 2 and 3 must be non-zero. Parameter 1 must be greater than or equal to parameter 2.
- When *rxTrafficDescType* is 8, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 traffic with cell tagging, and parameter 3 represents the MBS for CLP equal to 0 traffic. Parameters 1, 2 and 3 must be non-zero. Parameter 1 must be greater than or equal to parameter 2.
- When *rxTrafficDescType* is 9, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic. Parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the CDVT, parameter 3 represents the MCR.
- When *rxTrafficDescType* is any value from 3 through 8, parameter 4 represents the CDVT. If this value is zero, Multiservice Switch nodes take the CDVT from the *ConnectionAdministrator* defaults for the particular *atmServiceCategory* of this connection.

- When *rxTrafficDescriptorType* is 3 through 8, there are certain extreme combinations of *rxTrafficDescParm* which are outside the capabilities of the UPC hardware. The check prov command detects such cases and generates an error message. If this happens, adjust the parameters until they fall within the supported limits.

To calculate the limits, use the following formula:

$$\begin{aligned}I1 &= 1\,000\,000\,000 / \text{PCR} \\L1 &= \text{CDVT} * 1000 \\I2 &= 1\,000\,000\,000 / \text{SCR} \\L2 &= \text{CDVT} + (\text{MBS} - 1) * (I2 - I1)\end{aligned}$$

I1 and I2 must be less than or equal to 335 523 840. I1 + L1 must be less than or equal to 1 342 156 800. I2 + L2 must be less than or equal to 1 342 156 800. I2 and L2 only apply when the *rxTrafficDescriptorType* is 6 through 8.

If the values of I1, L1, I2 or L2 are closer to the limits described above, a further restriction applies. Specifically, if either:

$$\begin{aligned}I1 &> 41\,940\,480 \text{ or} \\I2 &> 41\,940\,480 \text{ or} \\I1 + L1 &> 167\,769\,600 \text{ or} \\I2 + L2 &> 167\,769\,600\end{aligned}$$

then both I1 and I2 must be greater than 20 480.

- Parameter 5 of the *rxTrafficDescParm* is always unused.

## Initiating a connection trace

Initiate a connection trace on point-to-point connections as part of monitoring your network.

### Procedure steps

- 1 Initiate a connection trace.

```
trace [-s] [-v] [-a] atmif/<n> vcc/<x.y>
```

### Variable values

| Variable | Value                            |
|----------|----------------------------------|
| <n>      | The number of the ATM interface. |
| <x.y>    | The VCC.                         |
|          |                                  |

## Using the RouteFinder component

Use the *RouteFinder* component to calculate a list of paths from the current node to a destination. For *RouteFinder* information related to PNNI load balancing and route caching, see “Setting RouteFinder component attributes supporting PNNI load balancing and route caching” (page 167).

The *RouteFinder* component lets you specify the traffic requirements for the calculated routes, including that for PNNI load balancing and route caching. Results include primary and alternate ports as well as PNNI paths.

*RouteFinder* indicates the actual path that a call setup packet travels. In the case of PNNI, *RouteFinder* calculates the complete path, for which you can check each link.

When *RouteFinder* provides a result, it is in the form of a port ID. See “Port ID information” (page 91) for information on converting port IDs to interface IDs.

For more information, see the following sections:

- “Setting the RouteFinder’s destination address and the number of computed routes” (page 153)
- “Setting the RouteFinder’s ATM traffic requirements” (page 154)
- “Setting RouteFinder component attributes supporting PNNI load balancing and route caching” (page 167)
- “Using the RouteFinder to set the highest PNNI level used for route computation” (page 170)

## Setting the RouteFinder's destination address and the number of computed routes

Set the RouteFinder's destination address and the maximum number of routes to that destination address.

### Procedure steps

- 1 Set the destination address.
 

```
set AtmRouting Pnni Rf destAddr <destAddr>
```
- 2 Set the maximum number of routes that you want to compute.
 

```
set AtmRouting Pnni Rf maxRoutes <maxRoutes>
```

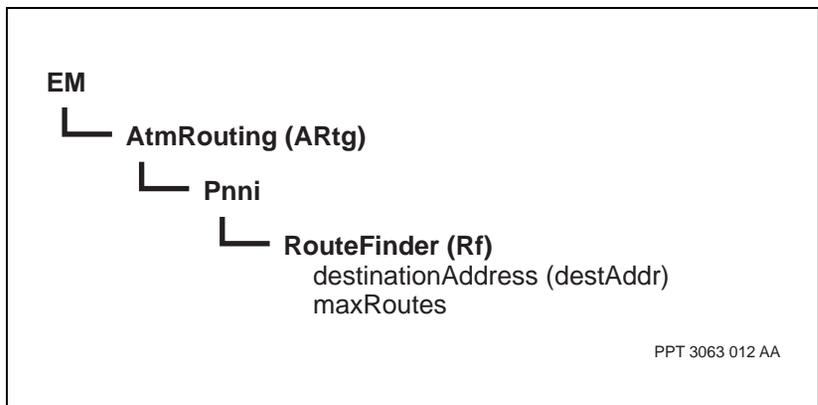
### Variable values

| Variable    | Value                                                                                                        |
|-------------|--------------------------------------------------------------------------------------------------------------|
| <destAddr>  | The NSAP address of the destination. If you enter an invalid address, the result of <i>RouteFinder</i> is 0. |
| <maxRoutes> | The maximum number of routes that you want to compute.                                                       |
|             |                                                                                                              |

### Procedure job aid

Figure 21

RouteFinder's destination address and the number of computed routes component hierarchy



## Setting the RouteFinder's ATM traffic requirements

Set the ATM traffic requirements for the RouteFinder.

### Prerequisites

- Complete the tasks in “Setting the RouteFinder's destination address and the number of computed routes” (page 153) before performing this procedure.

### Procedure steps

- 1 Optionally, set the traffic descriptor type for the transmit direction of a connection.

```
set ARTg Pnni Rf txTrafficDescType <txTdt>
```

- 2 If you set the *txTrafficDescType* in step 1, set the *txTrafficDescParm* attribute.

```
set ARTg Pnni Rf txTrafficDescParm <txTdp_parm1>
<txTdp_parm2> <txTdp_parm3> <txTdp_parm4>
<txTdp_parm5>
```

- 3 Optionally, set the traffic descriptor type for the receive direction.

```
set ARTg Pnni Rf rxTrafficDescType <rxTdt>
```

- 4 If you set the *rxTrafficDescType*, set the *rxTrafficDescParm*.

```
set ARTg Pnni Rf rxTrafficDescParm <rxTdp_parm1>
<rxTdp_parm2> <rxTdp_parm3> <rxTdp_parm4>
```

- 5 Optionally, set the ATM service category for both directions of a connection.

```
set ARTg Pnni Rf atmServiceCategory <service>
```

- 6 Optionally, set the QoS class for the forward direction of a connection.

```
set ARTg Pnni Rf fwdQoSClass <fwdQos>
```

- 7 Optionally, set the QoS class for the backward direction of a connection.

```
set ARTg Pnni Rf bwdQoSClass <bwdQos>
```

- 8 Optionally, set the bearer capability for a connection.

```
set ARTg Pnni Rf bearerClassBbc <bcBbc>
```

- 9 Optionally, set the transfer capability for a connection.

```
set ARTg Pnni Rf transferCapabilityBbc <tcBbc>
```

- 10 Optionally, set the clipping susceptibility for a connection.

```
set ARTg Pnni Rf clippingBbc <cBbc>
```

- 11 Optionally, set the best effort parameter for the ATM traffic descriptor information element (TD-IE) for a connection.

```
set ARTg Pnni Rf bestEffort <bestEffort>
```

- 12 Optionally, set the optimization metric for the route calculation.

```
set ARTg Pnni Rf optimizationMetric <optMetric>
```

- 13 Run the *RouteFinder* tool.

```
run ARTg Pnni Rf
```

## Variable values

| Variable       | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <bestEffort>   | <p>One of <i>indicated</i>, <i>notIndicated</i>, <i>derivedFromServiceCategory</i>. The default is <i>derivedFromServiceCategory</i>. This attribute is one of the broadband bearer capability attributes.</p> <p><i>Indicated</i> means that the quality of service for this connection is not guaranteed.</p> <p><i>NotIndicated</i> means that the quality of service for this connection is guaranteed.</p> <p>The value <i>derivedFromServiceCategory</i> specifies that the actual value which is used for this connection is derived from the value of the <i>atmServiceCategory</i>. Either, this attribute must be set to <i>derivedFromServiceCategory</i>, or the <i>atmServiceCategory</i> attribute must be set to <i>derivedFromBBC</i>, but not both.</p>                                                                                                                                                                   |
| <bwdQos>       | <p>One of <i>0</i>, <i>1</i>, <i>2</i>, <i>3</i>, <i>4</i>, or <i>sameAsFwd</i>. The default is <i>sameAsFwd</i>.</p> <p>Class <i>1</i> supports a QoS that meets service class A performance requirements (for example, circuit emulation, constant bit rate video).</p> <p>Class <i>2</i> supports a QoS that meets service class B performance requirements (for example, variable bit rate audio and video).</p> <p>Class <i>3</i> supports a QoS that meets service class C performance requirements (for example, connection-oriented data transfer).</p> <p>Class <i>4</i> supports a QoS that meets service class D performance requirements (for example, connectionless data transfer).</p> <p>Class <i>0</i> is the unspecified bit rate QoS class, with no objective for performance parameters.</p> <p>If the <i>bwdQosClass</i> attribute is <i>sameAsFwd</i>, nodes use the values in the <i>fwdQosClass</i> attribute.</p> |
| (Sheet 1 of 5) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

| Variable       | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <bcBbc>        | <p>One of <i>a</i>, <i>c</i>, <i>x</i>, and <i>derivedFromServiceCategory</i>. The default is <i>derivedFromServiceCategory</i>.</p> <p>Class <i>a</i> service is a connection-oriented, constant bit rate ATM transport service. Class <i>a</i> service has end-to-end timing requirements and may require stringent cell loss, cell delay, and cell delay variation performance. When <i>bearerClassBbc</i> is defined as Class <i>a</i>, the user is requesting more than an ATM-only service. The network looks at the AAL to provide interworking based upon its contents.</p> <p>Class <i>c</i> service is a connection-oriented, variable bit rate ATM transport service. Class <i>c</i> service has no end-to-end timing requirements. When <i>bearerClassBbc</i> is defined as Class <i>c</i>, the user is requesting more than an ATM-only service. The network interworking function looks at the AAL and provide service based on it.</p> <p>Class <i>x</i> service is a connection-oriented ATM transport service where the AAL, <i>traffic Type (vbr or cbr)</i> and timing requirements are user-defined (that is, transparent to the network). When <i>bearerClassBbc</i> is defined as Class <i>x</i>, the user is requesting an ATM-only service from the network. In this case, the network does not process higher layer protocols.</p> <p>The value <i>derivedFromServiceCategory</i> specifies that the nodes derive the actual value for this connection from the value of the <i>atmServiceCategory</i> attribute. Either this attribute has the value <i>derivedFromServiceCategory</i> or the <i>atmServiceCategory</i> attribute has the value <i>derivedFromBBC</i>, but not both.</p> |
| <cBbc>         | <p>Yes or <i>no</i>.</p> <p>This attribute specifies the value for the clipping susceptibility parameter in the BBC IE. The nodes use this attribute for SPVC connections only. It is one of the broadband bearer capability attributes.</p> <p>Clipping is an impairment in which the first fraction of a second of information to be transferred is lost. It occurs after a call is answered and before an associated connection is switched through.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| (Sheet 2 of 5) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

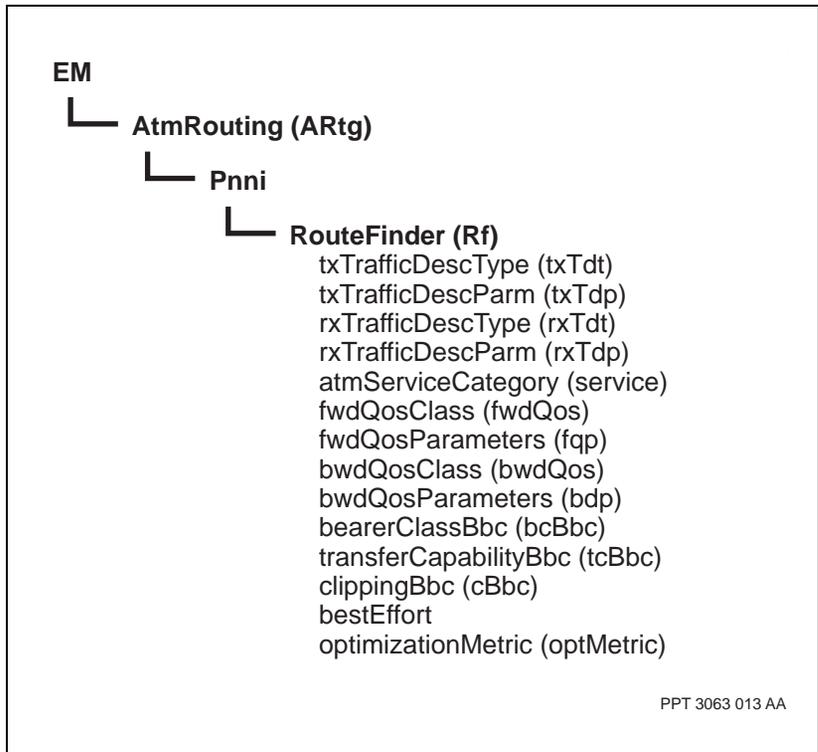
| Variable          | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <fwdQos>          | <p>One of is one of 0, 1, 2, 3, or 4. The default is 0.</p> <p>Class 1 supports a QoS that meets service class A performance requirements (for example, circuit emulation, constant bit rate video).</p> <p>Class 2 supports a QoS that meets service class B performance requirements (for example, variable bit rate audio and video).</p> <p>Class 3 supports a QoS that meets service class C performance requirements (for example, connection-oriented data transfer).</p> <p>Class 4 supports a QoS that meets service class D performance requirements (for example, connectionless data transfer).</p> <p>Class 0 is the unspecified bit rate QoS class, with no objective for performance parameters.</p> |
| <optMetric>       | <p>One of <i>cdv</i>, <i>maxCtd</i>, and <i>aw</i>. The default is <i>aw</i>.</p> <p>This attribute specifies the optimization metric that <i>RouteFinder</i> uses in the route computation.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <rxTdp_parm1 - 4> | <p>A vector of four decimal entries with values between 0 and 2147483647. The nodes associate these parameters with the <i>rxtrafficDescType</i> attribute. The default vector is 0 0 0 0.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <rxtdt>           | <p>One of 1, 2, 3, 4, 5, 6, 7, 8, 9, or <i>sameAsTx</i>. The default is <i>sameAsTx</i>.</p> <p>This attribute defines the type of traffic management that the nodes apply to the receive direction of a connection as defined in the ATM Forum standards. The <i>rxtrafficDescType</i> attribute determine the number and meaning of the parameters in the <i>rxTrafficDescParm</i> attribute. When you select <i>sameAsTx</i>, the nodes use the values for the <i>txTrafficDescType</i> and <i>txTrafficDescParm</i> attributes for the <i>rxTrafficDescType</i> and <i>rxTrafficDescParm</i> attributes.</p>                                                                                                    |
| (Sheet 3 of 5)    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

| Variable       | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <service>      | <p>One of <i>unspecifiedBitRate</i>, <i>constantBitRate</i>, <i>rtVariableBitRate</i>, <i>nrtVariableBitRate</i>, or <i>derivedFromBBC</i>. Default is <i>unspecifiedBitRate</i>.</p> <p>This attribute specifies the ATM service category for both directions of the connection.</p> <p>If this attribute is <i>derivedFromBBC</i>, the nodes use the BBC and <i>bestEffort</i> attributes to determine the <i>atmServiceCategory</i> for a connection. If this attribute is not <i>derivedFromBBC</i>, the nodes use the value of this attribute to override the provisioned BBC IE parameters. In those cases, the nodes do not use the BBC attributes.</p> <p>The <i>constantBitRate</i> service category is for real time applications (those requiring tightly constrained delay and delay variation), such as voice and video applications. The consistent availability of a fixed quantity of bandwidth is appropriate for CBR service. Cells that are delayed past the value for CTD are of significantly reduced value to the application.</p> <p>The <i>rtVariableBitRate</i> service category is for real time applications (those requiring tightly constrained delay and delay variation), such as voice and video applications. Sources transmit at a rate that varies with time (the source is bursty). Cells that are delayed past the value specified by CTD are of significantly reduced value to the application. VBR real time service may support statistical multiplexing of real time sources.</p> <p>The <i>nrtVariableBitRate</i> service category is for non-real time applications that have bursty traffic characteristics and that you can characterize in terms of a PCR, SCR, and MBS. For cells that the network transfers within the traffic contract, the application expects a low cell loss ratio. For all connections, the application expects a bound on the mean cell transfer delay. VBR non-real time service may support statistical multiplexing of connections.</p> |
| (Sheet 4 of 5) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| Variable          | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <tcBbc>           | <p>The <i>unspecifiedBitRate</i> service is for non-real time applications (those that do not need tightly constrained delay and delay variation). UBR sources are bursty. UBR service supports a high degree of statistical multiplexing among sources. UBR service does not specify traffic-related service guarantees. The nodes make no numerical commitments on cell loss ratio experienced by a UBR connection or on the cell transfer delay experienced by cells on the connection.</p> <p>One of <i>0, 1, 2, 5, 8, 9, 10, notApplicable</i>, or <i>derivedFromServiceCategory</i>. The default is <i>derivedFromServiceCategory</i>.</p> <p>The value <i>derivedFromServiceCategory</i> specifies that the nodes derive the actual value which for this connection from the value of the <i>atmServiceCategory</i>. Either this attribute has the value <i>derivedFromServiceCategory</i> or the <i>atmServiceCategory</i> attribute has the value <i>derivedFromBBC</i>, but not both.</p> <p>For more information, see the following documents:</p> <ul style="list-style-type: none"> <li>• NN10600-705 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Management Fundamentals</i></li> <li>• NN10600-706 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals</i></li> <li>• NN10600-707 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Queuing and Scheduling Fundamentals</i></li> <li>• NN10600-708 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM CAC and Bandwidth Fundamentals</i></li> </ul> |
| <txTdp_parm1 - 5> | <p>A vector of five decimal entries with values between 0 and 2147483647. The nodes associate these parameters with the <i>txtrafficDescType</i> attribute. The default vector is 0 0 0 0 0.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <txTdt>           | <p>One of 1, 2, 3, 4, 5, 6, 7, 8 or 9. The default is 1. This attribute defines the type of traffic management that the nodes apply to the transmit direction of a connection as defined in the ATM Forum standards. The <i>txtrafficDescType</i> attribute determine the number and meaning of the parameters in the <i>txTrafficDescParm</i> attribute.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| (Sheet 5 of 5)    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

## Procedure job aid

**Figure 22**  
RouteFinder's ATM traffic requirements component hierarchy



### Additional information about the *tx TrafficDesc Type* attribute

The *txTrafficDescType* attribute defines the meaning of each parameter.

Parameters express values as follows:

- peak cell rate (PCR), sustained cell rate (SCR) and requested shaping rate are in cell/s
- maximum burst size (MBS) is in cells
- CDVT is in microseconds

Nortel Networks Multiservice Switch nodes use the values of PCR, SCR, MBS and CDVT for connection admission control (CAC). The nodes use CDVT for CAC only when the *atmServiceCategory* attribute is set to

*constantBitRate*. For all other values of *atmServiceCategory*, Multiservice Switch CAC ignores CDVT. The values of PCR, SCR and requested shaping rate determine the actual shaping rate on connections with traffic shaping enabled.

Configure parameters by traffic descriptor type as follows:

- When *txTrafficDescType* is 1 or 2, all parameters must be zero.
- When *txTrafficDescType* is 3, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameter 1 must be greater than zero. Parameters 2 and 3 must be zero.
- When *txTrafficDescType* is 4, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic with cell discard, parameter 2 represents the PCR for CLP equal to 0 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameter 1 must be greater than or equal to parameter 2. Parameters 1 and 2 must be greater than zero. Parameter 3 must be zero.
- When *txTrafficDescType* is 5, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic with cell tagging, parameter 2 represents the PCR for CLP equal to 0 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameter 1 must be greater than or equal to parameter 2. Parameters 1 and 2 must be greater than zero. Parameter 3 must be zero.
- When *txTrafficDescType* is 6, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 and 1 traffic, parameter 3 represents the MBS for CLP equal to 0 and 1 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the

PCR. Parameters 1, 2 and 3 must be greater than zero. Parameter 1 must be greater than or equal to parameter 2. Parameter 5 must either be zero (unused) or greater than or equal to parameter 2.

- When *txTrafficDescType* is 7, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 with cell discard, parameter 3 represents the MBS for CLP equal to 0 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameters 1, 2 and 3 must be greater than zero. Parameter 1 must be greater than or equal to parameter 2. Parameter 5 must either be zero (unused) or greater than or equal to parameter 2.
- When *txTrafficDescType* is 8, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 traffic with cell tagging, parameter 3 represents the MBS for CLP equal to 0 traffic, parameter 4 represents the CDVT, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameters 1, 2 and 3 must be greater than zero. Parameter 1 must be greater than or equal to parameter 2. Parameter 5 must either be zero (unused) or greater than or equal to parameter 2.
- When *txTrafficDescType* is 9, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the CDVT, parameter 3 represents the MCR, and parameter 5 represents the requested shaping rate. A non-zero value in parameter 5 overrides any value in parameter 1. Multiservice Switch nodes use this result as the PCR. Parameter 1 must either be zero or be greater than or equal to parameter 3.

Traffic descriptor 9 is to be used exclusively by UBR with MDCR.

- Whenever it is valid to specify PCR, use parameter 5 to specify a requested shaping rate. A non-zero value in parameter 5 overrides the value in parameter 1 and Multiservice Switch nodes use parameter 5 as the PCR in calculations of CAC and shaping rate.
- For *txTrafficDescType* 3, 4, 5, and 9, Multiservice Switch nodes shape transmit traffic at the next rate less than the PCR.

- For *txTrafficDescType* 6, 7 and 8, Multiservice Switch nodes shape transmit traffic at the highest available rate that is between PCR and SCR. However, if there is no available shaping rate between PCR and SCR, the nodes shape traffic at the next rate above the PCR.

### **Additional information about the *rxtrafficDesc Type* attribute**

If the *rxTrafficDescType* attribute is *sameAsTx*, Nortel Networks Multiservice Switch nodes use the values in the *txTrafficDescParm* attribute.

The *rxtrafficDescType* attribute defines the meaning of each parameter. Parameters express values as follows:

- peak cell rate (PCR), sustained cell rate (SCR) and requested shaping rate are in cell/s
- maximum burst size (MBS) is in cells
- CDVT is in microseconds

Multiservice Switch nodes use the rx values of PCR, SCR, MBS and CDVT for usage parameter control (UPC).

- When *rxTrafficDescType* is 1 or 2, all parameters must be zero.
- When *rxTrafficDescType* is 3, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic. Parameter 1 must be non-zero. Parameters 2 and 3 must be zero (unused).
- When *rxTrafficDescType* is 4, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, and parameter 2 represents the PCR for CLP equal to 0 traffic with cell discard. Parameters 1 and 2 must be non-zero. Parameter 3 must be zero (unused). Parameter 1 must be greater than or equal to parameter 2.
- When *rxTrafficDescType* is 5, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, and parameter 2 represents the PCR for CLP equal to 0 traffic with cell tagging. Parameters 1 and 2 must be non-zero. Parameter 3 must be zero (unused). Parameter 1 must be greater than or equal to parameter 2.

- When *rxTrafficDescType* is a 6, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 and 1 traffic, and parameter 3 represents the MBS for CLP equal to 0 and 1 traffic. Parameters 1, 2 and 3 must be non-zero. Parameter 1 must be greater than or equal to Parameter 2.
- When *rxTrafficDescType* is 7, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 traffic with cell discard, and parameter 3 represents the MBS for CLP equal to 0 traffic. Parameters 1, 2 and 3 must be non-zero. Parameter 1 must be greater than or equal to parameter 2.
- When *rxTrafficDescType* is 8, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the SCR for CLP equal to 0 traffic with cell tagging, and parameter 3 represents the MBS for CLP equal to 0 traffic. Parameters 1, 2 and 3 must be non-zero. Parameter 1 must be greater than or equal to parameter 2.
- When *rxTrafficDescType* is 9, parameter 1 represents the PCR for CLP equal to 0 and 1 traffic. Parameter 1 represents the PCR for CLP equal to 0 and 1 traffic, parameter 2 represents the CDVT, parameter 3 represents the MCR.
- When *rxTrafficDescType* is any value from 3 through 8, parameter 4 represents the CDVT. If this value is zero, Multiservice Switch nodes take the CDVT from the *ConnectionAdministrator* defaults for the particular *atmServiceCategory* of this connection.

- When *rxTrafficDescriptorType* is 3 through 8, there are certain extreme combinations of *rxTrafficDescParm* which are outside the capabilities of the UPC hardware. The check prov command detects such cases and generates an error message. If this happens, adjust the parameters until they fall within the supported limits.

To calculate the limits, use the following formula:

$$\begin{aligned}I1 &= 1\,000\,000\,000 / \text{PCR} \\L1 &= \text{CDVT} * 1000 \\I2 &= 1\,000\,000\,000 / \text{SCR} \\L2 &= \text{CDVT} + (\text{MBS} - 1) * (I2 - I1)\end{aligned}$$

I1 and I2 must be less than or equal to 335 523 840. I1 + L1 must be less than or equal to 1 342 156 800. I2 + L2 must be less than or equal to 1 342 156 800. I2 and L2 only apply when the *rxTrafficDescriptorType* is 6 through 8.

If the values of I1, L1, I2 or L2 are closer to the limits described above, a further restriction applies. Specifically, if either:

$$\begin{aligned}I1 &> 41\,940\,480 \text{ or} \\I2 &> 41\,940\,480 \text{ or} \\I1 + L1 &> 167\,769\,600 \text{ or} \\I2 + L2 &> 167\,769\,600\end{aligned}$$

then both I1 and I2 must be greater than 20 480.

- Parameter 5 of the *rxTrafficDescParm* is always unused.

---

## Setting RouteFinder component attributes supporting PNNI load balancing and route caching

Set RouteFinder component attributes supporting PNNI load balancing and route caching using the *ARtg Pnni RouteFinder (RF)* component. You can specify the load balancing method and the variance factors used in the PNNI routing algorithm when computing a path to a destination address.

### Prerequisites

- “Setting the RouteFinder’s destination address and the number of computed routes” (page 153)
- “Setting the RouteFinder’s ATM traffic requirements” (page 154)

### Procedure steps

- 1 Set the *IbMinVariance (minVar)* attribute.  

```
set ARTg Pnni Rf minVar <minVar>
```
- 2 Set the *IbSlopeVariance (slopeVar)* attribute.  

```
set ARTg Pnni Rf slopeVar <slopeVar>
```
- 3 Set the *IbMethod (method)* attribute under the *ARtg Pnni RouteFinder (Rf)* subcomponent.  

```
set ARTg Pnni Rf method <method>
```
- 4 Set the *useRouteCaching (useRc)* attribute to allow the route finder to choose between using the route cache or performing an on-demand route computation.  

```
set ARTg Pnni Rf useRc <useRc>
```

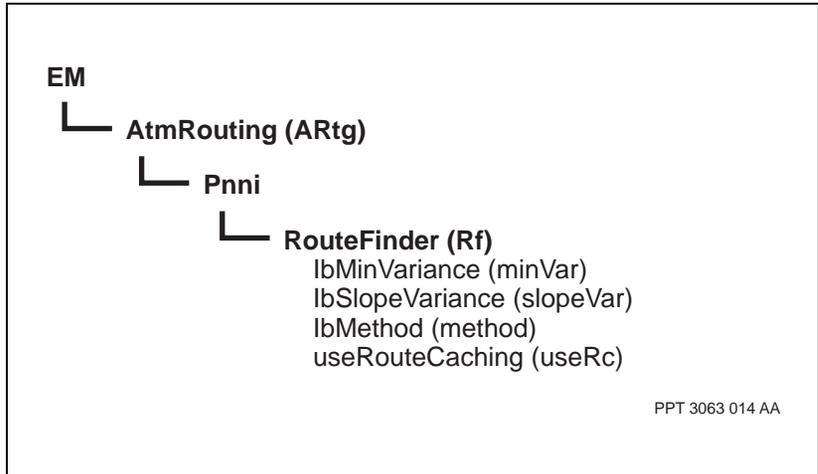
## Variable values

| Variable   | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <method>   | <p>The value specifying the method of load balancing under the <i>Rf</i> subcomponent. Values of the <i>method</i> attribute are maxAvCr, random, avCrProb, optMetricProb, avCrOptMetricProb, and none.</p> <p>If the value of the <i>method</i> attribute is set to none, then the PNNI routing algorithm does not perform load balancing and all available acceptable paths are displayed.</p>                                                                                                                                                                                                                                                                                                                         |
| <minVar>   | <p>The value specifying the minimum load balancing acceptable variance allowed for <i>RF</i>'s optimization metric and service category.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <slopeVar> | <p>The value specifying the slope of the load balancing variance allowed for <i>RF</i>'s optimization metric and service category.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <useRc>    | <p>Specifies whether the route cache or an on-demand route computation is used in determining the PNNI routes to the destination node.</p> <p>If the value of the <i>useRc</i> attribute is set to no, the RouteFinder tool will perform an on-demand route computation. The resulting paths from this computation are not stored in the route cache.</p> <p>If the value of the <i>useRc</i> attribute is set to yes, the RouteFinder tool uses the route cache only if the variance attributes (minVar, slopeVar) have the same values as that specified under the corresponding <i>LoadBalancing</i> component. If the values are not the same, the RouteFinder tool will perform an on-demand route computation.</p> |
|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## Procedure job aid

Figure 23

### RouteFinder route computation component hierarchy



## Using the RouteFinder to set the highest PNNI level used for route computation

Use the RouteFinder to set the highest PNNI level used for route computation by configuring the RouteFinder's *routingLevelScope* attribute.

### Procedure steps

- 1 Set the destination address.

```
set ARTg Pnni Rf destinationAddress
<destination_address>
```

- 2 Set the highest PNNI level that will be used in route computation.

```
set ARTg Pnni Rf routingLevelScope
<routingLevelScope_level>
```

- 3 Run the RouteFinder tool.

```
run ARTg Pnni Rf
```

- 4 Display highest PNNI level that will be used in route computation.

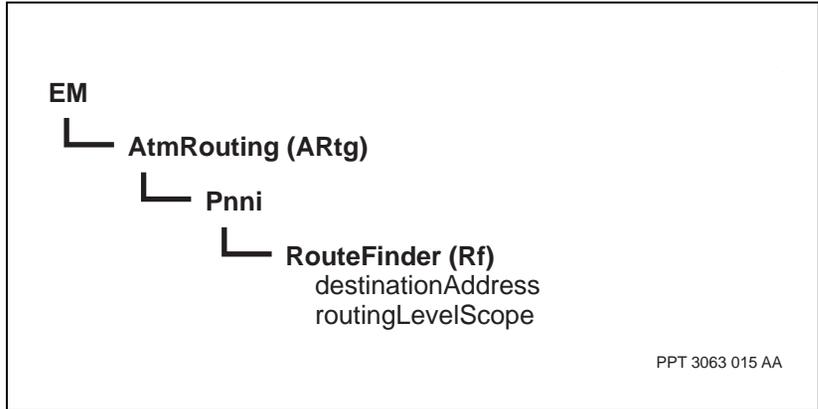
```
display ARTg Pnni Rf routingLevelScope
```

### Variable values

| Variable                  | Value                                                                                  |
|---------------------------|----------------------------------------------------------------------------------------|
| <destination_address>     | is the destination address.                                                            |
| <routingLevelScope_level> | is the highest PNNI level used in route computation, having a value between 0 and 104. |
|                           |                                                                                        |

## Procedure job aid

**Figure 24**  
**Setting the highest PNNI level used in route computation component hierarchy**



## Monitoring PNNI route caching

Monitor PNNI route caching by displaying route caching information related to PNNI call setup requests.

### Prerequisites

- For information on PNNI route caching, see NN10600-702 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals* and NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

### Procedure steps

- 1 Display the number of route cache entries stored in the PNNI route cache.

```
display ARtg Pnni Cache currentNumEntries
```

- 2 Display the highest number of route cache entries stored in the PNNI route cache since the route cache was last created or cleared.

```
display ARtg Pnni Cache pkEntries
```

- 3 Display the percentage of PNNI routing requests that were satisfied using the route cache since the route cache was last created or cleared.

```
display ARtg Pnni Cache hits
```

A relatively small value of the *hits* attribute indicates that the PNNI route cache is not configured properly or is not appropriate for the network's traffic profile.

- 4 Display the time since the route cache was last created or cleared.

```
display ARtg Pnni Cache uptime
```

- 5 Display the number of routing requests that used the route cache to determine the routing path.

```
display ARtg Pnni Cache numHits
```

- 6 Display the average lifetime of the route cache entries.

```
display ARtg Pnni Cache avgLifetime
```

If the value of the *avgLifeTime* attribute is much smaller than the configured value of the *agingPeriod* attribute, the route cache entries are being removed before they reach the normal expiry time. A high number of topology updates, or purging as a result of crankback or replacement

operations may be causing premature removal of the stored routing paths. See NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* to adjust the *agingPeriod* attribute to a value closer to the average lifetimes of the stored routing paths.

- 7 Display the number of route cache entries removed from the PNNI route cache due to replacement operations.

```
display ARtg Pnni Cache nRep
```

If the value of the *numReplacements* attribute is high, you should check to see if you need to increase the number of routing paths stored in the cache. See NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* to adjust the *maxNumEntries* attribute.

- 8 Display the number of route cache entries removed from the PNNI route cache due to crankbacks.

```
display ARtg Pnni Cache nCrank
```

If the value of the *nCrank* (*numCrankbackInvalidations*) attribute is high, you should check to see if you need to decrease the lifetime of routing paths stored in the cache. A high value indicates that the routing paths are stored in the cache too long and do not reflect the dynamics of the network. See NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* to adjust the *agingPeriod* attribute.

- 9 Display the number of route cache entries removed from the PNNI route cache due to topology updates.

```
display ARtg Pnni Cache nTopInv
```

If the value of the *nTopInv* (*numTopologyInvalidations*) attribute is high, this indicates that the network is generating too many topology updates. You will need to review the engineering of the network to determine the cause of the topology updates.

- 10 Display the number of entries removed from the PNNI route cache because the specified maximum lifetimes have been reached.

```
display ARtg Pnni Cache nAged
```

If the value of the *nAged* (*numAgedEntries*) attribute is small, you should check to see if you need to decrease the lifetime of the routing paths, or if the purging operations (through replacement, crankbacks or topology updates) are occurring too frequently. For more information, see NN10600-702 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*

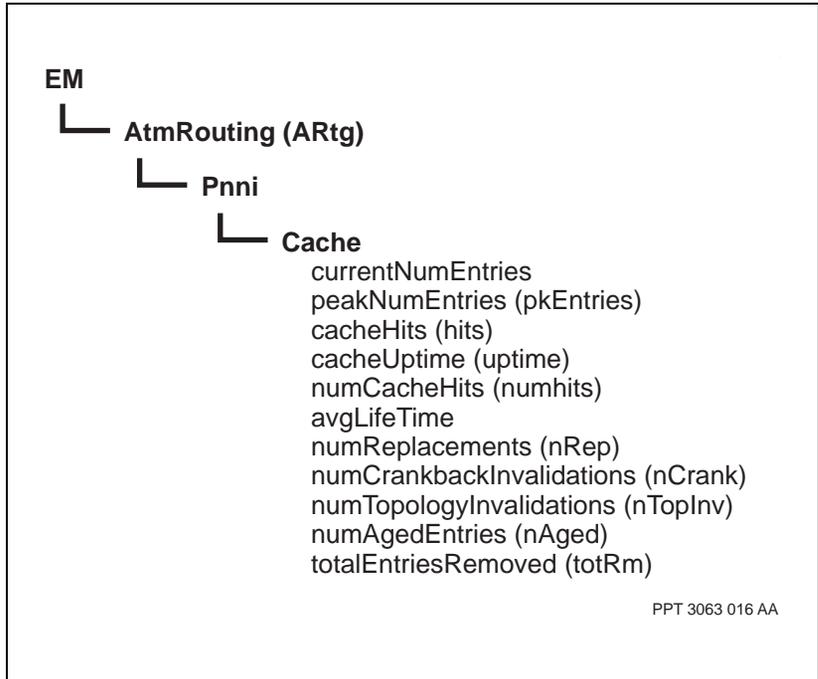
and NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

- 11 Display the number of route cache entries that have been removed since the route cache was last created or cleared.

```
display ARtg Pnni Cache totRm
```

## Procedure job aid

Figure 25  
PNNI route caching component hierarchy



## Clearing the PNNI route cache

Clear the PNNI route cache if you are concerned about its current capacity.

### Prerequisites

- “Monitoring PNNI route caching” (page 172)

### Procedure steps

- 1 Clear all routing path entries in the route cache.

```
clear ARTg Pnni Cache
```

## Monitoring PNNI node reachability

Monitor PNNI node reachability.

### Procedure steps

- 1 Determine if a PNNI node is reachable from the local node.

```
display ARtg Pnni Top Node/<Node> reachable
```

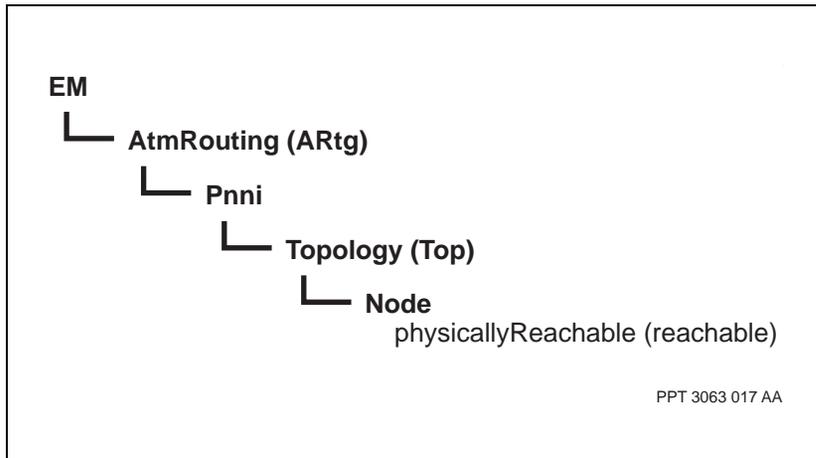
### Variable values

| Variable | Value        |
|----------|--------------|
| <Node>   | The node ID. |
|          |              |

### Procedure job aid

Figure 26

PNNI node reachability component hierarchy



## Monitoring the topology database using the active parent node

Monitor the topology database by displaying the active parent node's ATM end address and its peer group identifier.

### Procedure steps

- 1 Display the active parent node's ATM end-system address.

```
display ARtg Pnni Topology/<Topology_level>
activeParentNodeAddress
```

**Note:** Remote systems wishing to exchange PNNI protocol packets with the parent node should direct packets or calls to this address.

- 2 Display the active parent node's peer group identifier.

```
display ARtg Pnni Topology/<Topology_level>
activeParentPeerGroupId
```

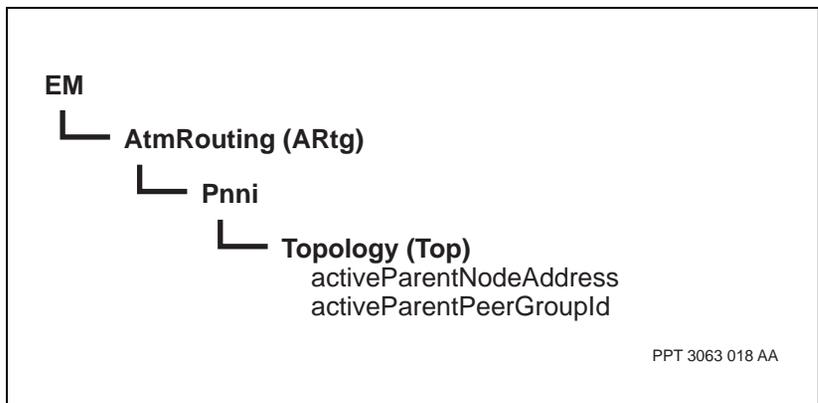
### Variable values

| Variable         | Value                                       |
|------------------|---------------------------------------------|
| <Topology_level> | The level in the PNNI networking hierarchy. |
|                  |                                             |

### Procedure job aid

Figure 27

Topology database active parent node component hierarchy



## Monitoring the topology database using the upnode

Monitor the topology database by displaying the upnode's ATM end address and the peer group identifier of the lowest level common peer group.

### Procedure steps

- 1 Display the upnode's (the neighbor node's) identity at the level of the common peer group).

```
display ARtg Pnni Topology/<Topology_level> Node ULnk
upNodeId
```

- 2 Display the ATM end system address used to establish connections to the upnode.

```
display ARtg Pnni Topology/<Topology_level> Node ULnk
upNodeAddress
```

**Note:** If the upnode has not yet been identified, the *upNodeAddress* attribute is set to zero.

- 3 Display the peer group identifier of the lowest level common peer group in the ancestry of the neighboring node and the node in the local switching system.

```
display ARtg Pnni Topology/<Topology_level> Node ULnk
upNodePeerGroupId
```

**Note:** The Hello exchange of hierarchical information that occurs between the two lowest-level border nodes sets the value of the *upNodeAddress*. If the upnode has not yet been identified, the *upNodeAddress* attribute is set to zero.

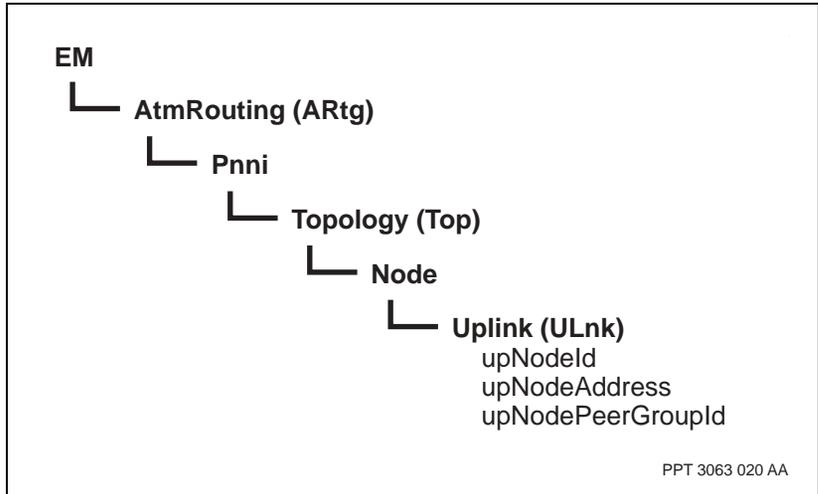
### Variable values

| Variable         | Value                                       |
|------------------|---------------------------------------------|
| <Topology_level> | The level in the PNNI networking hierarchy. |
|                  |                                             |

## Procedure job aid

Figure 28

### Topology database upnode component hierarchy



## Monitoring the topology database using horizontal link ATM service metrics

Monitor the topology database by displaying the ATM service category metrics for a horizontal link.

### Procedure steps

- 1 Display the administrative weight from the advertising node to the remote end of the PNNI entity or to the reachable address or transit address.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> HLnk/<HLnk_portID>
Metrics/<ATM_service_category> outAdminWeight
```

- 2 Display the available cell rate in cells per second.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> HLnk/<HLnk_portID>
Metrics/<ATM_service_category> outAvailableCellRate
```

- 3 Display the maximum cell rate in cells per second.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> HLnk/<HLnk_portID>
Metrics/<ATM_service_category> outMaxCellRate
```

- 4 Display the maximum cell transfer delay in microseconds.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> HLnk/<HLnk_portID>
Metrics/<ATM_service_category> outMaxCtd
```

- 5 Display the cell delay variation in microseconds.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> HLnk/<HLnk_portID>
Metrics/<ATM_service_category> outCdv
```

- 6 Display the cell loss ratio for CLP=0 traffic.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> HLnk/<HLnk_portID>
Metrics/<ATM_service_category> outClr0
```

- 7 Display the cell loss ratio for CLP=0+1 traffic.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> HLnk/<HLnk_portID>
Metrics/<ATM_service_category> outClr1
```

- 8 Display the cell rate margin in cells per second.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> HLnk/<HLnk_portID>
Metrics/<ATM_service_category> outCellRateMargin
```

- 9 Display the variance factor.

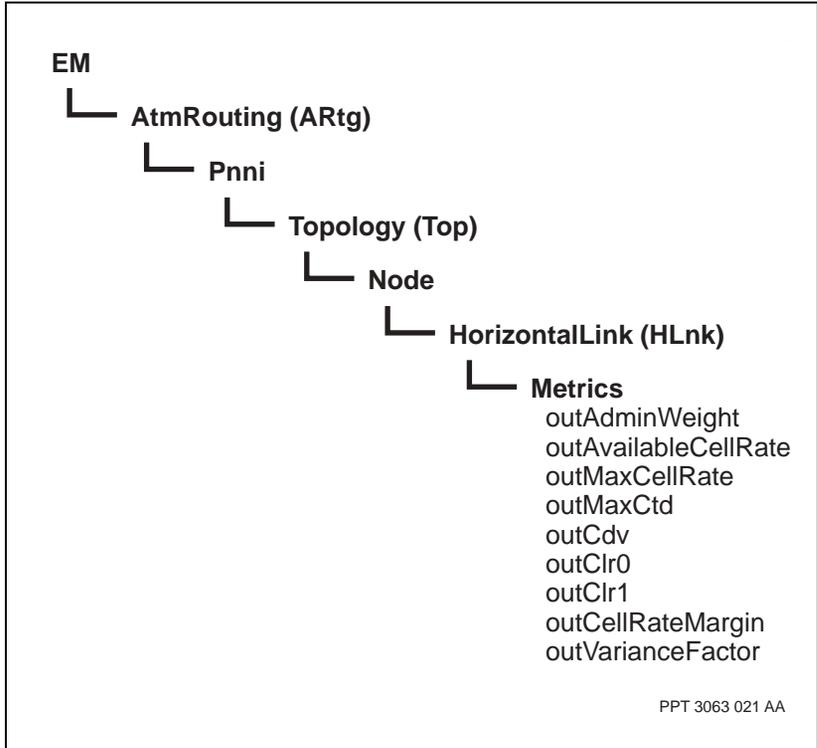
```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> HLnk/<HLnk_portID>
Metrics/<ATM_service_category> outVarianceFactor
```

## Variable values

| Variable               | Value                                                                                                                   |
|------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <ATM_service_category> | The ATM service category.                                                                                               |
| <HLnk_portID>          | The port ID identifying the logical connection between the ancestor ( <i>CfgNode</i> ) and its neighbor ( <i>Nbr</i> ). |
| <Node_nodeID>          | The node ID.                                                                                                            |
| <Topology_level>       | The level in the PNNI networking hierarchy.                                                                             |
|                        |                                                                                                                         |

## Procedure job aid

**Figure 29**  
**Topology database horizontal link ATM service metrics component hierarchy**



## Monitoring the topology database using uplink ATM service category metrics

Monitor the topology database by displaying the ATM service category metrics for an uplink.

### Procedure steps

- 1 Display the administrative weight from the advertising node to the remote end of the PNNI entity or to the reachable address or transit address using step 2 and step 3.
- 2 Display the administrative weight for the outgoing direction.
 

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk
Metrics/<ATM_service_category> outAdminWeight
```
- 3 Display the administrative weight for the incoming direction.
 

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> inAdminWeight
```
- 4 Display the available cell rate in cells per second using step 5 and step 6.
- 5 Display the available cell rate for the outgoing direction.
 

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outAvailableCellRate
```
- 6 Display the available cell rate for the incoming direction.
 

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> inAvailableCellRate
```
- 7 Display the maximum cell rate in cells per second using step 8 and step 9.
- 8 Display the maximum cell rate for the outgoing direction.
 

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outMaxCellRate
```
- 9 Display the maximum cell rate for the incoming direction.

- ```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> inMaxCellRate
```
- 10 Display the maximum cell rate in cells per second using step 11 and step 12.
- 11 Display the maximum cell rate in the outgoing direction.
- ```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outMaxCtd
```
- 12 Display the maximum cell rate for the incoming direction.
- ```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> inMaxCtd
```
- 13 Display the cell delay variation in microseconds using step 14 and step 15.
- 14 Display the cell delay variation in microseconds in the outgoing direction.
- ```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outCdv
```
- 15 Display the cell delay variation in microseconds in the incoming direction.
- ```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outCdv
```
- 16 Display the cell loss ratio for CLP=0 traffic using step 17 and step 18.
- 17 Display the cell loss ratio for CLP=0 traffic in the outgoing direction.
- ```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outClr0
```
- 18 Display the cell loss ratio for CLP=0 traffic in the incoming direction.
- ```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outClr0
```
- 19 Display the cell loss ratio for CLP=0+1 traffic using step 20 and step 21.
- 20 Display the cell loss ratio for CLP=0+1 traffic in the outgoing direction.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outClr1
```

- 21 Display the cell loss ratio for CLP=0+1 traffic in the incoming direction.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outClr1
```

- 22 Display the cell rate margin in cells per second using step 23 and step 24.

- 23 Display the cell rate margin in the outgoing direction.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outCellRateMargin
```

- 24 Display the cell rate margin in the incoming direction.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outCellRateMargin
```

- 25 Display the variance factor using step 26 and step 27.

- 26 Display the variance factor in the outgoing direction.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outVarianceFactor
```

- 27 Display the variance factor in the incoming direction.

```
display ARTg Pnni Topology/<Topology_level>
Node/<Node_nodeID> ULnk/<ULnk_portID>
Metrics/<ATM_service_category> outVarianceFactor
```

Variable values

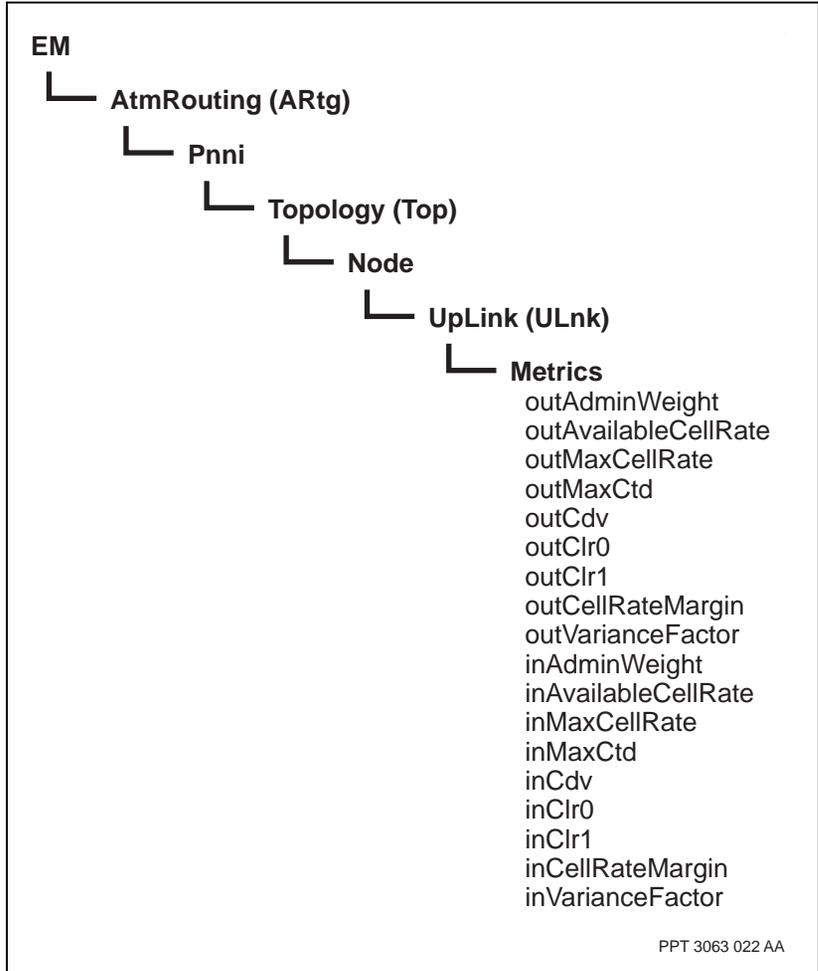
Variable	Value
<ATM_service_category>	The ATM service category.
<Node_nodeID>	The node ID.
(Sheet 1 of 2)	

Variable	Value
<Topology_level>	The level in the PNNI networking hierarchy.
<UpLink_portID>	The port ID representing the logical uplink associated with the <i>CfgNode</i> .
(Sheet 2 of 2)	

Procedure job aid

Figure 30

Topology database and uplink ATM service category metrics component hierarchy



Monitoring the topology database using the dynamically created PNNI network hierarchy

Monitor the topology database using the dynamically created PNNI network hierarchy. You can obtain a complete view of the network topology, given a set of physical nodes in a PNNI network hierarchy.

Procedure steps

- 1 For each physical and logical node, display its peer group ID.

```
display ARtg Pnni CfgNode/<CfgNode_level> pgIdOp
```

- 2 For each unique peer group ID found in step 1, select one physical node, and display the topology of the peer group and all the upper level nodes and links. Display all levels visible from the node.

```
display ARtg Pnni Top/*
```

- 3 For each unique peer group ID found in step 1, select one physical node, and display the topology of the peer group and all the upper level nodes and links. Display all the nodes in the same peer group at the specified level.

```
display ARtg Pnni Top/* Node/*
```

- 4 For each unique peer group ID found in step 1, select one physical node, and display the topology of the peer group and all the upper level nodes and links. Display all the links between the nodes.

```
display ARtg Pnni Topology/<Topology_level>  
Node/<Node_nodeID> HLnk/*
```

- 5 Display the state of all PNNI links on a node.

```
display AtmIf/* Pnni Rcc
```

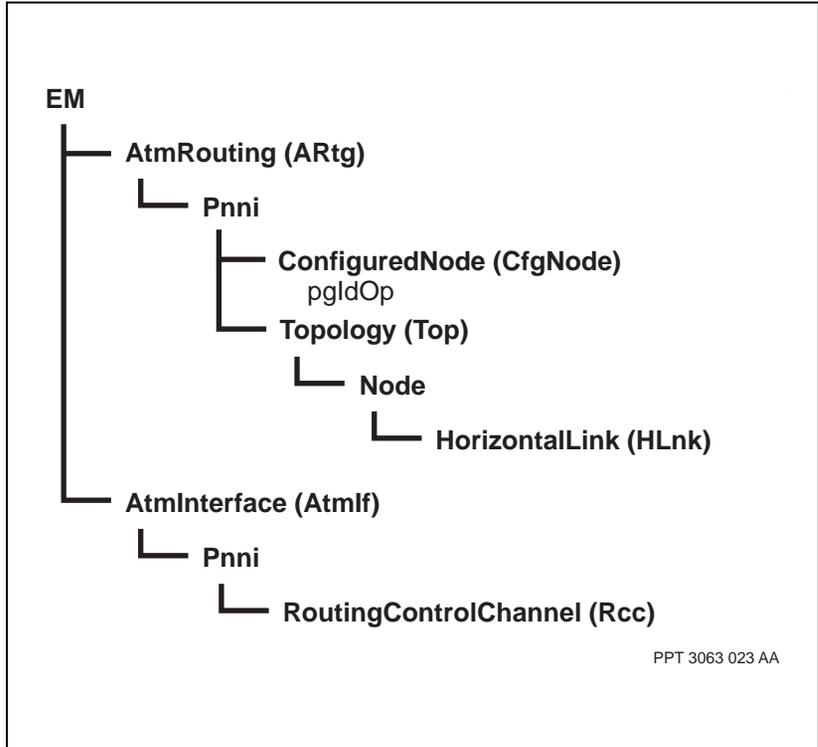
Variable values

Variable	Value
<CfgNode_level>	The level of the node in the PNNI networking hierarchy having a value of between 0 and 104, inclusive.
<Node_nodeID>	The node ID.
<Topology_level>	The level in the PNNI networking hierarchy.

Procedure job aid

Figure 31

Topology database and dynamically created PNNI network component hierarchy



Chapter 6

Multiservice Switch ATM fault management overview

This section provides an overview to Nortel Networks Multiservice Switch ATM fault management and defines the tasks which should be performed to ensure that the ATM network is operating correctly.

The following topics are included in this section:

- “ATM fault management” (page 191)
- “Monitoring ATM services” (page 192)
- “Troubleshooting ATM services” (page 193)

ATM fault management

ATM connections are a way to transport data for other applications such as CES or trunks. These applications may fail due to problems with the ATM connections. This document helps to

- identify why an ATM connection is not working
- identify potential future problems with connections
- determine that ATM connections are operating properly, and any problems that are occurring are created by other network elements

In Nortel Networks Multiservice Switch systems, ATM fault management can be divided into two main tasks: monitoring the ATM system to determine whether it is operating as expected and within the parameters set by your network engineers; and troubleshooting any problems that are detected through alarms or while routinely monitoring the system.

The section “Monitoring ATM services” (page 192) introduces the various components which should be monitored to determine how the ATM system is operating. The section “Troubleshooting ATM services” (page 193) identifies the sections where specific troubleshooting tasks are explained.

Operational attributes

This guide focuses on those Nortel Networks Multiservice Switch operational attributes which directly apply to specific fault management tasks. For a description of all operational attributes, see NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*. For an explanation of the use of Multiservice Switch operational attributes, see NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

Monitoring ATM services

Nortel Networks Multiservice Switch ATM systems should be routinely monitored to determine if any problems exist, and to ensure that traffic is being handled properly. Regularly monitoring the system will also help identify and prevent any potential problems, such as low buffers or high memory utilization. This document has been structured to illustrate the most appropriate sequence in which the various elements of your system should be examined. The following steps list the order in which you should approach monitoring your ATM system:

- 1 see “Monitoring ATM function processors” (page 192) to monitor your system at the FP level
- 2 see “Monitoring ATM interfaces” (page 193) to determine how ATM interface are handling ATM traffic
- 3 see “Monitoring ATM connections” (page 193) to examine individual connections

Monitoring ATM function processors

You should begin monitoring your Nortel Networks Multiservice Switch ATM system by examining the ATM function processors. If the FPs are not operating properly, none of the other elements of the system can effectively process ATM traffic. See “ATM function processor monitoring” (page 23) for a description of the procedures used to monitor ATM FPs.

Monitoring ATM interfaces

After the function processors have been examined, the ATM interfaces on each FP are the next appropriate system component to examine. Each interface supports a variety of traffic types and connections, and provides a summary of all the connections on that link. See “ATM interface monitoring” (page 33) for more information about monitoring ATM traffic at the interface level.

Monitoring ATM connections

Once you have determined how the FPs and ATM interfaces are operating, you should start examining the individual connections that are supported on each ATM interface. In conjunction with monitoring each connection, you should also review how the various routing and signaling options that can be provisioned in a Nortel Networks Multiservice Switch system are operating. The following sections provide information about monitoring ATM connections:

- “Connection monitoring” (page 51)
- “Signal monitoring” (page 85)
- “Routing monitoring” (page 89)

Troubleshooting ATM services

If any problems are detected while monitoring an ATM system component, or if you need to respond to any system alarms, refer to the sections listed below for troubleshooting information. Troubleshooting system components is approached in an opposite manner to monitoring. Start by examining the individual troubled connections, then work back to the ATM interface, and finally to the ATM function processor.

The following sections are listed in the order in which you should approach troubleshooting ATM connections:

- 1 “Troubleshooting connections” (page 229)
- 2 “Troubleshooting ATM interfaces” (page 251)
- 3 “Troubleshooting ATM routing and signaling” (page 257)
- 4 “Troubleshooting ATM function processors” (page 279)

Chapter 7

Performance monitoring for Multiservice Switch 7400 devices

Performance monitoring enables the periodic evaluation of ATM hardware and software through the use of performance management cells. These cells measure network performance and user quality of service in order to assess the ATM system and determine how the network is performing.

Performance monitoring can be activated, on a per connection basis, in order to calculate the cell loss ratio (CLR) and availability ratio (AR) for a connection. CLR represents a measurement of the ratio of total lost cells over total transmitted cells. AR is a measurement of the time in the available state over the total observation time. These measurements enable service providers to guarantee the quality of service provided to a customer through a service level agreement (SLA). nodes

For performance monitoring, Nortel Networks Multiservice Switch 7400 devices support the continuity check (CC) and segment remote defect indication (RDI) fault management cells for determining availability. Forward performance management cells (F-PM) and backwards reporting performance management cells (BR-PM) are used, in a bi-directional configuration, for determining parameters such as cell loss ratio. Activation and deactivation cells enable and disable the performance management and continuity check functions.

The following topics are included in this section:

- “OAM cells and their functions” (page 196)
- “Cell loss ratio (CLR)” (page 196)

- “CLR measurement method” (page 197)
- “CLR calculation” (page 199)
- “Accuracy of CLR measurements” (page 204)
- “Availability ratio” (page 208)
- “Accuracy of CLR measurements” (page 204)
- “Current performance monitoring statistics” (page 210)
- “Performance monitoring accounting” (page 211)
- “ATM IP FP deployment requirements” (page 212)
- “Performance monitoring and PNNI edge based rerouting” (page 216)
- “Expected behavior” (page 217)
- “PM limitations” (page 225)

OAM cells and their functions

OAM cells are a type of ATM cell, inserted into the traffic flow of a network to perform fault management and performance monitoring functions. Fault management functions are used to detect errors, and to notify the management station of congestion. Performance management functions are used to determine performance on a connection segment.

For more details on OAM cells, refer to ITU-T recommendation I.610 “BISDN Operation and Maintenance Principles and Functions.”

Nortel Networks Multiservice Switch ATM performance monitoring uses F-PM, BR-PM, and CC cells to calculate cell loss ratio (CLR) and availability ratio (AR) measurements according to ITU-T recommendations. These measurements are used for service level agreements (SLAs).

Cell loss ratio (CLR)

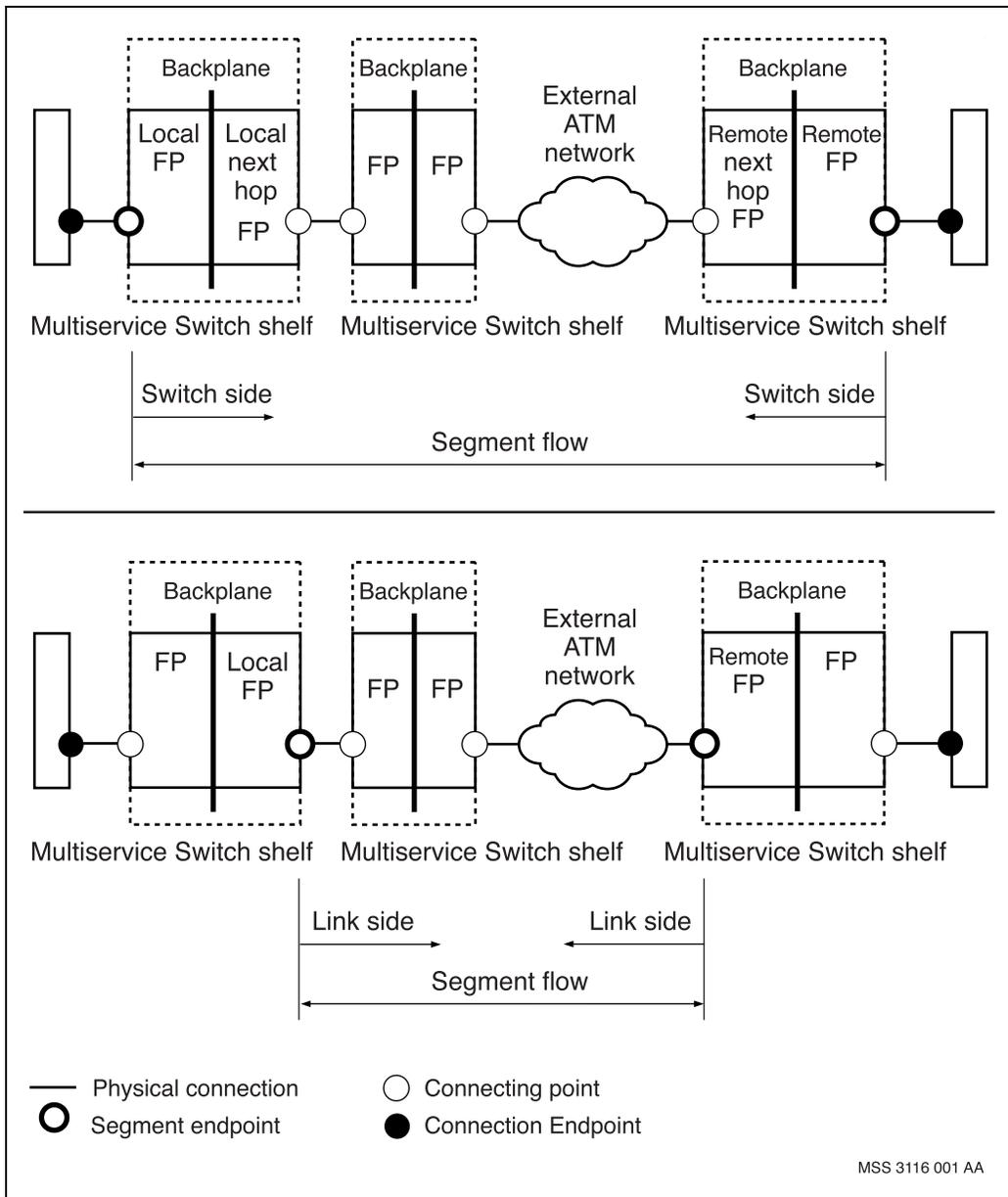
The cell loss ratio (CLR) parameter shows the ratio of total cells lost to total cells transmitted in a population of interest. This provides an indication of the level of congestion in the network, when the connection is available. The ITU-T defines two cases of CLR: the cell loss ratio for high priority cells (CLR0), and the cell loss ratio for the aggregate cell stream (CLR0+1).

For information on provisioning CLR calculation, see NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

CLR measurement method

Nortel Networks Multiservice Switch CLR can be measured from device side to device side, link side to link side, device side to link side, and link side to device side. The most common configuration for measuring CLR is device side to device side. Device side means that the OAM flow direction is towards the backplane. Link side means that the OAM flow direction is towards the link and out of the device. Figure “Sample boundary configuration for device and link side measurements” (page 198) shows a sample network configured with OAM boundaries. This figure distinguishes between device side and link side measurements. The CLR is reported at the provisioned node, and the results are placed into the accounting record for the connection under study and reported by the component administration system (CAS).

Figure 32
Sample boundary configuration for device and link side measurements



For device side measurements, the CLR is calculated by using a combination of PM measurements and discard statistics from the following four FPs: local FP, local next hop FP, remote next hop FP, and remote FP. The required statistics from each FP depends on whether the CLR measurements are taken in the forward direction or the backward direction; however, the local FP is responsible for all queries and calculations. PM is used to obtain the CLR across the network, based on a link side measurement. Discard statistics are also taken from the four FPs during the same interval, and are added to the calculation to achieve an accurate end-to-end CLR measurement.

For link side measurements, the CLR is calculated by using a combination of PM measurements and discard statistics from the following two FPs: local and remote FP. The required statistics from each FP depend on if the CLR measurements are taken in the forward direction or the backward direction, however, the local FP is responsible for all queries and calculations. PM is used to obtain the CLR across the network, based on a link side measurement. Discard statistics are also taken from the FP during the same interval, and are added to the calculation to achieve an accurate link side CLR measurement.

CLR calculation

OAM forward performance management (F-PM) and backwards reporting performance management (BR-PM) cells are used to report cell counts that are collected at the source and sink sides of a segment. F-PM involves generating cells from one network element to a receiving network element. BR-PM requires that the receiving network element check the cells and report back to the generating network element. These cell counts are used to determine the cell loss.

The local card (where the local segment endpoint is located) is the card that is being provisioned. This card initiates the activation sequence by sending an activation request to the remote card. The remote card (where the remote segment endpoint is located) is the card that receives the activation request from the local card. The remote card does not receive any provisioning.

When PM measurements start and if the remote end does not respond to the activation request within 30 seconds, the status will be set to `activationFailed` with a reason `remoteEndNoResponse`. If the PM mode of operation is `onDemand`, the PM status will remain at `activationFailed`. If the PM mode of

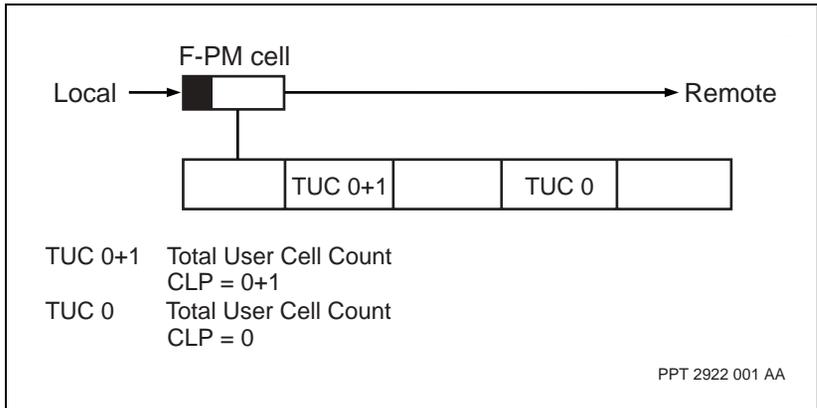
operations is autoStart, the local end automatically retries the activation request every 60 seconds after failure regardless of the failure reason. As long as the mode is autoStart, continuous retries will continue indefinitely until activation succeeds. The following example shows the cyclical behavior for autoStart PM connections where the local and remote end points have lost connectivity:

- 1 activating noError for 30 seconds
- 2 activationFailed remoteEndNoResponse for 60 seconds
- 3 repeat the above two steps until either the PM control mode is changed or connectivity is established.

CLR calculation process

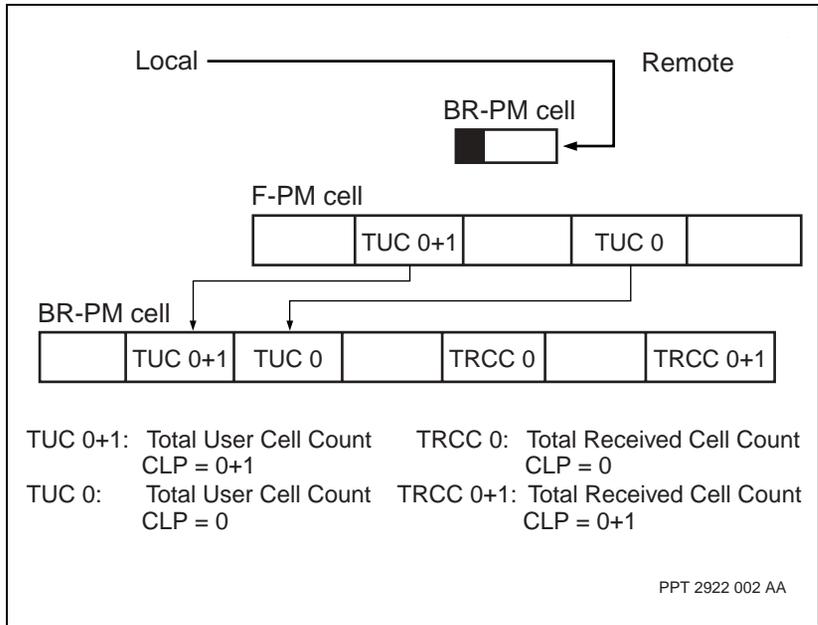
- 1 F-PM cells with transmitted cell counts are sent to the remote segment endpoint as part of the connection user traffic. These cells are inserted into the user cell stream after the transmission of a fixed number of cells, N, which is referred to as the block size. The block size is calculated during the activation procedures, and depends on the provisioned peak cell rate of user traffic. The recommended block sizes from ITU-T recommendation I.610 are used for performance monitoring.

Note: CLR cannot be provisioned on connections that have a configured PCR rate higher than 409 600 cells/sec.

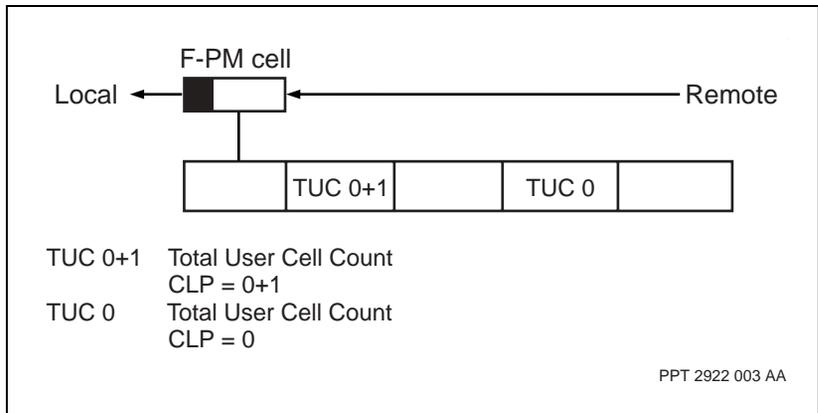


- 2 The remote segment endpoint generates a BR-PM cell, copies the F-PM transmitted cell counts (TUC) into the cell, and copies its own received cell counts (TRCC) into the cell. This cell is then put back into the user traffic

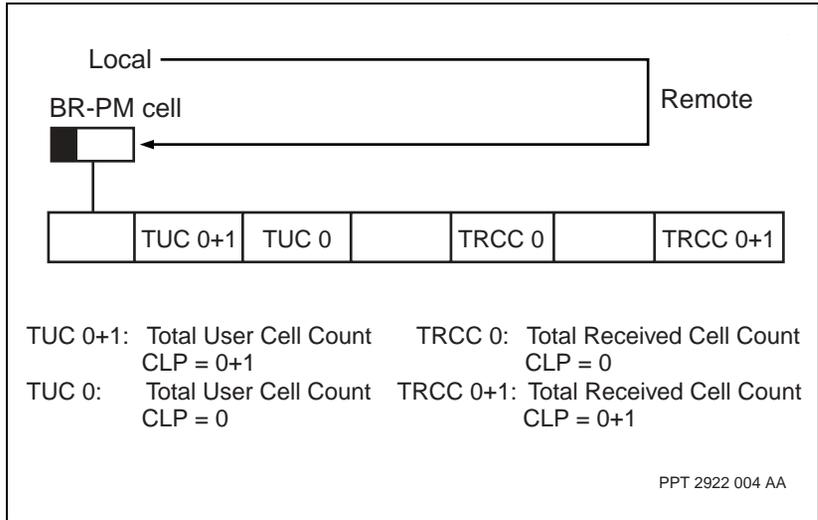
with its own incremented sequence number, and sent back to the source segment endpoint used for reporting statistics for the forward direction.



- The remote segment endpoint also generates a F-PM cell with the transmitted cell counts for the backward direction of the connection, and sends it to the source segment endpoint for processing.

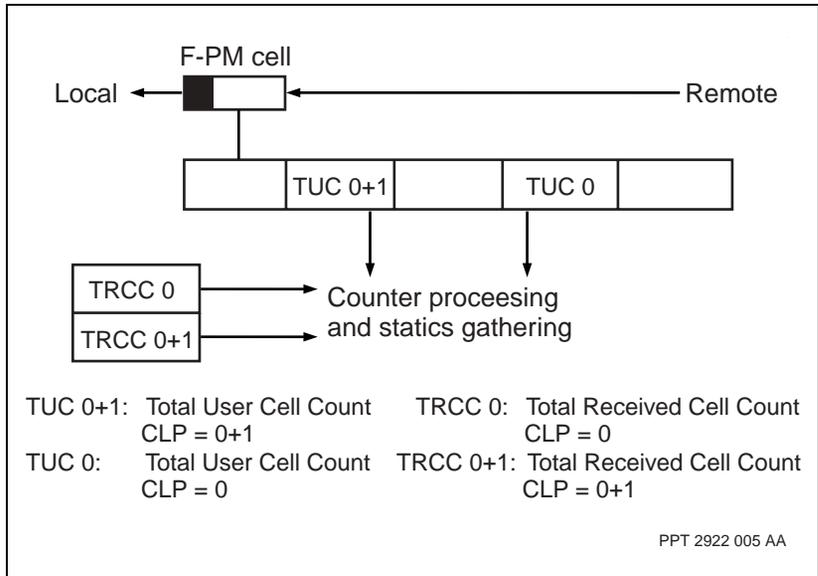


- 4 The local segment endpoint is responsible for the statistics gathering for both directions of the connection. The BR-PM cell contains the statistics for the forward direction, and the received F-PM cell contains the statistics for the backward direction.



- 5 The local segment endpoint stores the content of the received PM cells. The total user cell counts (TUC) and total received cell counts (TRCC),

are cumulated by software. These counts are stored so that software processing is minimized when each PM cell is received.



- 6 Once per second, these accumulated statistics are used to provide the CLR.

Cell loss ratio for high priority cells (CLR₀) and for the aggregate cell stream (CLR₀₊₁), is calculated according to the following equations:

$$CLR_0 = \frac{\text{NumberOfCellsTransmitted}_0 - \text{NumberOfCellsReceived}_0}{\text{NumberOfCellsTransmitted}_0}$$

$$CLR_{0+1} = \frac{\text{NumberOfCellsTransmitted}_{0+1} - \text{NumberOfCellsReceived}_{0+1}}{\text{NumberOfCellsTransmitted}_{0+1}}$$

PPT 2945 001 AA

Accuracy of CLR measurements

This section contains information on the accuracy of cell loss measurements. The following topics are included in this section:

- “Hardware measurements” (page 204)
- “OAM PM cell loss tolerance and counter rollover” (page 205)
- “Limits of accuracy due to PM cell loss” (page 207)
- “Forward direction” (page 207)
- “Backward direction” (page 208)

Hardware measurements

Since Nortel Networks Multiservice Switch FP hardware inserts a F-PM cell at exactly every N cells (where N is the block size), the transmitted and received counts are calculated for the exact same block of cells. The precision of CLR is therefore determined by the number of significant digits used in the calculations.

OAM PM cell loss tolerance and counter rollover

To evaluate the number of lost or misinserted cells during statistics gathering, the number of received cells is subtracted from the number of transmitted cells according to the values of the TRCC and TUC counts. These values can be used to determine CLR, even if a PM cell is lost. Under normal conditions, when no cell loss occurs, a rollover in the TUC and TRCC count will occur after 2^{16} cells are transmitted or received because the counts are free running and are not reset after each F-PM cell is sent. This is accounted for when the counts are evaluated.

Since the counts are free running, it is also possible to account for some F-PM cell loss, but only in the backward direction. Loss can be accounted for up to a certain threshold, depending on the block size. It is up to the local side to handle the different cases of F-PM cell loss and counter rollover by evaluating the values of the TUC, TRCC and monitoring cell sequence number (MCSN) fields of the next received F-PM cell.

The threshold of cell loss is determined by the size of the counter (16 bits), to ensure counter rollovers are detected. The figure “PM cell loss tolerance for each block size” (page 206) contains the tolerance to F-PM cell loss for the different block sizes. By evaluating the MCSN of the next received F-PM cell, the number of F-PM cells lost in sequence before the current F-PM cell is known for that direction. The sample is still considered valid if the jump in MCSN is under the tolerance shown in “PM cell loss tolerance for each block size” (page 206). If more F-PM cell loss is experienced, the sample will not be considered since the number of rollovers that occurred in the counters in the lost F-PM cells is not known.

Figure 33
PM cell loss tolerance for each block size

PCR (cells/s)	(User information rate in Mbit/s)	Block size (N)	PM cell loss tolerance (cells)
$0 < x \leq 3200$	$0 < y \leq 1.23$	128	255
$3200 < x \leq 6400$	$1.23 < y \leq 2.46$	256	127
$6400 < x \leq 12800$	$2.46 < y \leq 4.92$	512	63
$12800 < x \leq 25600$	$4.92 < y \leq 9.83$	1024	31
$25600 < x \leq 51200$	$9.83 < y \leq 19.66$	2048	15
$51200 < x \leq 102400$	$19.66 < y \leq 39.32$	4096	7
$102400 < x \leq 204800$	$39.32 < y \leq 78.64$	8192	3
$204800 < x \leq 409600$	$78.64 < y \leq 157.29$	16384	1

PPT 3025 003 AA

Note: A PCR > 409 600 cells/s is not supported because the PM cell loss tolerance is 0.

There is no tolerance of F-PM cell loss in the forward direction. Although it is possible to detect F-PM cell loss, the local end is unable to distinguish between one cell lost or several cells lost. The fact that a BR-PM cell is received and the change in TUC is greater than the block size informs the local card that some information is missing, for example, one or more F-PM cells are missing. There is however, no way of knowing how many cells were lost. In this case, the information in the received BR-PM cell is discarded and statistics gathering continues with the next BR-PM cell that is received with no indication of F-PM cell loss.

Limits of accuracy due to PM cell loss

PM cell loss is reported by the *fwdPmCellDiscardCount* and *bwdPmCellDiscardCount* attributes. When samples are not considered because the cell loss tolerance is exceeded, the limits of precision introduced can be understood using these attributes.

Consider as the worst case, the assumption that for each lost PM cell, all user cells transmitted in that block are also lost.

Forward direction

It is difficult to estimate the limits of precision introduced by PM cell loss in the forward direction because samples are discarded based on expected sample size, not by examining the MCSN of the F-PM cell. The *fwdPmCellDiscardCount* attribute indicates that either a BR-PM cell was lost, or the transmit (TX) jump is not equal to the block size. Since the probability of F-PM cells being discarded increases as the traffic congestion rate increases, only provide an estimation of the accuracy for the forward direction can be provided:

$$\text{Worst case CLR}_{\text{fwd}} = \frac{\text{totalTx} + (\text{fwdPmCellDiscardCount} * N) - \text{totalRx}}{\text{totalTx} + \text{fwdPmDiscardCount} * N}$$

The percent accuracy of the measurement then becomes

$$\frac{\text{measuredClr}}{\text{worstCaseClr}_{\text{bwd}}} \times 100$$

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The probability of PM cell discard increases as the rate of congestion in the forward direction increases.

Backward direction

The precision introduced by cell loss in the backward direction can be measured by using the number of discarded cells to the measured TX count to get a worst case estimation:

$$\text{Worst case CLR}_{\text{bwd}} = \frac{\text{totalTx} + (\text{bwdPmCellDiscardCount} * N) - \text{totalRx}}{\text{totalTx} + (\text{bwdPmDiscardCount} * N)}$$

The percent accuracy of the measurement then becomes

$$\frac{\text{measuredClr}}{\text{worstCaseClr}_{\text{bwd}}} \times 100$$

PPT 3025 001 AA

Availability ratio

The availability ratio provides an indication of the time for which the network is badly congested or faulty. A connection is available if, and only if, both directions of the segment are available. The AR parameter is defined as the duration for which the connection is available, compared to the total duration of the connection. No distinction is made between the time when the connection is in use and not in use.

Nortel Networks Multiservice Switch systems use a two-state availability model. This model defines the availability of a connection independent of user behavior. The connection can be declared unavailable even if the user is not transmitting ATM cells at a given time. The two availability states correspond to the ability, or inability, of the network to sustain a connection in the available state. Transition between the states of the model are governed by the loss of continuity (LOC) state in either direction of the connection.

When the segment sink-point does not receive any user cells or CC cells within 3-4 seconds, it will declare a LOC defect. This defect indicates that the normal cell flow is interrupted. The AR will consider the last 3.5 seconds as unavailable time. From the AR perspective, there is a transition into an available state when:

- the near-end of the segment detects an exit out of the LOC state and the far-end is not in the LOC state
- the far-end of the segment detects an exit out of the LOC state and the near-end is not in the LOC state
- both the near-end and the far-end of the segment detect an exit out of the LOC state.

For information on provisioning AR calculation, see NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

AR calculation

The availability ratio is determined through the use of continuity check (CC) and remote defect indication (RDI) cells. These cells are sent in the forward direction from the source point every second, independent of user behavior. The use of CC cells allows the sink side to distinguish between a connection that is idle, and one that is experiencing congestion. Each end of the segment acts as source and sink. This means that each end of the segment both inserts and monitors OAM CC cells.

Since CC cells monitor continuity in only one direction, the forward direction, segment RDI cells are sent to notify the local segment endpoint when continuity has been lost in the incoming direction. The segment RDI cells enable both segment endpoints to determine when a LOC defect is detected in one direction of the segment.

The AR process on the source side is as follows:

- 1 The source side inserts 1 CC cell in the forward direction every second, independent of user behavior.
- 2 If the source side receives a segment RDI, the source changes its availability state to unavailable, and considers the 3.5 seconds taken by the far end to declare LOC.

- 3 Once the source side has changed its availability state to unavailable, it remains unavailable until segment RDI cells are not received for 2.5 +/- 0.5 seconds.

The AR process on the sink side is as follows:

- 1 The sink side monitors the CC cells to determine when there is LOC.
- 2 Entry into LOC state occurs when no data cells and no CC cells have been received for 3.5 +/- 0.5 seconds.
- 3 When LOC is detected, segment RDI cells are sent to notify the source side on the local segment endpoint.
- 4 Nortel Networks Multiservice Switch hardware will perform a time-out check every 0.5 seconds in order to determine if a user data cell or CC cell was received within the last 0.5 seconds.
- 5 Exit of LOC state occurs when either a data cell is received or a CC cell is received.

The availability ratio is then calculated by monitoring the transition into and out of the LOC state. It can be expressed as:

$$AR = \frac{\text{time in available state}}{\text{total observation period}}$$

PPT 2945 002 AA

Current performance monitoring statistics

Performance monitoring measurements displayed under the operational *Pm* component provide the current, incremental statistics for the connection. See NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference* for details on the operational attributes that provide performance monitoring information.

Statistics are gathered for both directions of a connection, and reported by CAS at the source segment endpoint.

Considerations when viewing performance monitoring statistics

The CLR statistic that can be displayed from CAS indicates the total CLR performance of the connection since performance monitoring was activated. Until the activation procedures are complete and the first CLR sample is determined, the connection statistics remain at zero.

When considering the AR statistics, note that an AR ratio of 1 does not mean that no outages occurred on the monitored segment. An outage could occur and be resolved before an LOC defect is detected. Also, a very low AR ratio does not mean that the monitored segment was unavailable for a long period of time. An RDI from an atmIf beyond the measured segment could be the cause of the low ratio.

Performance monitoring accounting

When performance monitoring is activated, performance monitoring measurements are also spooled to disk by the accounting system. The accounting records for performance monitoring measurements are reported on the provisioned end of the connection only. (The provisioned end of the connection is the end of the connection where the PM measurements are configured.)

For information on ATM accounting see NN10600-560 *Nortel Networks Multiservice Switch 7400/15000/20000 Accounting*. For details on provisioning ATM accounting see NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

Location of Pm component and accounting record

For NPVC and NPVP, configure performance monitoring on one end of the connection only.

For SPVC and SPVP connections, PM can only be configured on the Src end.

For SVCs, configure PM under each ATM interface. PM measurements are generated on the originating node of the SVC. Operational *Pm* components are only created for SVC and SVP connections if the *callDirection* attribute under the *AtmIf Vcc* or *Vpc* is equal to *fromLink*.

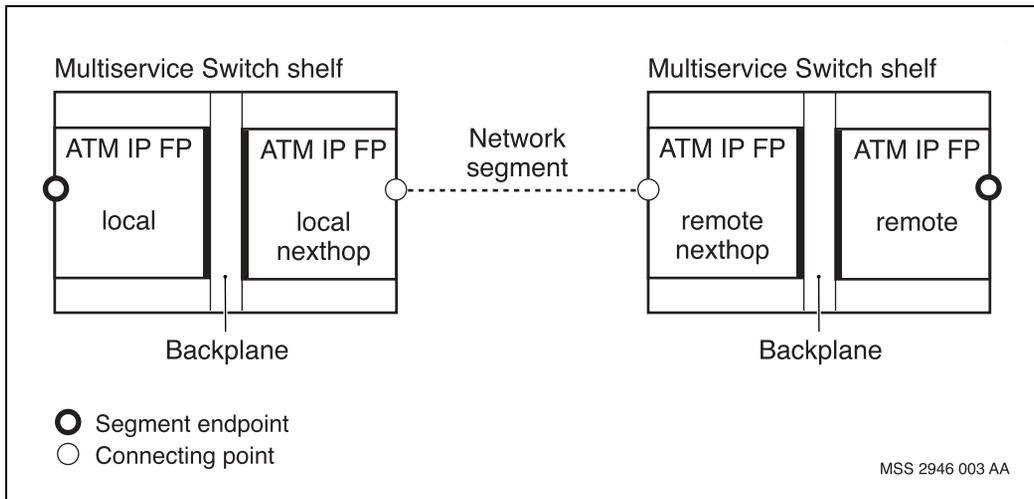
PM accounting records are created at the configured end of the connection.

ATM IP FP deployment requirements

ATM IP FPs must be deployed at all points involved with PM measurements. For link side measurements, this includes the local and remote FPs.

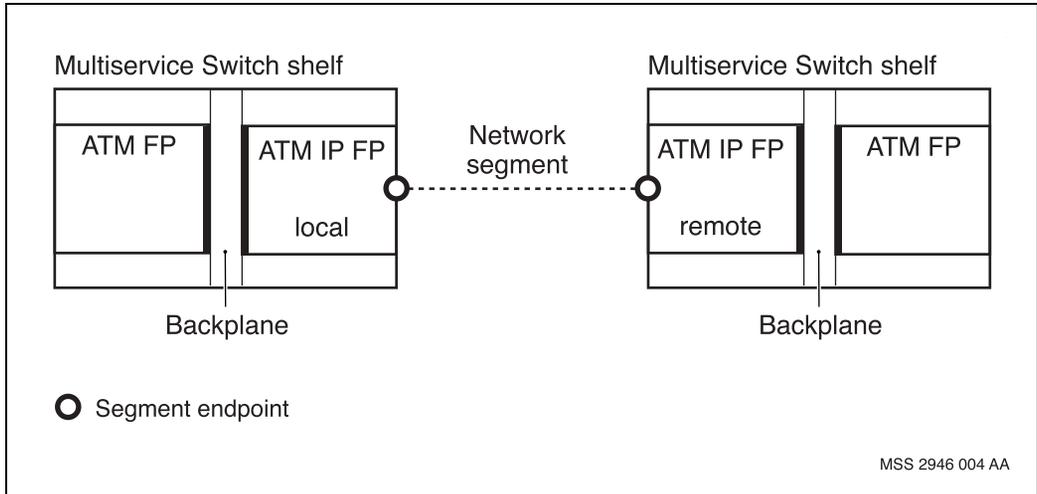
Nortel Networks Multiservice Switch ATM IP FP hardware inserts OAM PM cells towards the link. Therefore, for device side measurements, all four FPs must be ATM IP FPs, which include the local, local next hop, remote next hop, and remote FPs. For more information, see the figure “ATM IP FP locations for device side PM” (page 212).

Figure 34
ATM IP FP locations for device side PM



For link side Pm measurements, the ATM IP FP will be the OAM boundary, and will perform PM cell insertion. On the remote segment end point, the same FP may be the OAM boundary as well as the FP receiving and processing OAM PM cells, in which case, only the FP on the link side is required to be an ATM IP FP. See figure “ATM IP FP locations for link side PM” (page 213).

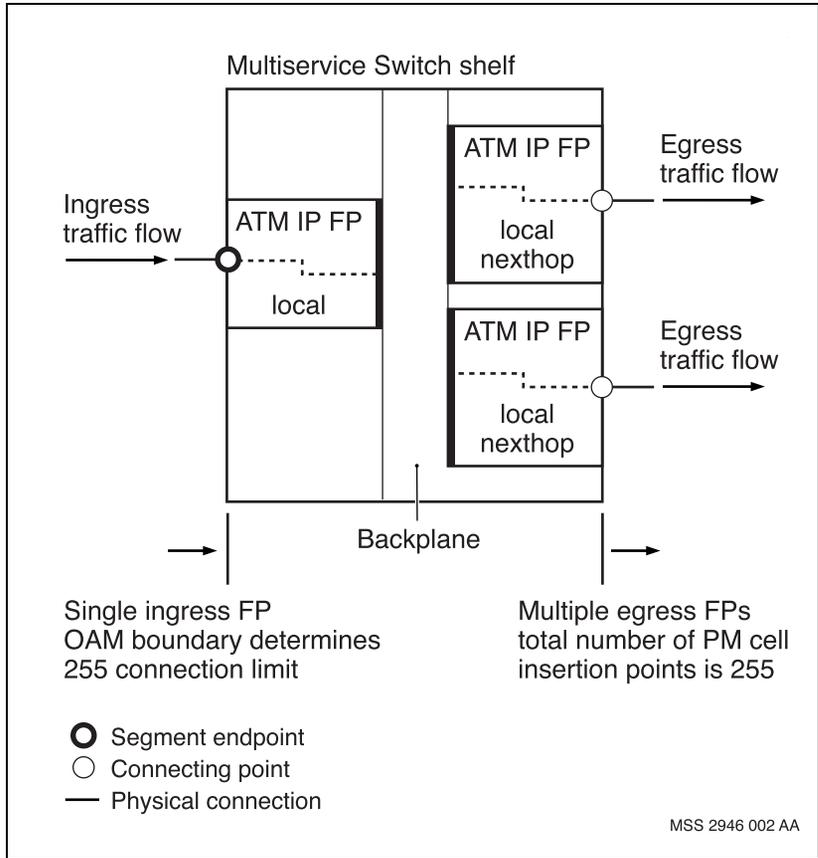
Figure 35
ATM IP FP locations for link side PM



The number of connections supported per FP depends on the location of the OAM segment boundary, which FPs the connection is traversing, and the type of FP.

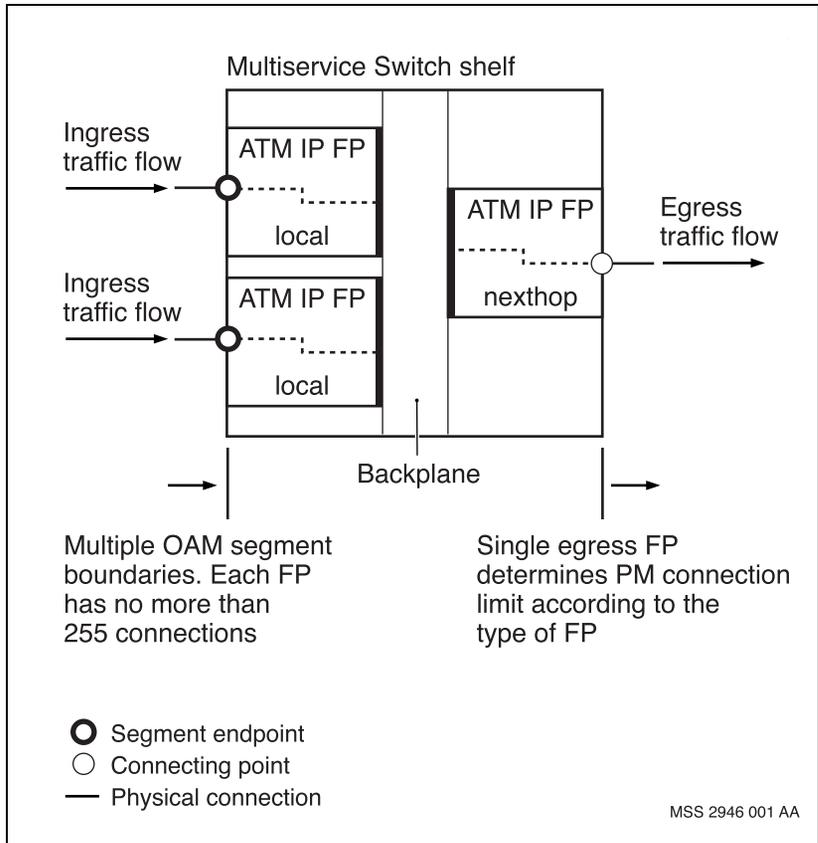
The OAM boundary defines which FP gathers and reports PM statistics. 255 PM connections can be supported on an FP that is an OAM segment boundary. The figure “Connection support determined by OAM boundary” (page 214) shows a device side configuration where the number of connections is limited by the OAM boundary. In this configuration, the limit of 255 PM connections per OAM boundary is reached before the maximum number of PM connections over ATM IP FP is reached for the multiple FPs on the egress side of the node.

Figure 36
Connection support determined by OAM boundary



The figure “Connection support determined by FP location and OAM boundary” (page 215) shows a device side configuration where the number of connections is limited by both the boundaries, and the maximum number of Pm connections supported by the ATM IP FP. Each ingress FP can handle Pm measurements on up to 255 connections (software limit on segment endpoint). The egress hardware limit is displayed in table “Maximum number of PM connections per card type” (page 216).

Figure 37
Connection support determined by FP location and OAM boundary



For FPs not on the OAM segment boundary, such as the egress FP in device side configurations, the maximum number of connections inserting PM cells is described in table “Maximum number of PM connections per card type” (page 216).

Table 13
Maximum number of PM connections per card type

FP types	Maximum number of PM connections	Maximum number of PM connections per FP
2-port OC-3 Single-Mode ATM IP FP	511 per port	1022
2-port OC-3 Multi-Mode ATM IP FP	511 per port	1022
3-port DS3 ATM IP FP	N/A	511
3-port E3 ATM IP FP	N/A	511
32-port DS1 + 1-port OC-3 MSA FP	511 for the OC-3 plus 511 in total for the remaining 32 ports	1022
32-port E1 + 1-port OC-3 MSA FP	511 for the OC-3 plus 511 in total for the remaining 32 ports	1022

Performance monitoring and PNNI edge based rerouting

When a connection undergoes a path optimization triggered by PNNI edge based rerouting, Pm measurements for that connection may be affected, depending on the configuration. There are three possible configurations to consider:

- “Source and sink segment endpoints are located at PNNI edge” (page 216)
- “Path optimization is performed inside the OAM segment” (page 217)
- “The OAM segment is part of the path that requires optimization” (page 217)

Source and sink segment endpoints are located at PNNI edge

In this configuration, the source segment endpoint is located at the reroute node, and the sink segment endpoint is located at the rendez-vous node. During path optimization, the OAM PM function will be terminated and

restarted on the new path, causing some sample loss for CLR calculations. The AR parameter however, will still be valid and account for connection unavailability.

Path optimization is performed inside the OAM segment

If the rerouting is performed inside the OAM segment, and neither the source nor the sink are rerouted, cell loss and unavailable time will be accounted for, but no reroute indication will be provided.

The OAM segment is part of the path that requires optimization

When both the source and the sink are rerouted by path optimization, the AR and CLR calculations will be terminated, and some sample loss will occur. If performance monitoring is enabled at the interface, performance monitoring will be restarted when the connection comes back up.

For information on PNNI edge based rerouting, see NN10600-702 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*.

Expected behavior

The following section contains information about the expected behavior outcomes for different measurement types that have different connection types. The behavior outcomes vary depending upon the network scenario and the location of the fault. This section contains the following topics:

- “Card failure” (page 217)
- “Port failure” (page 222)
- “SPVC scenarios” (page 224)

Card failure

The following tables contain information on types of card failure and the behaviors associated with certain connections:

- “Local segment endpoint card failure” (page 218)
- “Local next hop card failure” (page 219)
- “Remote segment endpoint card failure” (page 220)

- “Remote next hop card failure” (page 222)

Table 14
Local segment endpoint card failure

Connection type	Expected behaviors
PVC	Connections are lost when card goes down; all PM measurements are cleared. Remote end enters LOC and starts to send segment-RDI cells. Activation is restarted on card recovery. Remote end confirms re-activation.
SPVC	Re-establishes on card recovery and activation is restarted. All PM measurements are cleared.
SVC	Connection is released. Activation will restart only if SVC is setup by end user. All measurements are cleared.

Table 15
Local next hop card failure

Connection type	Expected behaviors
PVC	<p>Measurements are stored by the segment endpoint.</p> <p>AR state changes to unavailable until card recovers.</p> <p>CLR is not updated while unavailable.</p> <p>AR state changes to available when traffic is received.</p> <p>Device side CLR activation is triggered when PVC is configured.</p> <p>CA resources remain unchanged on local and remote ends.</p>
SPVC	<p>Connection is down until the card recovers and PNNI/UNI established.</p> <p>Link and device side AR in unavailable state.</p> <p>CLR is not updated.</p> <p>Measurements are stored at the segment endpoint.</p> <p>CA resources are decremented for F-PM and BR-PM, since the hardware is no longer configured.</p> <p>CA resources remain for CC since availability is measured while the connection is down.</p> <p>Activation for CLR restarts after SPVC re-establishes.</p>
SVC	<p>Connection is released. PM component is deleted.</p> <p>CA resources are decremented on the remote end.</p>

Table 16
Remote segment endpoint card failure

Connection type	Expected behaviors
PVC	<p>Local segment endpoint detects LOC and AR state changes to unavailable.</p> <p>CLR is not updated while AR is unavailable.</p> <p>CC or PM cells are received after card recovery, since it is no longer configured for AR/CLR. Local end is notified, which triggers re-activation of AR/CLR.</p> <p>CA resources on remote end are cleared when connection is down and incremented during re-activation.</p> <p>A sudden decrease in value may be observed at fwdTotalUserCellsRx0 and fwdTotalUserCellsRx01 when the remote card becomes available. During a reset, the remote next hop card discards cells in the forward direction, but is unable to report the discard until the reset is complete. The local card continues to increment the FwdRx cell counts in the PM display. This is because the hardware on the remote next hop card is still operational and continues to return BrPM cells indicating traffic received from the link at the card edge on its way to the remote card. When the remote card is available, it reports the discarded cells to the local card and the local card makes the adjustment by decreasing cell counts in FwdRx counter.</p>

(Sheet 1 of 2)

Table 16 (continued)
Remote segment endpoint card failure

Connection type	Expected behaviors
SPVC	<p>Connection is down until the card recovers and PNNI/UNI established.</p> <p>Link and device side AR in unavailable state.</p> <p>CLR is not updated.</p> <p>Measurements are stored at the segment endpoint.</p> <p>CA resources are decremented for F-PM and BR-PM, since the hardware is no longer configured.</p> <p>CA resources remain for CC since availability is measured while the connection is down.</p> <p>Activation for CLR restarts after SPVC re-establishes.</p>
SVC	<p>Connection is released. PM component is deleted.</p> <p>CA resources are decremented on the remote end.</p>
(Sheet 2 of 2)	

Table 17
Remote next hop card failure

Connection type	Expected behaviors
PVC	<p>Availability state changes to unavailable until the card recovers.</p> <p>CA resources on local and remote end remain the same during the crash and recovery.</p> <p>When the PVC AR status is unavailable, CLR is not computed.</p> <p>If AR is not turned on, CLR will not be computed until the PVC comes up.</p> <p>For device-side measurements, CLR must be re-activated, but there is no impact on the current measurements. No additional CLR measurements are taken until activation is complete.</p>
SPVC	<p>Connection is down until the card recovers and PNNI/UNI established.</p> <p>Link and device side AR in unavailable state.</p> <p>CLR is not updated.</p> <p>Measurements are stored at the segment endpoint.</p> <p>CA resources are decremented for F-PM and BR-PM, since the hardware is no longer configured.</p> <p>CA resources remain for CC since availability is measured while the connection is down.</p> <p>Activation for CLR restarts after SPVC re-establishes.</p>
SVC	<p>Connection is released. PM component is deleted.</p> <p>CA resources are decremented on the remote end.</p>

Port failure

The following tables contain information on the types of port failure and the behaviors associated with certain connections:

- “Local port failure” (page 223)
- “Remote port failure” (page 224)

Table 18
Local port failure

Connection type	Expected behaviors
PVC	<p>Device side AR stays available, since it is monitoring in the direction of the segment and the segment itself remains available.</p> <p>For link side AR, the availability status changes to unavailable until the port is up again.</p> <p>If AR is enabled CLR is unaffected while the AR state is available, and does not update when the AR state is unavailable.</p> <p>If AR is not enabled, CLR will update.</p>
SPVC	<p>Connection is down until the card recovers and PNNI/UNI established.</p> <p>Link and device side AR in unavailable state.</p> <p>CLR is not updated.</p> <p>Measurements are stored at the segment endpoint.</p> <p>CA resources are decremented for F-PM and BR-PM, since the hardware is no longer configured.</p> <p>CA resources remain for CC since availability is measured while the connection is down.</p> <p>Activation for CLR restarts after SPVC re-establishes.</p>
SVC	<p>Connection is released. PM component is deleted.</p> <p>CA resources are decremented on the remote end.</p>

Table 19
Remote port failure

Connection type	Expected behaviors
PVC	<p>Device side AR stays available because it is monitoring in the direction of the segment and the segment itself remains available.</p> <p>Link side AR state changes to unavailable.</p> <p>Local end will not receive the CC cells and enters into LOC.</p> <p>Remote end does not receive CC cells and enters LOC.</p> <p>The availability status changes to unavailable until the port is up again.</p> <p>CLR is the same as for local port behavior.</p>
SPVC	<p>Connection is down until the card recovers and PNNI/UNI established.</p> <p>Link and device side AR in unavailable state.</p> <p>CLR is not updated.</p> <p>Measurements are stored at the segment endpoint.</p> <p>CA resources are decremented for F-PM and BR-PM, since the hardware is no longer configured.</p> <p>CA resources remain for CC since availability is measured while the connection is down.</p> <p>Activation for CLR restarts after SPVC re-establishes.</p>
SVC	<p>Connection is released. PM component is deleted.</p> <p>CA resources are decremented on the remote end.</p>

SPVC scenarios

The following table “SPVC scenarios table” (page 225) contains the types of behaviors associated with certain commands:

Table 20
SPVC scenarios table

Scenario	Expected behaviors
Clear	<p data-bbox="455 290 1134 342">CLR and AR both need to re-activate in order to re-configure the remote end after re-establishment</p> <p data-bbox="455 363 1143 415">AR state is unaffected; no state change should be detected since re-establishment should occur before LOC would be detected</p> <p data-bbox="455 436 1029 462">No cell loss is reported because of the re-configuration</p>
Reroute	<p data-bbox="455 531 1147 612">CLR needs to re-activate in order to re-configure the remote end after the connection reroutes because of the device side next hop configuration.</p> <p data-bbox="455 633 1143 685">AR state is unaffected; no state change should be detected since re-establishment should occur before LOC would be detected.</p> <p data-bbox="455 706 1029 732">No cell loss is reported because of the reconfiguration.</p>

PM limitations

Here is a list of configurations that are not supported:

- “Provisioning the next hop ATM interface is not permitted” (page 226)
- “Limit of 255 connections per FP” (page 226)
- “Counting of CA resources” (page 226)
- “Requirements for forward traffic for certain recovery scenarios” (page 226)
- “Changes to the remote OAM segment boundary” (page 227)
- “Activation attempt on an unsupported remote card” (page 227)
- “Deleting a PVC with active PM measurements” (page 227)
- “UPC policing and CBR traffic” (page 227)
- “Accounting problem” (page 228)

Provisioning the next hop ATM interface is not permitted

With the local card being a segment boundary (it must be in order to provision PM) provisioning the next hop card as a segment boundary, in both permanent and switched connections, will result in the measurements being active, but no counts will be gathered. This is because activation will complete successfully between the two cards, but due to the hardware limitation of no performance monitoring cells being sent towards the backplane, there will be no F-PM or BR-PM cells being received at the local end to be processed. The local segment endpoint does not know that its next hop card is provisioned as a segment boundary. Activation appears successful even though measurements will never appear.

Limit of 255 connections per FP

The performance monitoring feature supports 255 connections per functional processor (FP). Whether the connections have CLR measurements, AR measurements, or AR and CLR measurements, there can only be 255 connections in total.

Counting of CA resources

CA resources are counted on both the remote card and the local card. The expected behavior of the performance monitoring feature when an SPVC/SPVP goes down (cleared or card reset) is that the remote card CA resources will have no counts (activation is being restarted) and the local card will only have the CA resource counts for the CC connections. This is correct because the CC connections are still monitoring availability in order to provide accurate measurements. The CA component will show F-PM and BR-PM connections to be zero until the re-activation completes. The number of CC connections should remain the same throughout the entire card reset (on the local side only).

Requirements for forward traffic for certain recovery scenarios

To support recovery for PM measurements on PVCs after remote and remote next hop card crash scenarios, there is a requirement for forward user traffic on the OAM segment. The remote card expects to receive F-PM cells in software from the local card when the hardware is deconfigured after a card crash occurs. Without forward traffic, the remote card will never receive an F-PM cell and the reactivation sequence will not happen. The measurements

will look like they are active, but the counters will never be updated because the remote ends AQM is cleared and it is not turning around any BR-PM cells or sending any F-PM cells. To recover from this scenario without any forward traffic, PM measurements can be turned off and then turned back on again. This will cause a reactivation.

Changes to the remote OAM segment boundary

This feature does not support changing the remote OAM segment boundary while PM measurements are active on PVCs and PVPs. This is not an issue for switched connections (SPVCs/SPVPs/SVCs) since the segment boundary change is critical and will cause the connection to re-establish. AR and CLR should be deactivated on PVCs and PVPs before changing the remote segment boundary.

Activation attempt on an unsupported remote card

A failure cause of *remoteEndNoResponse* is reported when activation is attempted with a CQC card as the remote card. Because the CQC card does not support activation/deactivation cells, it does not extract them from the link. Therefore, the activation cells are never received at the far end and the local end times out due to the lack of response from the remote card. This is expected behavior.

Deleting a PVC with active PM measurements

Deleting a PVC with active PM measurements is not supported because it will cause the resources on the remote end to remain active. When deleting the connection, deactivation of the measurements is not performed and all the resources (including the reading on the CA resources) on the remote end will remain active. There are two methods to recover from this situation. Either the connection has to be re-added and PM measurements turned on and then off again, or the remote and remote next hop cards must be reset.

UPC policing and CBR traffic

If UPC is enabled within the boundaries of an OAM segment, and CBR traffic is running, it is possible that activation cells will be discarded, and the activation process will subsequently fail.

Accounting problem

An accounting problem can occur if the PM measurements (link side or device side) are provisioned more than once within one TODA interval. For example, if the measurements are active, deprovisioned, and then reprovisioned all before a TODA, there will be a negative value in one accounting record. The following accounting record (after the negative value is displayed) is accurate.

Chapter 8

Troubleshooting connections

This section provides guidelines on how to solve problems that can occur while provisioning and monitoring connections on an ATM network.

The following topics are included:

- for a table explaining how to troubleshoot ATM connections, see “Handling problems” (page 230)
- for an explanation of troubleshooting ATM connections with the Trace command, see “Locating connection faults using the Trace command” (page 234)
- to identify the nature of problems with specific connections by displaying key attributes, see “Determining problems with connections in an ATM interface” (page 242)
- to troubleshoot on a per-connection basis using the *Test* and *Loop* components, see “Test capabilities” (page 244)

Handling problems

The table “Handling problems” (page 230) provides guidelines on how to respond to problems that may occur with connections on an ATM network.

Table 21
Handling problems

Problem	Probable causes	Corrective measures
Troubled connection alarm is set	ATM layer fault on one or more connections of an ATM interface	<p>Identify the connections associated with the ATM interface that have one of the following operational status group attributes with a value of <i>bad</i>: <i>segLinkSideLoopbackState</i>, <i>segSwitchSideLoopbackState</i>, <i>endToEndLoopbackState</i>, <i>aisState</i>, and <i>rdiState</i>. The value for status group attribute <i>troubled</i> must be <i>yes</i>.</p> <p>When you have identified these connections, see the probable causes and corrective measures in this table under “Problem with an ATM connection component” (page 232).</p>
	Fault within the non-ATM portion of the connection detected by the interworking function	<p>For ATM interface connections being used by an interworking function (for example FR-ATM) this may indicate a fault within the non-ATM portion of the connection.</p> <p>Identify the associated ATM interface connections that are being used by an interworking function and determine if the operational attributes <i>aisState</i> and/or <i>rdiState</i> are <i>bad</i>. This may or may not indicate an ATM layer fault (see “Determining the status of a virtual connection” (page 58)).</p> <p>To determine if the fault is within the ATM layer, see the probable causes and corrective measures in this table under “Problem with an ATM connection component.”</p> <p>To determine if the fault is within the non-ATM portion of the connection, see the document for that service. For FR-ATM, see NN10600-920 <i>Nortel Networks Multiservice Switch 7400/15000/20000 Operations: Frame Relay to ATM Interworking</i></p>
(Sheet 1 of 4)		

Table 21 (continued)
Handling problems

Problem	Probable causes	Corrective measures
<p>Troubled connection alarm is set and cleared quickly; no connection is visible with a <i>bad</i> state</p>	<p>ATM layer fault on a switched connection</p> <p>For example, if <i>segLinkSideLoopback</i> variable is set to on, but the equipment on the link side is not configured to return the segment loopback OAM cells</p>	<p>Occurs when the loopback settings for the connection cause an ATM layer fault. The connection sends out the loopback cells, and after a given time-out when they are not returned, the connection goes troubled. The connection is then cleared (torn down) immediately.</p>
<p>Loss of traffic on ATM connection</p>	<p>Multiservice Switch hardware problem</p>	<p>Check the integrity of each connection segment:</p> <ul style="list-style-type: none"> • Use the Trace command to verify the segment is unbroken, and • Ensure the operational state of the segment endpoints are “enabled” <p>If a problem is found with any connection component, see probable causes and corrective measures in this table under “Problem with an ATM connection component” (page 232).</p> <p>You can temporarily reconfigure the connection so that cells are looped back prior to exiting the device. This can be done to verify that a problem exists, and to locate the problem within the device portion of the connection.</p> <p>External equipment problem</p> <p>Check any external equipment that may be part of the connection to ensure it is working properly.</p> <p>You can temporarily reconfigure the connection so that cells are looped back prior to reaching the Multiservice Switch device. This can be done to verify that a problem exists, and to locate the problem outside the Multiservice Switch device portion of the connection.</p>

(Sheet 2 of 4)

Table 21 (continued)
Handling problems

Problem	Probable causes	Corrective measures
	Multiservice Switch-to-non-Multiservice Switch interworking problem	Check the provisioning of Multiservice Switch and non-Multiservice Switch sides of connection to ensure that it is compatible.
Unable to start test on ATM connection	Insufficient capacity on ATM interface	Compare the available capacity of <i>AtmIf</i> against the equivalent cell rate requirements of the disabled connection component in terms of the number of connections and bandwidth. Reprovision <i>AtmIf</i> or its connections (as required) to ensure sufficient capacity is available.
Problem with an ATM connection component	Link out of service	If the operational state of the connection component's <i>AtmIf</i> is disabled, then correct whatever problem has caused the associated port to become locked or disabled.
	ATM layer fault	Ensure that end-to-end or segment loopbacks are on. Then, use the Status group attributes to determine whether the problem is on the link side or on the device side of the connection component.
	Insufficient capacity on ATM interface	Compare the available capacity of <i>AtmIf</i> against the requirements of the disabled connection component in terms of the number of connections and bandwidth. Reprovision <i>AtmIf</i> or its connections (as required) to ensure sufficient capacity is available.
	Congestion	Check the Statistics group of the connection component to verify that traffic is being discarded. Reprovision <i>AtmIf</i> or its connections (as required) to prevent congestion.
Free list is congested at congestion control threshold 1 (90% of free list used).	If port aggregation is on, NRT-VBR and UBR traffic may be starving RT-VBR traffic.	The function processor is carrying too much traffic or too many NRT-VBR and UBR connections. Node re-engineering may alleviate high volume traffic. If not, network re-engineering in the area of the node is required.
(Sheet 3 of 4)		

Table 21 (continued)
Handling problems

Problem	Probable causes	Corrective measures
Steadily increasing number of dropped cells	VCC or VPC numbers do not match at remote end	Display the complete list of VCCs and VPC under the <i>AtmIf</i> component. Compare this list with the list of VCCs and VPCs at the remote end.
Increasing <i>rxCellDiscard</i> or <i>rxCellDiscardClp</i>	mismatch of UPC and traffic shaping	Display the provisioned and operational settings of the UPC and traffic descriptors at the local and remote end. If UPC is enabled at one end of a link, traffic shaping should be enabled at the other end. Also, the traffic descriptors and <i>atmServiceCategory</i> should also match.
Increasing <i>txCellDiscard</i> or <i>txCellDiscardClp</i>	Too much traffic for this link	Check the engineering of traffic being presented to this link to ensure that the link can handle all traffic. Verify link utilization by looking at the appropriate attribute under the port component.
	Shaping rate is lower than arriving cell rate	If traffic shaping is enabled, check the source of traffic; ensure that the source is not producing traffic at a rate which exceeds the shaping rate of the connection. Verify the shaping rate in use by displaying the operational attributes of the <i>Vcc</i> or <i>Vpc</i> components.
	Cell rate is limited by per-VC queueing	If the connection is unshaped, and the <i>unshapedTransmitQueueing</i> attribute is set to <i>perVc</i> , the maximum cell rate for a connection may be limited to 58 962 cell/s (for CQC cards only). This maximum limit applies where shapers are allocated on multiple ports. In this case, check the source of traffic to ensure that it is not producing traffic at a rate which exceeds the maximum shaping rate available.
(Sheet 4 of 4)		

Frame loss during ATM test on ATM IP function processors

When ATM test is started on an ATM IP function processor for a VCC that is configured for CBR service, some loading frames may be lost. This behavior is manifest as counts on the *loadingFrames* and *rxFrameDiscard* attributes.

Loss of loading frames occurs because of the bursty nature of traffic associated with ATM test. Losses occur only on VCCs configured for CBR service (the *atmServiceCategory* attribute equals *cbr*). VCCs for all other service categories do not exhibit this behavior.

Locating connection faults using the Trace command

The following procedure explains the use of the Trace command to locate VCC and VPC connection faults (see “Locating VCC faults” (page 238) and “Locating VPC faults” (page 240). The table “Interpreting the results of the Trace command” (page 241) explains how to interpret the results. The section “Trace loopbacks” (page 234) introduces the Trace command and provides examples of its use.

Trace loopbacks

Trace loopbacks are Nortel Networks Multiservice Switch-specific loopbacks that trace the path of a connection within a Multiservice Switch segment. The trace response displays a list of *Vcc* or *Vpc* components traversed by the segment.

The trace is invoked by the *Trace* operator command issued against the connection at any point within the segment. After five seconds following trace command, a trace response displays a list of all points along the connection. For each point identified in the response list the name of the Multiservice Switch module, the *AtmIf* component, and the *Vcc* or *Vpc* component is displayed. The response contains two sub-lists: a list of points found on the link side of the component where trace was issued, and a list of points found on the device side.

For examples of an execution of the *Trace* command, see “Example: Trace command issued on a segment end-point within a Multiservice Switch-only segment” (page 235), “Example: Trace command issued on a connecting point within a Multiservice Switch-only segment” (page 236), and “Example: Trace command issued on a connecting point within a multi-vendor segment” (page 237).

Note: The order of the connection points displayed in the trace response list may not correspond to the actual order of the connection points along the connection.

Figure 38

Example: Trace command issued on a segment end-point within a Multiservice Switch-only segment

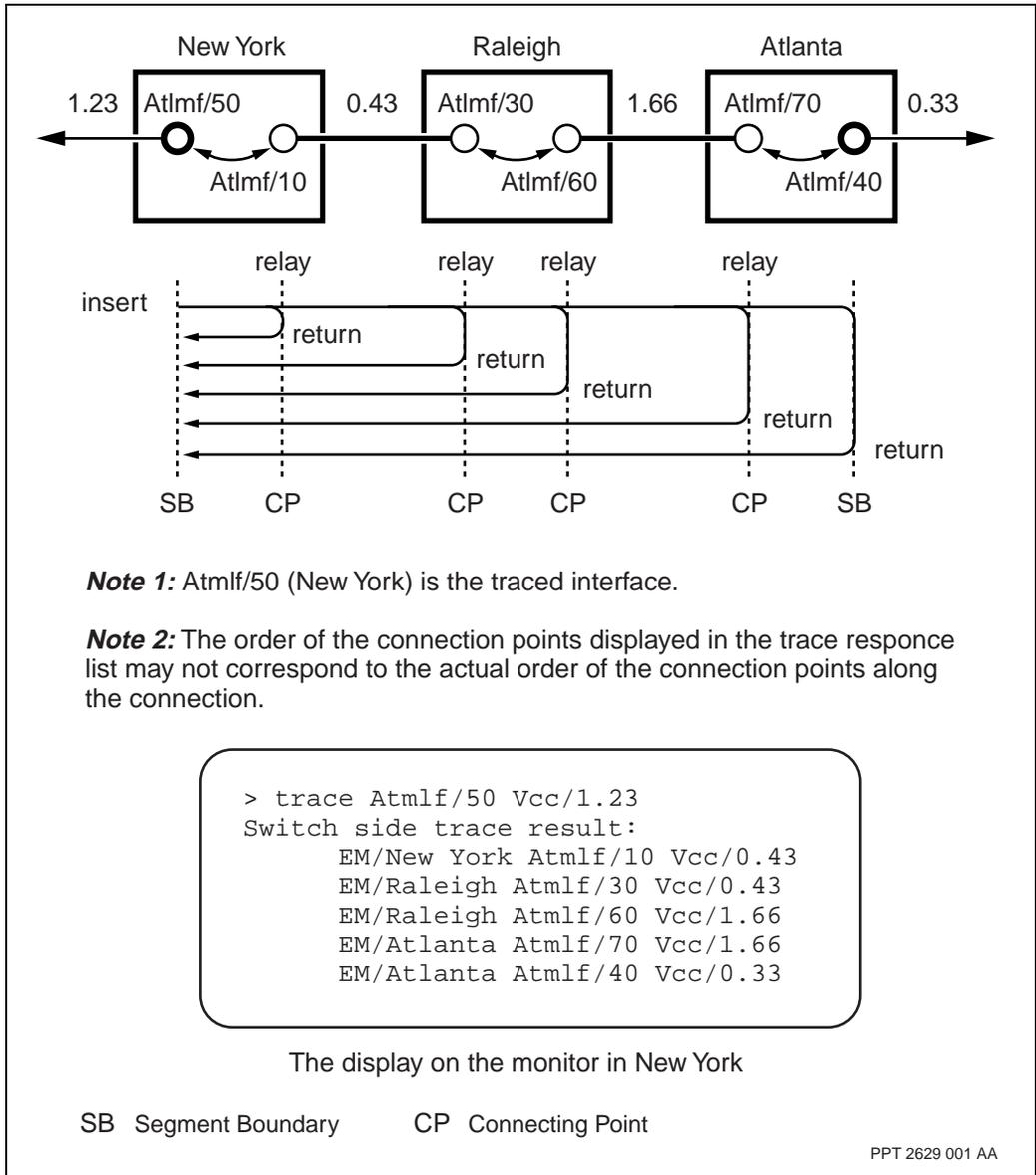


Figure 39

Example: Trace command issued on a connecting point within a Multiservice Switch-only segment

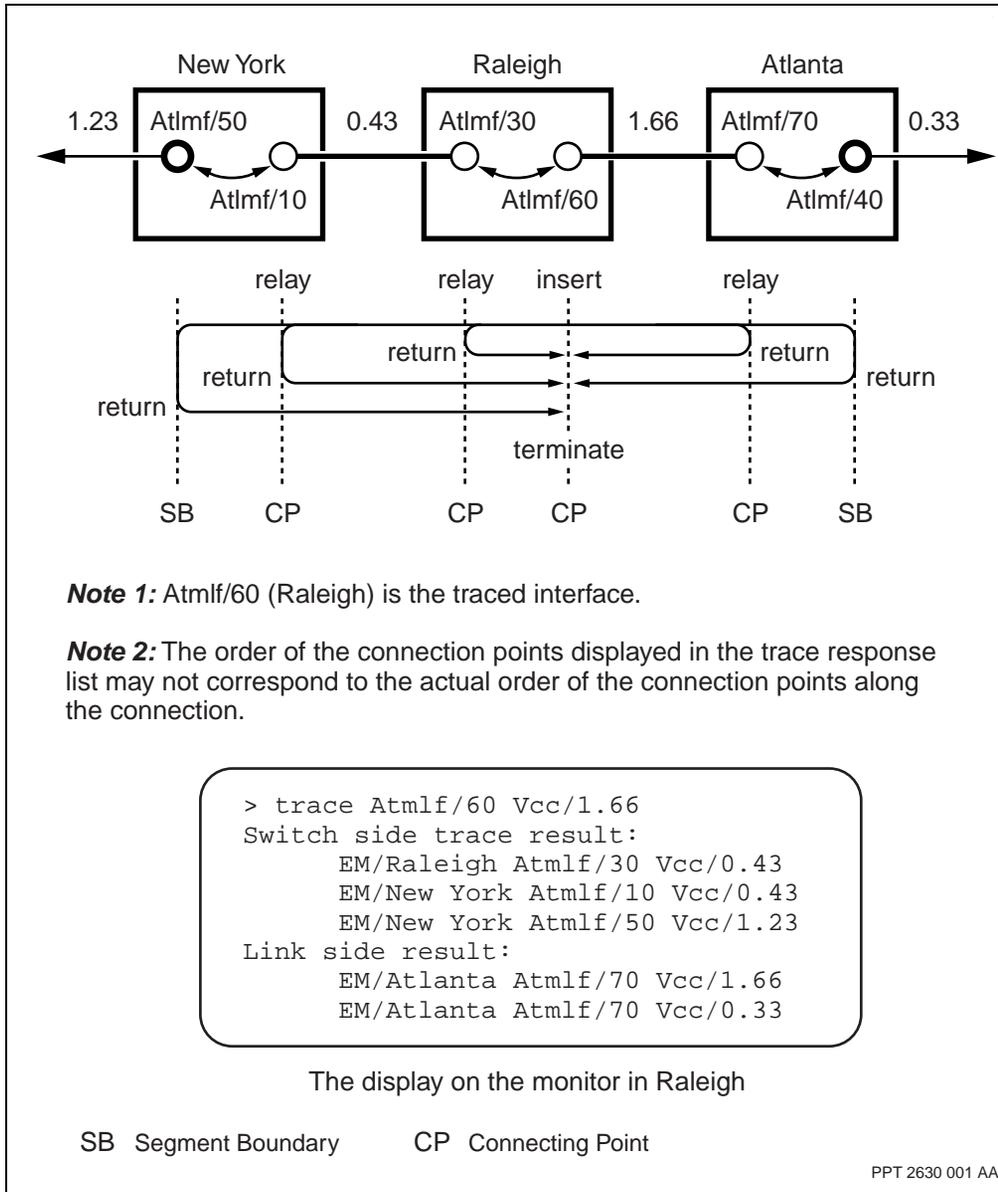
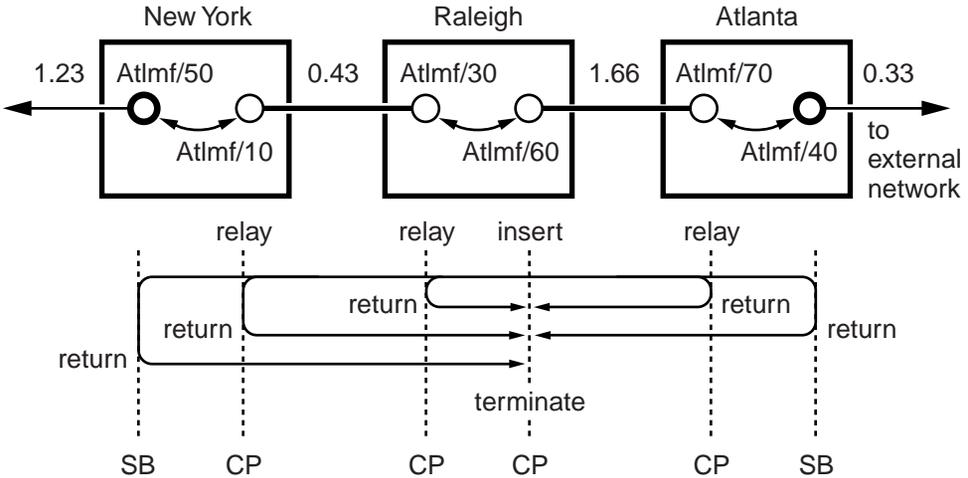


Figure 40

Example: Trace command issued on a connecting point within a multi-vendor segment



Note 1: Atmlf/60 (Raleigh) is the traced interface. In this example, the *Trace* command traverses the interface to the external network.

Note 2: The order of the connection points displayed in the trace response list may not correspond to the actual order of the connection points along the connection.

```
> trace Atmlf/60 Vcc/1.66
Switch side trace result:
  EM/Raleigh Atmlf/30 Vcc/0.43
  EM/New York Atmlf/10 Vcc/0.43
  EM/New York Atmlf/50 Vcc/1.23
Link side Result:
  EM/Atlanta Atmlf/70 Vcc/1.66
  EM/Atlanta Atmlf/70 Vcc/0.33
```

The display on the monitor in Raleigh

SB Segment Boundary CP Connecting Point

PPT 2631 001 AA

Only Multiservice Switch segments are traceable since the coding in the trace cell is proprietary to Multiservice Switch systems. Therefore, the trace command may have full, partial, or no effect, depending on the component against which it is issued. The effectiveness of a trace command is a function of the connection point type of the VCC or VPC component against which the trace was issued, and if the ATM interface is an OAM segment boundary. *Trace* effectiveness is summarized in the table “Trace command effectiveness” (page 238).

Table 22
Trace command effectiveness

Value of Vcc or Vpc connectionPointType attribute	Value of AtmIf oamSegmentBoundary attribute	
	Yes	No
connection end-point	no tracing performed	link-side tracing only
segment end-point	device-side tracing only	both link-side and device-side tracing performed two segments traced
connecting point	both link-side and device-side tracing performed	both link-side and device-side tracing performed
Note: With the connection point setting, proprietary (trace) OAM cells are sent to the external network.		

Locating VCC faults

- 1 Select a connection segment in which to locate a fault.
- 2 Compile a list Vcc components that you expect to see along the connection. Include the following information for each Vcc component:
 - Module name
 - *AtmIf* component instance number
 - VPI value
 - VCI value
- 3 Use the *Trace* command for any Vcc component within the segment selected.

```
trace AtmIf/<n> <Vpt> Vcc/<x>
```

where:

<V_{pt}> is the *VirtualPathTerminator* component. Use this variable if the virtual connection is associated with a *Vpt* component.

<x> defines the instance of the *Vcc*. If the virtual channel is associated with an *AtmIf* component, <x> represents the VPI.VCI value. If the virtual channel is associated with a *Vpt*, <x> represents VCI value.

Five seconds after issuing the *Trace* command, a response of the following form is displayed:

```
Switch side trace result:
<VccInstance1>
<VccInstance2>
.....
<VccInstance<n>>

Link side trace result:
<VccInstance<n>+1>
<VccInstance<n>+2>
.....
<VccInstance<n>+<m>>
```

where:

<n> is the number of *Vcc* components along the device side of the connection. <n> may be 0.

<m> is the number of *Vcc* components along the link side of the connection. <m> may be 0.

<VccInstance_k> is an instance of a *Vcc* component along the connection, and has the form of:

```
EM/<modk> AtmIf/<ik> Vcc/<VPIk>.<VCIk>
```

where:

<mod_k> is the name of the module

<i_k> is the *AtmIf* component instance

<VPI_k> is the VPI value for the *Vcc* component

<VCI_k> is the VCI value for the *Vcc* component

Note 1: The results of the *Trace* command do not always display in the corresponding order of the actual connections.

Note 2: Any missing *Vcc* components that you expect to see in the response to the *Trace* command may have a fault. If this occurs, investigate the cause of the fault. Possible reasons for this include

- the local physical link at the missing VCC is down
- the missing *Vcc* component has not been added and provisioned

- the missing *Vcc* component is in the unlocked-enabled-idle state indicating that the application (Test, Loop, or Nrp) has not activated for the VCC
- the application using the missing *Vcc* component is faulty

Locating VPC faults

- 1 Select a connection segment in which to locate a fault.
- 2 Compile a list of *Vpc* components that you expect to see along the connection. Include the following information for each *Vpc* component:
 - Module name
 - *AtmIf* component instance number
 - VPI value
- 3 Use the trace command for any *Vpc* component within the segment selected.

```
trace AtmIf/<n> Vpc/<VPI>
```

where:

<n> is the instance number of the ATM interface

<VPI> defines the instance value of the *Vpc* component

Five seconds after issuing the *Trace* command, a response of the following form is displayed.

```
Switch side trace result:
```

```
<VccInstance1>
```

```
<VccInstance2>
```

```
.....
```

```
<VccInstance<n>>
```

```
Link side trace result:
```

```
<VccInstance<n>+1>
```

```
<VccInstance<n>+2>
```

```
.....
```

```
<VccInstance<n>+<m>>
```

where:

<n> is the number of *Vpc* components along the device side of the connection. <n> can be 0.

<m> is the number of *Vpc* components along the link side of the connection <m> can be 0.

<VpcInstance_k> is an instance of a *Vpc* component along the connection, and has the form of:

EM/<mod_k> Atmlf/<i_k> vpc/<VPI_k>

where:

<mod_k> is the name of the module

<i_k> is the *Atmlf* component instance

<VPI_k> is the VPI value for the *Vpc* component

Any missing *Vpc* component that you expect to see in the response to the *Trace* command may have a fault. If this occurs, investigate the cause of the fault. Possible reasons for this include

- The local physical link at the missing VPC is down.
- The missing *Vpc* component has not been added and provisioned.
- The missing *Vpc* component is in the unlocked-enabled-idle state indicating that the application (Loop or Nrp) has not activated for the VPC.
- The application using the missing VPC is faulty.

Table 23
Interpreting the results of the Trace command

Type of connection point where Trace command is used	Note
connecting point	Both device-side and link-side results are expected. Missing device-side and/or link-side results indicate faults along the connection side where the <i>Trace</i> command is used.
(Sheet 1 of 2)	

Table 23 (continued)
Interpreting the results of the Trace command

Type of connection point where Trace command is used	Note
segment end-point	<p>When the <i>Trace</i> command is used for an <i>AtmIf</i> component with an <i>oamSegmentBoundary</i> attribute set to <i>yes</i>, only device-side results are expected. You do not see any link side results as only device-side tracing is performed. This result does not indicate any potential link-side problem.</p>
connection end-point	<p>When the <i>Trace</i> command is used for an <i>AtmIf</i> component with an <i>oamSegmentBoundary</i> attribute set to <i>no</i>, both device-side and link-side results are expected. The device-side results are a trace of one segment, while the link-side results are a trace of an adjoining segment.</p> <p>When the <i>Trace</i> command is used for an <i>AtmIf</i> component with an <i>oamSegmentBoundary</i> attribute set to <i>yes</i>, no device-side or link-side results are expected.</p> <p>When the <i>Trace</i> command is used for an <i>AtmIf</i> component with an <i>oamSegmentBoundary</i> attribute set to <i>no</i>, only link-side results are expected. You can expect to find missing device-side results.</p>
(Sheet 2 of 2)	

Determining problems with connections in an ATM interface

The procedure “Determining the status of a connection” (page 243) allows you to determine the nature of problems with certain connections by displaying the value of the following key attributes for each connection:

- *localFailureCause*
- *holdingPriority*
- *atmServiceCategory*
- *bandwidthReduction*

The *localFailureCause* attribute can be helpful in determining problems with connections. The table “The possible values of the attribute *localFailureCause*” (page 243) provides the possible values of the *localFailureCause* attribute.

Table 24
The possible values of the attribute *localFailureCause*

Value	Meaning
noFailure	The connection is admitted and has no failures related to bandwidth.
bwReduced	The connection is elastic and is operating at a state of reduced bandwidth.
portDown	The entire link is down (either the physical port or the IMA virtual link is down, or a VP-layer fault has been detected).
notAdmitted	The connection is waiting to be admitted. It was activated (or enabled) after all bandwidth was allocated to other connections, and insufficient bandwidth was left for to admit the connection.
localBwLoss	The connection was admitted, but has been released by the CBC algorithm due to bandwidth loss on the local IMA virtual link. The connection is waiting to be admitted.
disabledByApp	The connection has been disabled by the application using it. An example of this is when a trunking application is locked.
appNotRegistered	The application using the connection is inactive. An example of this is when a VCC test has not been started.

Determining the status of a connection

- 1 Evaluate the status of the connections in an ATM interface by using the display command to determine the value of certain key attributes.

```
display -o AtmIf/<n> Vcc/* localFailureCause
display -o AtmIf/<n> Vcc/* Tm holdingPriority,
atmServiceCategory,bandwidthReduction
```

where:

<n> can be set to any number between 1 and 1024

- 2 If *localFailureCause* has a value of *bwReduced*, you can verify the amount of bandwidth reduction by displaying the ECR as compared to the value of the *bandwidthReduction* attribute.

```
display AtmIf/<n> Vcc/* Tm txtDp, bwReduction
```

You should compare equivalent cell rate (ECR) for *TxDp*, with the value in the *bwReduction* column. For an elastic connection, current cell rate (CCR) can be determined as follows:

$$\text{CCR} = \text{<ECR>} - \text{<bwReduction>}$$

where:

<ECR> is the equivalent cell rate for the connection

<bwreduction> is the amount by which the speed of an elastic connection is reduced in cells per second. This is the value for the *bandwidthReduction* attribute for a *Vcc* component. CCR is used only when the value for <bwreduction> is greater than zero.

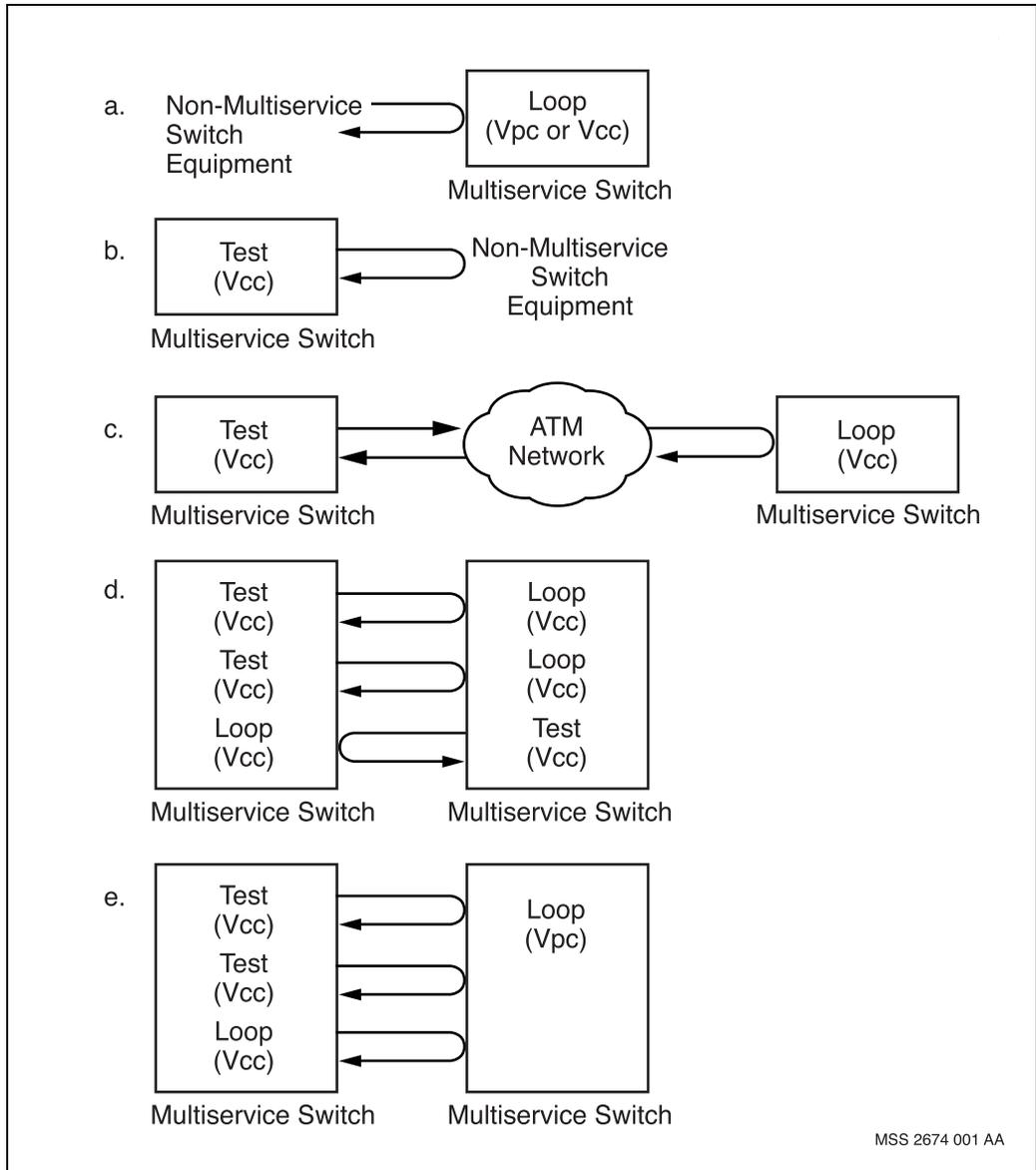
Test capabilities

Nortel Networks Multiservice Switch ATM core services provide for testing on a per-connection basis for point-to-point VCCs using the *Test* and *Loop* components. The *Test* component generates frames that are sent through a VCC. The size and pattern of the frame can be specified as attributes of the *Test* component. When these frames are received by a *Loop* component they are returned to the originating *Test* component. See “Examples of how to use the Test and Loop services” (page 245) for examples of usage of how to use Test and Loop services.

The *Test* component gathers statistics on the number of frames transmitted and received while the test is running. This information is presented in detail later in this section. The *Loop* component does not display any monitoring information. The service can be monitored by examining the associated connection. See “Connection monitoring” (page 51).

The procedure “Performing a connection test” (page 246) explains how to use this feature, while the procedure “Displaying connection test results” (page 248) explains how to display specific test results.

Figure 41
Examples of how to use the Test and Loop services



Performing a connection test

The procedure in this section explains how to test an ATM connection (*Vcc* or a *Vcc* under a *Vpt*) using the *Test* component.

You test any connection using the *Test* component. After the test, the connection can be configured for another service (for example a *Nrp* for ATM Bearer Service).

- 1 Use the display command to verify the setup of a Test component.

```
display AtmIf/<n> Vcc/<Vpi.Vci> Test
```

or

```
display AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test
```

where:

<n> is the instance number of the *AtmIf* component with the connection to be tested

Vpt/<Vpi> is the *VirtualPathTerminator* component. Use this parameter if you are configuring the virtual connection with a virtual path terminator.

<Vpi.Vci> defines the instance value of the *Vcc* component

- 2 Set the applicable *Test* component attributes (all are optional).

```
set AtmIf/<n> Vcc/<Vpi.Vci> Test frmTypes <frametype>
```

or

```
set AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test frmTypes  
<frametype>
```

where:

<frametype> is *loading*, *verification*, or *loading verification*. The default is *loading verification*. Three loading frames are transmitted at a time, and are circulated without verification of the frame content (although the sequence number is verified). Verification frames are transmitted one at a time and each returned frame is verified for bit corruption.

```
set AtmIf/<n> Vcc/<Vpi.Vci> Test frmSize <framesize>
```

or

```
set AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test frmSize  
<framesize>
```

where:

<framesize> is the size of the frame in bytes. Values can range from 4 to 4096. The default is 1024

```
set AtmIf/<n> Vcc/<Vpi.Vci> Test frmPatternType
<pattern>
```

or

```
set AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test frmPatternType
<pattern>
```

where:

<pattern> is one of either *ccitt32kBitPattern*, *ccitt8MBitPattern*, or *customizedPattern*. The default is *ccitt32kBitPattern*.

```
set AtmIf/<n> Vcc/<Vpi.Vci> Test customizedPattern
<hex>
```

or

```
set AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test
customizedPattern <hex>
```

where:

<hex> is the customized test pattern to be used. Possible values range from 0 to FFFFFFFF (hexadecimal). The default is 55555555 (hexadecimal).

```
set AtmIf/<n> Vcc/<Vpi.Vci> Test duration <min>
```

or

```
set AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test duration <min>
```

where:

<min> is the duration of the test in minutes. The default is 1.

3 Start the connection test.

```
start AtmIf/<n> Vcc/<Vpi.Vci> Test
```

or

```
start AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test
```

The test stops automatically after the specified test duration has elapsed, or when the test is stopped manually.

4 Display the test statistics (optional).

```
display AtmIf/<n> Vcc/<Vpi.Vci> Test
```

or

```
display AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test
```

You should notice the component traffic statistics for the connection incrementing. The OSI state for the connection should be unlocked-enabled-busy.

- 5 Stop the test (optional).

```
stop AtmIf/<n> Vcc/<Vpi.Vci> Test
```

or

```
stop AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test
```

Displaying connection test results

The following procedure explains how to display the attributes of the connection test. These attributes are

- *elapsedTime*
- *timeRemaining*
- *causeOfTermination*
- *bytesTx*
- *loadingFrmTx*
- *verificationFrmTx*
- *bytesRx*
- *loadingFrmRx*
- *verificationFrmRx*
- *verificationFrmBad*
- *unrecognizableFrmRx*

- 1 Display amount of time the test has run.

```
display AtmIf/<n> Vcc/<VPI.VCI> Test elapsedTime
```

where:

<n> is the instance number of the *AtmIf* component with the connection being tested

<VPI.VCI> defines the instance value of the *Vcc* component

This command displays the length of time (in minutes) that the connection test has been running.

- 2 Display the amount of time left before the test is completed.

```
display AtmIf/<n> Vcc/<VPI.VCI> Test timeRemaining
```

This command displays the maximum length of time (in minutes) that the connection test is set to continue before stopping.

- 3 Display the cause of test termination.

```
display AtmIf/n Vcc/<VPI.VCI> Test causeOfTermination
```

This command displays the reason why the connection test has ended. The reason can be one of the following:

- *neverStarted* means the connection test was not started.
- *testRunning* means connection test is currently running.
- *testTimeExpired* means connection test has run the specified duration.
- *stoppedByOperator* means a Stop command was issued.

- 4 Display the traffic transmitted by the *Test* component.

```
display AtmIf/n Vcc/<VPI.VCI> Test bytesTx,  
loadingFrmTx, verificationFrmTx
```

This command displays the total number of bytes, the number of loading frames, and the number of verification frames sent during the test period.

- 5 Display the traffic received by the *Test* component.

```
display AtmIf/n Vcc/<VPI.VCI> Test bytesRx,  
loadingFrmRx, verificationFrmRx
```

This command displays the total number of bytes, the number of loading frames, and the number of verification frames received during the test period.

- 6 Display the test's error statistics.

```
display AtmIf/n Vcc/<VPI.VCI> Test loadingFrmLost,  
verificationFrmBad, unrecognizableFrmRx
```

Displays the total number of loading frames lost during the test, the number of verification frames received with bit corruption, and the number of unrecognizable frames received during the test period.

Chapter 9

Troubleshooting ATM interfaces

This section provides guidelines on how to solve problems that can occur while monitoring the ATM interfaces provisioned on a function processor.

The following topics are included:

- “Identifying troubled connections at the interface level” (page 251)
- “Troubleshooting LRC errors at the ATM interface level” (page 253)

Identifying troubled connections at the interface level

You may receive an alarm stating that the ATM configuration contains one or more “troubled” connections. To examine these connections at the interface level and determine the cause of the trouble, perform the following steps:

- 1 Determine the connections that are troubled. See step 1 in “Identifying and determining troubled connections” (page 251).
- 2 Determine the status of the connection for either a *Vcc* or *Vpc* component. See step 2 in “Identifying and determining troubled connections” (page 251).
- 3 Isolate the location of a troubled connection to a particular Nortel Networks Multiservice Switch module, ATM interface component, and connection component. See step 3 in “Identifying and determining troubled connections” (page 251).

Identifying and determining troubled connections

- 1 Display the number of *Vpc*, *Vpt*, and *Vcc* components that are troubled.

```
display AtmIf/<n> Ca
```

where:

<n> is the instance number of the ATM interface.

- 2 If the value of at least one *troubledVpcs* attribute is other than 0, then display the attributes in the status group for all *Vpc* components.

```
display AtmIf/<n> Vpc/* status
```

If the value of at least one *troubledVpts* attribute is other than 0, then display the attributes in the status group for all *Vcc* components.

```
display AtmIf/<n> Vpt/* status
```

If the value of at least one *troubledVccs* attribute is other than 0, then display the attributes in the status group for all *Vcc* components.

```
display AtmIf/<n> Vcc/* status
```

For either the *Vcc* or *Vpc* component, the following operational attributes reflect the status of the respective connections:

- *segLinkSideLoopbackState*
- *segSwitchSideLoopbackState*
- *endToEndLoopbackState*
- *aisState*
- *rdiState*

For either the *Vcc* or the *Vpc* component, the operational attributes that are in a *bad* state indicate the cause of the connection trouble. However, the *aisState* may be *bad*, but the connection may not be troubled. (The value of the *troubled* status group attribute indicates if the connection is troubled.) For example, when a local failure occurs, the value of the *aisState* attribute is *bad* without the connection being in a troubled state.

- 3 If possible, isolate the location of a troubled connection to a particular Multiservice Switch module, ATM interface component, and connection component. See “Identifying troubled connections” (page 35) for more information about locating troubled connections.

Troubleshooting LRC errors at the ATM interface level

LRC errors are errors which are identified at the ATM interface level and indicate that the interface is in a degraded state. The table “Possible causes of LRC errors” (page 253) lists the various events which can create this error condition. The procedure “Diagnosing LRC errors” (page 254) describes the steps used to determine the exact cause of an LRC error and lists steps you can follow to rectify the problem.

Table 25
Possible causes of LRC errors

Possible cause	Description
ATM FP is faulty	Frames have been corrupted when received from the backplane or during transmission to the link. Depending on the nature of the defect, the percentage of frames being corrupted may range from less than 1% to 100%. The ATM FP is detecting LRC errors when the frame is transmitted to the link.
Another FP within the shelf is faulty	Frames have been corrupted when received from the link or during transmission to the backplane. Depending on the nature of the defect, the percentage of frames being corrupted may range from less the 1% to 100% of frames being received from the link. The ATM FP is detecting an LRC error when the frame is transmitted to the link.
(Sheet 1 of 2)	

Table 25 (continued)
Possible causes of LRC errors

Possible cause	Description
The node's bus or fabric is faulty	Frames have been corrupted during transmission over the node's bus or fabric. Each frame that is sent to the ATM FP over the bus or fabric is checked using parity bits. If incorrect parity is detected, the corrupted frame is discarded by the ATM FP. In rare instances, a multi-bit error may occur which generates correct parity, resulting in a corrupted frame arriving successfully at the ATM FP. The ATM FP may then detect an LRC error when frame is transmitted to the link.
The shelf is unstable	<p>Frames have been corrupted while being transferred to an ATM FP over the backplane, due to a transient condition occurring on the shelf. Such conditions may include these events:</p> <ul style="list-style-type: none"> • the ATM FP or a card sending frames to it has been reset • an ATM connection on the ATM FP has been enabled or disabled • a card has been inserted or removed from the shelf • the shelf switched from dual-bus/fabric mode to single-bus/fabric mode or single-bus/fabric mode to dual-bus/fabric mode • a bus or fabric test is being performed <p>Note: Frame corruption does not automatically occur as a result of the events listed above. Typically, these events are handled in a manner that prevents frame corruption.</p>
(Sheet 2 of 2)	

Diagnosing LRC errors

Use the following steps to determine the cause of LRC errors and the appropriate corrective action that should be taken.

- 1 Determine if any of the transient conditions listed in the table "Possible causes of LRC errors" (page 253) have occurred. If so, correct the

destabilizing factors and continue to monitor the situation to see if any LRC errors persist.

- 2 Use the procedure “Displaying ATM interface traffic statistics” (page 37) to examine the *IrcFrameErrors* attribute for all ATM interfaces on all ATM FPs in the shelf. If an unusual number of LRC errors are observed on only one ATM FP, then that ATM FP may be at fault.

If an unusual number of LRC errors are observed on two or more ATM FPs, examine the *lastLrcFrameErrorConnection* attribute for all ATM interfaces where error activity is occurring and record the VPI.VCI value associated with each error. If the ATM connections associated with the LRC errors are linked to a common FP within the shelf, suspect that FP to be at fault. If the ATM connections associated with the LRC errors cannot be linked to a common FP, the node’s bus or fabric may be at fault.

- 3 If a suspect FP has been identified, run a Card Test to see if verification frames can be passed between the suspect card and other cards in the shelf. The procedure for running the card test is described in NN10600-520 *Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting*. The card test should be run with a minimum of 10MB of total traffic to maximize the likelihood of detecting a bad frame block memory location on the suspect FP. Repeat the card test at least twice, using other cards as the source of the verification frames and the suspect FP as the target.

If more than one card test shows errors with the exchange of verification frames, then the suspect FP is probably faulty. Reset the FP and see whether the problem reoccurs. If LRC error are still being generated, replace the FP.

If only one card test shows errors, the source card may be faulty. Repeat the procedure and treat the source card as the new suspect FP.

If no card test shows errors, then the bus or fabric may be at fault.

- 4 If the suspect ATM FP is connected to another Multiservice Switch node, an additional method for testing the FP can be used to double-check the results of the card test. Select an unused VCC on the AtmIf displaying LRC errors and provision a *Loop* component so that all ATM cells received from the link on that VCC are re-transmitted back over the link. Then utilize the ATM connection test capability of the other node to see if verification frames can be successfully passed to the suspect ATM FP (see NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management* for more information about performing loop tests). The test should be run with a minimum of 10MB of total traffic to maximize the likelihood of detecting a bad ATM cell memory location on the suspect ATM FP.

If the connection test shows errors with the exchange of verification frames, the suspect ATM FP is probably faulty.

If no verification frame errors are seen, the fault may be limited to the portion of the ATM FP that handles frames.

- 5 If the node's bus or fabric is suspected to be at fault, examine the BusTap components of each card in the shelf to see if one or more of them have detected an unusual number of parity errors. If so, follow the standard troubleshooting procedure for the bus or fabric system to determine the cause (see NN10600-520 *Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting* for more information).

Chapter 10

Troubleshooting ATM routing and signaling

This section provides guidelines on how to solve problems that can occur while provisioning and monitoring dynamic connections on an ATM network.

The following topics are included:

- “Handling problems in ATM routing and signaling” (page 257)
- “Handling problems in ATM provisioning” (page 264)
- “Cause codes” (page 265)

Handling problems in ATM routing and signaling

The table “Handling problems in ATM routing and signaling” (page 258) provides a set of guidelines on how to respond to problems that occur in ATM routing and signaling. To use the table, follow these steps:

- 1 Identify the problem in the first column.
- 2 Observe the probable cause in the second column.
- 3 Take the corrective action described in the third column.

After you solve the problem, see “Signal monitoring” (page 85) and “Routing monitoring” (page 89) and verify that the network is operating correctly.

Table 26
Handling problems in ATM routing and signaling

Problem	Probable causes	Corrective measures
The integrated local management interface (ILMI) channel is down.	Interface side types are incompatible.	Check provisioning for the <i>side</i> attribute of the <i>Uni</i> component on each of the two ends of the link.
	One or both sides of the connection do not support ILMI.	Check provisioning for the <i>operatingMode</i> attribute of the <i>Ilmi</i> component under the <i>Uni</i> component for the source and destination points.
	Insufficient bandwidth on the channel.	Check settings for bandwidth pool management for the source and destination points to ensure that there is sufficient bandwidth to support the VPI.VCI that you allocate to the ILMI channel.
	The two sides use different VCIs.	Check the ILMI, and verify that both ends have the same VPI.VCI value.
	There is a problem on the control channel.	Check that the <i>rxCellDiscard</i> attribute is incrementing on the control channel VCC. Contact Nortel Networks for support.
The UNI, IISP, or AINI signaling channel is down.	Interface side types are incompatible.	Check provisioning for the <i>side</i> attribute of the <i>Uni</i> component for the source and destination points.
	Insufficient bandwidth on the channel.	Check settings for bandwidth pool management for the source and destination points to ensure that there is sufficient bandwidth to support the VPI.VCI used for signaling. If you have enabled usage parameter control (UPC) and traffic shaping, check the peak cell rate (PCR) value under the signaling <i>VCD</i> component to ensure sufficient bandwidth.
	ILMI is not up.	For UNIs, check the status of ILMI. If the ILMI is down, troubleshoot for an ILMI channel down.

(Sheet 1 of 7)

Table 26 (continued)
Handling problems in ATM routing and signaling

Problem	Probable causes	Corrective measures
PNNI signaling channel is down.	The two sides use different VCIs.	Verify that both ends of the signaling channel have the same VPI.VCI value.
	There is a problem on the control channel.	Check that the <i>rxCellDiscard</i> attribute is incrementing on the control channel VCC. Contact Nortel Networks for support.
	VCD provisioning does not match at both ends.	Verify that the provisioning at each end of the connection is compatible for the optional VCDs.
	The RCC is not in 2WayInside state.	Check the RCC, and verify that both ends of the RCC have the same VPI.VCI value.
The RCC does not go into 2WayInside state.	The two sides use different VCIs (5 is the default value, but operators can change this value through provisioning).	Check the signaling channel, and verify that both ends have the same VPI.VCI value.
	VCD provisioning does not match at both ends.	Verify that the provisioning at each end of the connection is compatible for the optional VCDs.
The RCC is down.	RCC channel is down.	Check the state of the VCC to see if it is up. If the RCC is down, troubleshoot for an RCC down.
	The remote node is in a different peer group.	Check that both nodes are in the same peer group.
	Insufficient bandwidth on the channel.	Check bandwidth pool settings for the RCC channel.
	The <i>AtmIf</i> is not active.	Check the operational status of the <i>AtmIf</i> .
	The far-end interface is not a PNNI.	Check both interfaces on the connection and verify that they are PNNI.
(Sheet 2 of 7)		

Table 26 (continued)
Handling problems in ATM routing and signaling

Problem	Probable causes	Corrective measures
SPVC or SPVP does not connect to the remote end (state of the VCC or VPC is <i>unlocked, enabled, and idle</i>).	The two sides of the connection disagree on the VCI to use for the RCC (18 is the default value, but operators can change this value through provisioning).	Check that both interfaces use the same VCC for the RCC.
	There is a problem on the control channel.	Check that the <i>rxCellDiscard</i> attribute is incrementing on the control channel VCC. Contact Nortel Networks for support.
	VCD provisioning does not match at both ends.	Verify that the provisioning at each end of the connection is compatible for the optional VCDs.
	The end points have mismatched UNI versions for signaling.	Determine the ATM version. Use the command: <pre>d -p atmif/<n> <sig_ver> sig</pre> where: <sig_ver> is <i>Uni, lisp or Aini</i>
	The connection cannot reach the destination address (that is, you have not configured static routing) or there is no path that can support the requested QoS.	Check the last diagnostic and cause codes for the connection. Use the commands: <pre>d atmif/<n> VCC/<Vpi.Vci> Src d atmif/<n> VPC/<Vpi> Src</pre> See "Cause codes" (page 265) for the complete list of cause and diagnostic codes and correct the problem that the cause code identifies.
	The VPI.VCI or VPI that the node requests for the connection is already in use at the far end.	
	There is insufficient bandwidth to establish connection.	
	(Sheet 3 of 7)	

Table 26 (continued)
Handling problems in ATM routing and signaling

Problem	Probable causes	Corrective measures
SVC is out of service.	There is a mismatch of OAM loopback cell configuration.	Turn off loopbacks unless you discover a fault that needs tracing.
	Connection retry times out.	<p>The connection retry period value can be very large, and the retry period has not yet timed out. As a result, the node has not tried to re-establish the SPVC.</p> <p>Check the last diagnostic and cause codes for the connection. Use the command:</p> <pre>> d atmif/<n> VCC/<Vpi.Vci> Src > d atmif/<n> VPC/<Vpi> Src</pre> <p>See "Cause codes" (page 265) for the complete list of cause and diagnostic codes.</p>
	<p>The connection cannot reach the destination address.</p> <p>The destination address not available.</p>	<p>Check the last diagnostic and cause codes for the connection. Use the commands:</p> <pre>d atmif/<n> VCC/<Vpi.Vci></pre> <p>See "Cause codes" (page 265) for the complete list of cause and diagnostic codes and correct the problem that the cause code identifies.</p> <p>Correct an invalid configuration of <i>atmServiceCategory</i> BBC or traffic parameters.</p>
	There is a mismatch of OAM loopback cell configuration.	Turn off loopbacks unless you discover a fault that needs tracing.
(Sheet 4 of 7)		

Table 26 (continued)
Handling problems in ATM routing and signaling

Problem	Probable causes	Corrective measures
The SPVC, SVC, or SPVP is not taking the correct path.	<p>A UNI/IISP/AINI static address has the best match.</p> <p>PNNI bandwidth is not available for the path.</p> <p>The route through the PNNI links is severed (the peer group is severed because of a link down).</p>	<p>Use <i>RouteFinder</i> to calculate the expected path.</p> <p>Check provisioning for ATM routing (UNI 3.x/IISP 1.0v3.1 versus PNNI 1.0).</p>
The network does not crankback a failed call.	The <i>maxReroutes-OnCrankback</i> attribute is set to 0.	Set <i>maxReroutesOnCrankback</i> to a value greater than 0.
A summary address is not active.	<p>There are no local addresses that the summary address on the node can summarize.</p> <p>For example, this condition occurs if the <i>SummaryAddress</i> component is set to <i>exterior</i>, and therefore does not summarize internal static addresses.</p> <p>Another node summary address exists with a matching and longer prefix, and it is summarizing all matching addresses. As a result, there are no addresses left for the subject node to summarize.</p>	<p>Verify that local addresses exist with a reachability setting and prefix match that the summary address can summarize.</p> <p>Verify that these addresses are advertised instead of being summarized. Use the command:</p> <pre>l artg pnni top/* node/* addr/*</pre> <p>If the node does not advertise the addresses, another summary address with a longer prefix is summarizing them.</p>
(Sheet 5 of 7)		

Table 26 (continued)
Handling problems in ATM routing and signaling

Problem	Probable causes	Corrective measures
An expected link is not showing up when you list links for a given node using the <code>artg pnni top/*</code> command.	The link is not horizontal.	On the node with the link, display the link and verify that the state is full. Use the command: <code>artg pnni cfg/<level> nbr/*</code>
The <i>peerState</i> operational attribute for the <i>Neighbour</i> component does not become full.	The RCC is not 2WayInside for any of the links to the neighbor.	Check the RCC, and verify that both ends of the RCC have the same VPI.VCI value. Check the signaling channel, and verify that both ends have the same VPI.VCI value.
A call is not coming up.	A path matching the traffic requirements does not exist (for example, due to insufficient bandwidth, or no traffic descriptor match, etc.).	Use <i>RouteFinder</i> to calculate the expected path. Check the last diagnostic and cause codes for the connection. See “Cause codes” (page 265) for the complete list of cause and diagnostic codes and correct the problem that the cause code identifies.
Point-to-multipoint call fails. Cause code 45 appears.	Resources are not provisioned for point-to-multipoint calls or provisioned capacities are exhausted.	Confirm provisioning for the <i>multicastBranchesCapacity</i> attribute under the <i>AtmResourceControl</i> component. Ensure that the value for this attribute is sufficient to accommodate the number of branches that the call requires at this node.
<i>RouteFinder</i> finds a path, but the call still does not come up.	The best path passes GCAC but fails ACAC at some point on the selected path, and the number of allowed crankbacks is too low to find another path.	Increase the number of crankbacks for PNNI calls by increasing the provisioned value for the <i>maxReroutesOnCrankback</i> attribute under the <i>AtmRouting/Pnni</i> component.
(Sheet 6 of 7)		

Table 26 (continued)
Handling problems in ATM routing and signaling

Problem	Probable causes	Corrective measures
After provisioning a node with Restricted Transit Flag in a mixed PNNI and IISP network, new calls continued to transit through the Restricted Transit node.	The best-matching address for call routing is an IISP address and the static route that the node chooses goes through the Restricted Transit node.	Remove static routes through the desired Restricted Transit node or ensure that the best-matching address is a PNNI address.
An SPVC reroutes over a different link each time that end-station manually clears the connection.	<p>The initial link will refuse the call if these two conditions are in place:</p> <ul style="list-style-type: none"> • the subsequent SPVC call request occurs before the node completes the topology database update to release the bandwidth • the call requires bandwidth such that the initial link cannot admit the call until the node releases the bandwidth allocated in the previous call setup 	If it is important that cleared calls reroute over the same link, ensure that sufficient link bandwidth is available to accommodate call reroutes even before the call is released by the topology database update.

(Sheet 7 of 7)

Handling problems in ATM provisioning

The table “Handling problems in ATM routing and signaling” (page 258) provides a set of guidelines on how to respond to problems that arise from incorrect provisioning. To use the table, follow these steps:

- 1 Identify the problem in the first column.
- 2 Observe the probable cause in the second column.
- 3 Take the corrective action described in the third column.

Table 27
Handling problems in ATM provisioning

Problem	Probable causes	Corrective measures
CP does not reload after removing PNNIs from all ATM interfaces.	You removed the PNNIs from the ATM interfaces and the <i>AtmRouting</i> component, but not the <i>atmPnni</i> software package.	Remove the <i>atmPnni</i> software package from all LPs. Reload the CP.

Cause codes

Cause codes indicate a failure condition within Nortel Networks Multiservice Switch equipment, or within external equipment connected to it. there are three sets of cause codes:

- one set that complies with *ATM User-to-Network Interface Specification Version 3.0*
- one set that complies with *ATM User-to-Network Interface Specification Version 3.1*
- one set that complies with *Private Network-Network Interface (PNNI) Specification Version 1.0*

Both sets of UNI cause codes also apply to the specific ATM UNI version supporting *Interim Inter-switch Signaling Protocol (IISP) Specification Version 1.0*.

There are no new cause codes introduced with UNI 4.0. All of the cause codes for UNI 3.0 and UNI 3.1 also apply to UNI 4.0.

For a more detailed explanation of these failure conditions, see “Cause code definitions” (page 281).

Cause codes for ATM UNI version 3.0

The table “Summary of cause codes for ATM UNI version 3.0” (page 266) summarize the cause codes that appear on a Nortel Networks Multiservice Switch device based on the following signaling protocols:

- *ATM User-to-Network Interface Specification Version 3.0*

- *Interim Inter-switch Signaling Protocol (IISP) Specification* Version 1.0 (based on ATM UNI 3.0)

The Diagnostics column of the table shows whether diagnostics apply and the coding format of the diagnostics field. A blank entry on this column indicates that no diagnostics are available. For information on failure diagnostics, see “Diagnostics for UNI versions 3.0 and 3.1” (page 272).

For a more detailed explanation of the cause code meanings, see the table “Cause code definitions for ATM UNI version 3.0” (page 282).

Table 28
Summary of cause codes for ATM UNI version 3.0

Cause number	Meaning	Diagnostics
1	unallocated (unassigned) number	“Diagnostics note 2” (page 273)
2	no route to specified transit network	
3	no route to destination	“Diagnostics note 2” (page 273)
10	VPCI/VCI unacceptable	
17	user busy	
18	no user responding	
21	call rejected	“Diagnostics note 3” (page 274)
22	number changed	New destination (“Diagnostics note 4” (page 275))
23	user rejects all calls with calling line identification restriction (CLIR)	
27	destination out of order	
28	invalid number format (address incomplete)	
30	response to STATUS ENQUIRY	

(Sheet 1 of 3)

Table 28 (continued)
Summary of cause codes for ATM UNI version 3.0

Cause number	Meaning	Diagnostics
31	normal, unspecified	
35	requested VPCI/VCI not available	
38	network out of order	
41	temporary failure	
43	access information discarded	"Diagnostics note 6" (page 275), "Diagnostics note 7" (page 275)
45	no VPCI/VCI available	
47	resource unavailable, unspecified	
49	Quality of Service unavailable	"Diagnostics note 2" (page 273)
51	User cell rate not available	"Diagnostics note 8" (page 276)
57	bearer capability not authorized	
63	Service or option not available, unspecified	
65	bearer capability not implemented	
73	unsupported combination of traffic parameters	
81	invalid call reference value	
82	identified channel does not exist	"Diagnostics note 9" (page 276)
88	incompatible destination	"Diagnostics note 6" (page 275)
89	invalid endpoint reference value	
91	invalid transit network selection	
92	too many pending add party requests	
(Sheet 2 of 3)		

Table 28 (continued)
Summary of cause codes for ATM UNI version 3.0

Cause number	Meaning	Diagnostics
93	AAL parameters can not be supported	
96	mandatory information element is missing	“Diagnostics note 6” (page 275), “Diagnostics note 7” (page 275)
97	message type non-existent or not implemented	“Diagnostics note 10” (page 276)
99	information element non-existent or not implemented	“Diagnostics note 6” (page 275), “Diagnostics note 7” (page 275)
100	invalid information element contents	“Diagnostics note 6” (page 275), “Diagnostics note 7” (page 275)
101	message not compatible with call state	“Diagnostics note 10” (page 276)
102	recovery on timer expiry	Timer Number (“Diagnostics note 11” (page 276))
104	incorrect message length	
111	protocol error, unspecified	
(Sheet 3 of 3)		

Cause codes for ATM UNI version 3.1

The table “Summary of cause codes for ATM UNI version 3.1” (page 269) summarize the cause codes that appear on a Nortel Networks Multiservice Switch device based on the following signaling protocols:

- *ATM User-to-Network Interface Specification* Version 3.1
- *Interim Inter-switch Signaling Protocol (IISP) Specification* Version 1.0 (based on ATM UNI 3.1)

The Diagnostics column of the table shows if diagnostics apply and the coding format of the diagnostics field. A blank entry on this column indicates that no diagnostics are available. For information on failure diagnostics, see “Diagnostics for UNI versions 3.0 and 3.1” (page 272).

For a more detailed explanation of the cause code meanings, see the table “Cause code definitions for ATM UNI version 3.1” (page 286).

Table 29
Summary of cause codes for ATM UNI version 3.1

Cause number	Meaning	Diagnostics
1	unallocated (unassigned) number	“Diagnostics note 2” (page 273)
2	no route to specified transit network	
3	no route to destination	“Diagnostics note 2” (page 273)
16	normal call clearing	
17	user busy	
18	no user responding	
21	call rejected	“Diagnostics note 3” (page 274)
22	number changed	New destination (“Diagnostics note 4” (page 275))
23	user rejects all calls with calling line identification restriction (CLIR)	
27	destination out of order	
28	invalid number format (address incomplete)	
30	response to STATUS ENQUIRY	
31	normal, unspecified	
35	requested VPCI/VCI not available	
36	VPCI/VCI assignment failure	
37	user cell rate not available	“Diagnostics note 8” (page 276)
38	network out of order	
(Sheet 1 of 3)		

Table 29 (continued)
Summary of cause codes for ATM UNI version 3.1

Cause number	Meaning	Diagnostics
41	temporary failure	
43	access information discarded	"Diagnostics note 6" (page 275), "Diagnostics note 7" (page 275)
45	no VPCI/VCI available	
47	resource unavailable, unspecified	
49	Quality of Service unavailable	"Diagnostics note 2" (page 273)
57	bearer capability not authorized	
63	Service or option not available, unspecified	
65	bearer capability not implemented	
73	unsupported combination of traffic parameters	
78	AAL parameters cannot be supported	
81	invalid call reference value	
82	identified channel does not exist	"Diagnostics note 9" (page 276)
88	incompatible destination	"Diagnostics note 6" (page 275)
89	invalid endpoint reference	
91	invalid transit network selection	
92	too many pending add party requests	
96	mandatory information element is missing	"Diagnostics note 6" (page 275), "Diagnostics note 7" (page 275)
97	message type non-existent or not implemented	"Diagnostics note 10" (page 276)
99	information element non-existent or not implemented	"Diagnostics note 6" (page 275), "Diagnostics note 7" (page 275)
100	invalid information element contents	"Diagnostics note 6" (page 275), "Diagnostics note 7" (page 275)
101	message not compatible with call state	"Diagnostics note 10" (page 276)
(Sheet 2 of 3)		

Table 29 (continued)
Summary of cause codes for ATM UNI version 3.1

Cause number	Meaning	Diagnostics
102	recovery on timer expiry	Time Number (“Diagnostics note 11” (page 276))
104	incorrect message length	
111	protocol error, unspecified	
(Sheet 3 of 3)		

Cause codes for ATM PNNI version 1.0

The table “Summary of cause codes for ATM PNNI version 1.0” (page 272) summarize the cause codes that are specific to PNNI. These codes appear on a Nortel Networks Multiservice Switch device in addition to the UNI 3.x cause codes. PNNI cause codes on nodes are based on the following signaling protocols:

- *Private Network-Network Interface (PNNI) Specification Version 1.0* (af-pnni-0055.000), ATM Forum Technical Committee, 1997
- *PNNI V1.0 Errata and PICS* (af-pnni-0081.000), ATM Forum Technical Committee, 1997

The Diagnostics column of the table shows if diagnostics apply and the coding format of the diagnostics field. A blank entry on this column indicates that no diagnostics are available. For information on failure diagnostics, see “Diagnostics for UNI versions 3.0 and 3.1” (page 272).

For a more detailed explanation of the cause code meanings, see the table “Cause code definitions for ATM PNNI version 1.0” (page 292).

Table 30
Summary of cause codes for ATM PNNI version 1.0

Cause number	Meaning	Diagnostics
34	Requested called party soft PVPC/ PVCC not available	
50	Requested facility not subscribed	
53	Call cleared due to change in PGL	

Diagnosics for UNI versions 3.0 and 3.1

This section provides diagnostic coding information. Diagnostic coding formats apply to *ATM User-to-Network Interface Specification* Version 3.0 and 3.1.

Diagnosics note 1

The cause value contains two fields: a class (bits 5 through 7) indicating the general nature of the event, and a value within the class (bits 1 through 4).

Classes are:

Bits 7 6 5	Meaning
0 0 0	normal event
0 0 1	normal event
0 1 0	resource unavailable
0 1 1	service or option not available
1 0 0	service or option not implemented
1 0 1	invalid message
1 1 0	protocol error
1 1 1	interworking event/error

Diagnostics note 2

The cause value uses the following coding:

8	7	6	5	4	3	2	1	Octet
1 ext	0	Spare 0 0		P-U	N-A	Condition		7

P-U (octet 7):

Bit 4	Meaning
0	Network service - Provider
1	Network service - User

N-A (octet 7):

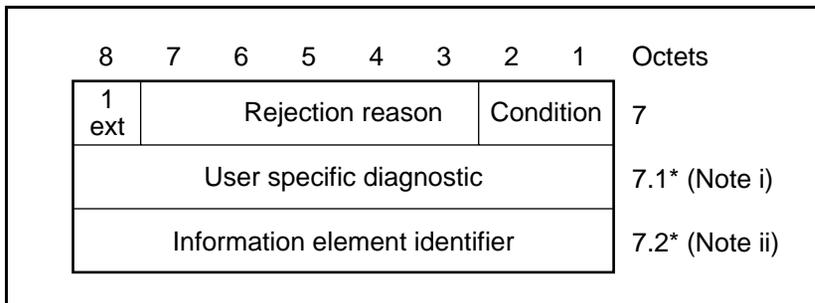
Bit 3	Meaning
0	Normal
1	Abnormal

Condition (octet 7):

Bit 2 and 1	Meaning
0 0	Unknown
0 1	Permanent
1 0	Transient

Diagnostics note 3

The cause code uses the following coding:



Note 1: This octet is present only if octet 7 indicates user specific diagnostic.

Note 2: This octet is present only if octet 7 indicates information element missing or information element contents are not sufficient.

Rejection reason (octet 7):

Bit 7 6 5 4 3	Meaning
0 0 0 0 0	User specific
0 0 0 0 1	Information element missing
0 0 0 1 0	Information element contents are not sufficient

Condition (octet 7):

Bit 2 1	Meaning
0 0	Unknown
0 1	Permanent
1 0	Transient

User-specific diagnostic (octet 7.1). You code this diagnostic according to the user specification, subject to the maximum length of the cause information element.

Information element identifier (octet 7.1). You code bits 8 to 1 with the information element identifier of the missing or insufficient information element.

Diagnostics note 4

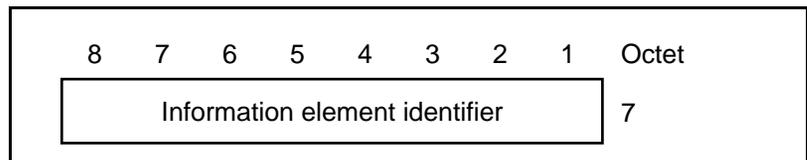
The network formats the new destination as the called party number information element, including information element identifier. The network also includes the transit network selection.

Diagnostics note 5

The network uses this cause value with coding standard 1 1 (in the ITU-T Recommendation Q.850, *Usage of Cause and Location in the Digital Subscriber Signalling System No. 1 and the Signalling System No. 7 ISDN user part*). The specification defines this standard for the network (either public or private). The cause code is present on the network side of the interface.

Diagnostics note 6

The cause code uses the following coding:

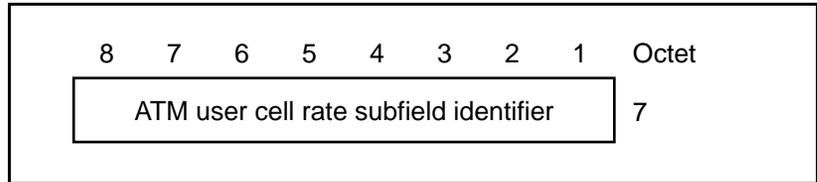


Diagnostics note 7

The cause code can include multiple information identifiers.

Diagnostics note 8

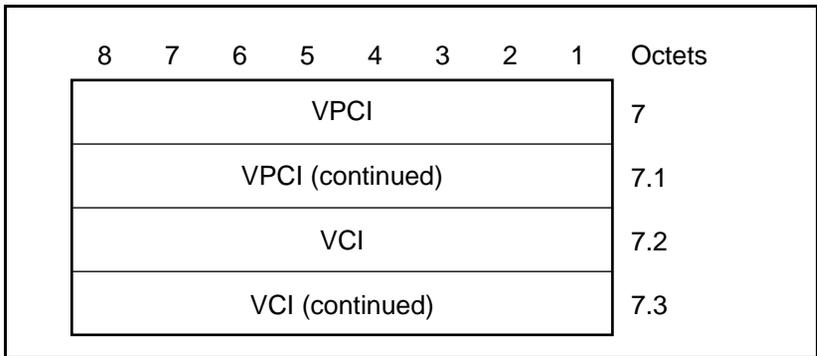
The cause code uses the following coding:



The node repeats octet 7 to identify multiple ATM traffic descriptor subfield identifiers.

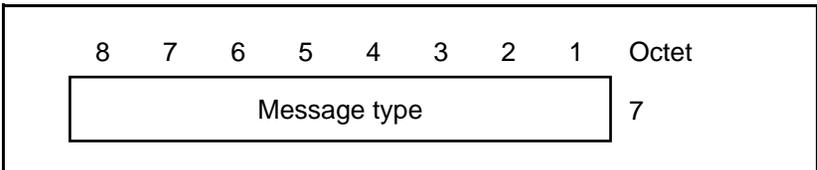
Diagnostics note 9

The cause code uses the following coding:



Diagnostics note 10

The cause code uses the following coding:



Diagnostics note 11

The network codes the timer number in IA5 characters (for example, the network codes T308 3, 0, 8). The network uses the following in each octet:

Bit 8: Spare 0
Bit 7-1: IA5 character

The cause code uses the following coding:

8	7	6	5	4	3	2	1	Octets
0 Spare	IA5 character						7	
0 Spare	IA5 character						7.1	
0 Spare	IA5 character						7.2	

Chapter 11

Troubleshooting ATM function processors

This section provides guidelines on how to solve problems that can occur while monitoring ATM function processors. Most of the problems encountered at the function processor level are related to the physical operation of the function processor card itself, the initial provisioning of the card, or with conflicts between the capacity of the card and the type or volume of traffic it is expected to process. These problems can be identified using the procedures listed in the section “ATM function processor monitoring” (page 23).

If you encounter problems with an ATM FP, use the steps listed below to resolve the problem or contact Nortel Networks technical assistance for further help. The table “Handling ATM FP related problems” (page 280) lists troubleshooting steps for specific FP related alarms. See NN10600-500 *Nortel Networks Multiservice Switch 6400/7400/15000/20000 Alarms Reference* for specific information about alarms.

- 1 Check the physical setup of the card to determine whether its hardware is properly connected and operating. For Nortel Networks Multiservice Switch 7400 series devices, see NN10600-175 *Nortel Networks Multiservice Switch 7400 Hardware Installation, Maintenance, and Upgrade* and NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures* for further information about the installation and configuration of ATM function processors. For Multiservice Switch 15000 and Multiservice Switch 20000 devices, see NN10600-130 *Nortel Networks Multiservice Switch 15000/20000 Hardware Installation, Maintenance, and Upgrade* and NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

- 2 Determine if the provisioning of the card is appropriate and correct for the type function processor you are using. See NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures* for more information about configuring function processors. See NN10600-520 *Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting* for more information about troubleshooting function processors.
- 3 Determine if the type or volume of traffic is appropriate for the type of card you are using. Use the steps listed in “ATM function processor monitoring” (page 23) to determine how the card’s resources are being utilized within your network, and compare those values with the ones engineered for the card by your system or network administrator.

Table 31
Handling ATM FP related problems

Problem	Probable causes	Corrective measures
Congestion alarms (alarm numbers 7013 0002, 7013 0003, 7013 0004, 7013 0005)	Unbalanced flow of traffic	Re-engineering is required to balance the flow of traffic through the FP, in order to reduce the amount of traffic and the length of queues.
IP routes/sub connections overbooking, alarm number 7060 1000	The number of IP routing entries and/or sub connections has exhausted the amount of memory available.	Lower the number of IP routing entries in the Lp/<instance> Eng Fcrc Pqc Ov attribute <i>ipRoutesPoolCapacity</i> and/or the number of sub connection in the Lp/<instance> Eng Fcrc Ov attribute <i>subConnectionPool Capacity</i>
<i>txCellmemoryAvailable</i> resources reaching a low level	The LP’s specified AQM has decreased below 20% of the total egress cell-blocks.	Frequent or prolonged occurrences of this condition indicate that re-engineering is required to balance the flow of traffic through this card.

Appendix

Cause code definitions

This section provides additional details on the cause codes shown in the section “Cause codes” (page 265).

The cause codes in this section can appear on a Nortel Networks Multiservice Switch device. They indicate a failure condition within either the equipment or external equipment connected to Multiservice Switch devices. There are three sets of cause codes:

- “Cause code definitions for ATM UNI version 3.0” (page 282)
- “Cause code definitions for ATM UNI version 3.1” (page 286)
- “Cause code definitions for ATM PNNI version 1.0” (page 292)

Cause code definitions for ATM UNI version 3.0

The table “Cause code definitions for ATM UNI version 3.0” (page 282) describes the cause codes that can appear on a Nortel Networks Multiservice Switch device based on the following signaling protocols:

- *ATM User-to-Network Interface Specification* Version 3.0
- *Interim Inter-switch Signaling Protocol (IISP) Specification* Version 1.0 (based on ATM UNI 3.0)

Table 32
Cause code definitions for ATM UNI version 3.0

Cause	Meaning	Definition
1	unallocated (unassigned) number	This cause indicates that the called party cannot be reached because, although the number is in a valid format, it is not currently assigned (allocated).
2	no route to specified transit network	This cause indicates that the equipment sending this cause has received a request to route the call through a particular network which it does not recognize. The equipment sending this cause does not recognize the transit network either because the transit network does not exist or because that particular transit network, while it does exist, does not serve the equipment which is sending this cause. This cause is supported on a network-dependent basis.
3	no route to destination	This cause indicates that the called party cannot be reached because the network through which the call has been routed does not serve the destination desired. This cause is supported on a network-dependent basis.
10	VPCI/VCI unacceptable	This cause indicates that the virtual channel most recently identified is not acceptable to the sending entity for use in this call.
17	user busy	This cause is used to indicate that the called party is unable to accept another call because the user busy condition has been encountered. This cause value can be generated by the called user or by the network.
18	no user responding	This cause is used when a called party does not respond to a call establishment message with a connect indication within the prescribed period of time allocated.
(Sheet 1 of 5)		

Table 32 (continued)
Cause code definitions for ATM UNI version 3.0

Cause	Meaning	Definition
21	call rejected	This cause indicates that the equipment sending this cause does not wish to accept this call, although it could have accepted the call because the equipment sending this cause is neither busy nor incompatible.
22	number changed	This cause is returned to a calling party when the called party number indicated by the calling user is no longer assigned. The new called party number can optionally be included in the diagnostic field. If a network does not support this capability, cause number #1, <i>unassigned (unallocated) number</i> , shall be used.
23	user rejects all calls with calling line identification restriction (CLIR)	This cause is returned by the called party when the call is offered without calling party number information and the called party requires this information.
27	destination out of order	This cause indicates that the destination indicated by the user cannot be reached because the interface to the destination is not functioning correctly. The term <i>not functioning correctly</i> indicates that a signalling message was unable to be delivered to the remote user; e.g., a physical layer or SAAL failure at the remote user, user equipment off-line. SAAL stands for signaling ATM adaptation layer.
28	invalid number format (address incomplete)	This cause indicates that the called user cannot be reached because the called party number is not in a valid format or is not complete.
30	response to STATUS ENQUIRY	This cause is included in the STATUS message when the reason for generating the STATUS message was the prior receipt of a STATUS ENQUIRY message.
31	normal, unspecified	This cause is used to report a normal event only when no other cause in the normal class applies.
35	requested VPCI/VCI not available	This cause indicates that the requested VPCI/VCI is not available.
38	network out of order	This cause indicates that the network is not functioning correctly and that the condition is likely to last a relatively long period of time; e.g., immediately re-attempting the call is not likely to be successful.

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Table 32 (continued)
Cause code definitions for ATM UNI version 3.0

Cause	Meaning	Definition
41	temporary failure	This cause indicates that the network is not functioning correctly and that the condition is not likely to last a long period of time; e.g., the user can try another call attempt immediately.
43	access information discarded	This cause indicates that the network could not deliver access information to the remote user as requested: i.e., ATM adaptation layer parameters, Broadband low layer information, Broadband high layer information, or sub-address as indicated in the diagnostic.
45	no VPCI/VCI available	This cause indicates that there is no appropriate VPCI/VCI presently available to handle the call.
47	resource unavailable, unspecified	This cause is used to report a resource unavailable event only when no other cause in the resource unavailable class applies.
49	Quality of Service unavailable	This cause is used to report that the requested Quality of Service cannot be provided.
51	User cell rate not available	This cause is used to report that the requested ATM User Cell Rate is unobtainable.
57	bearer capability not authorized	This cause indicates that the user has requested a bearer capability which is implemented by the equipment which generated this cause but the user is not authorized to use.
63	Service or option not available, unspecified	This cause is used to report a service or option not available event only when no other cause in the service or option not available class applies.
65	bearer capability not implemented	This cause indicates that the equipment sending this cause does not support the bearer capability requested.
73	unsupported combination of traffic parameters	This cause code indicates one of two things: the combination of traffic parameters contained in the ATM user cell rate information element is not supported or force tagging is enabled on non-UBR switched connections.
(Sheet 3 of 5)		

Table 32 (continued)
Cause code definitions for ATM UNI version 3.0

Cause	Meaning	Definition
81	invalid call reference value	This cause indicates that the equipment sending this cause has received a message with a call reference which is not currently in use on the user-network interface.
82	identified channel does not exist	This cause indicates that the equipment sending this cause has received a request to use a channel not activated on the interface for a call.
88	incompatible destination	This cause indicates that the equipment sending this cause has received a request to establish a call which has Broadband low layer information, Broadband high layer information, or other compatibility attributes which cannot be accommodated.
89	invalid endpoint reference value	This cause indicates that the equipment sending this cause has received a message with an endpoint reference which is currently not in use on the user-network interface.
91	invalid transit network selection	This cause indicates that a transit network identification was received which is of an incorrect format as defined in Annex D. <i>See ATM User-to-Network Interface Specification Version 3.0.</i>
92	too many pending add party requests	This cause indicates a temporary condition when the calling party sends an add party message but the network is unable to accept another add party message because its queues are full.
93	AAL parameters cannot be supported	This cause indicates that the equipment sending this cause has received a request to establish a call which has ATM adaptation layer parameters which cannot be accommodated.
96	mandatory information element is missing	This cause indicates that the equipment sending this cause has received a message which is missing an information element which must be present in the message before the message can be processed.
97	message type non-existent or not implemented	This cause indicates that the equipment sending this cause has received a message with a message type it does not recognize either because this is a message not defined or defined but not implemented by the equipment sending this cause.
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Table 32 (continued)
Cause code definitions for ATM UNI version 3.0

Cause	Meaning	Definition
99	information element non-existent or not implemented	This cause indicates that the equipment sending this cause has received a message which includes information element(s) not recognized because the information element identifier(s) are not defined or are defined but not implemented by the equipment sending the cause. This cause indicates that the information element(s) were discarded. However, the information element is not required to be present in the message in order for the equipment sending this cause to process the message.
100	invalid information element contents	This cause indicates that the equipment sending this cause has received an information element which it has implemented; however, one or more of the fields in the information element are coded in such a way which has not been implemented by the equipment ending this cause.
101	message not compatible with call state	This cause indicates that a message has been received which is incompatible with the call state.
102	recovery on timer expiry	This cause indicates that a procedure has been initiated by the expiry of a timer in association with error handling procedures.
104	incorrect message length	This cause is used to report an inconsistent message length.
111	protocol error, unspecified	This cause is used to report a protocol error event only when no other cause in the protocol error class applies

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Cause code definitions for ATM UNI version 3.1

The table “Cause code definitions for ATM UNI version 3.1” (page 287) summarizes the cause codes that appear on a Nortel Networks Multiservice Switch device based on the following signaling protocols:

- *ATM User-to-Network Interface Specification* Version 3.1, and
- *Interim Inter-switch Signaling Protocol (IISP) Specification* Version 1.0 (based on ATM UNI 3.0)

Table 33
Cause code definitions for ATM UNI version 3.1

Cause	Meaning	Definition
1	unallocated (unassigned) number	This cause indicates that the called party cannot be reached because, although the number is in a valid format, it is not currently assigned (allocated).
2	no route to specified transit network	This cause indicates that the equipment sending this cause has received a request to route the call through a particular network which it does not recognize. The equipment sending this cause does not recognize the transit network either because the transit network does not exist or because that particular transit network, while it does exist, does not serve the equipment which is sending this cause. This cause is supported on a network-dependent basis.
3	no route to destination	This cause indicates that the called party cannot be reached because the network through which the call has been routed does not serve the destination desired. This cause is supported on a network-dependent basis.
16	normal call clearing	This cause indicates that the call is being cleared because one of the users involved in the call has requested that the call be cleared. Under normal situations, the source of this cause is not the network.
17	user busy	This cause is used to indicate that the called party is unable to accept another call because the user busy condition has been encountered. This cause value can be generated by the called user or by the network.
18	no user responding	This cause is used when a called party does not respond to a call establishment message with a connect indication within the prescribed period of time allocated.
21	call rejected	This cause indicates that the equipment sending this cause does not wish to accept this call, although it could have accepted the call because the equipment sending this cause is neither busy nor incompatible.
22	number changed	This cause is returned to a calling party when the called party number indicated by the calling user is no longer assigned. The new called party number can optionally be included in the diagnostic field. If a network does not support this capability, cause number #1, <i>unassigned (unallocated) number</i> , shall be used.

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Table 33 (continued)
Cause code definitions for ATM UNI version 3.1

Cause	Meaning	Definition
23	user rejects all calls with calling line identification restriction (CLIR)	This cause is returned by the called party when the call is offered without calling party number information and the called party requires this information.
27	destination out of order	This cause indicates that the destination indicated by the user cannot be reached because the interface to the destination is not functioning correctly. The term <i>not functioning correctly</i> indicates that a signalling message was unable to be delivered to the remote user; e.g., a physical layer or SAAL failure at the remote user, user equipment off-line. SAAL stands for signaling ATM adaptation layer.
28	invalid number format (address incomplete)	This cause indicates that the called user cannot be reached because the called party number is not in a valid format or is not complete.
30	response to STATUS ENQUIRY	This cause is included in the STATUS message when the reason for generating the STATUS message was the prior receipt of a STATUS ENQUIRY message.
31	normal, unspecified	This cause is used to report a normal event only when no other cause in the normal class applies.
35	requested VPCI/VCI not available	This cause indicates that the requested VPCI/VCI is not available.
36	VPCI/VCI assignment failure	Not provided.
37	user cell rate not available	Not provided.
38	network out of order	This cause indicates that the network is not functioning correctly and that the condition is likely to last a relatively long period of time; e.g., immediately re-attempting the call is not likely to be successful.
41	temporary failure	This cause indicates that the network is not functioning correctly and that the condition is not likely to last a long period of time; e.g., the user can try another call attempt immediately.

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Table 33 (continued)
Cause code definitions for ATM UNI version 3.1

Cause	Meaning	Definition
43	access information discarded	This cause indicates that the network could not deliver access information to the remote user as requested: i.e., ATM adaptation layer parameters, Broadband low layer information, Broadband high layer information, or sub-address as indicated in the diagnostic.
45	no VPCI/VCI available	This cause indicates that there is no appropriate VPCI/VCI presently available to handle the call.
47	resource unavailable, unspecified	This cause is used to report a resource unavailable event only when no other cause in the resource unavailable class applies.
49	Quality of Service unavailable	This cause is used to report that the requested Quality of Service cannot be provided.
57	bearer capability not authorized	This cause indicates that the user has requested a bearer capability which is implemented by the equipment which generated this cause but the user is not authorized to use.
63	Service or option not available, unspecified	This cause is used to report a service or option not available event only when no other cause in the service or option not available class applies.
65	bearer capability not implemented	This cause indicates that the equipment sending this cause does not support the bearer capability requested.
73	unsupported combination of traffic parameters	This cause code indicates one of two things: the combination of traffic parameters contained in the ATM user cell rate information element is not supported or force tagging is enabled on non-UBR switched connections.
78	AAL parameters cannot be supported	Not provided.
81	invalid call reference value	This cause indicates that the equipment sending this cause has received a message with a call reference which is not currently in use on the user-network interface.

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Table 33 (continued)
Cause code definitions for ATM UNI version 3.1

Cause	Meaning	Definition
82	identified channel does not exist	This cause indicates that the equipment sending this cause has received a request to use a channel not activated on the interface for a call.
88	incompatible destination	This cause indicates that the equipment sending this cause has received a request to establish a call which has Broadband low layer information, Broadband high layer information, or other compatibility attributes which cannot be accommodated.
89	invalid endpoint reference	This cause indicates that the equipment sending this cause has received a message with an endpoint reference which is currently not in use on the user-network interface.
91	invalid transit network selection	This cause indicates that a transit network identification was received which is of an incorrect format as defined in Annex D. <i>See ATM User-to-Network Interface Specification Version 3.1.</i>
92	too many pending add party requests	This cause indicates a temporary condition when the calling party sends an add party message but the network is unable to accept another add party message because its queues are full.
96	mandatory information element is missing	This cause indicates that the equipment sending this cause has received a message which is missing an information element which must be present in the message before the message can be processed.
97	message type non-existent or not implemented	This cause indicates that the equipment sending this cause has received a message with a message type it does not recognize either because this is a message not defined or defined but not implemented by the equipment sending this cause.
99	information element non-existent or not implemented	This cause indicates that the equipment sending this cause has received a message which includes information element(s) not recognized because the information element identifier(s) are not defined or are defined but not implemented by the equipment sending the cause. This cause indicates that the information element(s) were discarded. However, the information element is not required to be present in the message in order for the equipment sending this cause to process the message.
(Sheet 4 of 5)		

Table 33 (continued)
Cause code definitions for ATM UNI version 3.1

Cause	Meaning	Definition
100	invalid information element contents	This cause indicates that the equipment sending this cause has received an information element which it has implemented; however, one or more of the fields in the information element are coded in such a way which has not been implemented by the equipment ending this cause.
101	message not compatible with call state	This cause indicates that a message has been received which is incompatible with the call state.
102	recovery on timer expiry	This cause indicates that a procedure has been initiated by the expiry of a timer in association with error handling procedures.
104	incorrect message length	Not provided.
111	protocol error, unspecified	This cause is used to report a protocol error event only when no other cause in the protocol error class applies.
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Cause code definitions for ATM PNNI version 1.0

The table “Cause code definitions applicable to ATM PNNI Specification 1.0” (page 292) describes the cause codes that are specific to PNNI. These codes appear on the Nortel Networks Multiservice Switch device in addition to the UNI 3.x cause codes. PNNI cause codes on nodes are based on the following signaling protocols:

- *ATM User-to-Network Interface Specification* Version 3.1
- *Interim Inter-switch Signaling Protocol (IISP) Specification* Version 1.0 (based on ATM UNI 3.0)

Table 34
Cause code definitions applicable to ATM PNNI Specification 1.0

Cause number	Meaning	Definition
34	Requested called party soft PVPC/PVCC not available	The requested destination for the SPVC/SPVP is already in use.
50	Requested facility not subscribed	This cause indicates that the user has requested a supplementary service which is implemented by the equipment which generated this cause, but the user is not authorized to use.
53	Call clear due to change in PGL	This cause indicates that although the calling party is a member of the CUG for the outgoing CUG call, outgoing calls are not allowed for this member of the CUG.

Multiservice Switch 7400/15000/20000

ATM Fault and Performance Management

Release 6.1

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Publication: NN10600-715
Document status: Standard
Document version: 6.1S2
Document date: November 2004
Printed in Canada

