Nortel Multiservice Switch 7400/15000/20000

ATM Fault and Performance Management

NN10600-715

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What's new

The following feature was added to this document:

- Load Re-Balancing on Parallel Links (page 7)

Other changes made to this document include the following:

- Updated Cause code definitions for ATM UNI version 3.0 (page 228) and Cause code definitions for ATM UNI version 3.1 (page 232) with additional details about cause code 47.

Attention: To ensure that you are using the most current version of an NTP, check the current NTP list in NN10600-000 *Nortel Multiservice Switch 7400/15000/20000 What's New*.

Load Re-Balancing on Parallel Links

The following sections were added for this feature:

- Verifying Load Re-Balancing on Parallel Links (page 94)
- Monitoring Load Re-Balancing on Parallel Links (page 95)
- Running Load Re-Balancing on Parallel Links for a particular group (page 96)

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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.

Navigation

- Checking the OSI status of the FP (page 9)
- Examining the buffer usage of ATM FPs (page 10)
- Displaying the overall connection usage of ATM FPs (page 12)
- Displaying specialized connection usage of ATM FPs (page 14)

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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.

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

Also see NN10600-520 *Nortel 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.

Procedure steps

Step	Action
1	Determine the OSI states of the FP. `display Shelf Card/<n> OsiState`
	--End--

Variable definitions

Variable	Value
<n>	is the slot number of the FP.

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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.

Aqm is the component in ATM IP FPs where most queuing of ATM cells occurs. For more information about the *Aqm* component, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*.

Procedure steps

Step	Action
1	Display all the information associated with the *Arc* component operational attributes for the LP associated with the FP. **`display Lp/<n> Eng Arc`** For ATM IP FPs, the attributes described in this step apply to PQC memory.
2	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 ATM function processors troubleshooting (page 226) 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>`** The *Aqm* component of ATM-IP FPs does not use receive buffers.
5	Examine the attributes listed below to determine the status and availability of *Aqm* cell memory. • *txCellMemoryCongestionState* • *txCellMemoryUsage* • *txCellMemoryMaxUsage*

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6 If any of these values indicate a problem, see ATM function processors troubleshooting (page 226) 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 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 ATM function processors troubleshooting (page 226) or consult your network engineer.

--End--

Variable definitions

Variable	Value
<m>	is the instance number of the *Aqm* component.
<n>	is the instance number of the LP you want to monitor.

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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

Step	Action
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	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	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.

--End--

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Variable definitions

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

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Displaying specialized connection usage of ATM FPs

Determine how multicast connections are being handled by the FP.

Procedure steps

Step	Action
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	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	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. • *lnnConnectionPoolAvailable* • *lnnConnectionPoolUsage*

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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 Examine the attributes listed below to determine the status and availability of the frame memory IP routing entries pool.

- *ipRoutesPoolSize*
- *ipRoutesPoolUsage*
- *ipRoutesPoolAvailableEst*

11 If the number of available IP routing entries is near zero, increase the maximum number of IP routing entries permitted on the LP.

--End--

Variable definitions

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

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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

- The ATM FPs are operating properly. See ATM function processor monitoring (page 8).

Navigation

- Displaying the OSI state of the ATM interface (page 17)
- Identifying troubled connections (page 18)
- Examining connection admission (page 19)
- Displaying ATM interface traffic statistics (page 21)
- Displaying ATM interface operational attributes (page 27)
- Displaying the last alarmed peak transmit utilization of an ATM link (page 29)
- Displaying the ConnectionMapping attributes (page 30)

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Displaying the OSI state of the ATM interface

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

Procedure steps

Step	Action
1	Display the OSI state attributes of the *AtmIf* component. **`display AtmIf/<n> osiState`** The table OSI states for the ATM interface (page 17) shows the possible OSI state outputs that may appear as a result of using this command.

--End--

Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface.

Procedure job aid

OSI states for the ATM interface

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

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Identifying troubled connections

Determine whether there are any troubled connections associated with the ATM interface.

Procedure steps

Step	Action
1	Display status information about the *ConnectionAdministrator* (*Ca*) component belonging to the interface. **`display AtmIf/<n> Ca`**
2	Examine the following attributes to determine whether any trouble connection exist: • *troubledVpcs* • *troubledVpt*s • *troubledVccs* If any value greater then 0 is displayed for any of the attributes listed above, see ATM interfaces troubleshooting (page 203).

--End--

Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface.

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Examining connection admission

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

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

Step	Action
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* 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 ATM interfaces troubleshooting (page 203).
3	Examine the attributes listed below in the following order to determine how connections are being admitted on the interface: • *poolRequestedBandwidth* • *poolAdmittedBandwidth* • *poolAvailableBandwidth* • *poolProvisionedBandwidth* The values for requested bandwidth should be equal to those for admitted bandwidth. If there is a discrepancy between these values, see ATM interfaces troubleshooting (page 203).
	--End--

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Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface.

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Displaying ATM interface traffic statistics

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* component and associated connections may not be zero.

Procedure steps

Step	Action
1	Display information about a specific *AtmIf* 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 24). For the APC-based FPs, see the table AtmIf statistics available on APC-based FPs (page 25) for a listing of supported statistics.
2	Display statistics specific to cell and frame discards, for AQM-based FPs. **`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.

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

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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 194) for more information about dropped cells.

For the 1pOC48ChSmIrAtm card, the *droppedRxCells* attribute may not reset to zero. To obtain an accurate reading, subtract the initial value from the attribute value.

4 Display statistics on dropped cells for the connection, for AQM-based FPs.

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 1pOC48ChSmIrAtm 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 Display statistics on the number of AAL5 frame assembly errors and aborts, for AQM and APC-based FPs.

display AtmIf/<n> aal5RxErrors, aal5RxAborts

6 Display statistics on the connection, if there are lost cells, for AQM and APC-based FPs.

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 Display statistics on the number of LRC frame errors received across the bus, for AQM and APC-based FPs.

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 206) for more information about fault management for LRC errors.

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

display AtmIf/<n> lastLrcFrameErrorConnection

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The *IrcFrameErrorConnections* 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 *IrcFrameErrors* attribute.

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

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

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.

--End--

Variable definitions

Variable	Value
<n>	is the instance number of the *AtmIf* component being monitored.

Procedure job aid

The figure Summary of AtmIf statistics collection (page 24) 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 25).

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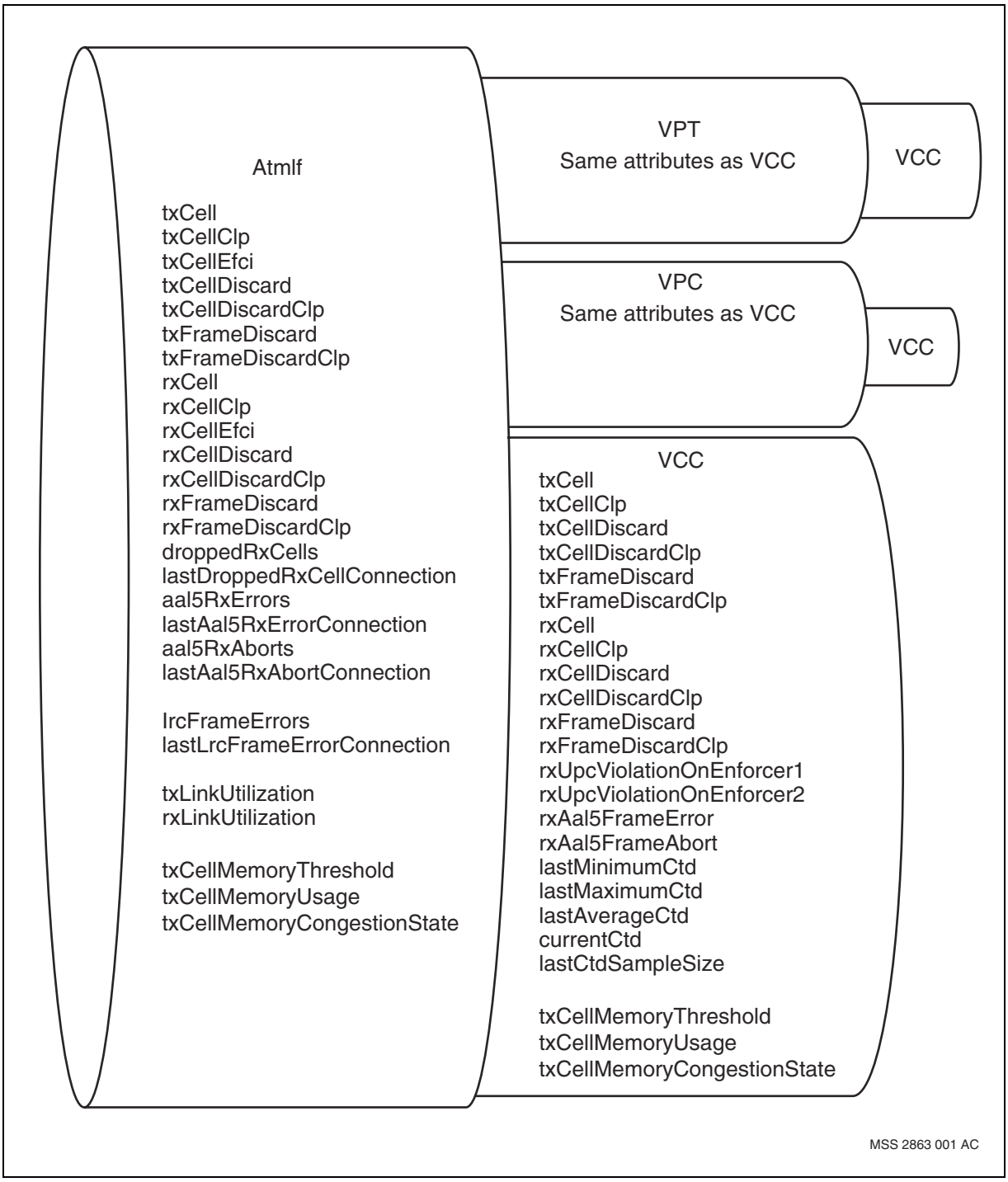
Summary of AtmIf statistics collection



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AtmIf statistics available on APC-based FPs

Statistic Name	Attribute	per port		per connection
		(16pOC3SmIrAtm)	(4pOC12SmIrAtm)	
TxCellCountCLP0+1	txCell	Yes	Yes	Yes
RxCellCountCLP0+1	rxCell	Yes	Yes	Yes *(see Attention)*
TxCellCountCLP1	txCellClp	Yes	No	Yes
RxCellCountCLP1	rxCellClp	Yes	No	No
TxCellDiscard CLP0+1	txCellDiscard	Yes	Yes	Yes
TxCellDiscard CLP1	rxCellDiscardClp	No	No	No
RxCellDiscard CLP0+1	rxCellDiscard	No	Yes	Yes *(see Attention)*
RxCellDiscard CLP1	rxCellDiscardClp	No	No	No
Rx UPC Violation on Enforcer	rxUpcViolationOn Enforcer1, rxUpcViolationOn Enforcer2	N/A	N/A	N/A
txCellMemoryThreshold/ Usage/Congestion State	txCellMemoryThreshold, txCellMemoryUsage, txCellMemoryCongestionState	No	No	N/A
DroppedRxCell	droppedRxCells	No	No	N/A
Lastdroppedrxcellconnection	lastDroppedRxCellConnection	No	No	N/A
TxCellEfciCLPO+1	txCellEfci	No	No	N/A
RxCellEfciCLPO+1	rxCellEfci	No	No	N/A
TxFrameDiscardCLPO+1	txFrameDiscard	No	No	No
TxFrameDiscardCLPO1	rxFrameDiscard	No	No	No
RxFrameDiscardCLPO+1	rxFrameDiscard	No	No	No
RxFrameDiscardCLPO+1	rxFrameDiscard CLP	No	No	No
txCellMemoryThreshold Usage/Congestion State under *Lp Eng Arc*	txCellMemoryThreshold, txCellMemory Usage, txCellMemoryCongestionState, txCellMemoryMaxUsage	No	No	N/A

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AtmIf statistics available on APC-based FPs (continued)

Statistic Name	Attribute	per port		per connection
		(16pOC3SmIrAtm)	(4pOC12SmIrAtm)	
txCellMemoryThreshold/ Usage/Congestion State under *Lp Eng Arc APC/0 (or 1,2,3)*	txCellMemoryThreshold, txCellMemory Usage, txCellMemoryCongestionState	No	No	N/A
Attention: Per-connection RxCellCountCLP0+1 and per connection RxCellDiscardCLP0+1 on the 4pOC12SmIrAtm and 16pOC3SmIrAtm is counted after traffic policing by UPC at the ingress. This is different from other FPs where RxCellCount are counted before UPC policing. Similar notation applies to the port statistics.				
(2 of 2)				

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.

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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

- You have read Summary of AtmIf statistics collection (page 24) and AtmIf statistics available on APC-based FPs (page 25).

Procedure steps

Step	Action
1	Display information about transmit cell memory usage for a specific ATM interface, for the AQM-based FPs. **`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	Display information about the congestion state of a specific interface, for the AQM-based FPs. **`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	Display the values in cells/s, of the 31 shaping rates currently in use at the interface, for the APC-based FPs. **`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	Display the number of VCCs that currently use the 31 shaping rates, for the APC-based FPs. **`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. **`display AtmIf/<n> operational`** This command displays the information described in the above steps relevant to the FP in use.

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--End--

Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface being monitored.

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Displaying the last alarmed peak transmit utilization of an ATM link

Display 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.

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.

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 Multiservice Switch 7400/15000/20000 ATM Configuration Management* for details on adding the ATM link transmit utilization alarm for the ATM interface.

Procedure steps

Step	Action
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.

--End--

Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface.

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Displaying the ConnectionMapping attributes

Display 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 30).

Procedure steps

Step	Action
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`**

--End--

Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface.

Procedure job aid

Function processors supporting the ConnMap component

Function processor	ASIC
3-port DS3	CQC
3-port E1	CQC

(1 of 2)

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Function processors supporting the ConnMap component (continued)

Function processor	ASIC
3-port E3	CQC
3-port OC-3	CQC
4-port OC-12/STM-4 (4pOC12SmIrAtm or 4pOC12SmLrAtm)	APC
16-port OC-3/STM-1 (16pOC3SmIr)	APC

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Connections monitoring

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

Prerequisites to connections monitoring

- The ATM interface is operating correctly. See ATM interface monitoring (page 16).

Navigation

- Determining the OSI state of virtual connections (page 33)
- Determining the OSI state of the source and destination SPVCs and SPVPs (page 35)
- Determining the status of a virtual connection (page 38)
- Displaying the status of call redirection (page 43)
- Monitoring an ATM multicast connection (page 45)
- Examining VPT connection admission (page 47)
- Viewing ATM connection statistics (page 49)
- Viewing ATM traffic descriptor parameters (page 56)
- Viewing congestion control activity for connections (page 53)
- Viewing CTD calculations (page 51)
- Monitoring a point-to-multipoint SPVC connection (page 57)
- Considerations for monitoring queue length (page 184)

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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.

Refer to the table Interpreting OSI states for an ATM connection (page 34) for an explanation of the result displayed with this procedure.

Procedure steps

Step	Action
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`**
	--End--

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Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface.

Procedure job aid

Interpreting OSI states for an ATM connection

State	Meaning
adminState = unlocked operationalState = enabled usageState = idle	The *Vcc* or *Vpc* is available to send and receive traffic over the local physical link, but has not been activated by the application. For a *Vpt*, this state indicates that the *Vpt* is unable to allocate its VPI channel resource.
adminState = unlocked operationalState = enabled usageState = busy	The *Vcc* or *Vpc* has been activated by the application to send and receive traffic over the local physical link. A *Vpt* is not controlled by an application, so it is activated when it is provisioned. The *Vcc* or *Vpc* may be troubled if traffic loss is occurring.
adminState = unlocked operationalState = disabled usageState = idle	The *Vcc, Vpt,* or *Vpc* 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.

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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.

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

Refer to the tables Interpreting OSI states of the Src and Dst component state combinations (page 36) and Interpreting OSI states of the Msrc and Party component state combinations (page 37) for an explanation of the results displayed by this procedure.

Prerequisites

- An ATM interface has ben configured. See NN10600-710 *Nortel Multiservice Switch 7400/15000/20000 ATM Configuration Management* for details.
- A *Vcc*, *Vpc*, and *Vpt* component has been configured. See NN10600-710 *Nortel Multiservice Switch 7400/15000/20000 ATM Configuration Management* for details.

Procedure steps

Step	Action
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**
2	Display the OSI state of all source or destination components under an *AtmIf* component, for SPVPs. **display AtmIf/<n> Vpc/* Src OsiState** **display AtmIf/<n> Vpc/* Dst OsiState**
3	Display the OSI state of all source or destination components under an *AtmIf* component, for VPT SPVCs. **display AtmIf/<n> Vpt/* Vcc/* Src OsiState** **display AtmIf/<n> Vpt/* Vcc/* Dst OsiState**

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--End--

Variable definitions

Variable	Value
<n>	is the instance value of the ATM interface.

Procedure job aid

Interpreting OSI states of the Src and Dst component state combinations

State	Meaning
src/dst adminState = unlocked src/dst operationalState = enabled src/dst usageState = idle 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 src/dst operationalState = enabled src/dst usageState = idle 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 *aisGeneration* attribute is set to *enabled*).
src/dst adminState = unlocked src/dst operationalState = enabled src/dst usageState = idle vcc/vpc usageState = idle (Rx is down, Tx is up, not *permLocked*)	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 *txCell* attribute is used to verify if AIS cells are being generated. For the 16 port OC-3/STM-1 POS and ATM and 4 port Multi-rate POS and ATM FPs, the *txCell* attribute does not include locally generated AIS cells. AIS cells generated on the destination side of an SPVC or SPVP and AIS cells generated on the link side of a PVC or PVP are not included.
src/dst adminState = unlocked src/dst operationalState = enabled src/dst usageState = idle vcc/vpc usageState = idle (*permLock*ed)	The SPVC or SPVP is provisioned with permLocked. Though the SPVC or SPVP is disconnected, AIS cells cannot be generated.
src/dst adminState = unlocked src/dst operationalState = enabled src/dst usageState = active vcc/vpc usageState = active	The SPVC or SPVP is connected. AIS cells are not being generated.

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Interpreting OSI states of the Msrc and Party component state combinations

State	Meaning
msrc/party adminState = unlocked msrc/party operationalState = disabled 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 msrc/party operationalState = enabled 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. party: This is valid when the party is in the process of trying to establish.
msrc/party adminState = unlocked msrc/party operationalState = enabled 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. party: This is valid when all dependencies are enabled and the party is established.
msrc/party adminState = unlocked msrc/party operationalState = enabled msrc/party usageState = busy	msrc: This is valid when all dependencies are enabled and the PMP SPVC has established all parties. party: This is never reported. It is an invalid state.

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Determining the status of a virtual connection

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

See the table Interpreting the status of the ATM connection (page 39) for an explanation of the results of this procedure.

Procedure steps

Step	Action
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`**

--End--

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Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface
<Vpi>	is the instance value of the *Vpc* component
Vpt/<Vpi>	is the instance value of the *Vpt* component

Procedure job aid

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 *Ima* 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.
		(1 of 4)

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Interpreting the status of the ATM connection (continued)

Attribute	Value	Meaning
	bad	A failure has been detected that affects the ATM layer in the receive direction of the connection. The reasons for the value *bad* include: • ATM layer OAM AIS cells are being received (for example, due to an upstream layer physical problem). • The parent VPT is receiving OAM VP AIS cells (this condition applies only to VPT VCCs). • A local failure is detected because the port associated with the connection point has failed or is locked. (In this case, the *localFailureCause* attribute has the value *portdown*.) • 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, *localFailureCause* would have the value *notAdmitted*. If the connection was released, *localFailureCause* would have the value *localBwLoss*.) 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 *Nortel Multiservice Switch 7400/15000/20000 Operations: Frame Relay to ATM Interworking*
	notApplicable	The *Vcc* or *Vpc* 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.
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.

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Interpreting the status of the ATM connection (continued)

Attribute	Value	Meaning
	bad	A failure has been detected that affects the ATM layer in the receive direction of the connection. The value *bad* 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. 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 *Nortel Multiservice Switch 7400/ 15000/20000 Operations: Frame Relay to ATM Interworking*.
	notApplicable	The *Vcc* or *Vpc* 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.
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 *bad* for a time-out period of one minute before returning to *good* 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).

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Interpreting the status of the ATM connection (continued)

Attribute	Value	Meaning
endToEndLoopbackState segmentLinkSideLoopbackState segmentSwitchSideLoopbackState	good	Loopback insertion and termination is enabled and ATM-layer continuity exists; as expected, inserted cells are returning and are being terminated.
	bad	Loopback insertion and termination is enabled and ATM-layer continuity does not exist; inserted cells are not returning. 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. Dynamic ATM connections are torn down when loopback status goes from a value of good to bad.
	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.

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Displaying the status of call redirection

Display the status of call redirection to monitor the connection.

See the table Interpreting the display of the callRedirection component (page 44) for an explanation of the results of this procedure.

See the NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference* for additional information about operational attributes.

Prerequisites

- You must be in operational mode to perform this procedure.

Procedure steps

Step	Action
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`**

--End--

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Variable definitions

Variable	Value
<vci>	is the instance value of the vpt vcc.
<vpi>	is the instance value of the vpc or vpt.
<vpi.vci>	is the instance value of the vcc.

Procedure job aid

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.

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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.

The maximum number of relay points that can be displayed is 60.

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

See the table Interpreting the display of the ATM connectionInfo (page 46) for an explanation of the results of this procedure.

Prerequisites

- An ATM FP must be configured and in-service.

Procedure steps

Step	Action
1	Display the multicast connection information for a VPC. **display AtmIf/<n> Vpc/<Vpi> connectionInfo**
2	Display the multicast connection information for a VCC. **display AtmIf/<n> Vpt/<Vpt> Vcc/<Vpi.Vci> connectionInfo**
3	Query the status of multicast branch resources using step 4 through step 6.
4	Display the number of switched multicast branch resources used by all PMP SVCs on the port. **display Atmif/<n> ca switchedMulticastBranches**
5	Display the number of permanent multicast branch resources used by all PMP SPVCs and PMP PVCs on the port **display Atmif/<n> ca permanentMulticastBranches**
6	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**
7	Display all the relay points (branches) of this connection. **display Atmif/<n> Vpc/<Vpi> RP** **display Atmif/<n> Vpt/<Vpt> Vcc/<Vpi.Vci> RP**

--End--

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Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface.
<Vci>	is the instance value of the *Vpi* component.
<Vpi>	is the instance value of the *Vpc* component.
<Vpi.Vci>	is the instance value of the *Vcc* component.
<Vpt>	is the instance value of the *Vpt* component.

Procedure job aid

Interpreting the display of the ATM connectionInfo

Attribute	Value	Meaning
distributionType	pointToMultipoint	The attribute indicates the way data is distributed in the connection. The value indicates this connection point is part of a multicast connection.
numLeaves	0 to 64K	The attribute indicates the number of leaves of the multicast connection. 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.

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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

Step	Action
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* 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.
3	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. 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.
	--End--

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Variable definitions

Variable	Value
<n>	is the instance value of the *AtmInterface* component.
<Vpi>	is the instance value of the *Vpt* component.

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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 24). 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 25) for a listing of supported per-connection statistics.

Procedure steps

Step	Action
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*

Attention: 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.

If the values displayed are higher than expected, see Connections troubleshooting (page 188).

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--End--

Variable definitions

Variable	Value
<n>	is the instance number of the *AtmIf* component being monitored.
<Vpi>	is the instance value of the *Vpc* component.
<Vpi.Vci>	is the instance number of the *Vcc* component.
<Vpt>	is the instance number of the *Vpt* component.

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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 Multiservice Switch systems calculate the CTD by dividing the round trip delay (RTD) in half. CTD is measured with microsecond precision.

The inter-relationship between the statistics described in this section is shown in the figure Summary of AtmIf statistics collection (page 24). 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 25) for a listing of supported per-connection statistics.

Procedure steps

Step	Action
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 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 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.

--End--

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Variable definitions

Variable	Value
<n>	is the instance number of the *AtmIf* component being monitored.
<Vpi>	is the instance number of the *Vpc* component.
<Vpi.Vci>	is the instance number of the *Vcc* component.

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

The inter-relationship between the statistics described in this section is shown in the figure Summary of AtmIf statistics collection (page 24). 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 25) 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 Multiservice Switch 7400/15000/20000 Component Reference*.

Procedure steps

Step	Action
1	Display the connection's traffic shaping state. **`display Atmif/<n> Vcc/<Vpi.Vci> Tm trafficShaping`**

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2 Determine queue congestion for all connections on the interface. 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 *txCellEfci* attribute. EFCI-related statistics are not available on the CQC and APC-based function processors.)

```
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
```

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

3 Discarded cells or frames that are counted through the *txDiscard* and *txDiscardClp* attributes are discarded on transmission to the link. For AQM, APC 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
```

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

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

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

Attention: 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.

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

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


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Attention: 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).

6 Determine which connections are experiencing UPC violations or partial pack discard (PPD) in the ingress direction, for AQM and CQC-based function processors.

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

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

7 Determine which connections are experiencing UPC violations or partial pack discard (PPD) in the ingress direction, for AQM-based function processors.

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

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

--End--

Variable definitions

Variable	Value
<n>	is the instance number of the *AtmIf* component under examination.
<vpi>	is the instance value of the *Vpt* component.

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Viewing ATM traffic descriptor parameters

View ATM traffic descriptor parameters to monitor additional connection statistics.

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

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

Procedure steps

Step	Action
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**

--End--

Variable definitions

Variable	Value
<n>	is the instance number of the *AtmIf* component under examination.
<Vpi>	is the instance value of the *Vpc* and *Vpt* components.
<Vpi.vci>	is the instance value of the *Vcc* component.

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Monitoring a point-to-multipoint SPVC connection

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

For more information on interpreting the OSI states, see Interpreting OSI states of the Msrc and Party component state combinations (page 37).

Procedure steps

Step	Action
1	Query the status of the VCC component, using the procedure Monitoring an ATM multicast connection (page 45).
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`**

Attention: 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>`**

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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
```

Attention: 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)
```

--End--

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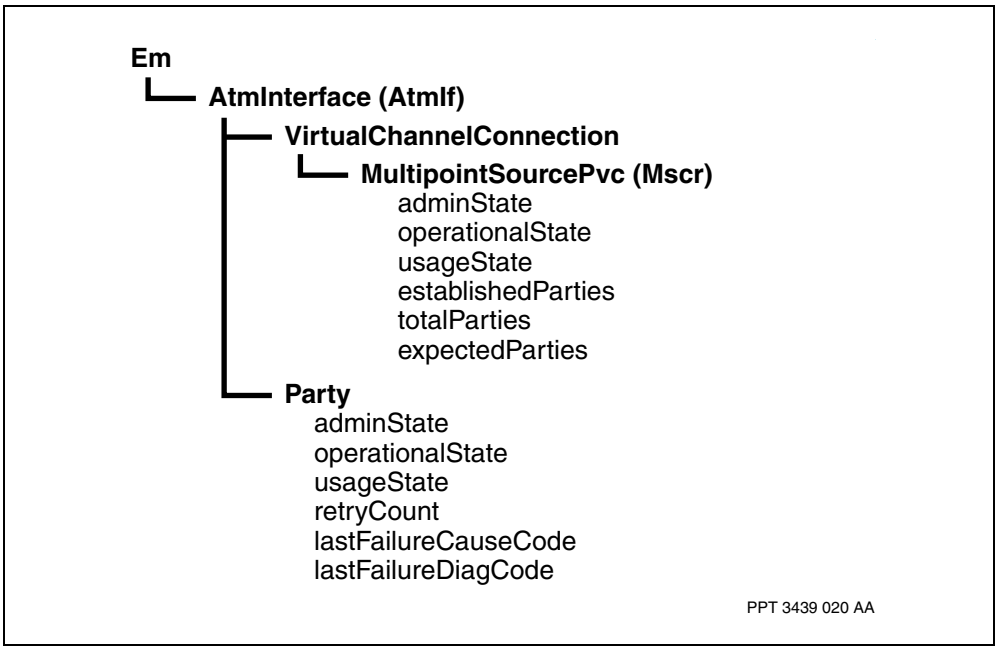
Variable definitions

Variable	Value
<lp>	is the number of the LP associated with the ATM function processor.
<n>	is the instance value of the *AtmIf* component, and can be any unique value from 1 to 4 095.
<party>	is the number of the party.
<vpi.vci>	is the instance value of the *Vcc* component.

Procedure job aid

Point-to-multipoint SPVC connection component hierarchy



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Signaling 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.

See Connections troubleshooting (page 188) for information and procedures that are common to monitoring for all connection types.

Navigation

- Displaying information on the signaling channel (page 61)
- Displaying information on ILMI PDUs (page 62)

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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 61).

Procedure steps

Step	Action
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.

--End--

Variable definitions

Variable	Value
<ifType>	is the interface type, either Uni, Lisp, Aini, or Pnni.
<n>	is the instance number of the ATM interface.

Procedure job aid

Switched connection statistics under the Signalling component

Attribute	Meaning
peakConnections	high water mark of connections
successfulConnections	the number of switched connections that have been successfully established
failedConnections	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.

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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

Step	Action
1	Display the attributes for the subcomponent under the interface. **`display AtmIf/<AtmIf> Uni Ilmi`** The attribute *txPdus* lists the number of transmitted ILMI PDUs. The attribute *rxPdus* lists the number of received ILMI PDUs.
	--End--

Variable definitions

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

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Routing monitoring

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

Prerequisites to routing monitoring

- You have read Connections monitoring (page 32) for information and procedures that are common to monitoring for all connection types.

Navigation

- Displaying information on the number of calls routed (page 65)
- Displaying a physical link or a virtual path connection (page 66)
- Monitoring PNNI networking operational measurements (page 67)
- Displaying OSI state information for SVCC RCC operational information (page 70)
- Displaying SVCC RCC operational attributes (page 71)
- Displaying SVCC-based statistics (page 73)
- Displaying the exit Vcc used by the SVCC-based RCC (page 75)
- Displaying logical link relationships in the PNNI networking hierarchy (page 76)
- Displaying the physical links making up a logical linking the PNNI networking hierarchy (page 78)
- Displaying the physical nodes reachable from a logical node in the PNNI networking hierarchy (page 80)
- Activating a module optimization pass on a PNNI node (page 82)
- Optimizing connections on an ATM interface (page 83)
- Monitoring path optimization on an ATM interface (page 84)
- Optimizing an individual connection (page 88)
- Listing the signaling interfaces that have rerouting capabilities (page 89)
- Monitoring connections on an ATM interface (page 90)

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- Monitoring PNNI path load balancing (page 91)
- Clearing PNNI load balancing (page 93)
- Verifying Load Re-Balancing on Parallel Links (page 94)
- Monitoring Load Re-Balancing on Parallel Links (page 95)
- Running Load Re-Balancing on Parallel Links for a particular group (page 96)
- Setting up AtmPathTrace override configuration (page 97)
- Initiating a path trace filter (page 99)
- Initiating a PathTrace Test connection (page 101)
- Initiating a connection trace (page 108)
- Setting the destination address of the RouteFinder and the number of computed routes (page 109)
- Setting the RouteFinder's ATM traffic requirements (page 110)
- Setting RouteFinder component attributes supporting PNNI load balancing and route caching (page 118)
- Setting the highest PNNI level used for route computation (page 120)
- Monitoring PNNI route caching (page 122)
- Clearing the PNNI route cache (page 125)
- Monitoring PNNI node reachability (page 126)
- Monitoring the topology database using the active parent node (page 127)
- Monitoring the topology database using the upnode (page 128)
- Monitoring the topology database using horizontal link ATM service metrics (page 130)
- Monitoring the topology database using uplink ATM service category metrics (page 133)
- Monitoring the topology database using the dynamically created PNNI network hierarchy (page 137)
- Monitoring the topology database using on-switch PNNI topology information translation (page 139)

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Displaying information on the number of calls routed

Display information on the number of calls routed. Nortel 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

Step	Action
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.

--End--

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Displaying a physical link or a virtual path connection

Display a physical link or virtual path connection. Nortel 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

Step	Action
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`**

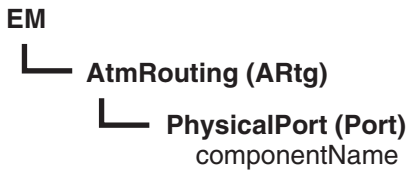
--End--

Variable definitions

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

Procedure job aid

Physical link or virtual path connection component hierarchy



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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 OSI state information for SVCC RCC operational information (page 70).

Procedure steps

Step	Action
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`** 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. For the *AtmIf* component: **`display AtmIf/<AtmIf> Pnni Rcc/<remote_LGN_address> derivedAggregationToken`**

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For the *AtmIf Vpt* component:

```
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/*
```

--End--

Variable definitions

Variable	Value
<AtmIf>	is the instance number of the ATM interface.
<CfgNode_level>	is the level of the node in the PNNI networking hierarchy having a value of between 0 and 104, inclusive.
<HLnk_portID>	is the port ID identifying the logical connection between the ancestor (*CfgNode*) and its neighbor (*Nbr*).
<remote_LGN_address>	is the address of the node that is acting as the LGN at the specified level in the hierarchy.
<UpLink_portID>	is the port ID representing the logical uplink associated with the *CfgNode*.

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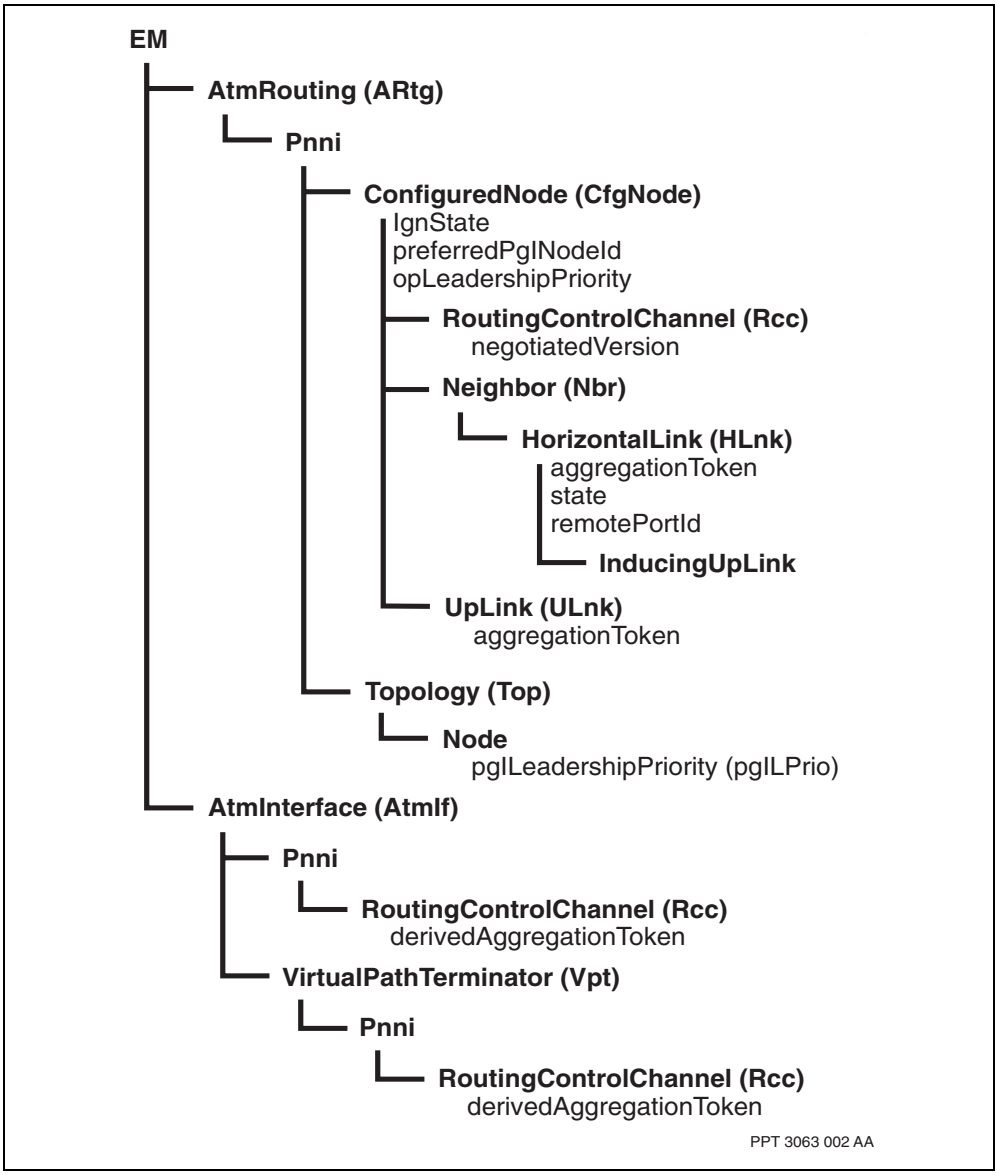
Procedure job aid

Component tree for querying PNNI networking operational measurements



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Displaying OSI state information for SVCC RCC operational information

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

Procedure steps

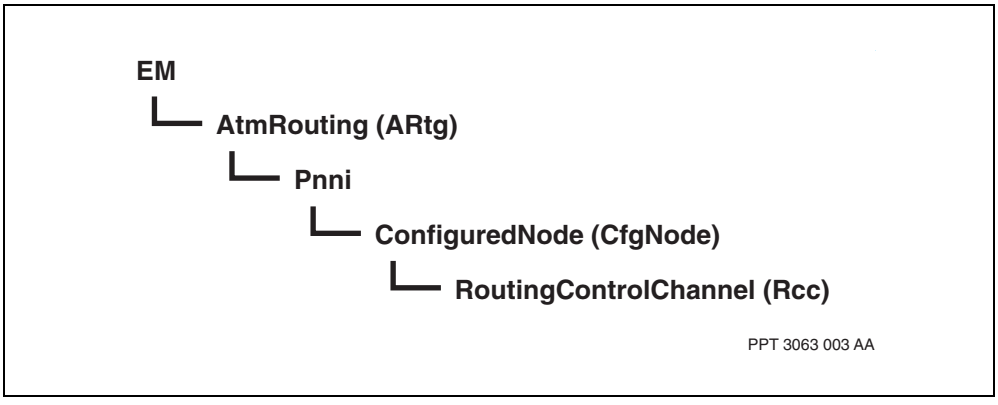
Step	Action
1	Display the OSI state information level that will be used in route computation. **display ARtg Pnni CfgNode/<CfgNode_level> Rcc/<remote_LGN_address> state**
	--End--

Variable definitions

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

OSI state information for SVCC RCC operational information component hierarchy



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Displaying SVCC RCC operational attributes

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

Procedure steps

Step	Action
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. 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. **display ARtg Pnni CfgNode/<CfgNode_level> Rcc/<remote_LGN_address> lastFailureDiagCode**

--End--

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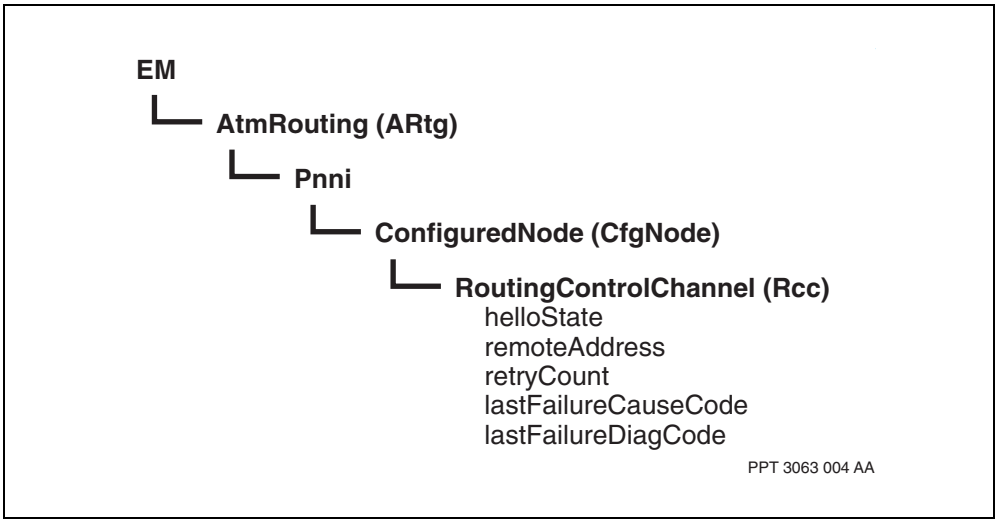
Variable definitions

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

SVCC RCC operational attributes component hierarchy



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Displaying SVCC-based statistics

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

Procedure steps

Step	Action
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**

--End--

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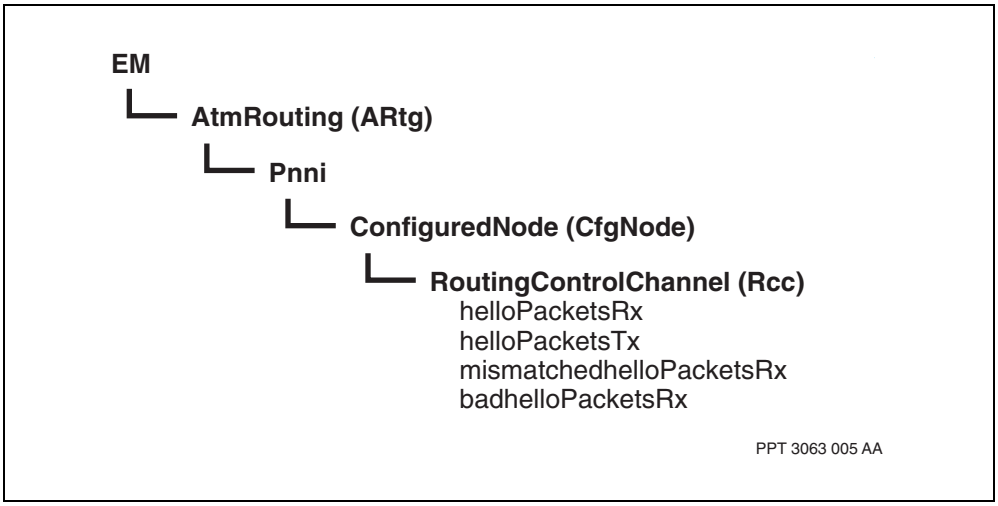
Variable definitions

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

SVCC-based statistics component hierarchy



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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

Step	Action
1	Display the exit Vcc used by the SVCC-based RCC. **display ARtg Pnni CfgNode/<CfgNode_level> Rcc/<remote_LGN_address> AtmCon nextHop**

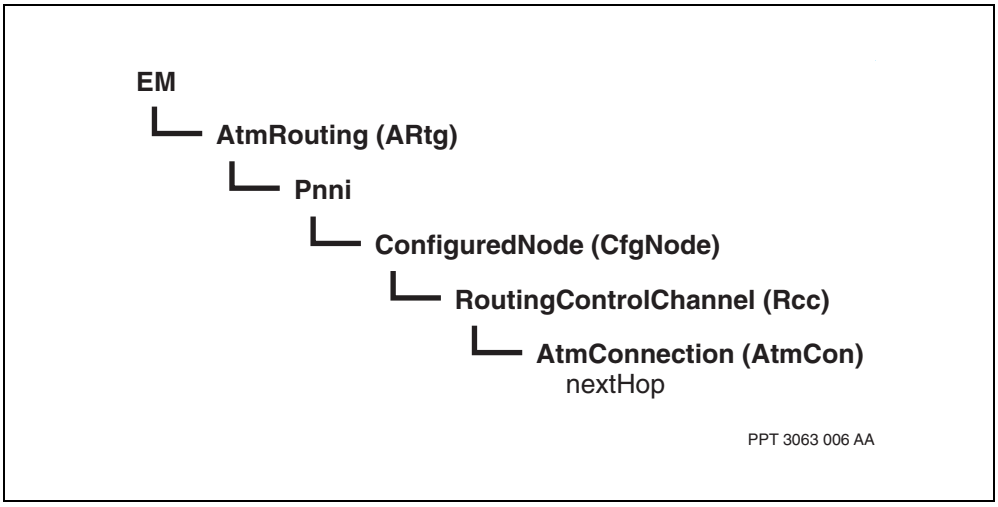
--End--

Variable definitions

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

Exit Vcc component hierarchy



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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

Step	Action
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. 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. **display ARtg Pnni CfgNode/<CfgNode_level> Nbr/ <Nbr_nodeID> HLnk/***
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>**

--End--

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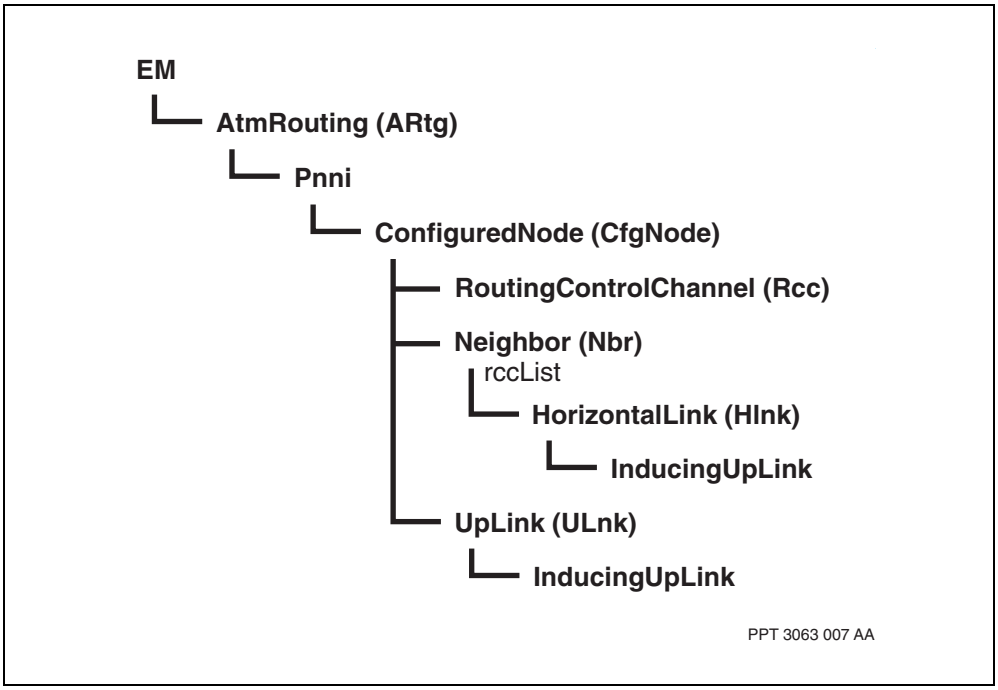
Variable definitions

Variable	Value
<CfgNode_level>	is the level of the node in the PNNI networking hierarchy having a value between 0 and 104, inclusive.
<HLnk_portID>	is the port ID identifying the logical connection between the ancestor (*CfgNode*) and its neighbor (*Nbr*).
<InducingUpLink_nodeID> <InducingUpLink_portID>	is 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 *CfgNodes,* and the port ID is the ID representing an *UpLink* from that *CfgNode*.
<Nbr_nodeID>	is the node ID representing the neighbor node.
<UpLink_portID>	is the port ID representing the logical uplink associated with the *CfgNode*.

Procedure job aid

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

Step	Action
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.

--End--

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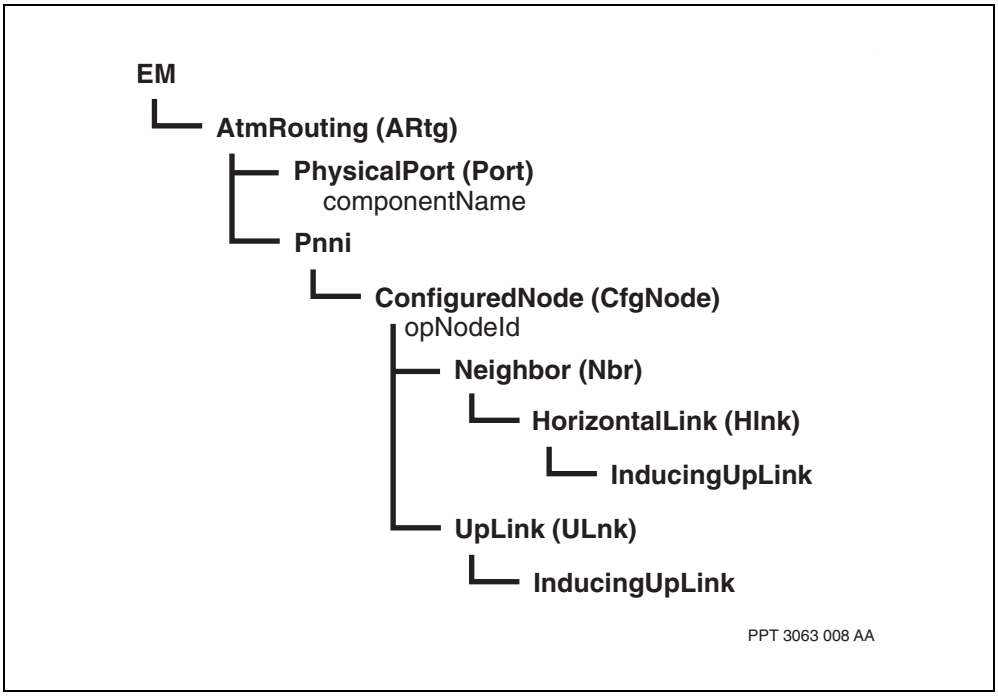
Variable definitions

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

Procedure job aid

Physical links making up a logical link component hierarchy



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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

Step	Action
1	Check to see if the node is a physical node by seeing if it appears as the lowest level in the CfgNode listing. If the node is not at the lowest level, this command displays all levels. 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. **`display ARtg Pnni CfgNode/*`**
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/*`**

--End--

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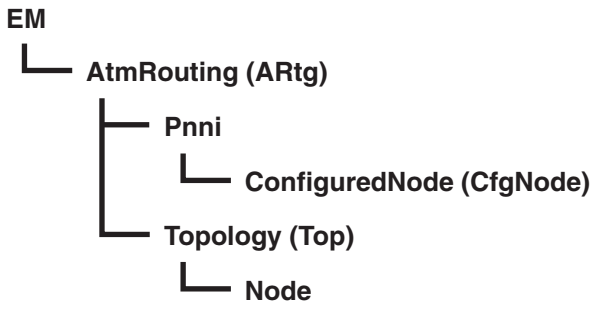
Variable definitions

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

Procedure job aid

Physical nodes reachable from a logical node component hierarchy



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Activating a module optimization pass on a PNNI node

Activate a module optimization pass on a PNNI node manually.

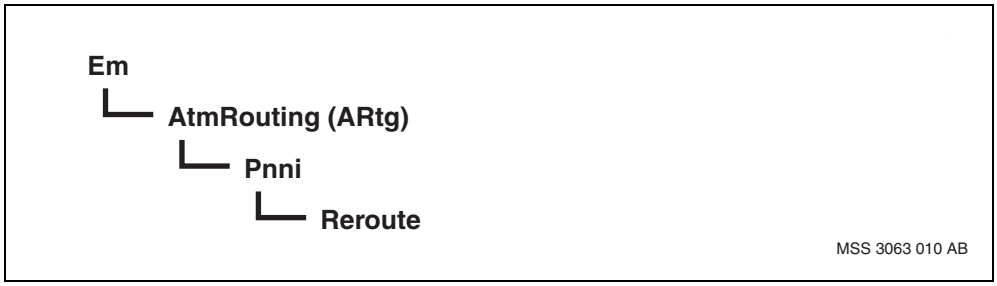
Procedure steps

Step	Action
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`**

--End--

Procedure job aid

Module optimization pass on a PNNI node component hierarchy



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Optimizing connections on an ATM interface

Optimize connections on an ATM interface manually.

Procedure steps

Step	Action
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**
	--End--

Variable definitions

Variable	Value
<AtmIf>	is the instance number of the ATM interface.
<ifType>	is the interface type, either Uni, Iisp, Aini, or Pnni.

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Monitoring path optimization on an ATM interface

Monitor path optimization on an ATM interface if required.

Use the table Rerouting cause codes (page 86) to obtain a list of the possible rerouting cause codes and their description.

Procedure steps

Step	Action
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.

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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

--End--

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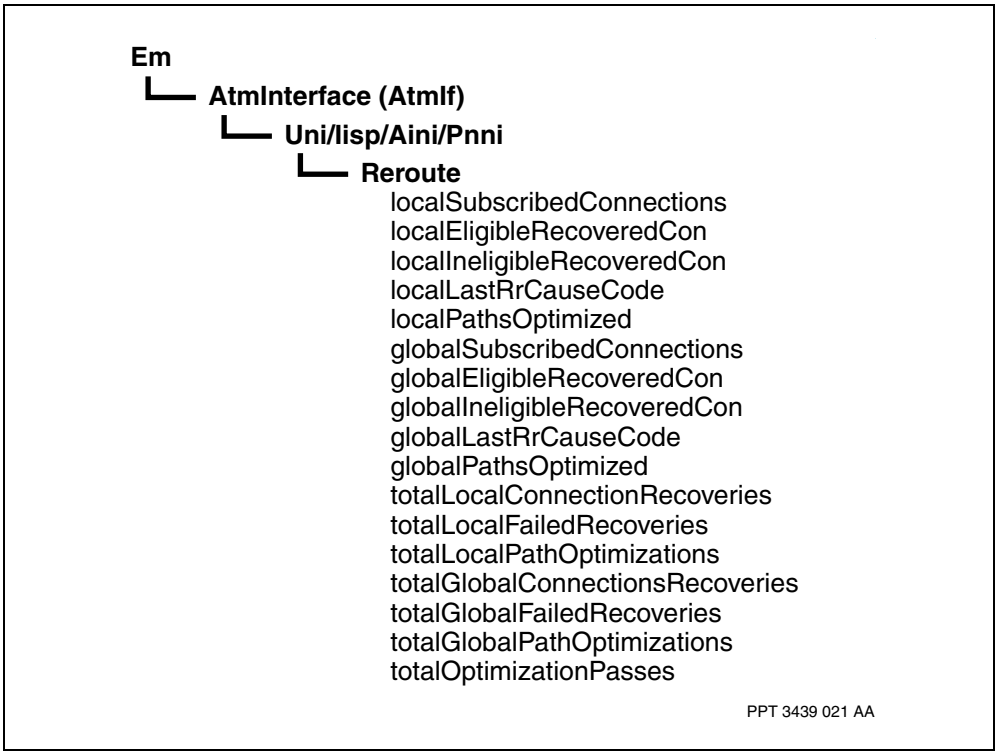
Variable definitions

Variable	Value
<AtmIf>	is the instance number of the ATM interface.
<IfType>	is the interface type, either Uni, Iisp, Aini, or Pnni.

Procedure job aid

Path optimization on an ATM interface component hierarchy



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.

(1 of 2)

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Rerouting cause codes (continued)

Value	Description	Details
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.
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)

(2 of 2)

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Optimizing an individual connection

Manually optimize an individual connection, if required.

Procedure steps

Step	Action
1	Use the reroute command to optimize an individual connection. **`optimize AtmIf/<AtmIf> Vcc/*|Vpc/*|Vpt/*Vcc/* Src RerouteOv`** 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.

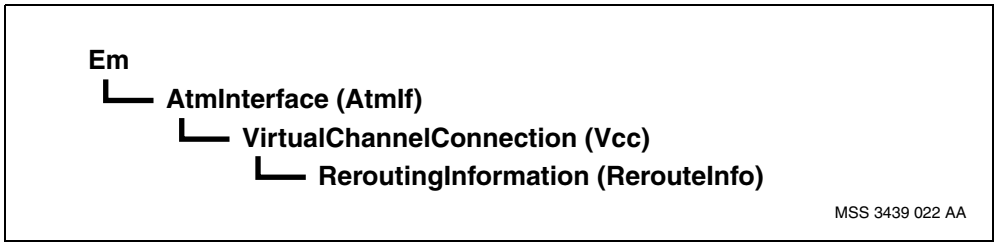
--End--

Variable definitions

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

Procedure job aid

Individual connection component hierarchy



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Listing the signaling interfaces that have rerouting capabilities

List the signaling interfaces that have rerouting capabilities.

Procedure steps

Step	Action
1	List the signaling interfaces that have rerouting capabilities. **`list AtmIf/* [Vpt/*] <IfType> Reroute`**
	--End--

Variable definitions

Variable	Value
<IfType>	is the interface type, either Uni, Iisp, Aini, or Pnni.

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Monitoring connections on an ATM interface

Monitor connections on an ATM interface, if required.

Procedure steps

Step	Action
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**

--End--

Variable definitions

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

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Monitoring PNNI path load balancing

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

Prerequisites

- You have read NN10600-710 *Nortel Multiservice Switch 7400/15000/20000 ATM Configuration Management* for information on changing load balancing variance attributes, and changing the load balancing method.

Procedure steps

Step	Action
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`**

--End--

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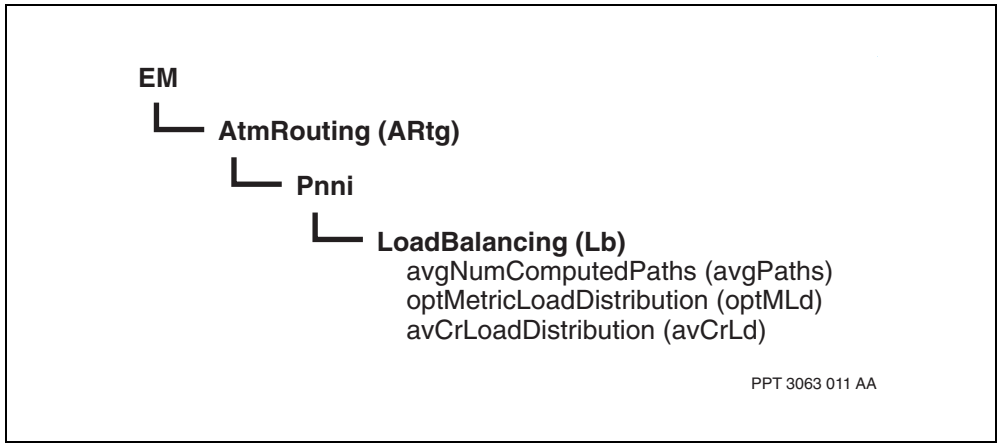
Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface.

Procedure job aid

PNNI path load balancing component hierarchy



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Clearing PNNI load balancing

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

Procedure steps

Step	Action
1	Clear all *LoadBalancing* operational attributes. **`clear ARtg Pnni Lb/n`**

--End--

Variable definitions

Variable	Value
<n>	is the load balance value, either cbr, rtvbr, ntvbr, or ubr.

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Verifying Load Re-Balancing on Parallel Links

Verify that each PNNI link under the *LRBG* component is configured properly.

Procedure steps

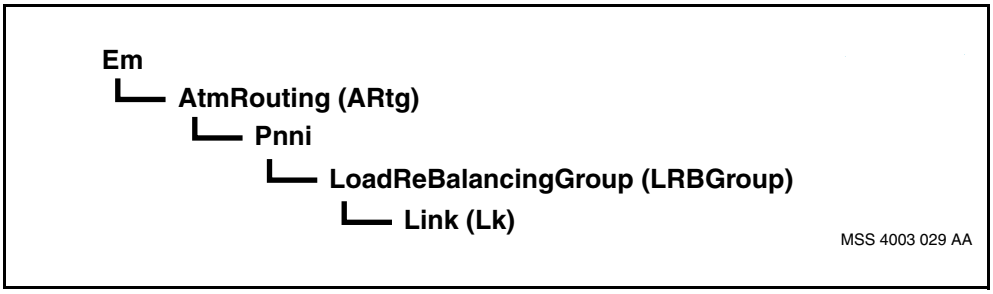
Step	Action
1	Display the *LRBG* component. **`display artg pnni Lrbg/<x> Link/<l>`**
	--End--

Variable definitions

Variable	Value
<l>	is the PNNI parallel link number.
<x>	is the *LRGB* number.

Procedure job aid

Load Re-Balancing on Parallel Links component hierarchy



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Monitoring Load Re-Balancing on Parallel Links

Monitor the *LRBG* component.

Procedure steps

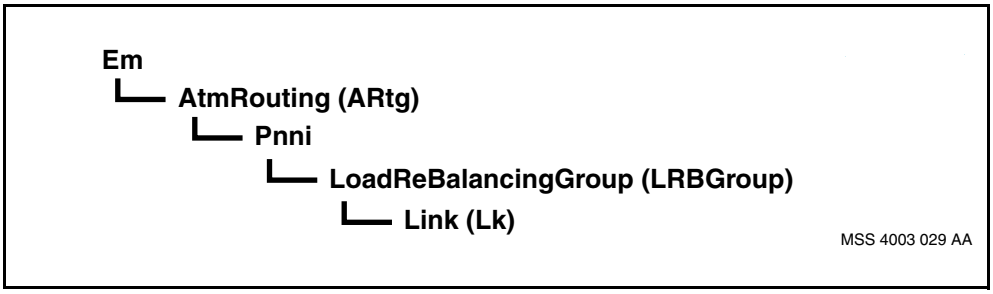
Step	Action
1	Display each PNNI link under the *LRBG* component. **`display artg pnni Lrbg/<x>`**
	--End--

Variable definitions

Variable	Value
<x>	is the *LRGB* number.

Procedure job aid

Load Re-Balancing on Parallel Links component hierarchy



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Running Load Re-Balancing on Parallel Links for a particular group

Run load re-balancing for a particular *LRGB*.

Procedure steps

Step	Action
1	Run load re-balancing for a particular group. **`rebalance artg pnni lrbg/<x>`**
2	Optionally, cancel load re-balancing for a particular group. **`rebalance -cancel artg pnni lrbg/<x>`**

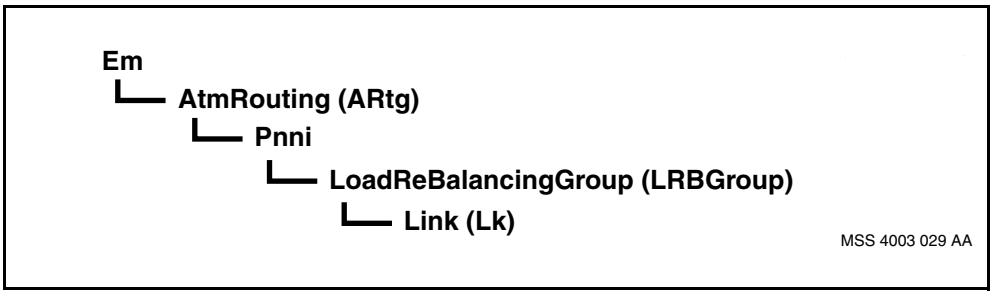
--End--

Variable definitions

Variable	Value
<x>	is the *LRGB* number.

Procedure job aid

Load Re-Balancing on Parallel Links component hierarchy



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Setting up AtmPathTrace override configuration

Set up AtmPathTrace override configuration to set the *maxTraceRecords* and *maxConcurrentTraceRecords* attributes.

Prerequisites

CAUTION
This procedure resets the function processor
Configure the *AtmPathTrace* component before you activate any ATM service to prevent service interruption.

- Prior to configuring the path trace filter, you have added the *AtmPathTrace* override component and have configured its *maxTraceRecords* and *maxConcurrentTraceRequests* attributes using the path trace filter configuration procedure in NN10600-710 *Nortel Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
- By default, once the atmUni, atmIisp, 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

Step	Action
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>`

--End--

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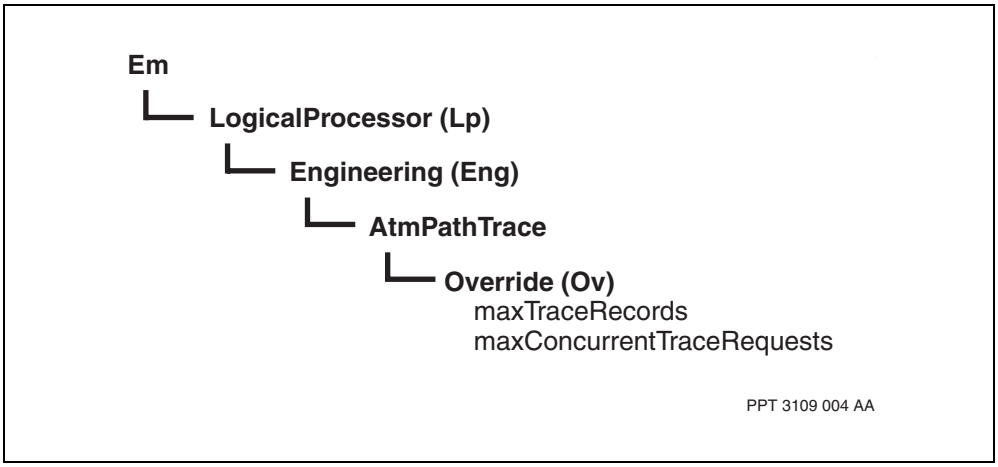
Variable definitions

Variable	Value
<atmPathTraceOverrideAttributes>	is a value of either maxTraceRecords or maxConcurrentTraceRequests.
<lp>	is the number of the LP associated with the ATM function processor.

Procedure job aid

atmPathTrace override configuration component hierarchy



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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 have added the *AtmPathTrace* override component and have configured its *maxTraceRecords* and *maxConcurrentTraceRequests* attributes using the procedure Setting up AtmPathTrace override configuration (page 97).

Procedure steps

Step	Action
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 Multiservice Switch 7400/15000/20000 ATM Configuration Management* to define a UNI. • Configure an IISP interface in NN10600-710 *Nortel Multiservice Switch 7400/15000/20000 ATM Configuration Management* to define an IISP. • Configure an AINI interface in NN10600-710 *Nortel Multiservice Switch 7400/15000/20000 ATM Configuration Management* to define an AINI. • Configure a PNNI in NN10600-710 *Nortel 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`**

--End--

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Variable definitions

Variable	Value
<IfType>	is the interface type, either Uni, Iisp, Aini, or Pnni.
<n>	is the number of the ATM interface.

Procedure job aid

Path trace filter component hierarchy

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Initiating a PathTrace Test connection

Use the *PathTraceTestConnection* component to manage the path trace test connection.

Procedure steps

Step	Action
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.. **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. **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.

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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>

--End--

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Variable definitions

Variable	Value
<bcBbc>	is the *bcBbc* value, one of *a*, *c*, *x*, and *derivedFromServiceCategory*. The default is *derivedFromServiceCategory*. Class *a* service is a connection-oriented, constant bit rate ATM transport service. Class *a* service has end-to-end timing requirements and may require stringent cell loss, cell delay, and cell delay variation performance. When *bearerClassBbc* is defined as Class *a*, the user is requesting more than an ATM-only service. The network looks at the AAL to provide interworking based upon its contents. Class *c* service is a connection-oriented, variable bit rate ATM transport service. Class *c* service has no end-to-end timing requirements. When *bearerClassBbc* is defined as Class *c*, the user is requesting more than an ATM-only service. The network interworking function looks at the AAL and provide service based on it. Class *x* service is a connection-oriented ATM transport service where the AAL, *trafficType* (*vbr* or *cbr*) and timing requirements are user-defined (that is, transparent to the network). When *bearerClassBbc* is defined as Class *x,* the user is requesting an ATM-only service from the network. In this case, the network does not process higher layer protocols. The value *derivedFromServiceCategory* specifies that the nodes derive the actual value for this connection from the value of the *atmServiceCategory* attribute. Either this attribute has the value *derivedFromServiceCategory* or the *atmServiceCategory* attribute has the value *derivedFromBBC*, but not both.
<bestEffort>	is the *bestEffort* value, one of *indicated*, *notIndicated*, *derivedFromServiceCategory*. The default is *derivedFromServiceCategory*. This attribute is one of the broadband bearer capability attributes. *Indicated* means that the quality of service for this connection is not guaranteed. *NotIndicated* means that the quality of service for this connection is guaranteed. The value *derivedFromServiceCategory* specifies that the actual value which is used for this connection is derived from the value of the *atmServiceCategory*. This attribute must either be set to *derivedFromServiceCategory*, or the *atmServiceCategory* attribute must be set to *derivedFromBBC*, but not both.

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Variable	Value
<bwdQos>	is the *bwdQos* value, one of *0*, *1*, *2*, *3*, *4*, or *sameAsFwd*. The default is *sameAsFwd*. Class *1* supports a QoS that meets service class A performance requirements (for example, circuit emulation, constant bit rate video). Class *2* supports a QoS that meets service class B performance requirements (for example, variable bit rate audio and video). Class *3* supports a QoS that meets service class C performance requirements (for example, connection-oriented data transfer). Class *4* supports a QoS that meets service class D performance requirements (for example, connectionless data transfer). Class *0* is the unspecified bit rate QoS class, with no objective for performance parameters. If the *bwdQosClass* attribute is *sameAsFwd*, the nodes use the values in the *fwdQosClass* attribute.
<cBbc>	is the *cBbc* value, either *Yes* or *no*. The default value is *no*. 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. 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.
<fwdQos>	is the fwdQos value, one of *0*, *1*, *2*, *3*, or *4*. The default is *0*. Class *1* supports a QoS that meets service class A performance requirements (for example, circuit emulation, constant bit rate video). Class *2* supports a QoS that meets service class B performance requirements (for example, variable bit rate audio and video). Class *3* supports a QoS that meets service class C performance requirements (for example, connection-oriented data transfer). Class *4* supports a QoS that meets service class D performance requirements (for example, connectionless data transfer). Class *0* is the unspecified bit rate QoS class, with no objective for performance parameters.
<IfType>	is the interface type, one of Uni, Iisp, Aini, or Pnni
<rxTdp_parm1 - 4>	is a vector of four decimal entries with values between 0 and 2147483647. The nodes associate these parameters with the *rxtrafficDescType* attribute. The default vector is 0 0 0 0.

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Variable	Value
<rxtdt>	is the *rxtdt* value, one of 1, 2, 3, 4, 5, 6, 7, 8, 9 or *sameAsTx*. The default is *sameAsTx*. 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 *rxtrafficDescType* attribute determine the number and meaning of the parameters in the *rxTrafficDescParm* attribute. When you select *sameAsTx*, the nodes use the values for the *txTrafficDescType* and *txTrafficDescParm* attributes for the *rxTrafficDescType* and *rxTrafficDescParm* attributes.
<service>	is the service value, one of *unspecifiedBitRate*, *constantBitRate*, *rtVariableBitRate*, *nrtVariableBitRate*, or *derivedFromBBC*. The default is *unspecifiedBitRate*. This attribute specifies the ATM service category for both directions of the connection. If this attribute is *derivedFromBBC*, the nodes use the BBC and *bestEffort* attributes to determine the *atmServiceCategory* for a connection. If this attribute is not *derivedFromBBC*, 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. The *constantBitRate* 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. The *rtVariableBitRate* 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. The *nrtVariableBitRate* 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.

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Variable	Value
	The *unspecifiedBitRate* 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.
<specifiedPath>	is 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.
<tcBbc>	is the *tcBbc* value, one of *0*, *1*, *2*, *5*, *8*, *9*, *10*, *notApplicable*, or *derivedFromServiceCategory*. The default is *derivedFromServiceCategory*. The value *derivedFromServiceCategory* specifies that the nodes derive the actual value which for this connection from the value of the *atmServiceCategory*. Either this attribute has the value *derivedFromServiceCategory* or the *atmServiceCategory* attribute has the value *derivedFromBBC*, but not both. For more information, see the following documents: • NN10600-705 *Nortel Multiservice Switch 7400/15000/20000 ATM Traffic Management Fundamentals* • NN10600-706 *Nortel Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals* • NN10600-707 *Nortel Multiservice Switch 7400/15000/20000 ATM Queuing and Scheduling Fundamentals* • NN10600-708 *Nortel Multiservice Switch 7400/15000/20000 ATM CAC and Bandwidth Fundamentals*
<testCalledAddress>	is the *testCalledAddress* value, which value specifies the destination address of the test connection. The default value is a 0 to 40 hexadecimal string.
<testCalledVpiVci>	is the *testCalledVpiVci* value, which specifies the called VPI and VCI values for this test connection on the destination interface. The default value is 0.1.
<tracecrankback>	is the *tracecrankback* value, either *Yes or no*. The default value is *no*.

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Variable	Value
<txTdp_parm1 - 5>	is a vector of five decimal entries with values between 0 and 2147483647. The nodes associate these parameters with the *txtrafficDescType* attribute. The default vector is 0 0 0 0 0.
<txTdt>	is the *txTdt* value, 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 *txtrafficDescType* attribute determine the number and meaning of the parameters in the *txTrafficDescParm* attribute.
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Procedure job aid

PathTraceTest connection component hierarchy

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Initiating a connection trace

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

Procedure steps

Step	Action
1	Initiate a connection trace. **`trace [-s] [-v] [-a] atmif/<n> vcc/<x.y>`**
	--End--

Variable definitions

Variable	Value
<n>	is the number of the ATM interface.
<x.y>	is the VCC.

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Setting the destination address of the RouteFinder and the number of computed routes

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

Procedure steps

Step	Action
1	Set the destination address of the *RouteFinder*. **`set AtmRouting Pnni Rf destAddr <destAddr>`**
2	Set the maximum number of routes that you want to compute. **`set AtmRouting Pnni Rf maxRoutes <maxRoutes>`**

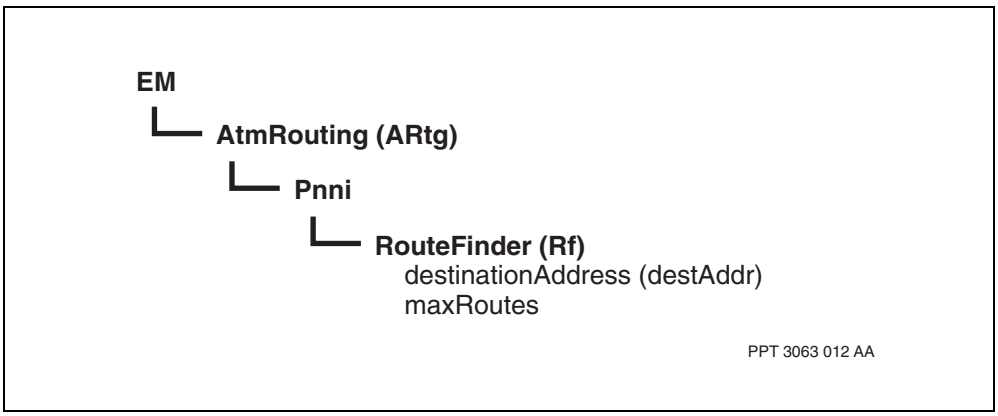
--End--

Variable definitions

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

Procedure job aid

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



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Setting the RouteFinder's ATM traffic requirements

Set the ATM traffic requirements for the RouteFinder.

Prerequisites

- You have completed the procedure Setting the destination address of the RouteFinder and the number of computed routes (page 109) before performing this procedure.

Procedure steps

Step	Action
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.

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```
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
```

--End--

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Variable definitions

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

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

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

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Variable	Value
<service>	is the service value, one of *unspecifiedBitRate*, *constantBitRate*, *rtVariableBitRate*, *nrtVariableBitRate*, or *derivedFromBBC*. Default is *unspecifiedBitRate*. This attribute specifies the ATM service category for both directions of the connection. If this attribute is *derivedFromBBC*, the nodes use the BBC and *bestEffort* attributes to determine the *atmServiceCategory* for a connection. If this attribute is not *derivedFromBBC*, 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. The *constantBitRate* 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. The *rtVariableBitRate* 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. The *nrtVariableBitRate* 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. The *unspecifiedBitRate* 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.

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Variable	Value
<tcBbc>	is the *tcBbc* value, one of *0*, *1*, *2*, *5*, *8*, *9*, *10*, *notApplicable*, or *derivedFromServiceCategory*. The default is *derivedFromServiceCategory*. The value *derivedFromServiceCategory* specifies that the nodes derive the actual value which for this connection from the value of the *atmServiceCategory*. Either this attribute has the value *derivedFromServiceCategory* or the *atmServiceCategory* attribute has the value *derivedFromBBC*, but not both. For more information, see the following documents: • NN10600-705 *Nortel Multiservice Switch 7400/15000/20000 ATM Traffic Management Fundamentals* • NN10600-706 *Nortel Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals* • NN10600-707 *Nortel Multiservice Switch 7400/15000/20000 ATM Queuing and Scheduling Fundamentals* • NN10600-708 *Nortel Multiservice Switch 7400/15000/20000 ATM CAC and Bandwidth Fundamentals*
<txTdp_parm1 - 5>	is a vector of five decimal entries with values between 0 and 2147483647. The nodes associate these parameters with the txtrafficDescType attribute. The default vector is 0 0 0 0 0.
<txTdt>	is the *txTdt* value, 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 *txtrafficDescType* attribute determine the number and meaning of the parameters in the *txTrafficDescParm* attribute.

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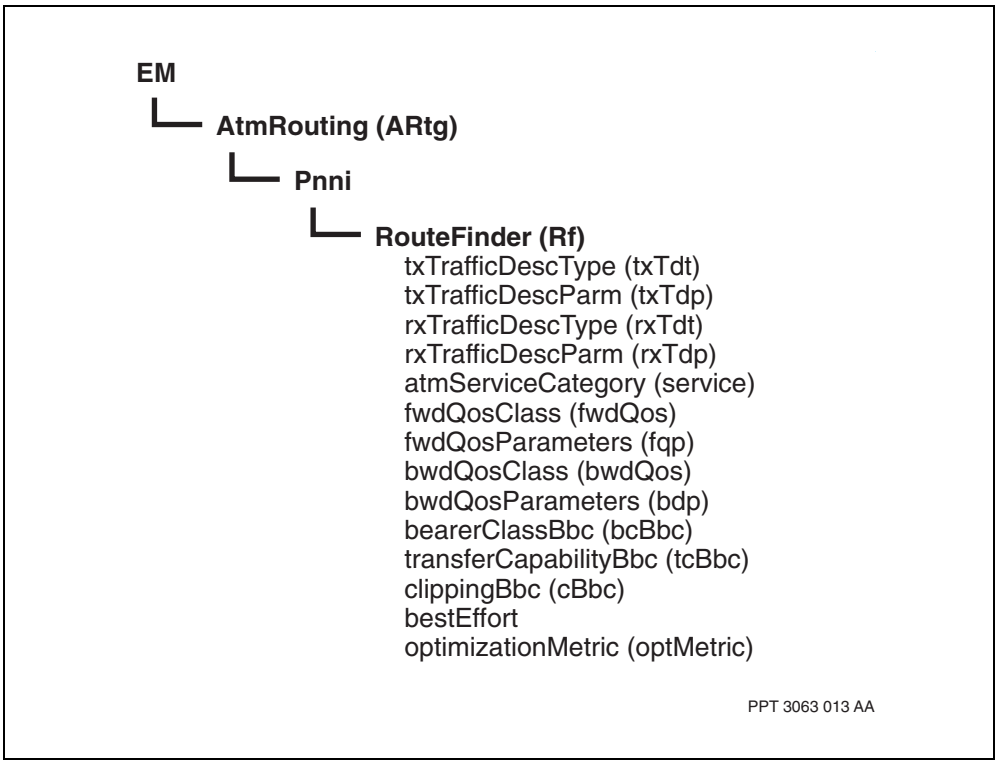
Procedure job aid

RouteFinder's ATM traffic requirements component hierarchy



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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

- You have performed the procedure Setting the destination address of the RouteFinder and the number of computed routes (page 109).
- You have performed the procedure Setting the RouteFinder's ATM traffic requirements (page 110).

Procedure steps

Step	Action
1	Set the *lbMinVariance (minVar)* attribute. **`set ARtg Pnni Rf minVar <minVar>`**
2	Set the *lbSlopeVariance* (*slopeVar*) attribute. **`set ARtg Pnni Rf slopeVar <slopeVar>`**
3	Set the *lbMethod* (*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>`**

--End--

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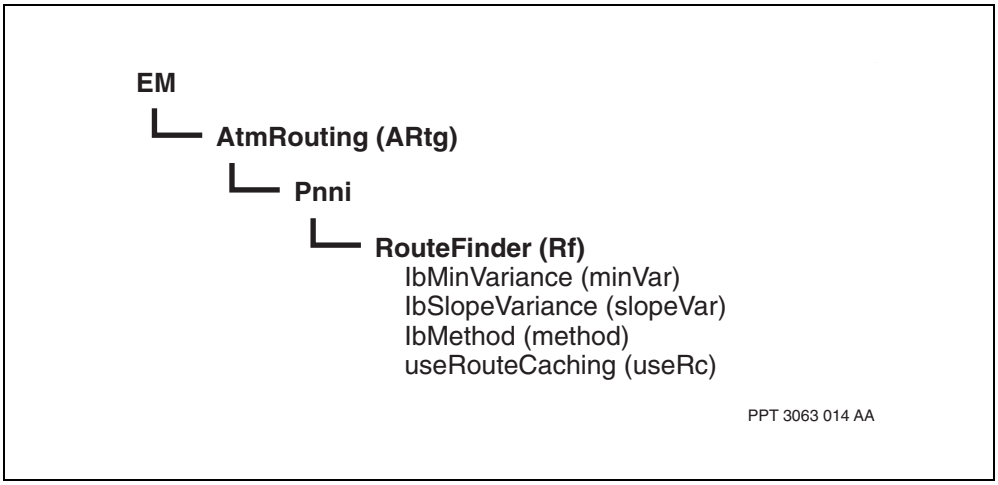
Variable definitions

Variable	Value
<method>	is the value specifying the method of load balancing under the *Rf* subcomponent. Values of the *method* attribute are maxAvCr, random, avCrProb, optMetricProb, avCrOptMetricProb, and none. If the value of the *method* attribute is set to none, then the PNNI routing algorithm does not perform load balancing and all available acceptable paths are displayed.
<minVar>	is the value specifying the minimum load balancing acceptable variance allowed for *RF's* optimization metric and service category.
<slopeVar>	is the value specifying the slope of the load balancing variance allowed for *RF's* optimization metric and service category.
<useRc>	is the value specifying whether the route cache or an on-demand route computation is used in determining the PNNI routes to the destination node. If the value of the *useRc* 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. If the value of the *useRc* 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 *LoadBalancing* component. If the values are not the same, the RouteFinder tool will perform an on-demand route computation.

Procedure job aid

RouteFinder route computation component hierarchy



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Setting the highest PNNI level used for route computation

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

Procedure steps

Step	Action
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**

--End--

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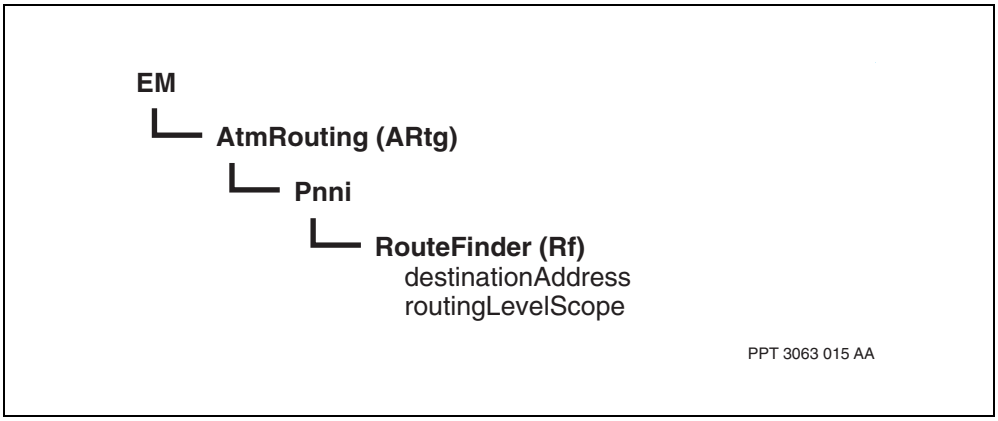
Variable definitions

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

Setting the highest PNNI level used in route computation component hierarchy



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Monitoring PNNI route caching

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

Procedure steps

Step	Action
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 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.

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See NN10600-710 *Nortel 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 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 Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals* and NN10600-710 *Nortel 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
```

--End--

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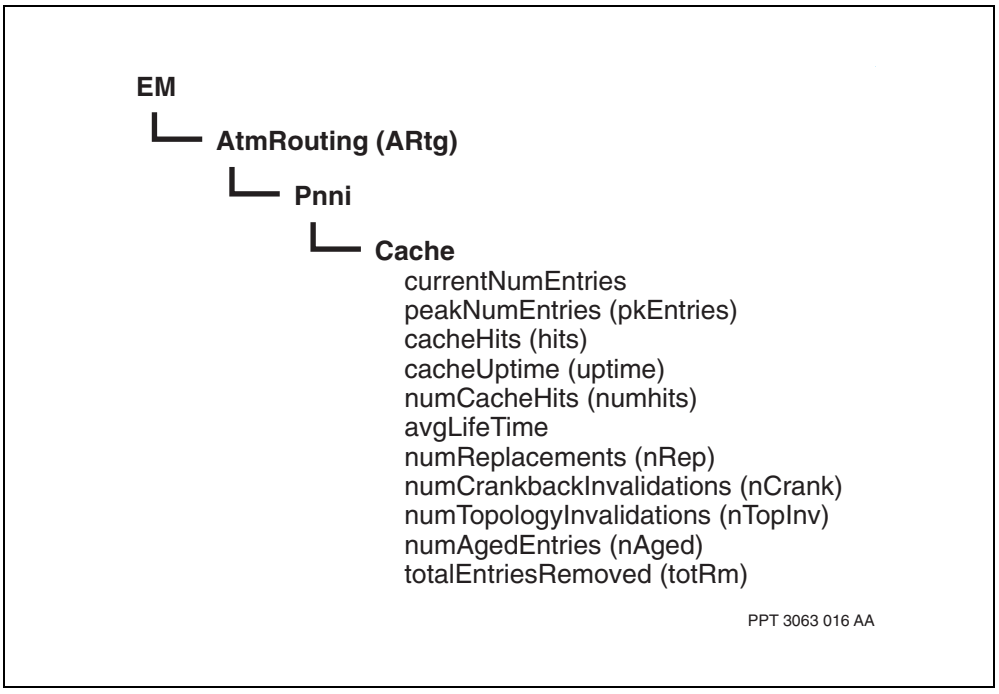
Procedure job aid

PNNI route caching component hierarchy



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Clearing the PNNI route cache

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

Prerequisites

- You have performed the procedure Monitoring PNNI route caching (page 122).

Procedure steps

Step	Action
1	Clear all routing path entries in the route cache. `clear ARtg Pnni Cache`
	--End--

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Monitoring PNNI node reachability

Monitor PNNi node reachability.

Procedure steps

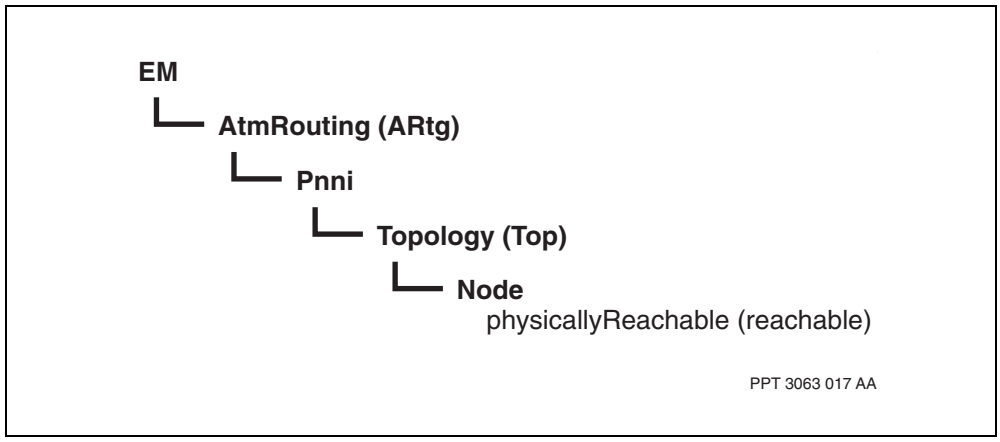
Step	Action
1	Determine if a PNNI node is reachable from the local node. **`display ARtg Pnni Top Node/<Node> reachable`**
	--End--

Variable definitions

Variable	Value
<Node>	is the node ID.

Procedure job aid

PNNI node reachability component hierarchy



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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

Step	Action
1	Display the active parent node's ATM end-system address. **display ARtg Pnni Topology/<Topology_level> activeParentNodeAddress** 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**

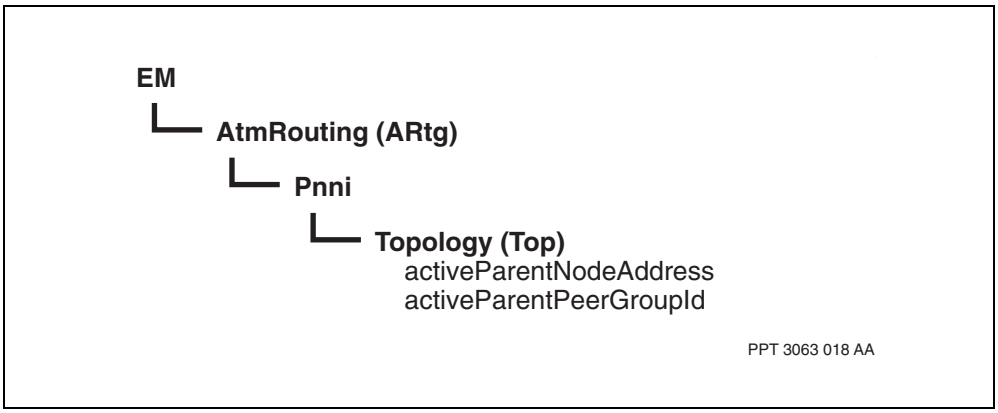
--End--

Variable definitions

Variable	Value
<Topology_level>	is the level in the PNNI networking hierarchy.

Procedure job aid

Topology database active parent node component hierarchy



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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

Step	Action
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. If the upnode has not yet been identified, the *upNodeAddress* attribute is set to zero. **`display ARtg Pnni Topology/<Topology_level> Node ULnk upNodeAddress`**
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`** 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.

--End--

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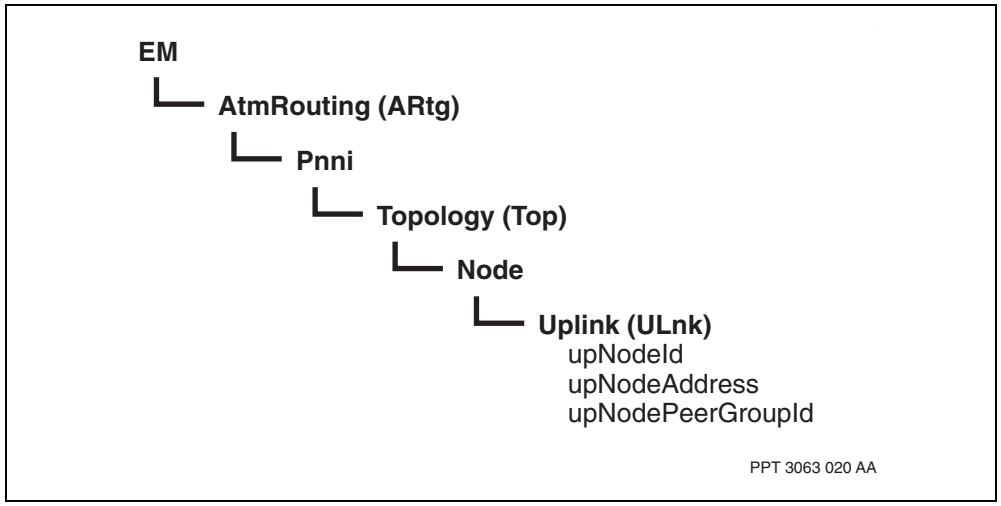
Variable definitions

Variable	Value
<Topology_level>	is the level in the PNNI networking hierarchy.

Procedure job aid

Topology database upnode component hierarchy



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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

Step	Action
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.

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```
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
```

--End--

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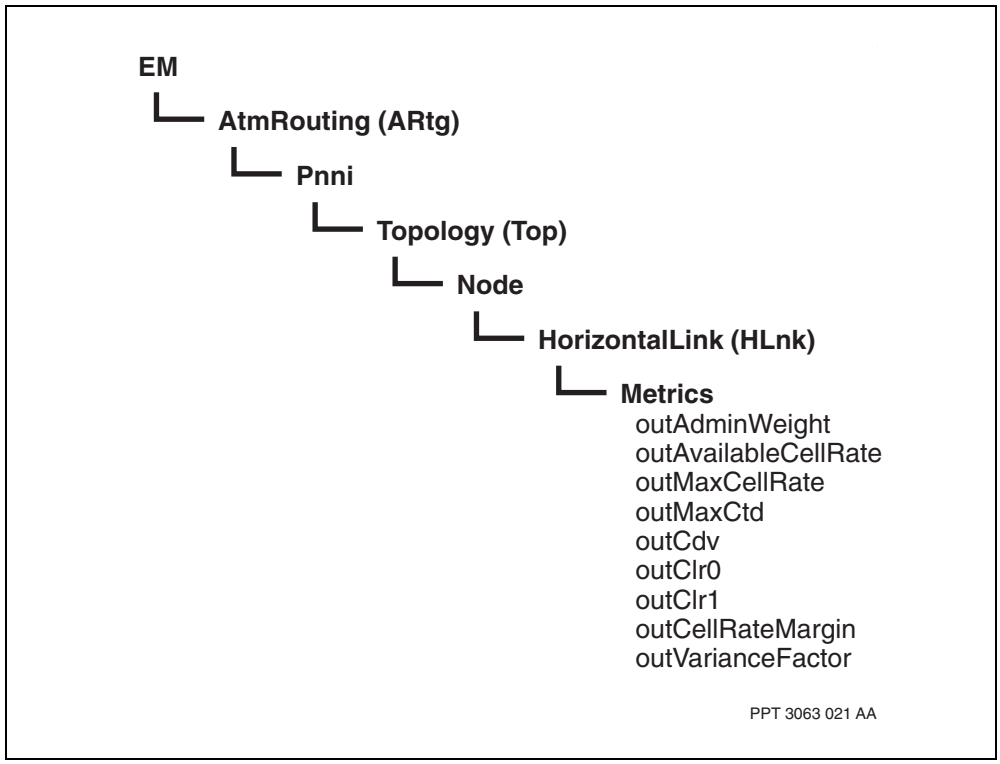
Variable definitions

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

Procedure job aid

Topology database horizontal link ATM service metrics component hierarchy



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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

Step	Action
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.

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```
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.

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```
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
```

--End--

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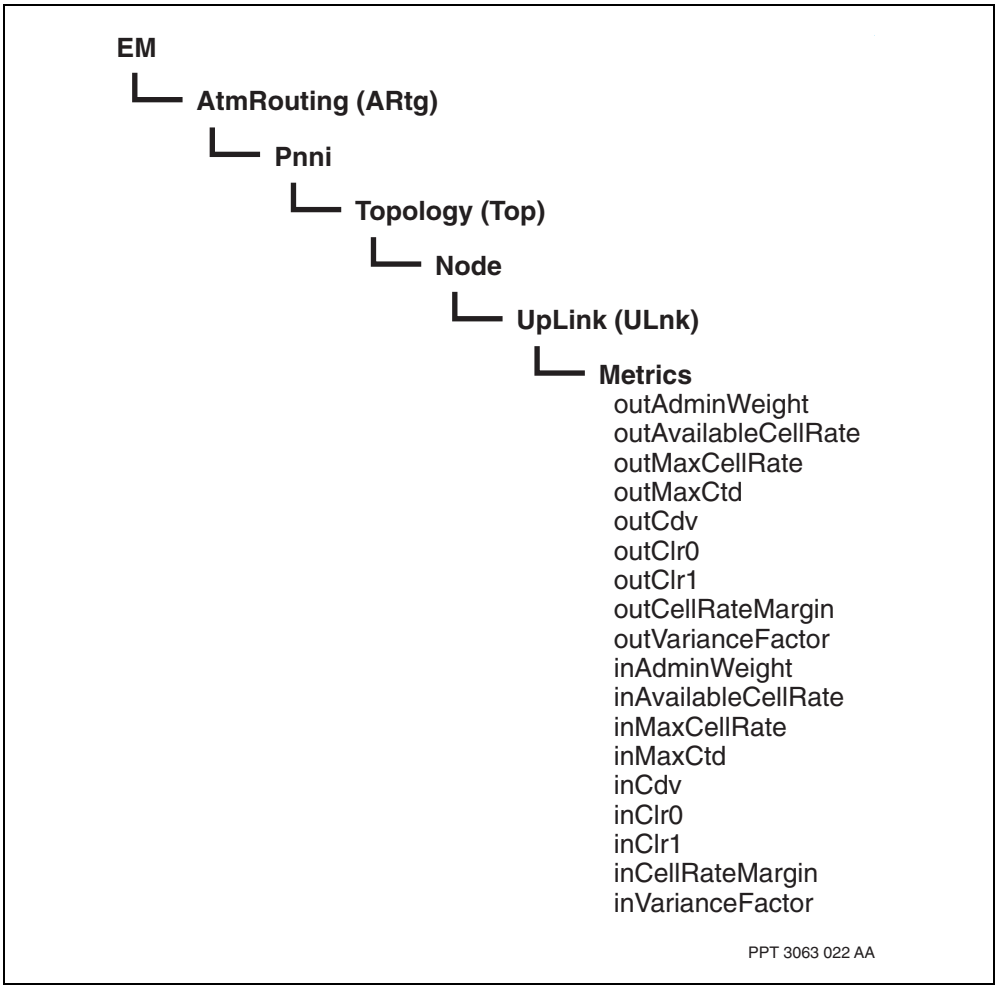
Variable definitions

Variable	Value
<ATM_service_category>	is the ATM service category.
<Node_nodeID>	is the node ID.
<Topology_level>	is the level in the PNNI networking hierarchy.
<UpLink_portID>	is the port ID representing the logical uplink associated with the *CfgNode*.

Procedure job aid

Topology database and uplink ATM service category metrics component hierarchy



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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

Step	Action
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**

--End--

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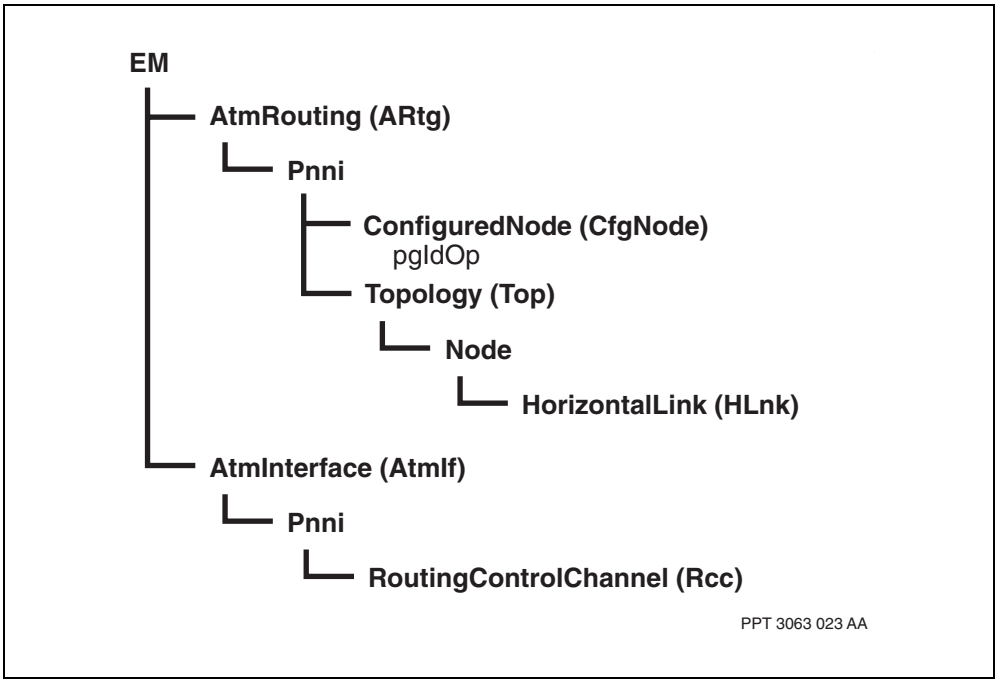
Variable definitions

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

Procedure job aid

Topology database and dynamically created PNNI network component hierarchy



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Monitoring the topology database using on-switch PNNI topology information translation

Monitor the topology database using on-switch PNNI topology information translation. You can obtain a complete view of the network topology, given a set of physical nodes in a PNNI network hierarchy.

Procedure steps

Step	Action
1	Display the NodeName component under Artg Pnni Top using step 2 through step 6.
2	Display the corresponding node ID instance for this node name. **display Artg PNNI Topology/<level> NodeName/<nodeName> nodeId**
3	Display whether there exists a PNNI path that connects the node corresponding to this component to the local node. **display Artg PNNI Topology/<level> NodeName/<nodeName> physicallyReachabl**
4	Display the preferred Peer Group Leader node ID advertised by the parent node component. **display Artg PNNI Topology/<level> NodeName/<nodeName> preferedPglNodeId**
5	Display the preferred Peer Group Leader node name advertised by the parent node component. **display Artg PNNI Topology/<level> NodeName/<nodeName> preferedPglNodeName**
6	Display the leadership priority advertised by the parent node component. **display Artg PNNI Topology/<level> NodeName/<nodeName> pglLeadershipPriority**
7	Display the HLnk component under Artg Pnni Top NodeName using step 8 through step 13.
8	Display the node ID of the node at the near end of this horizontal link:. **display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> nodeId**
9	Display the link's port ID on the node at the near end of this horizontal link **display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> portId**
10	Display the node ID of the node at the far end of this horizontal link.

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display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> remoteNodeId

11 Display the node name of the node at the far end of this horizontal link.

display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> remoteNodeName

12 Display the link's port ID on the node at the far end of this horizontal link.

display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> remotePortId

13 Display the interface name on the node at the far end of this horizontal link.

display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> remoteInterfaceName

14 Display the Metrics component under Artg Pnni Topology NodeName Hlink using step 15 through step 23.

15 Display the advertised administrative weight of a horizontal link for the specified service category for the outgoing direction.

display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> Metrics/<service> outAdminWeight

16 Display the advertised available cell rate of a horizontal link, in cells per second, for the specified service category for the outgoing direction.

display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> Metrics/<service> outAvailableCellRate

17 Display the advertised maximum cell rate of a horizontal link, in cells per second, for the specified service category for the outgoing direction.

display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> Metrics/<service> outMaxCellRate

18 Display the advertised maximum cell transfer delay of a horizontal link, in microseconds, for the specified service category for the outgoing direction.

display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> Metrics/<service> outMaxCtd

19 Display the advertised peak-to-peak cell delay variation of a horizontal link, in microseconds, for the specified service category for the outgoing direction.

display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> Metrics/<service> outCdv

20 Display the advertised cell loss ratio for CLP0 of a horizontal link for the specified service category for the outgoing direction.

display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> Metrics/<service> outClr0

21 Display the advertised cell loss ratio for CLP0+1 of a horizontal link for the specified service category for the outgoing direction.

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display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> Metrics/<service> outClr01

22 Display the advertised cell rate margin in cells per second of a horizontal link for the specified service category for the outgoing direction.

display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> Metrics/<service> outCellRateMargin

23 Display the advertised variance factor of a horizontal link for the specified service category for the outgoing direction.

display Artg PNNI Topology/<level> NodeName/<nodeName> HLnk/<interfaceName> Metrics/<service> outVarianceFactor

24 Display the UpLink component under Artg Pnni Top NodeName using step 25 through step 28.

25 Display the node ID of the node at the far end of this uplink.

display Artg PNNI Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> upnodeId

26 Display the node name and the level at which the node operates for the node at the far end of the uplink.

display Artg PNNI Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> upnodeName

27 Display the address of the node at the far end of this uplink.

display Artg PNNI Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> upnodeAddress

28 Display the peer group ID of the node at the far end of this uplink.

display Artg PNNI Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> upnodePeerGroupId

29 Display the Metrics component under Artg Pnni Top NodeName UpLink using step 30 through step 45.

30 Display the advertised administrative weight of an uplink for the specified service category for the outgoing direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> outAdminWeight

31 Display the advertised available cell rate of an uplink, in cells per second, for the specified service category for the outgoing direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> outAvailableCellRate

32 Display the advertised maximum cell rate of an uplink, in cells per second, for the specified service category for the outgoing direction.

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display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> outMaxCellRate

33 Display the advertised max. cell transfer delay of an uplink, in microseconds, for the specified service category for the outgoing direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> outMaxCtd

34 Display the advertised cell delay variation of an uplink, in microseconds, for the specified service category for the outgoing direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> outCdv

35 Display the advertised cell loss ratio for CLP0 of an uplink for the specified service category for the outgoing direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> outClr0

36 Display the advertised cell loss ratio for CLP0+1 of an uplink for the specified service for the outgoing direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> outClr01

37 Display the advertised cell rate margin in cells per second of an uplink for the specified service category for the outgoing direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> outCellRateMargin

38 Display the advertised variance factor of an uplink for the specified service category for the outgoing direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> outVarianceFactor

39 Display the advertised administrative weight of an uplink for the specified service category for the incoming direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> inAdminWeight

40 Display the advertised available cell rate of an uplink, in cells per second, for the specified service category for the incoming direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> inAvailableCellRate

41 Display the advertised maximum cell rate of an uplink, in cells per second, for the specified service category for the incoming direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> inMaxCellRate

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42 Display the advertised max. cell transfer delay of an uplink, in microseconds, for the specified service category for the incoming direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> inMaxCtd

43 Display the advertised cell delay variation of an uplink, in microseconds, for the specified service category for the incoming direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> inCdv

44 Display the advertised cell loss ratio for CLP0 of an uplink for the specified service category for the incoming direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> inClr0

45 Display the advertised cell loss ratio for CLP0+1 of an uplink for the specified service for the incoming direction.

display Artg Pnni Topology/<level> NodeName/<nodeName> UpLink/<interfaceName> Metrics/<service> inClr01

46 Display the Addr Component under Artg Pnni Top NodeName, indicating the highest level in the PNNI hierarchy up to which this address will be advertised.

display Artg Pnni Top/<level> NodeName/<nodeName> Addr/<instance> scope

47 Display the CfgNode Component under Artg Pnni, indicating the nodeName of the node which this node believes is the peer group leader.

display Pnni CfgNode/<level> preferredPglNodeName

48 Display the Nbr component under Artg Pnni CfgNode, indicating the name of the node that is a neighbor to this node at this level.

display Artg Pnni CfgNode/<level> Nbr/<nodeId> neighborName

49 Display the Rcc Component under Artg Pnni CfgNode, indicating the neighboring peer LGN's name.

display Artg Pnni CfgNode/<level> Rcc/<nodeAddr> neighborName

50 Display the UpLink Component under Artg Pnni CfgNode, indicating the name of the node at the far end of this link and the level at which the node operates.

display Artg Pnni CfgNode/<level> UpLink/<nodeAddr> upnodeName

51 Display the Node Component under Artg Pnni Topology using step 52 and step 54.

52 Display the name of the corresponding instance for this Node component under the ARtg Pnni Top/<level> NodeName/<node name> component.

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Display Artg Pnni Top/<level> Node/<nodeId> nodeName

display Artg Pnni Top/<level> Node/<nodeId> preferredPglNodeName

53 Display the HLnk Component under Artg Pnni Top Node using step 54 through step 57.

54 Display the node name of the node at the far end of this horizontal link.

display Artg Pnni Top/<level> Node/<nodeId> HLnk/ <portId> nodeName

55 Display the interface name on the node at the far end of this horizontal link.

display Artg Pnni Top/<level> Node/<nodeId> HLnk/ <portId> interfaceName

56 Display the interface name at this end of the horizontal link.

display Artg Pnni Top/<level> Node/<nodeId> HLnk/ <portId> remoteNodeName

57 Display the interface name on the node at the far end of this horizontal link.

display Artg Pnni Top/<level> Node/<nodeId> HLnk/ <portId> remoteInterfaceName

58 Display the UpLink component under Artg Pnni Top Node, indicating the node name of the node at the far end of the uplink and the level at which the node.

display Artg Pnni Top/<level> Node/<nodeId> UpLink/ <portId> upnodeName

59 Display the Rcc Component under AtmIf Pnni using step 60 and step 61.

60 Display the node name of the node at the far end of the PNNI link and the level at which the node operates.

display AtmIf/<instance> Pnni Rcc remoteNodeName

61 Display the interface name at the far end of the PNNI link.

display AtmIf/<instance> Pnni Rcc remoteInterfaceName

--End--

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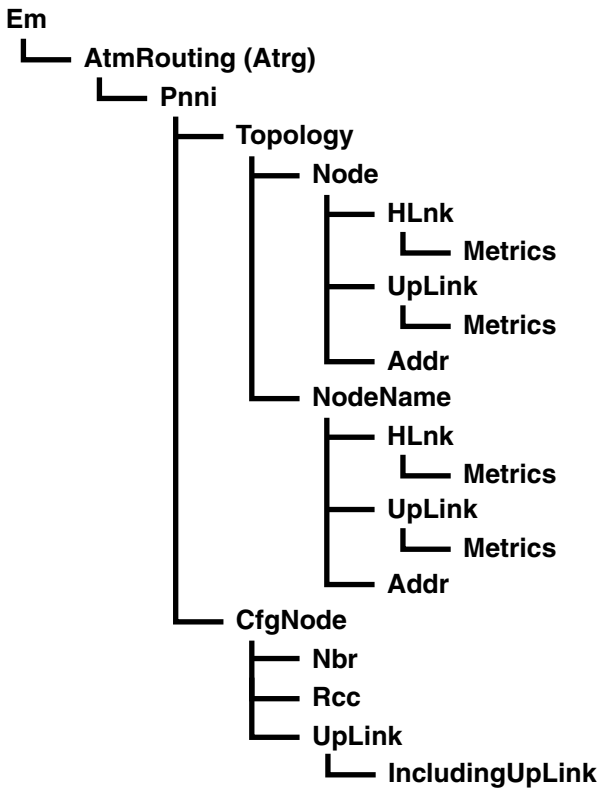
Variable definitions

Variable	Value
<instance>	is the *AtmIf* instance.
<interfaceName>	is the interface name.
<level>	is the *PNNI* or *CfgNode* level.
<nodeAddr>	is the node address.
<nodeID>	is the node ID.
<service>	is the service value.

Procedure job aid

Topology database on-switch PNNI topology information translation component hierarchy



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Monitoring performance for Multiservice Switch 7400 devices

Use this section to learn about 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 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.

Navigation

- OAM cells and their functions (page 147)
- Cell loss ratio (CLR) (page 147)
- CLR measurement method (page 147)
- CLR calculation (page 149)
- Accuracy of CLR measurements (page 153)
- Availability ratio (page 156)

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- Accuracy of CLR measurements (page 153)
- Current performance monitoring statistics (page 158)
- Performance monitoring accounting (page 158)
- ATM IP FP deployment requirements (page 159)
- Performance monitoring and PNNI edge based rerouting (page 163)
- Expected behavior (page 164)
- PM limitations (page 170)

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 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 Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

CLR measurement method

Nortel 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. The figure Sample boundary configuration for device and link side measurements (page 148) shows a sample network configured with OAM boundaries. This figure distinguishes between device side and link side

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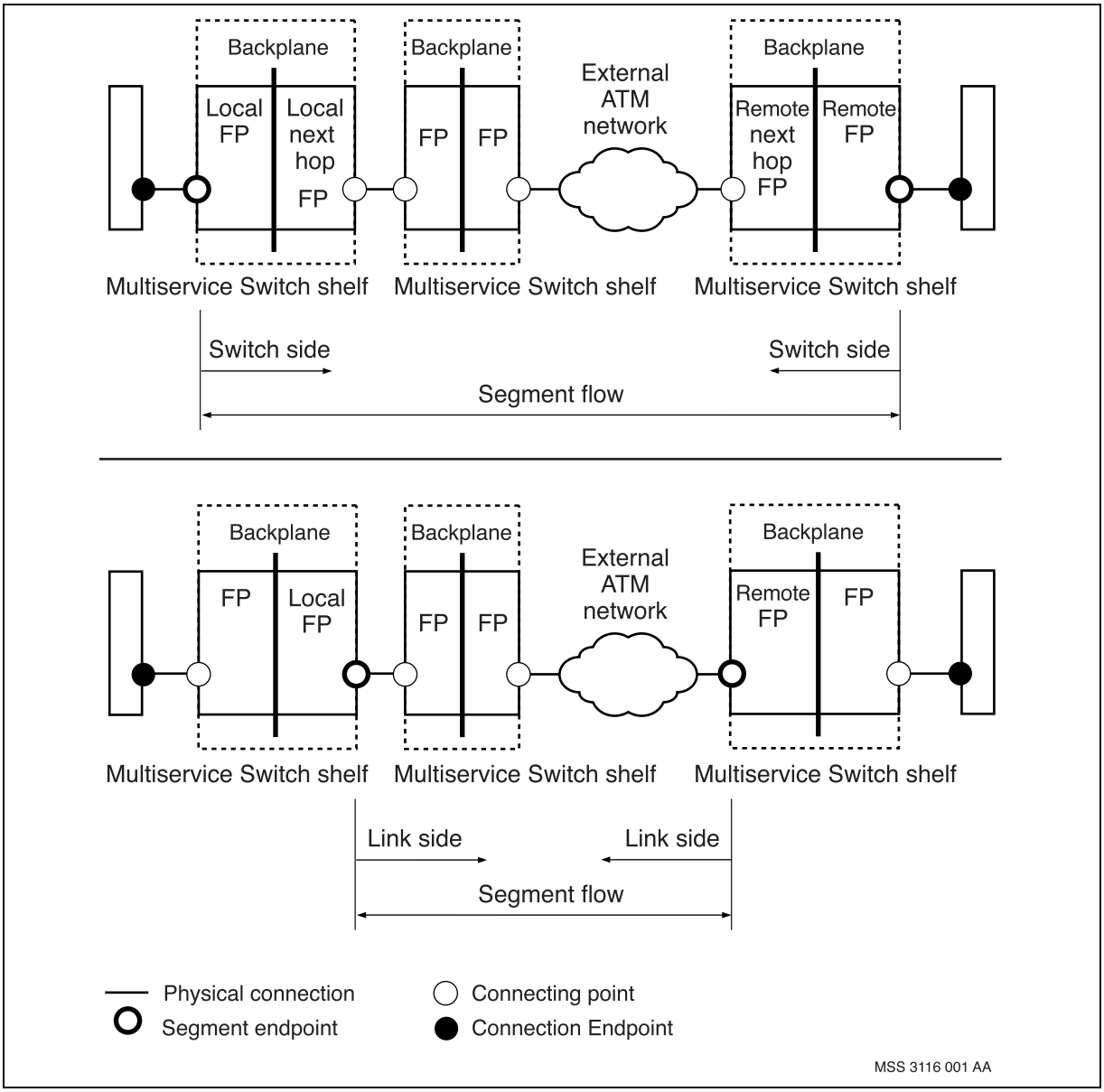
measurements. The CLR is reported at the provisioned node, and the results are placed into the accounting record for the connection under study and reported by the component administration system (CAS).

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

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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.

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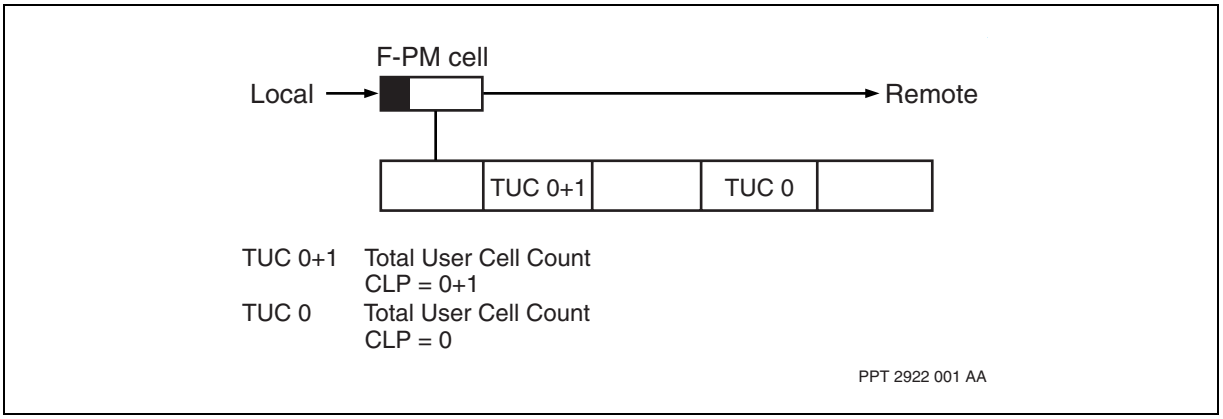
CLR calculation process

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.

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.

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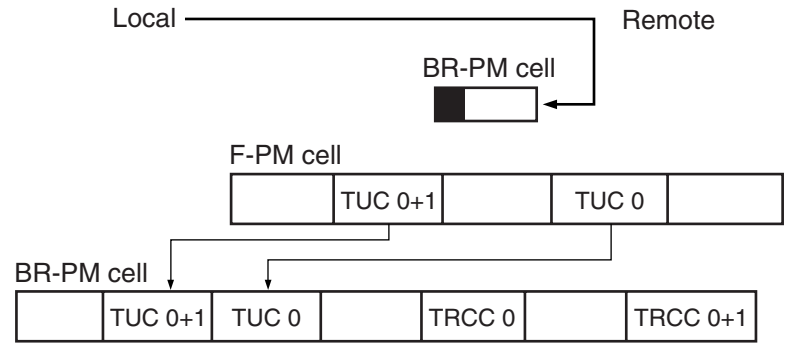
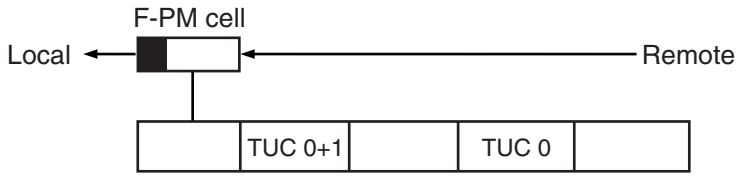


TUC 0+1: Total User Cell Count CLP = 0+1
TUC 0: Total User Cell Count CLP = 0
TRCC 0: Total Received Cell Count CLP = 0
TRCC 0+1: Total Received Cell Count CLP = 0+1

PPT 2922 002 AA

3 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.



TUC 0+1 Total User Cell Count CLP = 0+1
TUC 0 Total User Cell Count CLP = 0

PPT 2922 003 AA

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.

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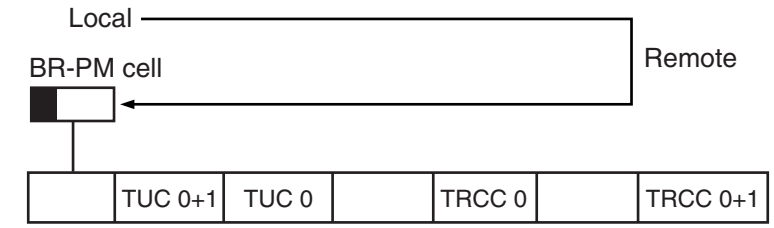
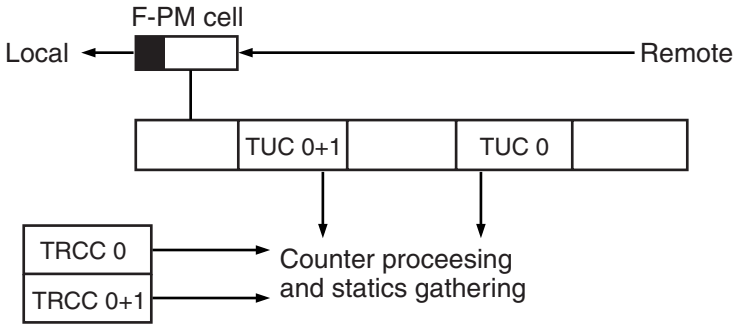


TUC 0+1: Total User Cell Count CLP = 0+1
TUC 0: Total User Cell Count CLP = 0
TRCC 0: Total Received Cell Count CLP = 0
TRCC 0+1: Total Received Cell Count CLP = 0+1

PPT 2922 004 AA

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.



TUC 0+1: Total User Cell Count CLP = 0+1
TUC 0: Total User Cell Count CLP = 0
TRCC 0: Total Received Cell Count CLP = 0
TRCC 0+1: Total Received Cell Count CLP = 0+1

PPT 2922 005 AA

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:

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$$CLR_0 = \frac{NumberOfCellsTransmitted_0 - NumberOfCellsReceived_0}{NumberOfCellsTransmitted_0}$$

$$CLR_{0+1} = \frac{NumberOfCellsTransmitted_{0+1} - NumberOfCellsReceived_{0+1}}{NumberOfCellsTransmitted_{0+1}}$$

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 153)
- OAM PM cell loss tolerance and counter rollover (page 153)
- Limits of accuracy due to PM cell loss (page 155)
- Forward direction (page 155)
- Backward direction (page 155)

Hardware measurements

Since Nortel 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

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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 154) 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 154). 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.

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

Attention: PCR > 409 600 cell/s are 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.

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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:

$$\text{Worst case } CLR_{fwd} = \frac{\text{totalTx} + (\text{fwdPmCellDiscardCount} * N) - \text{totalRx}}{\text{totalTx} + \text{fwdPmDiscardCount} * N)}$$

The percent accuracy of the measurement then becomes

$$\frac{\text{measuredClr}}{\text{worstCaseClr}_{bwd}} \times 100$$

PPT 3121 001 AA

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:

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$$\text{Worst case } CLR_{bwd} = \frac{\text{totalTx} + (\text{bwdPmCellDiscardCount} * N) - \text{totalRx}}{\text{totalTx} + (\text{bwdPmDiscardCount} * N)}$$

The percent accuracy of the measurement then becomes

$$\frac{\text{measuredClr}}{\text{worstCaseClr}_{bwd}} \times 100$$

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 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 Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

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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 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:

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$$AR = \frac{\text{time in available state}}{\text{total observation period}}$$

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 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 Multiservice Switch 7400/15000/20000 Accounting*. For details on provisioning ATM accounting see NN10600-710 *Nortel Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

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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*.

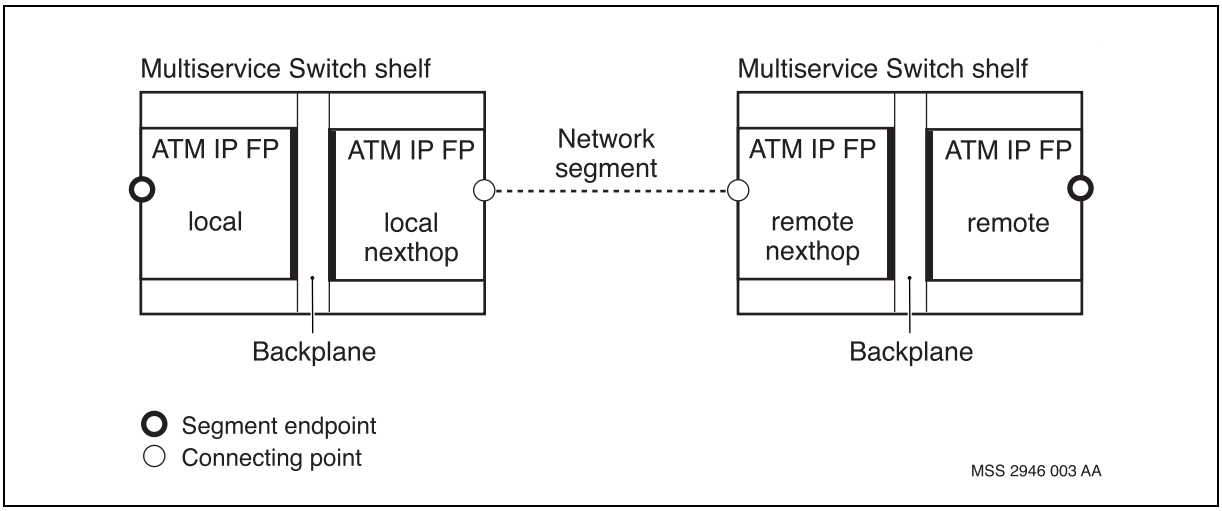
PM accounting records are created at the configured end of the connection.

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 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 159).

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 160).

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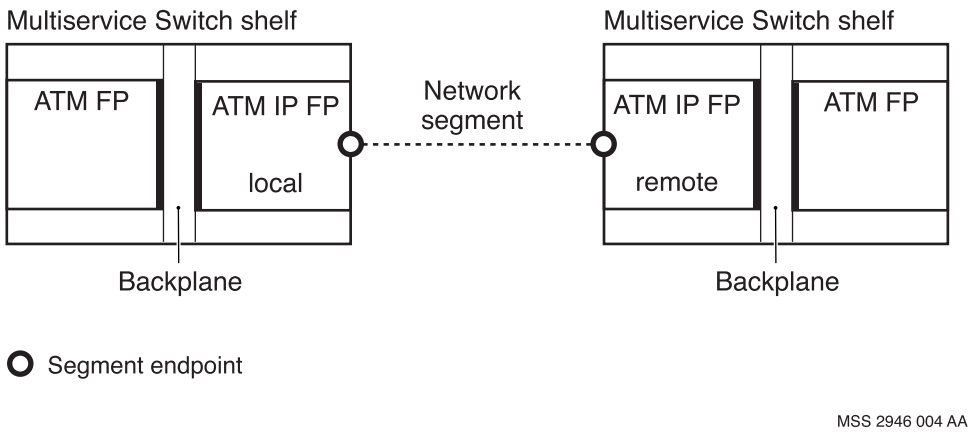
ATM IP FP locations for link side PM



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 161) 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.

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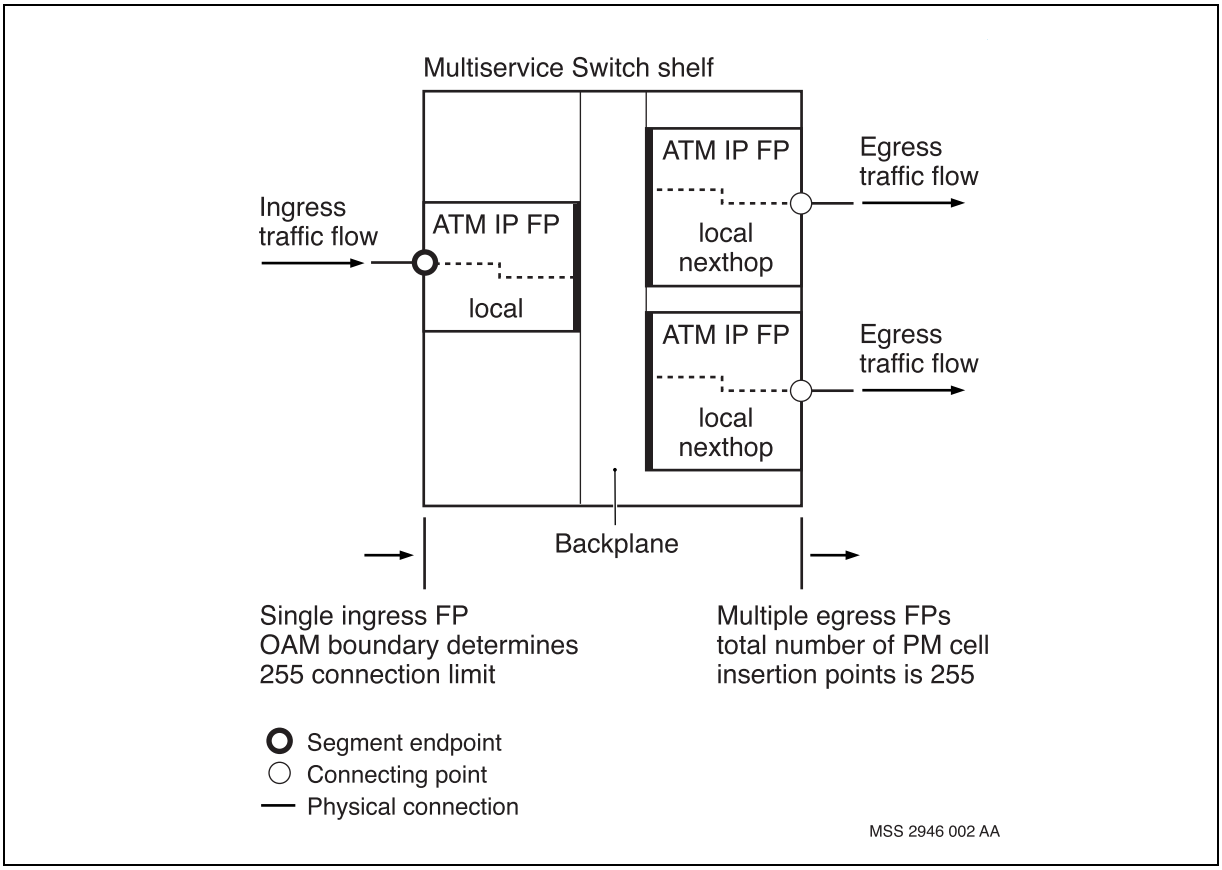
Connection support determined by OAM boundary



The figure Connection support determined by FP location and OAM boundary (page 162) 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 162).

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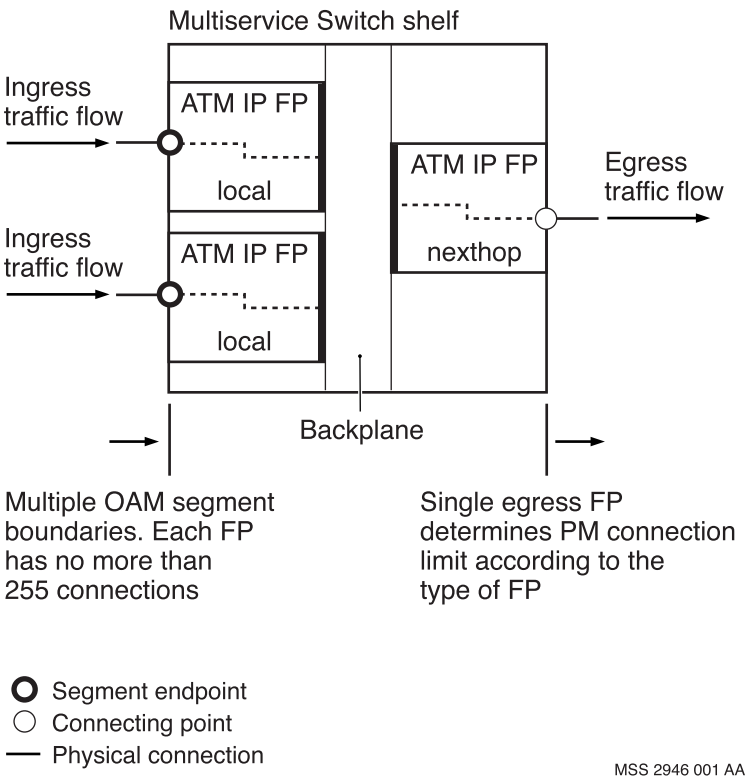
Connection support determined by FP location and OAM boundary



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 162).

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

(1 of 2)

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Maximum number of PM connections per card type (continued)

FP types	Maximum number of PM connections	Maximum number of PM connections per FP
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
(2 of 2)		

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 163)
- Path optimization is performed inside the OAM segment (page 163)
- The OAM segment is part of the path that requires optimization (page 163)

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 Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*.

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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 164)
- Port failure (page 167)
- SPVC scenarios (page 169)

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 164)
- Local next hop card failure (page 165)
- Remote segment endpoint card failure (page 166)
- Remote next hop card failure (page 167)

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.

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Local next hop card failure

Connection type	Expected behaviors
PVC	Measurements are stored by the segment endpoint.
	AR state changes to unavailable until card recovers.
	CLR is not updated while unavailable.
	AR state changes to available when traffic is received.
	Device side CLR activation is triggered when PVC is configured.
	CA resources remain unchanged on local and remote ends.
SPVC	Connection is down until the card recovers and PNNI/UNI established.
	Link and device side AR in unavailable state.
	CLR is not updated.
	Measurements are stored at the segment endpoint.
	CA resources are decremented for F-PM and BR-PM, since the hardware is no longer configured.
	CA resources remain for CC since availability is measured while the connection is down.
	Activation for CLR restarts after SPVC re-establishes.
SVC	Connection is released. PM component is deleted.
	CA resources are decremented on the remote end.

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Remote segment endpoint card failure

Connection type	Expected behaviors
PVC	Local segment endpoint detects LOC and AR state changes to unavailable.
	CLR is not updated while AR is unavailable.
	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.
	CA resources on remote end are cleared when connection is down and incremented during re-activation.
	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.
SPVC	Connection is down until the card recovers and PNNI/UNI established.
	Link and device side AR in unavailable state.
	CLR is not updated.
	Measurements are stored at the segment endpoint.
	CA resources are decremented for F-PM and BR-PM, since the hardware is no longer configured.
	CA resources remain for CC since availability is measured while the connection is down.
	Activation for CLR restarts after SPVC re-establishes.
SVC	Connection is released. PM component is deleted.
	CA resources are decremented on the remote end.

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Remote next hop card failure

Connection type	Expected behaviors
PVC	Availability state changes to unavailable until the card recovers. CA resources on local and remote end remain the same during the crash and recovery. When the PVC AR status is unavailable, CLR is not computed. If AR is not turned on, CLR will not be computed until the PVC comes up. 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.
SPVC	Connection is down until the card recovers and PNNI/UNI established. Link and device side AR in unavailable state. CLR is not updated. Measurements are stored at the segment endpoint. CA resources are decremented for F-PM and BR-PM, since the hardware is no longer configured. CA resources remain for CC since availability is measured while the connection is down. Activation for CLR restarts after SPVC re-establishes.
SVC	Connection is released. PM component is deleted. CA resources are decremented on the remote end.

Port failure

The following tables contain information on the types of port failure and the behaviors associated with certain connections:

- Local port failure (page 168)
- Remote port failure (page 169)

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Local port failure

Connection type	Expected behaviors
PVC	Device side AR stays available, since it is monitoring in the direction of the segment and the segment itself remains available. For link side AR, the availability status changes to unavailable until the port is up again. If AR is enabled CLR is unaffected while the AR state is available, and does not update when the AR state is unavailable. If AR is not enabled, CLR will update.
SPVC	Connection is down until the card recovers and PNNI/UNI established. Link and device side AR in unavailable state. CLR is not updated. Measurements are stored at the segment endpoint. CA resources are decremented for F-PM and BR-PM, since the hardware is no longer configured. CA resources remain for CC since availability is measured while the connection is down. Activation for CLR restarts after SPVC re-establishes.
SVC	Connection is released. PM component is deleted. CA resources are decremented on the remote end.

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Remote port failure

Connection type	Expected behaviors
PVC	Device side AR stays available because it is monitoring in the direction of the segment and the segment itself remains available. Link side AR state changes to unavailable. Local end will not receive the CC cells and enters into LOC. Remote end does not receive CC cells and enters LOC. The availability status changes to unavailable until the port is up again. CLR is the same as for local port behavior.
SPVC	Connection is down until the card recovers and PNNI/UNI established. Link and device side AR in unavailable state. CLR is not updated. Measurements are stored at the segment endpoint. CA resources are decremented for F-PM and BR-PM, since the hardware is no longer configured. CA resources remain for CC since availability is measured while the connection is down. Activation for CLR restarts after SPVC re-establishes.
SVC	Connection is released. PM component is deleted. CA resources are decremented on the remote end.

SPVC scenarios

The following table SPVC scenarios table (page 169) contains the types of behaviors associated with certain commands:

SPVC scenarios table

Scenario	Expected behaviors
Clear	CLR and AR both need to re-activate in order to re-configure the remote end after re-establishment AR state is unaffected; no state change should be detected since re-establishment should occur before LOC would be detected No cell loss is reported because of the re-configuration

(1 of 2)

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SPVC scenarios table (continued)

Scenario	Expected behaviors
Reroute	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. AR state is unaffected; no state change should be detected since re-establishment should occur before LOC would be detected. No cell loss is reported because of the reconfiguration.
(2 of 2)	

PM limitations

Here is a list of configurations that are not supported:

- Provisioning the next hop ATM interface is not permitted (page 170)
- Limit of 255 connections per FP (page 170)
- Counting of CA resources (page 171)
- Requirements for forward traffic for certain recovery scenarios (page 171)
- Changes to the remote OAM segment boundary (page 171)
- Activation attempt on an unsupported remote card (page 171)
- Deleting a PVC with active PM measurements (page 171)
- UPC policing and CBR traffic (page 172)
- Accounting problem (page 172)

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.

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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

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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.

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Multiservice Switch ATM fault management overview

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

Navigation

- ATM fault management (page 174)
- Monitoring ATM services (page 175)
- Converting port ID interfaces (page 182)
- Considerations for monitoring queue length (page 184)
- Troubleshooting ATM services (page 185)

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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 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.

ATM fault troubleshooting can be done by sending F4/F5 OAM cells from third party equipment to Nortel Multiservice Switch systems. However, to implement this protection mechanism, Multiservice Switch answers up to 3 OAM cells per second. Once this limit is achieved, the vpc/vcc enters the OAM congestion state, so the next loopback cells are dropped. The exit criteria of the OAM congestion state is to stay one second without receiving the F4/F5 OAM cells.

The section Monitoring ATM services (page 175) introduces the various components which should be monitored to determine how the ATM system is operating. The section Troubleshooting ATM services (page 185) identifies the sections where specific troubleshooting tasks are explained.

Operational attributes

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

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Monitoring ATM services

Nortel 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 175) to monitor your system at the FP level

2 see Monitoring ATM interfaces (page 175) to determine how ATM interface are handling ATM traffic

3 see Monitoring ATM connections (page 175) to examine individual connections

Monitoring ATM function processors

You should begin monitoring your Nortel 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 8)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 16)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 Multiservice Switch system are operating. The following sections provide information about monitoring ATM connections:

- Connections monitoring (page 32)
- Signaling monitoring (page 60)
- Routing monitoring (page 63)

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Troubleshooting connections on an ATM network

The table Handling problems (page 194) provides guidelines on how to respond to problems that may occur with connections on an ATM network.

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 Trace command allows you to locate VCC and VPC connection faults (refer to the procedures Locating VCC faults (page 189) and Locating VPC faults (page 191). The section Trace loopbacks (page 176) introduces the Trace command and provides examples of its use.

Trace loopbacks

Trace loopbacks are Nortel 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 177), Example: Trace command issued on a connecting point within a Multiservice Switch-only segment (page 178), and Example: Trace command issued on a connecting point within a multi-vendor segment (page 179).

Attention: 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.

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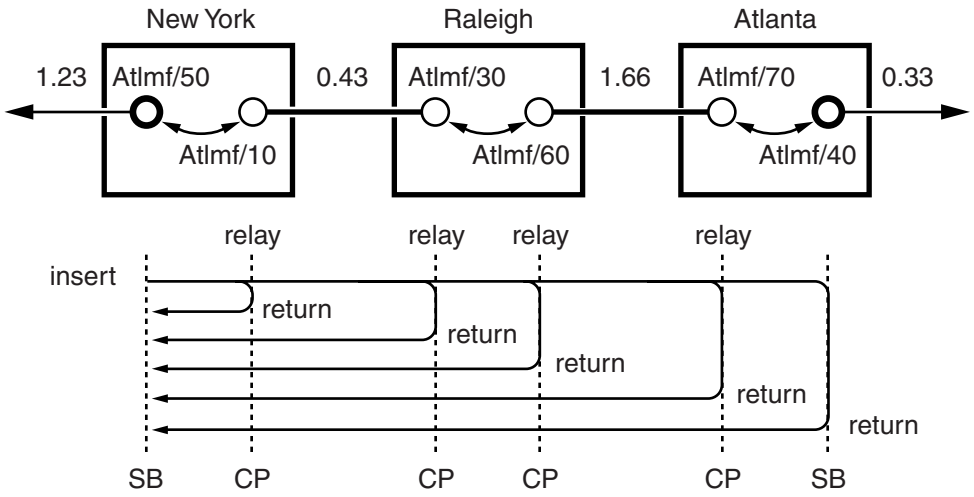
Example: Trace command issued on a segment end-point within a Multiservice Switch-only segment



Note 1: Atmlf/50 (New York) is the traced interface.

Note 2: The order of the connection points displayed in the trace responce list may not correspond to the actual order of the connection points along the connection.

```
> trace Atmlf/50 Vcc/1.23
Switch side trace result:
      EM/New York Atmlf/10 Vcc/0.43
      EM/Raleigh Atmlf/30 Vcc/0.43
      EM/Raleigh Atmlf/60 Vcc/1.66
      EM/Atlanta Atmlf/70 Vcc/1.66
      EM/Atlanta Atmlf/40 Vcc/0.33
```

The display on the monitor in New York

SB Segment Boundary CP Connecting Point

PPT 2629 001 AA

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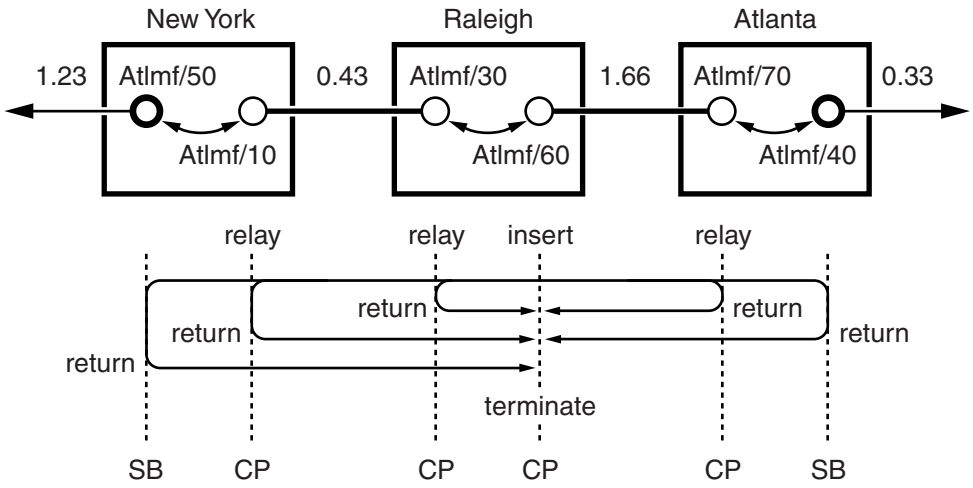
Example: Trace command issued on a connecting point within a Multiservice Switch-only segment



Note 1: Atmlf/60 (Raleigh) is the traced interface.

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 2630 001 AA

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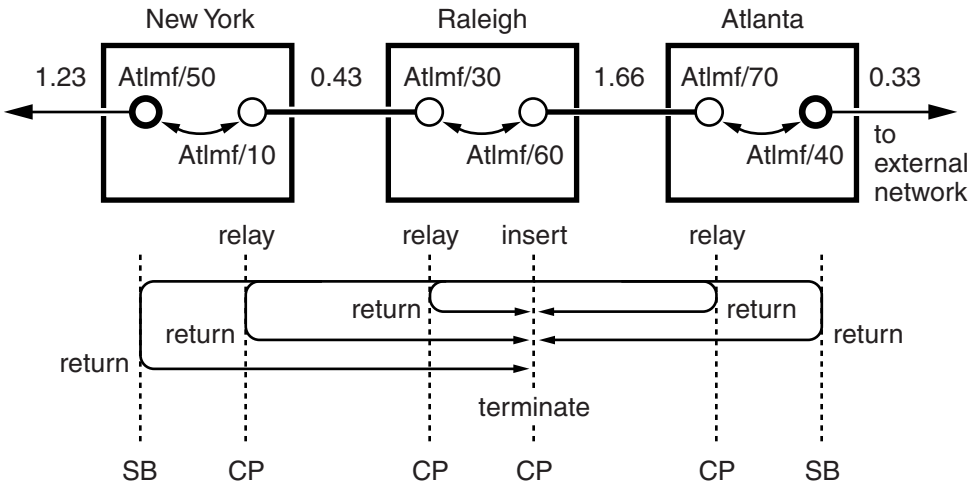
Example: Trace command issued on a connecting point within a multi-vendor segment



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 180).

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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
With the connection point setting, proprietary (trace) OAM cells are sent to the external network.		

Test capabilities

Nortel 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 181) 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 Connections monitoring (page 32).

The procedure Performing a connection test (page 199) explains how to use this feature. The procedure Displaying connection test results (page 201) explains how to display specific test results.

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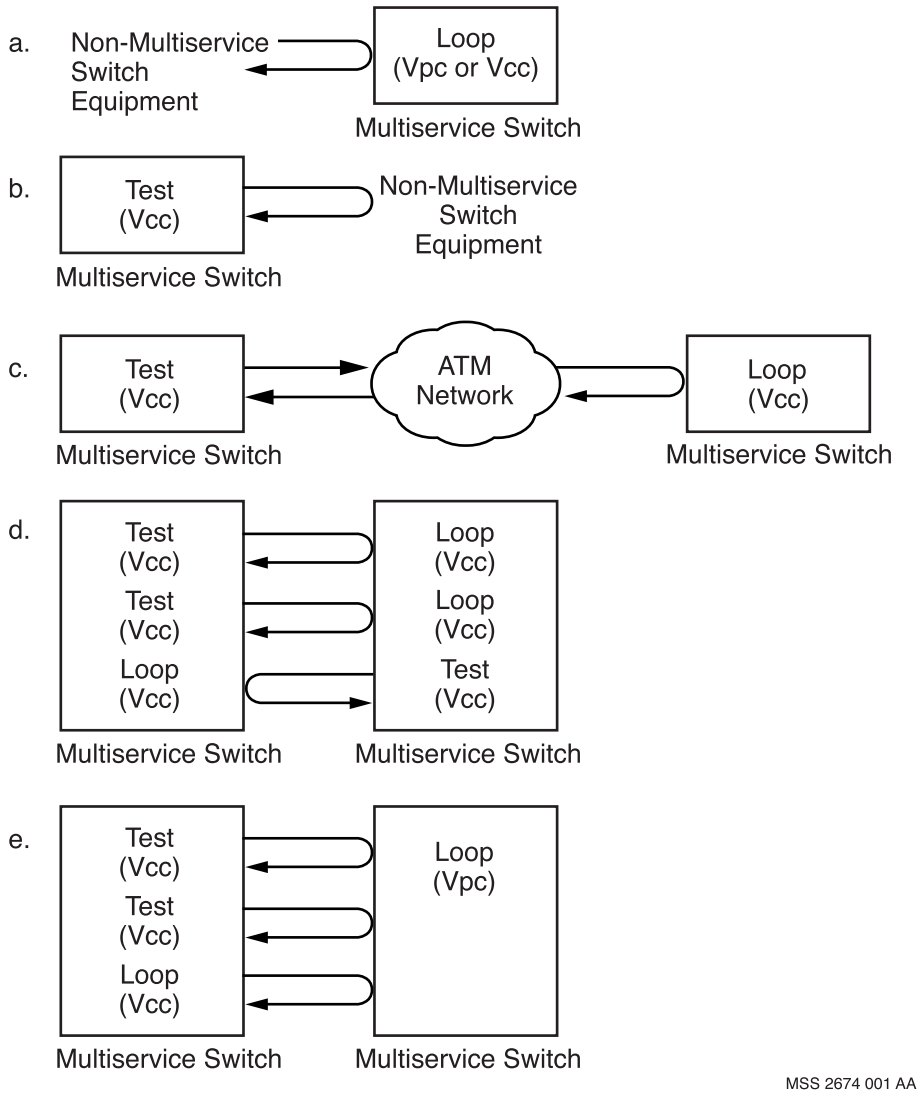
Examples of how to use the Test and Loop services



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Converting port ID interfaces

Nortel Multiservice Switch node port IDs can be converted to interface IDs. Refer to the figure Example of RouteFinder (Rf) output (page 182) to understand how this conversion can be performed.

Example of RouteFinder (Rf) output

```
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
```

PPT 3063 025 AA

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 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

Refer to the figure Example of RouteFinder (Rf) output (page 182) to understand how this conversion can be performed.

For the port ID of 720897, 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 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.

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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.

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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.

Information on how to monitor connections is contained in Connections monitoring (page 32).

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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 troubleshoot ATM connections:

1 Connections troubleshooting (page 188)

2 ATM interfaces troubleshooting (page 203)

3 ATM routing and signaling troubleshooting (page 209)

4 ATM function processors troubleshooting (page 226)

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Troubleshooting scenarios for optimizing connection and monitoring rerouting

The following table contains troubleshooting scenarios for optimizing connections and monitoring rerouting. Information on how to monitor routing is contained in Routing monitoring (page 63).

Troubleshooting scenario	Verify the following items:
The connection tried to subscribe to rerouting, but was unable to subscribe to rerouting.	Verify that the connection is active. Verify that at least one rerouting capability is active. Verify that the routing protocol is ATM. Verify that the rendezvous node supports a rerouting connection. Verify that the rendezvous node supports the requested rerouting protocol. 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.
The connection has a *rerouteInfo* component, but the requested rerouting protocol is localGlobal but only global attributes are displayed.	Verify that the global rendezvous node is the same as the local rendezvous node. If they are the same, it is not an issue. Verify your local domain border node. Verify that locally, the node does act as a one node domain.
The connection has a *rerouteInfo* component, but the requested rerouting protocol is localGlobal but only local attributes are displayed.	Verify that the global destination supports a global rerouting connection. Verify that the connection is the DTL originator. Only the DTL originator can display local and global attributes

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.

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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.

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Connections troubleshooting

Use this section to solve problems that can occur while provisioning and monitoring connections on an ATM network.

The table Handling problems (page 194) provides guidelines on how to respond to problems that may occur with connections on an ATM network.

Prerequisites

- You have read the section Troubleshooting connections on an ATM network (page 176).

Navigation

- Locating VCC faults (page 189)
- Locating VPC faults (page 191)
- Determining the status of a connection (page 197)
- Performing a connection test (page 199)
- Displaying connection test results (page 201)

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Locating VCC faults

Use the Trace command to locate VCC connection faults.

Procedure steps

Step	Action
1	Select a connection segment in which to locate a fault.
2	Compile a list of *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>** 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>> <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> is an instance of a *Vcc* component along the connection, and has the form of: EM/<modk> AtmIf/<ik> Vcc/<VPIk>.<VCIk> <mod> is the name of the module <i> is the *AtmIf* component instance <VPI> is the VPI value for the *Vcc* component <VCI> is the VCI value for the *Vcc* component

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Attention: The results of the Trace command do not always display in the corresponding order of the actual connections.

Attention: 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; or the application using the missing *Vcc* component is faulty.

Refer to the table Interpreting the results of the Trace command (page 192).

--End--

Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface.
<Vpt>	is the *VirtualPathTerminator* component. Use this variable if the virtual connection is associated with a *Vpt* component.
<x>	is 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.

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Locating VPC faults

Use the Trace command to locate VPC connection faults.

Procedure steps

Step	Action
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>`
	Five seconds after issuing the *Trace* command, a response of the following form is displayed:
	`Switch side trace result:`
	`<VpcInstance1>`
	`<VpcInstance2>`
	`••••••`
	`<VpcInstance<n>>`
	`Link side trace result:`
	`<VpcInstance<n>+1>`
	`<VpcInstance<n>+2>`
	`••••••`
	`<VpcInstance<n>+<m>>`
	<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> is an instance of a *Vpc* component along the connection, and has the form of:
	`EM/<modk> AtmIf/<ik> vpc/<VPIk>`
	<mod> is the name of the module
	<i> is the *AtmIf* component instance
	<VPI> is the VPI value for the *Vpc* component.

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Attention: 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; or the application using the missing VPC is faulty.

Refer to the table Interpreting the results of the Trace command (page 192).

--End--

Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface.
<Vpi>	is the instance value of the *Vpc* component.

Procedure job aid

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 *Trace* command is used.

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Interpreting the results of the Trace command (continued)

Type of connection point where Trace command is used	Note
segment end-point	When the *Trace* command is used for an *AtmIf* component with an *oamSegmentBoundary* attribute set to *yes*, 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. When the *Trace* command is used for an *AtmIf* component with an *oamSegmentBoundary* attribute set to *no*, 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.
connection end-point	When the *Trace* command is used for an *AtmIf* component with an *oamSegmentBoundary* attribute set to *yes*, no device-side or link-side results are expected. When the *Trace* command is used for an *AtmIf* component with an *oamSegmentBoundary* attribute set to *no*, only link-side results are expected. You can expect to find missing device-side results.

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Handling problems

Problem	Probable causes	Corrective measures
Troubled connection alarm is set	ATM layer fault on one or more connections of an ATM interface	Identify the connections associated with the ATM interface that have one of the following operational status group attributes with a value of *bad*: *segLinkSideLoopbackState, segSwitchSideLoopbackState, endToEndLoopbackState, aisState*, and *rdiState*. The value for status group attribute *troubled* must be *yes*. When you have identified these connections, see the probable causes and corrective measures in this table under Problem with an ATM connection component (page 195).
	Fault within the non-ATM portion of the connection detected by the interworking function	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. Identify the associated ATM interface connections that are being used by an interworking function and determine if the operational attributes *aisState* and/or *rdiState* are *bad*. This may or may not indicate an ATM layer fault (see Determining the status of a virtual connection (page 38)). 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.” 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 *Nortel Multiservice Switch 7400/15000/20000 Operations: Frame Relay to ATM Interworking*
Troubled connection alarm is set and cleared quickly; no connection is visible with a *bad* state	ATM layer fault on a switched connection For example, if *segLinkSideLoopback* variable is set to on, but the equipment on the link side is not configured to return the segment loopback OAM cells	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.

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Handling problems (continued)

Problem	Probable causes	Corrective measures
Loss of traffic on ATM connection	Multiservice Switch hardware problem	Check the integrity of each connection segment: • Use the Trace command to verify the segment is unbroken, and • Ensure the operational state of the segment end-points are “enabled” 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 195). 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.
	External equipment problem	Check any external equipment that may be part of the connection to ensure it is working properly. 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.
	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 *AtmIf* against the equivalent cell rate requirements of the disabled connection component in terms of the number of connections and bandwidth. Reprovision *AtmIf* 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 *AtmIf* 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.

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Handling problems (continued)

Problem	Probable causes	Corrective measures
	Insufficient capacity on ATM interface	Compare the available capacity of *AtmIf* against the requirements of the disabled connection component in terms of the number of connections and bandwidth. Reprovision *AtmIf* 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 *AtmIf* 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.
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 *AtmIf* component. Compare this list with the list of VCCs and VPCs at the remote end.
Increasing *rxCellDiscard* or *rxCellDiscardClp*	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 *atmServiceCategory* should also match.
Increasing *txCellDiscard* or *txCellDiscardClp*	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 *Vcc* or *Vpc* components.
	Cell rate is limited by per-VC queueing	If the connection is unshaped, and the *unshapedTransmitQueueing* attribute is set to *perVc*, 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.

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Determining the status of a connection

Determine the nature of problems with certain connections in an ATM interface 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 198) provides the possible values of the *localFailureCause* attribute.

Procedure steps

Step	Action
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**
2	If *localFailureCause* has a value of bwReduced, verify the amount of bandwidth reduction by displaying the ECR as compared to the value of the attribute. **display AtmIf/<n> Vcc/* Tm txtdp, bwReduction**
3	Compare equivalent cell rate (ECR) for *TxTdp,* with the value in the *bwReduction* column. For an elastic connection, the current cell rate (CCR) can be determined as follows: **CCR = <ECR> - <bwReduction>**

--End--

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Variable definitions

Variable	Value
<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.
<ECR>	is the equivalent cell rate for the connection
<n>	is the instance number of the ATM interface.

Procedure job aid

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.

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Performing a connection test

Test an ATM connection (*Vcc* or a *Vcc* under a *Vpt*) using the *Test* component. After the test, the connection can be configured for another service (for example an*Nrp* for ATM Bearer Service).

Procedure steps

Step	Action
1	Use the display command to verify the setup of a *Test* component. For a *Vcc*: **display AtmIf/<n> Vcc/<Vpi.Vci> Test** For a *Vcc* under a *Vpp*: **display AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test**
2	Set the applicable *Test* component attributes (all are optional). For a *Vcc*: **set AtmIf/<n> Vcc/<Vpi.Vci> Test frmTypes <frametype>** **set AtmIf/<n> Vcc/<Vpi.Vci> Test frmSize <framesize>** **set AtmIf/<n> Vcc/<Vpi.Vci> Test frmPatternType <pattern>** **set AtmIf/<n> Vcc/<Vpi.Vci> Test customizedPattern <hex>** **set AtmIf/<n> Vcc/<Vpi.Vci> Test duration <min>** For a *Vcc* under a *Vpp*: **set AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test frmTypes <frametype>** **set AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test frmSize <framesize>** **set AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test frmPatternType <pattern>** **set AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test customizedPattern <hex>** **set AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test duration <min>**
3	Start the connection test. For a *Vcc*: **start AtmIf/<n> Vcc/<Vpi.Vci> Test** For a *Vcc* under a *Vpp*: **start AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test**

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4 Display the test statistics (optional).

For a *Vcc*:

```
display AtmIf/<n> Vcc/<Vpi.Vci> Test
```

For a *Vcc* under a *Vpp*:

```
display AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test
```

5 Stop the test (optional.

For a *Vcc*:

```
stop AtmIf/<n> Vcc/<Vpi.Vci> Test
```

For a *Vcc* under a *Vpp*:

```
stop AtmIf/<n> Vpt/<Vpi> Vcc/<Vci> Test
```

--End--

Variable definitions

Variable	Value
<framesize>	is the size of the frame in bytes. Values can range from 4 to 4096. The default is 1024.
<frametype>	is the loading frame type, either 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.
<hex>	is the customized test pattern to be used. Possible values range from 0 to FFFFFFFF (hexadecimal). The default is 55555555 (hexadecimal).
<min>	is the duration of the test in minutes. The default is 1.
<n>	is the instance number of the ATM interface.
<pattern>	is the frame pattern, one of either ccitt32kBitPattern, ccitt8MBitPattern, or customizedPattern. The default is ccitt32kBitPattern.
<Vpi>	is the *VirtualPathTerminator* component. Use this parameter if you are configuring the virtual connection with a virtual path terminator.
<Vpi.Vci>	is the instance value of the *Vcc* component

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Displaying connection test results

Display the attributes of the connection test. These attributes are:

- *elapsedTime*
- *timeRemaining*
- *causeOfTermination*
- *bytesTx*
- *loadingFrmTx*
- *verificationFrmTx*
- *bytesRx*
- *loadingFrmRx*
- *verificationFrmRx*
- *verificationFrmBad*
- *unrecognizableFrmRx*

Procedure steps

Step	Action
1	Display the length of time (in minutes) that the connection test has been running. **display AtmIf/<n> Vcc/<VPI.VCI> Test elapsedTime**
2	Display the maximum length of time (in minutes) that the connection test is set to continue before stopping. **display AtmIf/<n> Vcc/<VPI.VCI> Test timeRemaining**
3	Display the cause of test termination. 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 **display AtmIf/n Vcc/<VPI.VCI> Test causeOfTermination**
4	Display the total number of bytes, the number of loading frames, and the number of verification frames sent during the test period. **display AtmIf/n Vcc/<VPI.VCI> Test bytesTx, loadingFrmTx, verificationFrmTx**

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5 Display the total number of bytes, the number of loading frames, and the number of verification frames received during the test period.

```
display AtmIf/n Vcc/<VPI.VCI> Test bytesRx,
loadingFrmRx, verificationFrmRx
```

6 Display 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.

```
display AtmIf/n Vcc/<VPI.VCI> Test loadingFrmLost,
verificationFrmBad, unrecognizableFrmRx
```

--End--

Variable definitions

Variable	Value
<n>	is the instance number of the ATM interface.
<Vpi.Vci>	is the instance value of the *Vcc* component

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ATM interfaces troubleshooting

Use this section to learn about guidelines on how to solve problems that can occur while monitoring the ATM interfaces provisioned on a function processor.

Navigation

- Identifying troubled connections at the interface level (page 204)
- Identifying and determining troubled connections (page 205)
- Troubleshooting LRC errors at the ATM interface level (page 206)

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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:

Procedure steps

Step	Action
1	Determine the connections that are troubled. See step 1 in Identifying and determining troubled connections (page 205).
2	Determine the status of the connection for either a *Vcc* or *Vpc* component. See step 2 in Identifying and determining troubled connections (page 205).
3	Isolate the location of a troubled connection to a particular Nortel Multiservice Switch module, ATM interface component, and connection component. See step 3 in Identifying and determining troubled connections (page 205).

--End--

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Identifying and determining troubled connections

Identify the troubled connection.

Procedure steps

Step	Action
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 18) for more information about locating troubled connections.

--End--

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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 207) lists the various events which can create this error condition. This procedure describes the steps used to determine the exact cause of an LRC error and lists steps you can follow to rectify the problem.

Use the following procedure to determine the cause of LRC errors and the appropriate corrective action that should be taken.

Procedure steps

Step	Action
1	Determine if any of the transient conditions listed in the table Possible causes of LRC errors (page 207) 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 21) to examine the *lrcFrameErrors* 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 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 are the new suspect FP. If no card test shows errors, then the bus or fabric may be at fault.

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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 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 Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting* for more information).

--End--

Procedure job aid

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.

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Possible causes of LRC errors (continued)

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	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: • 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 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.

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ATM routing and signaling troubleshooting

Use this section to learn about guidelines on how to solve problems that can occur while provisioning and monitoring dynamic connections on an ATM network.

Navigation

- Handling problems in ATM routing and signaling (page 209)
- Handling problems in ATM provisioning (page 215)
- Cause codes (page 216)

Handling problems in ATM routing and signaling

The table Handling problems in ATM routing and signaling (page 209) 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 Signaling monitoring (page 60) and Routing monitoring (page 63) and verify that the network is operating correctly.

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 *side* attribute of the *Uni* 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 *operatingMode* attribute of the *Ilmi* component under the *Uni* component for the source and destination points.
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Handling problems in ATM routing and signaling (continued)

Problem	Probable causes	Corrective measures
	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 *rxCellDiscard* 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 *side* attribute of the *Uni* 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 *VCD* 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.
	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 *rxCellDiscard* 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.

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Handling problems in ATM routing and signaling (continued)

Problem	Probable causes	Corrective measures
PNNI signaling channel is down.	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 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 does not go into 2WayInside state.	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.
The RCC is down.	Insufficient bandwidth on the channel.	Check bandwidth pool settings for the RCC channel.
	The *AtmIf* is not active.	Check the operational status of the *AtmIf*.
	The far-end interface is not a PNNI.	Check both interfaces on the connection and verify that they are PNNI.
	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 *rxCellDiscard* 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.
SPVC or SPVP does not connect to the remote end (state of the VCC or VPC is *unlocked*, *enabled*, and *idle*).	The end points have mismatched UNI versions for signaling.	Determine the ATM version. Use the command: **`d -p atmif/<n> <sig_ver> sig`** where: `<sig_ver>` is *Uni*, *Iisp or Aini*

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Handling problems in ATM routing and signaling (continued)

Problem	Probable causes	Corrective measures
	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: **`d atmif/<n> VCC/<Vpi.Vci> Src`** **`d atmif/<n> VPC/<Vpi> Src`** See Cause codes (page 216) 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.	
	There is a mismatch of OAM loopback cell configuration.	Turn off loopbacks unless you discover a fault that needs tracing.
	Connection retry times out.	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. Check the last diagnostic and cause codes for the connection. Use the command: **`> d atmif/<n> VCC/<Vpi.Vci> Src`** **`> d atmif/<n> VPC/<Vpi> Src`** See Cause codes (page 216) for the complete list of cause and diagnostic codes.
SVC is out of service.	The connection cannot reach the destination address.	Check the last diagnostic and cause codes for the connection. Use the commands: **`d atmif/<n> VCC/<Vpi.Vci>`** See Cause codes (page 216) for the complete list of cause and diagnostic codes and correct the problem that the cause code identifies.
	The destination address not available.	
		Correct an invalid configuration of *atmServiceCategory* BBC or traffic parameters.
	There is a mismatch of OAM loopback cell configuration.	Turn off loopbacks unless you discover a fault that needs tracing.

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Handling problems in ATM routing and signaling (continued)

Problem	Probable causes	Corrective measures
The SPVC, SVC, or SPVP is not taking the correct path.	A UNI/IISP/AINI static address has the best match. PNNI bandwidth is not available for the path. The route through the PNNI links is severed (the peer group is severed because of a link down).	Use *RouteFinder* to calculate the expected path. Check provisioning for ATM routing (UNI 3.x/ IISP 1.0v3.1 versus PNNI 1.0).
The network does not crankback a failed call.	The *maxReroutes-OnCrankback* attribute is set to 0.	Set *maxReroutesOnCrankback* to a value greater than 0.
A summary address is not active.	There are no local addresses that the summary address on the node can summarize. For example, this condition occurs if the *SummaryAddress* component is set to *exterior*, and therefore does not summarize internal static addresses.	Verify that local addresses exist with a reachability setting and prefix match that the summary address can summarize.
	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.	Verify that these addresses are advertised instead of being summarized. Use the command: **`l artg pnni top/* node/* addr/*`** If the node does not advertise the addresses, another summary address with a longer prefix is summarizing them.
An expected link is not showing up when you list links for a given node using the `artg pnni top/*` 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: **`artg pnni cfg/<level> nbr/*`**
The *peerState* operational attribute for the *Neighbour* 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.

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Handling problems in ATM routing and signaling (continued)

Problem	Probable causes	Corrective measures
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 *RouteFinder* to calculate the expected path. Check the last diagnostic and cause codes for the connection. See Cause codes (page 216) 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 *multicastBranchesCapacity* attribute under the *AtmResourceControl* component. Ensure that the value for this attribute is sufficient to accommodate the number of branches that the call requires at this node.
RouteFinder 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 *maxReroutesOnCrankback* attribute under the *AtmRouting/Pnni* component.

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Handling problems in ATM routing and signaling (continued)

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.	The initial link will refuse the call if these two conditions are in place: • 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.
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Handling problems in ATM provisioning

The table Handling problems in ATM routing and signaling (page 209) 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.

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 *AtmRouting* component, but not the *atmPnni* software package.	Remove the atmPnni software package from all LPs. Reload the CP.

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Cause codes

Cause codes indicate a failure condition within Nortel 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 228).

Cause codes for ATM UNI version 3.0

The table Summary of cause codes for ATM UNI version 3.0 (page 217) summarize the cause codes that appear on a Nortel 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 221).

For a more detailed explanation of the cause code meanings, see the table Cause code definitions for ATM UNI version 3.0 (page 228).

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Summary of cause codes for ATM UNI version 3.0

Cause number	Meaning	Diagnostics
1	unallocated (unassigned) number	Diagnostics note 2 (page 221)
2	no route to specified transit network	
3	no route to destination	Diagnostics note 2 (page 221)
10	VPCI/VCI unacceptable	
17	user busy	
18	no user responding	
21	call rejected	Diagnostics note 3 (page 222)
22	number changed	New destination (Diagnostics note 4 (page 223))
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	
38	network out of order	
41	temporary failure	
43	access information discarded	Diagnostics note 6 (page 223), Diagnostics note 7 (page 224)
45	no VPCI/VCI available	
47	resource unavailable, unspecified	
49	Quality of Service unavailable	Diagnostics note 2 (page 221)
51	User cell rate not available	Diagnostics note 8 (page 224)
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	

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Summary of cause codes for ATM UNI version 3.0 (continued)

Cause number	Meaning	Diagnostics
82	identified channel does not exist	Diagnostics note 9 (page 224)
88	incompatible destination	Diagnostics note 6 (page 223)
89	invalid endpoint reference value	
91	invalid transit network selection	
92	too many pending add party requests	
93	AAL parameters can not be supported	
96	mandatory information element is missing	Diagnostics note 6 (page 223), Diagnostics note 7 (page 224)
97	message type non-existent or not implemented	Diagnostics note 10 (page 224)
99	information element non-existent or not implemented	Diagnostics note 6 (page 223), Diagnostics note 7 (page 224)
100	invalid information element contents	Diagnostics note 6 (page 223), Diagnostics note 7 (page 224)
101	message not compatible with call state	Diagnostics note 10 (page 224)
102	recovery on timer expiry	Timer Number (Diagnostics note 11 (page 224))
104	incorrect message length	
111	protocol error, unspecified	

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Cause codes for ATM UNI version 3.1

The table Summary of cause codes for ATM UNI version 3.1 (page 219) summarize the cause codes that appear on a Nortel 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 221).

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For a more detailed explanation of the cause code meanings, see the table Cause code definitions for ATM UNI version 3.1 (page 232).

Summary of cause codes for ATM UNI version 3.1

Cause number	Meaning	Diagnostics
1	unallocated (unassigned) number	Diagnostics note 2 (page 221)
2	no route to specified transit network	
3	no route to destination	Diagnostics note 2 (page 221)
16	normal call clearing	
17	user busy	
18	no user responding	
21	call rejected	Diagnostics note 3 (page 222)
22	number changed	New destination (Diagnostics note 4 (page 223))
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 224)
38	network out of order	
41	temporary failure	
43	access information discarded	Diagnostics note 6 (page 223), Diagnostics note 7 (page 224)
45	no VPCI/VCI available	
47	resource unavailable, unspecified	
49	Quality of Service unavailable	Diagnostics note 2 (page 221)
57	bearer capability not authorized	
63	Service or option not available, unspecified	
65	bearer capability not implemented	

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Summary of cause codes for ATM UNI version 3.1 (continued)

Cause number	Meaning	Diagnostics
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 224)
88	incompatible destination	Diagnostics note 6 (page 223)
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 223), Diagnostics note 7 (page 224)
97	message type non-existent or not implemented	Diagnostics note 10 (page 224)
99	information element non-existent or not implemented	Diagnostics note 6 (page 223), Diagnostics note 7 (page 224)
100	invalid information element contents	Diagnostics note 6 (page 223), Diagnostics note 7 (page 224)
101	message not compatible with call state	Diagnostics note 10 (page 224)
102	recovery on timer expiry	Time Number (Diagnostics note 11 (page 224))
104	incorrect message length	
111	protocol error, unspecified	

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Cause codes for ATM PNNI version 1.0

The table Summary of cause codes for ATM PNNI version 1.0 (page 221) summarize the cause codes that are specific to PNNI. These codes appear on a Nortel 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 221).

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For a more detailed explanation of the cause code meanings, see the table Cause code definitions for ATM PNNI version 1.0 (page 236).

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	

Diagnostics 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.

Diagnostics note 1

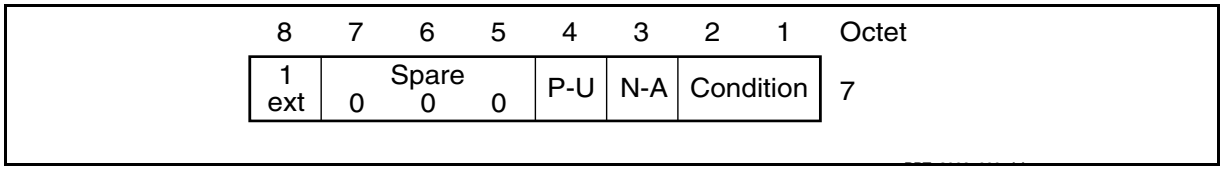
The cause value contains two fields: a class (bits 5 through 7) indicating the general nature of the event, and a value within the class (bits 1 through 4).

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:



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P-U (octet 7):

Bit 4	Meaning
0	Network service - Provider
1	Network service - User

N-A (octet 7):

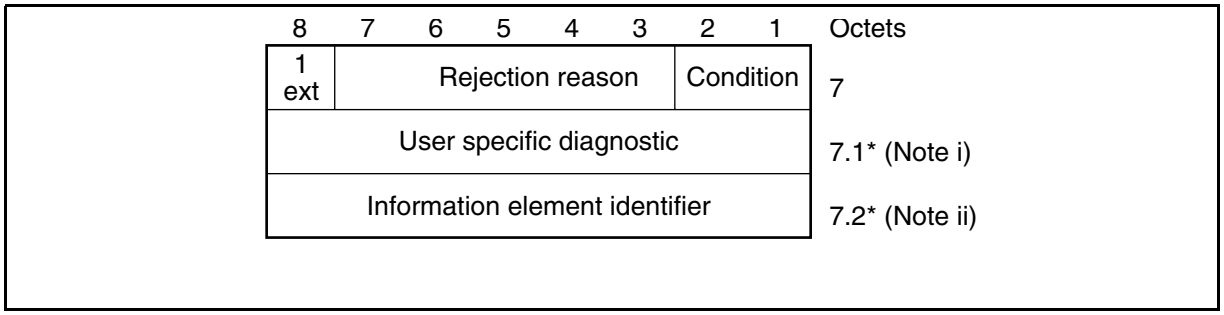
Bit 3	Meaning
0	Normal
1	Abnormal

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:



Attention: This octet is present only if octet 7 indicates user specific diagnostic.

Attention: This octet is present only if octet 7 indicates information element missing or information element contents are not sufficient.

Rejection reason (octet 7):

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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

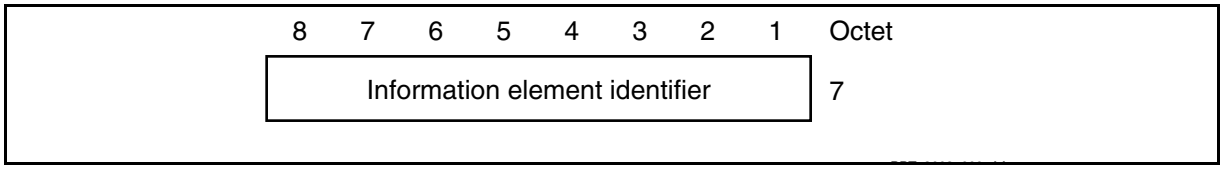
The network formats the new destination as the called party number information element, including information element identifier. The network also includes the transit network selection.

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:



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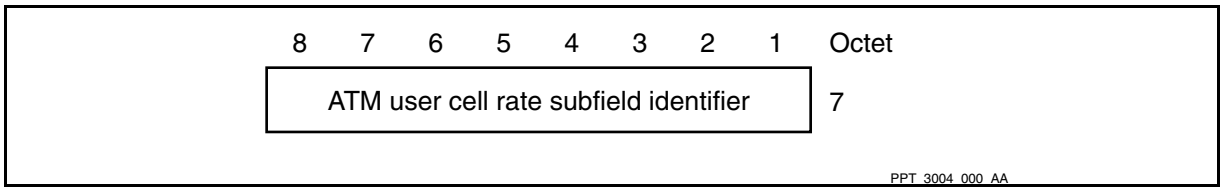
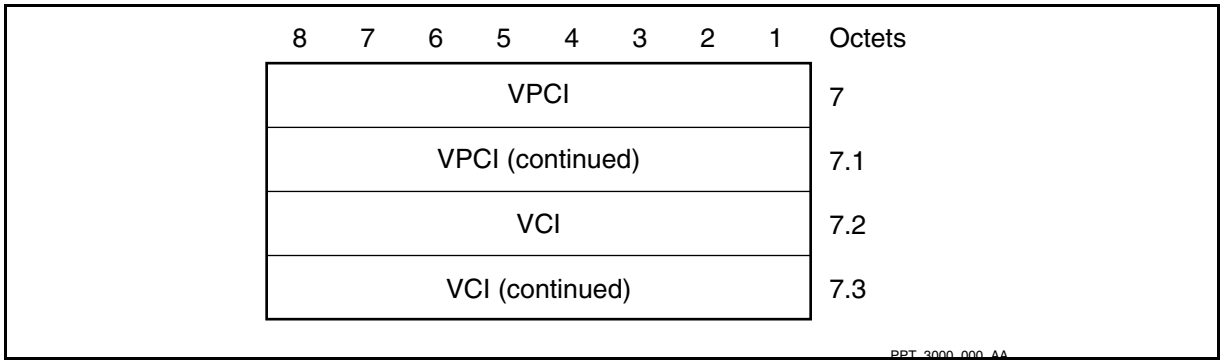
Diagnostics note 7
The cause code can include multiple information identifiers.

Diagnostics note 8
The cause code uses the following coding:

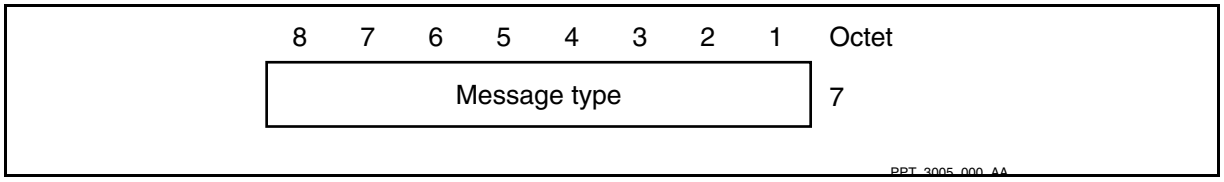


The node repeats octet 7 to identify multiple ATM traffic descriptor subfield identifiers.

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:

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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

PPT_3006_000_AA

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ATM function processors troubleshooting

Use this section to learn about 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 8).

Navigation

- Problem resolution (page 226)

Problem resolution

If you encounter problems with an ATM FP, use the steps listed below resolve the problem or contact Nortel Networks technical assistance for further help. The table Handling ATM FP related problems (page 227) list troubling shooting steps for specific FP related alarms. See NN10600-500 *Nortel 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 Multiservice Switch 7400 series devices, see NN10600-175 *Nortel Multiservice Switch 7400 Hardware Installation, Maintenance, and Upgrade* and NN10600-550 *Nortel 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 Multiservice Switch 15000/20000 Hardware Installation, Maintenance, and Upgrade* and NN10600-550 *Nortel 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 Multiservice Switch 7400/15000/20000 Common Configuration Procedures* for more information about configuring function processors.

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See NN10600-520 *Nortel 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 8) 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.

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 *ipRoutesPoolCapacity* and/or the number of sub connection in the Lp/<instance> Eng Fcrc Ov attribute *subConnectionPool Capacity*
txCellmemoryAvailable 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.

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Cause code definitions

Use this section to learn about additional details on the cause codes shown in the section Cause codes (page 216).

The cause codes in this section can appear on a Nortel 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.

Navigation

- Cause code definitions for ATM UNI version 3.0 (page 228)
- Cause code definitions for ATM UNI version 3.1 (page 232)
- Cause code definitions for ATM PNNI version 1.0 (page 236)

Cause code definitions for ATM UNI version 3.0

The table Cause code definitions for ATM UNI version 3.0 (page 229) describes the cause codes that can appear on a Nortel 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)

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Cause code definitions for ATM UNI version 3.0

Cause Number	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.
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, *unassigned (unallocated) number*, 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.

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Cause code definitions for ATM UNI version 3.0 (continued)

Cause Number	Meaning	Definition
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 *not functioning correctly* 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.
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. **Attention:** One possible reason for this cause code is a missing software feature in the destination node. Verify the *featureList* to see if a software feature is missing.
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.

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Cause code definitions for ATM UNI version 3.0 (continued)

Cause Number	Meaning	Definition
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.
58	bearer capability not presently available	This cause indicates that the user requested a bearer capability which is implemented by the equipment which generated the cause but which is not available at this time.
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.
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. See *ATM User-to-Network Interface Specification* Version 3.0.
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.

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Cause code definitions for ATM UNI version 3.0 (continued)

Cause Number	Meaning	Definition
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.
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 233) summarizes the cause codes that appear on a Nortel 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)

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Cause code definitions for ATM UNI version 3.1

Cause Number	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, *unassigned (unallocated) number*, 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.

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Cause code definitions for ATM UNI version 3.1 (continued)

Cause Number	Meaning	Definition
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 *not functioning correctly* 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.
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. **Attention:** One possible reason for this cause code is a missing software feature in the destination node. Verify the *featureList* to see if a software feature is missing.

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Cause code definitions for ATM UNI version 3.1 (continued)

Cause Number	Meaning	Definition
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.
58	bearer capability not presently available	This cause indicates that the user requested a bearer capability which is implemented by the equipment which generated the cause but which is not available at this time.
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 indicates that the combination of traffic parameters contained in the ATM traffic descriptor information element is not supported. 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.
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. See *ATM User-to-Network Interface Specification* Version 3.1.

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Cause code definitions for ATM UNI version 3.1 (continued)

Cause Number	Meaning	Definition
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.
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 237) describes the cause codes that are specific to PNNI. These codes appear on the Nortel 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

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- *Interim Inter-switch Signaling Protocol (IISP) Specification* Version 1.0 (based on ATM UNI 3.0)

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.

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Nortel Multiservice Switch 7400/15000/20000

ATM Fault and Performance Management

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