Troubleshooting ATM Switch Router Network Connections

This chapter describes troubleshooting information about connectivity and performance problems in ATM switching network connections, and contains the following sections:

- Checking Network Connections
- Troubleshooting PVP and PVC Connections
- Troubleshooting Soft PVC Connections
- Troubleshooting SVC Connections on a PNNI Routing Network
- Troubleshooting the PNNI Database
- Troubleshooting PNNI Peer Group Leaders
- Troubleshooting the PNNI Lowest Level Interface
- Troubleshooting PNNI SVCC-RCC and Higher Level Links
- Troubleshooting PNNI Hierarchical Networks
- Troubleshooting PNNI Addresses and Address Summarizations
- Troubleshooting Virtual Path Tunnel Connections
- Troubleshooting Dropped Connections

Checking Network Connections

Before you begin, make sure that all physical port connections are working correctly. See Chapter 4, "Troubleshooting ATM Switch Router Interface Connections." Confirm the following:

- Proper cable insertion. Be sure that transmit and receive cable pairs match.
- Proper cable types. Connector fit does not ensure that the cables are the proper types or are cross-connected correctly.
- Reliable cables.
- No-shutdown mode on all interfaces on both ends of the cable.
- Proper interface configuration (for example, framing and line coding).
- Proper interface types on both ends of the cable.

Troubleshooting PVP and PVC Connections

This section describes how to troubleshoot permanent virtual paths (PVPs) and permanent virtual circuits (PVCs). PVP and PVC connections are used primarily between buildings as the backbone connection and between frequently accessed hosts, such as the Domain Name System (DNS) server.

In the example network in Figure 5-1, the primary PVC configured as the backbone connection between the ATM switch router on Floor 1 in the administration building and the ATM switch router on Floor 1 in the manufacturing building has the following virtual path identifier (VPI) and virtual channel identifier (VCI) numbers:

- AdminFl1Ls1, ATM interface 3/1/0, VPI 50, and VCI 100
- ManuFl1Ls1, ATM interface 0/1/0, VPI 75, and VCI 150

Figure 5-1   PVC VPI and VCI Test in the Example Network
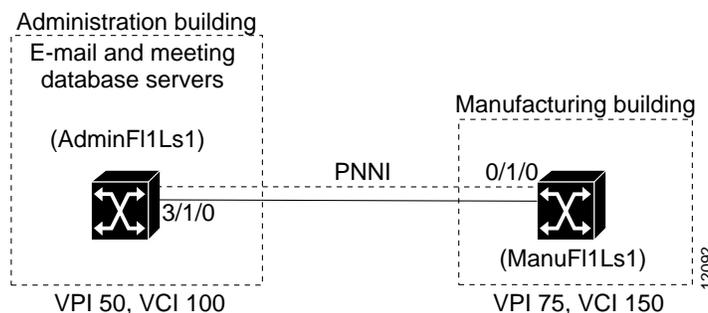
This section contains the following procedures:

- Checking the PVC Interface Status
- Checking the VPI and VCI Numbers
- Checking the VPI and VCI Ranges
- Checking the UBR
- Checking the VBR or CBR Resource
- Debugging the PVC Connection Management

For detailed configuration information, see Chapter 6, "Configuring Virtual Connections," in the *ATM Switch Router Software Configuration Guide*.

Checking the PVC Interface Status

Use the following command to confirm that the configured PVC interface status is up:

Command	Purpose
show atm status	Confirms the interface status.

Follow these steps to check the interface status:

Step 1   Use the **show atm status** command to check the interface PVP status.

```
Switch# show atm status

NUMBER OF INSTALLED CONNECTIONS: (P2P=Point to Point, P2MP=Point to MultiPoint)
Type      PVCs SoftPVCs    SVCs     TVCs     PVPs SoftPVPs     SVPs      Total
P2P        26      0         1        0        0       0         0         27
P2MP        0      0         0        0        0       0         0          0
                                    TOTAL INSTALLED CONNECTIONS =         27
PER-INTERFACE STATUS SUMMARY AT 16:02:57 UTC Mon May 11 1998:
    Interface      IF       Admin  Auto-Cfg     ILMI Addr     SSCOP     Hello
      Name       Status    Status    Status     Reg State     State     State
  ------------- -------- ------------ -------- ------------ --------- --------
  ATM10/0/0        UP          up      done   UpAndNormal    Active   LoopErr
  ATM10/0/1        UP          up      done   UpAndNormal    Active      n/a
  ATM10/0/2        DOWN      down   waiting           n/a      Idle      n/a
  ATM10/0/3        UP          up      done   UpAndNormal    Active   LoopErr
  ATM10/0/3.80     UP          up      done   UpAndNormal    Active   LoopErr
  ATM10/1/0        DOWN      down   waiting           n/a      Idle      n/a
  ATM10/1/1        UP          up      done   UpAndNormal    Active      n/a
  ATM10/1/2        UP          up      done   UpAndNormal    Active   LoopErr
  ATM10/1/3        UP          up      done   UpAndNormal    Active   LoopErr
  ATM10/1/3.80     UP          up      done   UpAndNormal    Active   LoopErr
  ATM13/0/0        UP          up       n/a   UpAndNormal      Idle      n/a
Switch#
```

Step 2   Check the IF (Interface) Status field to confirm that the interface is up. If not, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

Step 3   Check the Admin (Administration) Status field to confirm that the interface is up. If not, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

Checking the VPI and VCI Numbers

Use the following command to confirm the configured PVC interface VPI and VCI numbers:

Command	Purpose
show atm vc interface atm *card/subcard/port vpi vci*	Confirms the interface status.

Follow these steps to check the VPI and VCI numbers configured for the PVC connection:

Step 1   Use the **show atm vc interface atm** command to confirm the numbers at both ends of the connection between the administration building and the manufacturing building:

```
AdminFl1Ls1# show atm vc interface atm 3/1/0 50 100
Interface: ATM3/1/0, Type: oc12suni
VPI = 50 VCI = 100
Status: UP
Time-since-last-status-change: 5w1d
Connection-type: PVC
Cast-type: point-to-point
Packet-discard-option: disabled
Usage-Parameter-Control (UPC): pass
Wrr weight: 32
Number of OAM-configured connections: 0
OAM-configuration: disabled
OAM-states:  Not-applicable
Cross-connect-interface: ATM0/1/0, Type: oc12suni
Cross-connect-VPI = 75
Cross-connect-VCI = 150
Cross-connect-UPC: pass
Cross-connect OAM-configuration: disabled
Cross-connect OAM-state:  Not-applicable
Threshold Group: 5, Cells queued: 0
Rx cells: 0, Tx cells: 0
Tx Clp0:0,  Tx Clp1: 0
Rx Clp0:0,  Rx Clp1: 0
Rx Upc Violations:0, Rx cell drops:0
Rx Clp0 q full drops:0, Rx Clp1 qthresh drops:0
Rx connection-traffic-table-index: 1
Rx service-category: UBR (Unspecified Bit Rate)
Rx pcr-clp01: 7113539
Rx scr-clp01: none
Rx mcr-clp01: none
Rx      cdvt: 1024 (from default for interface)
Rx       mbs: none
Tx connection-traffic-table-index: 1
Tx service-category: UBR (Unspecified Bit Rate)
Tx pcr-clp01: 7113539
Tx scr-clp01: none
Tx mcr-clp01: none
Tx       cdvt: none
Tx        mbs: none
AdminFl1Ls1#
```

Step 2 Check the VPI and VCI fields. They show the VPI and VCI of the PVC connection at the administration building.

Step 3 Check the Cross-connect-interface and Cross-connect-VPI and Cross-connect-VCI fields. They indicate the VPI and VCI of the PVC connection at the manufacturing building.

Checking the VPI and VCI Ranges

Use the following commands to check the VPI and VCI ranges of the PVC connection:

Command	Purpose
show atm ilmi-status atm *card*/*subcard*/*port*	Confirms the range configuration of the PVC and its VPI and VCI numbers.

Follow these steps to check the VPI and VCI ranges of the PVC connection at the administration building:

Step 1 Use the **show atm ilmi-status atm** command to confirm the ranges of the connection at the administration building.

```
AdminFl1Ls1# show atm ilmi-status atm 3/1/0
Interface : ATM3/1/0 Interface Type : Private NNI
ILMI VCC : (50, 100) ILMI Keepalive : Disabled
ILMI State:         UpAndNormal
Peer IP Addr:     172.20.41.93     Peer IF Name:     ATM0/1/1
Peer MaxVPIbits:  8               Peer MaxVCIbits:  14
Peer MaxVPCs:     255             Peer MaxVCCs:     16383
Peer MaxSvccVpi:  255             Peer MinSvccVci:  33
Peer MaxSvpcVpi:  255
Configured Prefix(s) :
47.0091.8100.0000.0040.0b0a.2a81
AdminFl1Ls1#
```

Step 2 Check the Peer MaxVPCs and Peer MaxVCCs fields. They indicate the VPI and VCI ranges of the PVC connection at the manufacturing building.

Step 3   Use the **show atm ilmi-status atm** command to confirm VPI and VCI ranges of the PVC connection at the manufacturing building.

```
ManuFl1Ls1# show atm ilmi-status atm 0/1/0
Interface : ATM0/1/0 Interface Type : Private NNI
ILMI VCC : (75, 150) ILMI Keepalive : Disabled
ILMI State:        UpAndNormal
Peer IP Addr:     172.20.41.93     Peer IF Name:     ATM0/1/0
Peer MaxVPIbits:  8                Peer MaxVCIbits:  14
Peer MaxVPCs:     255              Peer MaxVCCs:     16383
Peer MaxSvccVpi:  255              Peer MinSvccVci:  33
Peer MaxSvpcVpi:  255
Configured Prefix(s) :
47.0091.8100.0000.0040.0b0a.2a81
ManuFl1Ls1#
```

Step 4   Check the Peer MaxVPCs and Peer MaxVCCs fields. They indicate the VPI and VCI ranges of the PVC connection at the administration building.

Step 5   If either the VPI or VCI of the PVC are configured incorrectly, go to Chapter 6, "Configuring Virtual Connections," of the *ATM Switch Router Software Configuration Guide*.

Checking the UBR

Use the following commands to confirm unspecified bit rate (UBR) for the PVP and PVC best-effort connection limit configuration:

Command	Purpose
show atm interface resource atm *card*/*subcard*/*port*	For UBR connections, confirms connection admission control (CAC) best-effort limit configuration.
show atm resource	For VBR and CBR connections, confirms that the resources requested are available.

Follow these steps to confirm UBR for the PVC and PVP best-effort connection limit configuration on the interface.

Step 1   Use the **show atm interface resource atm** *card/subcard/port* command to confirm the maximum number best-effort connection limit configuration number.

```
Switch# show atm interface resource atm 10/0/0
Resource Management configuration:
    Output queues:
        Max sizes(explicit cfg): none cbr, none vbr-rt, none vbr-nrt, none abr-ubr
        Max sizes(installed): 256 cbr, 256 vbr-rt, 4096 vbr-nrt, 12032 abr-ubr
        Efci threshold: 25% cbr, 25% vbr-rt, 25% vbr-nrt, 25% abr, 25% ubr
        Discard threshold: 87% cbr, 87% vbr-rt, 87% vbr-nrt, 87% abr, 87% ubr
        Abr-relative-rate threshold: 25% abr
    Pacing: disabled   0 Kbps rate configured, 0 Kbps rate installed
    Service Categories supported: cbr,vbr-rt,vbr-nrt,abr,ubr
    Link Distance: 0 kilometers
    Controlled Link sharing:
        Max aggregate guaranteed services: none RX,  none TX
        Max bandwidth: none cbr RX, none cbr TX, none vbr RX, none vbr TX,
                       none abr RX, none abr TX, none ubr RX, none ubr TX
        Min bandwidth: none cbr RX, none cbr TX, none vbr RX, none vbr TX,
                       none abr RX, none abr TX, none ubr RX, none ubr TX
    Best effort connection limit: 10 max connections
    Max traffic parameters by service (rate in Kbps, tolerance in cell-times):
        Peak-cell-rate RX: none cbr, none vbr, none abr, none ubr
        Peak-cell-rate TX: none cbr, none vbr, none abr, none ubr
        Sustained-cell-rate: none vbr RX, none vbr TX
        Minimum-cell-rate RX: none abr, none ubr
        Minimum-cell-rate TX: none abr, none ubr
        CDVT RX: none cbr, none vbr, none abr, none ubr
        CDVT TX: none cbr, none vbr, none abr, none ubr
        MBS: none vbr RX, none vbr TX
Resource Management state:
    Cell-counts: 0 cbr, 0 vbr-rt, 0 vbr-nrt, 0 abr-ubr
    Available bit rates (in Kbps):
        147743 cbr RX, 147743 cbr TX, 147743 vbr RX, 147743 vbr TX,
        0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX
    Allocated bit rates:
        0 cbr RX, 0 cbr TX, 0 vbr RX, 0 vbr TX,
 0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX
    Best effort connections: 1 pvcs,  0 svcs
Switch#
```

Step 2   Check the Best effort connection limit field max (maximum) connections number.

Step 3   Check the Best effort connection field to determine the connections established. If no connections are available, the connection fails.

To modify the best-effort connection limit, see Chapter 8, "Configuring Resource Management," in the *ATM Switch Router Software Configuration Guide*.

Checking the VBR or CBR Resource

Use the following commands to confirm the VBR and CBR resources of the configured PVP:

Command	Purpose
show atm interface resource atm *card/subcard/port*	For UBR connections, confirms CAC best-effort-limit configuration.
show atm resource	For VBR and CBR connections, confirms that the resources requested are available.

Debugging the PVC Connection Management

Use the following commands to debug the PVC connection management:

Command	Purpose
debug atm conn errors	Enables connection management error debugging.
debug atm conn events	Enables connection management event debugging.
no debug all	Disables all debugging.

Troubleshooting Soft PVC Connections

This section describes how to troubleshoot a soft PVC configuration. Soft PVCs are used primarily to connect hosts that do not support signaling and cannot use SVCs.

In the example network in Figure 5-2, the connection between the ATM switch router on Floor 1 in the administration building and the e-mail server has the following VPI and VCI numbers and ATM address:

- AdminFl1Ls1, ATM interface 4/0/0, VPI 150, and VCI 250
- E-mail server, ATM interface VPI 100, VCI 200, with an ATM address 11.1111.1111.00.1111.1111.1111.1111.1111.1111.00

Figure 5-2   Soft PVC Test in the Example Network

Administration building

E-mail and meeting
database servers

(AdminFl1Ls1)

4/0/0

Soft
PVC

VPI 150,
VCI 250

VPI 100, VCI 200
ATM address =
11.1111.1111.00.1111.1111.1111.1111.1111.1111.00

12093
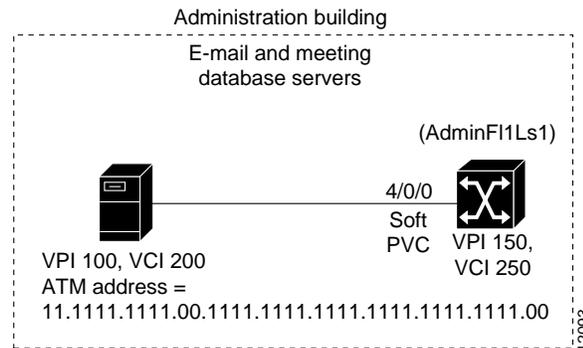
This section contains the following procedures:

- Checking the Interface Status

- Checking the VPI Number, VCI Number, and ATM Address

- Checking the Connection Management

- Debugging the Connection Management

For detailed information, see Chapter 6, "Configuring Virtual Connections," in the *ATM Switch Router Software Configuration Guide*.

Checking the Interface Status

Use the following command to check soft PVC connection interface status:

Command	Purpose
show atm status	Confirms the interface status is up.

Follow these steps to confirm the soft PVC interface is up:

Step 1 Use the **show atm status** command to check the interface status.

```
Switch# show atm status
NUMBER OF INSTALLED CONNECTIONS: (P2P=Point to Point, P2MP=Point to MultiPoint)
Type    PVCs SoftPVCs    SVCs     TVCs     PVPs SoftPVPs     SVPs     Total
P2P       17        0        0        0        0        0        0        17
P2MP       0        0        0        0        0        0        0         0
                                          TOTAL INSTALLED CONNECTIONS =        17
PER-INTERFACE STATUS SUMMARY AT 13:41:00 UTC Tue May 12 1998:
    Interface      IF       Admin  Auto-Cfg     ILMI Addr     SSCOP    Hello
    Name        Status     Status   Status     Reg State     State    State
  ------------- -------- ------------ -------- ------------ --------- --------
  ATM-P0/0/3      UP          up    waiting            n/a     none      n/a
  ATM0/1/0        DOWN       down    waiting            n/a     Idle      n/a
  ATM0/1/1        DOWN       down    waiting            n/a     Idle      n/a
  ATM0/1/2        DOWN       down    waiting            n/a     Idle      n/a
  ATM0/1/3        DOWN       down    waiting            n/a     Idle      n/a
  ATM1/0/0        UP          up       n/a     UpAndNormal   Active      n/a
  ATM1/0/0.80     UP          up    waiting     WaitDevType     Idle      n/a
  ATM1/0/1        DOWN       down    waiting            n/a     Idle      n/a
  ATM1/0/2        DOWN       down    waiting            n/a     Idle      n/a
  ATM1/0/3        UP          up       done     UpAndNormal   Active      n/a
  ATM1/1/0        UP          up       n/a     UpAndNormal   Active      n/a
  ATM1/1/1        DOWN       down    waiting            n/a     Idle      n/a
  ATM1/1/2        DOWN       down    waiting            n/a     Idle      n/a
  ATM1/1/3        UP          up       done     UpAndNormal   Active      n/a
  ATM1/1/3.80     UP          up    waiting     WaitDevType     Idle      n/a
  ATM2/0/0        UP          up       n/a     UpAndNormal     Idle      n/a
  ATM4/1/0        DOWN       down    waiting            n/a     Idle      n/a
  ATM4/1/1        DOWN       down    waiting            n/a     Idle      n/a
  ATM4/1/2        DOWN       down    waiting            n/a     Idle      n/a
  ATM4/1/3        DOWN       down    waiting            n/a     Idle      n/a
Switch#
```

Step 2 Confirm that the IF Status field corresponding to the soft PVC interface is up. If it is down, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

Step 3 Confirm that the Admin Status field is up. If it is down, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

Step 4 If both fields are up, continue with the following troubleshooting sections.

Checking the VPI Number, VCI Number, and ATM Address

Use the following command to confirm the VPI, VCI, and ATM address of the configured soft PVC:

Command	Purpose
show atm vc interface atm *card*/*subcard*/*port*	Confirms the configuration of VPI, VCI, and ATM address numbers of a soft PVC.

Follow these steps to confirm the VPI, VCI, and ATM address of the configured soft PVC:

Step 1 Use the **show atm vc interface atm** command to confirm the numbers at both ends of the connection between the administration building ATM switch router and the e-mail server that does not support signaling:

```
AdminFl1Ls1# show atm vc interface atm 4/0/0 150 250
Interface: ATM4/0/0, Type: oc3suni
VPI = 150 VCI = 250
Status: NOT CONNECTED
Time-since-last-status-change: 00:00:45
Connection-type: SoftVC
Cast-type: point-to-point
Soft vc location: Source
Remote ATM address: 11.1111.1111.00.1111.1111.1111.1111.1111.1111.00
Remote VPI: 100
Remote VCI: 200
Soft vc call state: Active
Number of soft vc re-try attempts: 4
Slow-retry-interval: 60 seconds
Next retry in: 29 seconds
Aggregate admin weight: 0
Packet-discard-option: disabled
Usage-Parameter-Control (UPC): pass
Wrr weight: 32
Number of OAM-configured connections: 0
OAM-configuration: disabled
OAM-states:  Not-applicable
Threshold Group: 5, Cells queued: 0
Rx cells: 0, Tx cells: 0
Tx Clp0:0,  Tx Clp1: 0
Rx Clp0:0,  Rx Clp1: 0
Rx Upc Violations:0, Rx cell drops:0
Rx Clp0 q full drops:0, Rx Clp1 qthresh drops:0
Rx connection-traffic-table-index: 1
Rx service-category: UBR (Unspecified Bit Rate)
Rx pcr-clp01: 7113539
Rx scr-clp01: none
Rx mcr-clp01: none
Rx tolerance: 1024 (from default for interface)
Tx connection-traffic-table-index: 1
Tx service-category: UBR (Unspecified Bit Rate)
Tx pcr-clp01: 7113539
Tx scr-clp01: none
Tx mcr-clp01: none
Tx tolerance: none
AdminFl1Ls1#
```

Step 2 Check the Remote ATM address. This address should match the ATM address at the other end of the soft PVC connection.

Step 3 Check the VPI and VCI fields. They indicate the VPI and VCI configuration of this interface.

Step 4 Check the Remote VPI and Remote VCI fields. They indicate the VPI and VCI configuration of the interface in the e-mail server.

If you determine that the VPI and VCI configurations are incorrect, refer to Chapter 6, "Configuring Virtual Connections," of the *ATM Switch Router Software Configuration Guide*.

Step 5   Check the Soft vc call state field. This field should be Active.

Step 6   Check the Number of soft vc retry attempts. The number should be 0.

Checking the Connection Management

Use the following command to check soft PVC connection management:

Command	Purpose
show atm interface atm *card/subcard/port*	Confirms the interface status and configuration.

Debugging the Connection Management

Use the following commands to debug the PVC connection management:

Command	Purpose
debug atm conn errors	Enables connection management error debugging.
debug atm conn events	Enables connection management event debugging.
no debug all	Disables all debugging.

Troubleshooting SVC Connections on a PNNI Routing Network

This section describes how to troubleshoot SVC connections using the **show** command and **debug** command. These commands can be used to troubleshoot problems with SVC setup between end systems. The SVCs are automatically configured on the ATM switch router when the cables are connected and the ATM switch router is on.

In the example network in Figure 5-3, EndSys1 originates the signaling messages, which attempt to establish an SVC connection to EndSys2. In this example, Endsys1 connects directly to the ATM switch router, named RemDvLs1, over the User-Network Interface (UNI) connection at ATM interface 3/1/1. Endsys2 is connected directly to the ATM switch router, EngFl1Ls1, over the UNI connection at ATM interface 0/0/0. Both ATM switch routers connect to other ATM switch routers using network-to-network interface (NNI) connections.

Figure 5-3   SVC Connection Example
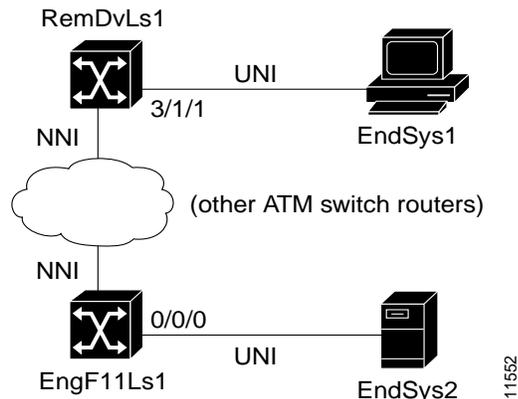
This section contains the following procedures:

- Checking the SVC Status at the End UNI Interface
- Checking UNI Interfaces
- Debug SVC signaling
- Alternate SVC Diagnostic
- Debugging PNNI SVC Routing
- Checking ATM Routes
- Checking PNNI Topology
- Checking SVC Downstream

Checking the SVC Status at the End UNI Interface

Use the following commands to check SVC interface status:

Command	Purpose
show atm vc signalling interface atm *card*/*subcard*/*port* **detail**	Confirms the SVC connection to the intended destination ATM NSAP address.
show atm vc interface atm *card/subcard/port vpi vci*	Confirms the destination UNI connection is up, and confirms the correct traffic characteristics are being used.

Follow these steps to confirm whether there is a new SVC connection from the originating side of the UNI interface to the intended remote or destination ATM network service access point (NSAP) address:

Step 1   Use the **show atm vc signalling interface atm** *card/subcard/port* **detail** command on the originating side.

```
RemDvLs1# show atm vc signalling interface atm 3/1/1 detail
interface = ATM3/1/1, call remotely initiated, call reference = 19
vcnum = 0, vpi = 0, vci = 18, state = Active(EngFl1Ls1), point-to-point call

<Information Deleted>

timer currently inactive, timer value = 00:00:00
  Remote Atm Nsap address: 47.0091810000000060705BD900.123412344321.11
  local , Req Connect Ack -> Active(EngFl1Ls1),

<Information Deleted>

RemDvLs1#
```

Step 2   If the connection is up, confirm the correct traffic characteristics using the VPI and VCI listed in the previous command for the SVC to the target ATM NSAP address.

```
RemDvLs1# show atm vc interface atm 3/1/1 0 18
Interface: ATM3/1/1, Type: oc3suni
VPI = 0  VCI = 18
Status: UP

<Information Deleted>

Rx connection-traffic-table-index: 2147483647
Rx service-category: UBR (Unspecified Bit Rate)
Rx pcr-clp01: 7113539

<Information Deleted>

Tx connection-traffic-table-index: 2147483647
Tx service-category: UBR (Unspecified Bit Rate)
Tx pcr-clp01: 7113539

<Information Deleted>

RemDvLs1#
```

Step 3   If the connection is not UP, or not shown, continue with the following section, "Checking UNI Interfaces."

Checking UNI Interfaces

Use the following commands to check the UNI configuration on the *originating* and *terminating* interfaces of the end systems:

Command	Purpose
show atm interface atm *card/subcard/port*	Confirms the interface status, UNI type, and UNI version.
show atm interface atm *card/subcard/port* **status**	Confirms the interface ILMI[1] and active signaling (SSCOP) status.
show running-config	Confirms the interface configuration is valid.
show atm ilmi-status atm *card/subcard/port*	Confirms the end systems ATM addresses are registered for the UNI interface.

1.   ILMI = Integrated Local Management Interface

Follow these steps to confirm that the *originating* end of the SVC connection (RemDvLs1 ATM 3/1/1 in this example) has the correct interface status, type, and UNI version compatible with the end system:

Step 1   Use the **show atm interface** command on the RemDvLs1 ATM 3/1/1 in this example.

```
RemDvLs1# show atm interface atm 3/1/1
Interface:      ATM3/1/1        Port-type:      oc3suni
IF Status:      UP              Admin Status:   up
Auto-config:    enabled         AutoCfgState:   completed
IF-Side:        Network         IF-type:        UNI
Uni-type:       Private         Uni-version:    V3.1
Max-VPI-bits:   2               Max-VCI-bits:   10
Max-VP:         255             Max-VC:         16383
ConfMaxSvpcVpi: 255             CurrMaxSvpcVpi: 3
ConfMaxSvccVpi: 255             CurrMaxSvccVpi: 3
ConfMinSvccVci: 33              CurrMinSvccVci: 33
Svc Upc Intent: pass            signalling:     Enabled
ATM Address for Soft VC: 47.0091.8100.0000.00e0.4fac.b401.4000.0c85.0000.00
Configured virtual links:
  PVCLs SoftVCLs  SVCLs   TVCLs   PVPLs SoftVPLs   SVPLs Total-Cfgd Inst-Conns   2
  0       0        0       0       0     0           2       2
Logical ports(VP-tunnels):    0
Input cells:    113971          Output cells:   98053
5 minute input rate:            2000 bits/sec,      4 cells/sec
5 minute output rate:           2000 bits/sec,      4 cells/sec
Input AAL5 pkts: 64732, Output AAL5 pkts: 80752, AAL5 crc errors: 0
EngFl1Ls1#
```

Step 2   Check that the IF Status is UP. If not, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

Step 3   Check that the IF-type is UNI. If not, refer to Chapter 17, "Configuring Interfaces," in the *ATM Switch Router Software Configuration Guide*.

Step 4   Check that the UNI-version is compatible at both end systems. If not, refer to Chapter 17, "Configuring Interfaces," in the *ATM Switch Router Software Configuration Guide*.

Step 5   Next use the **show atm interface** command to confirm the EngFl1Ls1 ATM0/0/0 in this example:

```
EngFl1Ls1# show atm interface atm 0/0/0
Interface:      ATM0/0/0        Port-type:      oc3suni
IF Status:      UP              Admin Status:   up
Auto-config:    enabled         AutoCfgState:   completed
IF-Side:        Network         IF-type:        UNI
Uni-type:       Private         Uni-version:    V3.1
Max-VPI-bits:   2               Max-VCI-bits:   10
Max-VP:         255             Max-VC:         16383
ConfMaxSvpcVpi: 255             CurrMaxSvpcVpi: 3
ConfMaxSvccVpi: 255             CurrMaxSvccVpi: 3
ConfMinSvccVci: 33              CurrMinSvccVci: 33
Svc Upc Intent: pass            signalling:     Enabled
ATM Address for Soft VC: 47.0091.8100.0000.00e0.4fac.b401.4000.0c85.0000.00
Configured virtual links:
  PVCLs SoftVCLs   SVCLs   TVCLs   PVPLs SoftVPLs   SVPLs Total-Cfgd Inst-Conns   2
0       0          0       0       0       0          2       2
Logical ports(VP-tunnels):     0
Input cells:    113971          Output cells:   98053
5 minute input rate:           2000 bits/sec,       4 cells/sec
5 minute output rate:          2000 bits/sec,       4 cells/sec
Input AAL5 pkts: 64732, Output pkts: 80752, AAL5 crc errors: 0
EngFl1Ls1#
```

Step 6   Check that the IF Status is UP. If not, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

Step 7   Check that the IF-type is UNI. If not, refer to Chapter 17, "Configuring Interfaces," in the *ATM Switch Router Software Configuration Guide*.

Step 8   Check that the Uni-version is compatible at both end systems. If not, refer to Chapter 17, "Configuring Interfaces," in the *ATM Switch Router Software Configuration Guide*.

Follow these steps to confirm that the SVC connections have the correct ILMI and active signaling SSCOP status:

Step 1   Use the **show atm interface atm** command to confirm the *originating* end of the SVC connection:

```
RemDvLs1# show atm interface atm 3/1/1 status
  Interface      IF        Admin  Auto-Cfg     ILMI Addr    SSCOP     Hello      Name
Status         Status    Status   Reg State    State     State
-------------- -------- ------------ -------- ------------ --------- --------
ATM3/1/1          UP         up     done  UpAndNormal   Active  n/a
RemDvLs1#
```

Step 2   Use the **show atm interface atm** command to confirm the *terminating* end of the SVC connection:

```
EngFl1Ls1# show atm interface atm 0/0/0 status
  Interface      IF        Admin  Auto-Cfg     ILMI Addr    SSCOP    Hello
    Name         Status    Status   Status   Reg State    State     State
-------------- -------- ------------ -------- ------------ --------- --------
ATM0/0/0          UP         up     done  UpAndNormal   Active  n/a
EngFl1Ls1#
```

Step 3   Check that the IF Status is UP. If not, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

Step 4   Confirm the ILMI Addr Reg State is Up And Normal.

Step 5   Confirm the SSCOP State is Active.

If either of these steps indicate a problem, use the **show running-config** command to check both terminating and originating ends of the SVC connection for a valid interface configuration. Otherwise, continue with the following checks.

Follow these steps to check the addresses registered for the UNI interfaces:

Step 1   If the interfaces support ILMI, use the **show atm ilmi-status** command on the *originating* end of the SVC to verify that the expected end-system ATM addresses are registered for the UNI interfaces.

Step 2   If the interfaces support ILMI, use the **show atm ilmi-status** command on the *terminating* end of the SVC to verify that the expected end-system ATM addresses are registered for the UNI interfaces.

Step 3   Check that the expected end-system ATM addresses are registered for the UNI interfaces.

For interfaces that do not support ILMI, use the **show running-config** command to verify that a static route has been configured with the correct end-system ATM address.

If static route has not been configured, go to Chapter 3, "Initially Configuring the ATM Switch Router," in the *ATM Switch Router Software Configuration Guide*. Otherwise, continue with the next phase of SVC troubleshooting if you still have not determined the problem with the SVC configuration.

Debugging SVC Signaling

Use the following debug commands to check SVC signaling:

Command	Purpose
debug atm sig-all atm *card/subcard/port*	Confirms the SVC connection to the intended destination ATM NSAP address.
no debug all	Turns off debugging.

Follow these steps to turn on signaling debugging and then retry the setup of the SVC from EndSys1.

Step 1   Use the **debug atm sig-all atm** *card/subcard/port* command to enable signaling debugging for the originating end ATM switch router UNI interface (on RemDvLs1 ATM 3/1/1).

Step 2   Retry to set up the SVC from EndSys1.

If no debug printouts occur on the ATM switch router (RemDvLs1 in this example), then the problem is upstream on either the originating UNI interface, on the originating switch router itself, or in EndSys1.

Note   Confirm that terminal monitor has been enabled on the switch router by entering the **terminal monitor** EXEC command.

Step 3 If debug printouts do occur, turn off further printouts using the **no debug all** command.

Step 4 Scroll up to the beginning of the debug printouts to confirm the following:

- Check for a valid Called Party Addr and Calling Party Address. If these are not valid or are not displayed, recheck the EndSys1 configuration.

- Check for the message ROUTING INTERFACE: err_code = PNNI_SUCCESS. If you do not see this message, continue to the "Debugging PNNI SVC Routing" section on page 5-20.

- Check if there is an Input Event: Rcvd Release printout indicating a received release and look at the cause = *reason* and *location*. This indicates that the problem is downstream of the originating UNI, so continue to the "Debugging PNNI SVC Routing" section on page 5-20 and then continue to the "Checking SVC Downstream" section on page 5-23.

Alternate SVC Diagnostic

This section describes an alternate method you can use to troubleshoot SVC signaling using the **atm signalling diagnostics** command.

Use the following commands starting at the privileged EXEC prompt to check SVC signaling:

	Command	Purpose
Step 1	Switch# **configure terminal** Switch (config)#	Enters configuration mode from the terminal.
Step 2	Switch (config)# **atm signalling diagnostics enable** Switch (config-atmsig-diag)#	Enables ATM signaling diagnostics.
Step 3	Switch (config-atmsig-diag)# **atm signalling diagnostics** *filter-index-number*	Starts ATM signaling diagnostics using an index number from 1 to 50 and changes prompt to ATM signaling diagnostics configuration mode.
Step 4	Switch (config-atmsig-diag)# **incoming-port atm** *card/subcard/port*	Configures the incoming port to filter.
Step 5	Switch (config-atmsig-diag)# **called-nsap-address** *full-called-side-NSAP-address*	Sets the NSAP address to filter.
Step 6	Switch (config-atmsig-diag)# **status active**	Activates the filter.
Step 7	Switch (config-atmsig-diag)# **end** Switch#	Exits signaling diagnostic configuration mode
Step 8	Switch# **show atm signalling diagnostics filter** *filter-index-number*	Displays the configuration of the ATM signaling diagnostics filter.
Step 9	Switch# **show atm signalling diagnostic records** *filter-index-number*	Displays any captured records for this signaling diagnostics filter.

	Command	Purpose
Step 10	Switch# **configure terminal** Switch (config)#	At the privileged EXEC prompt, enters configuration mode from the terminal.
Step 11	Switch (config)# **no atm signalling diagnostics enable**	Disables ATM signaling diagnostics.

Follow these steps to check SVC signaling:

Step 1 Use the **atm signalling diagnostics enable** command to enable ATM signaling diagnostics.

```
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# atm signalling diagnostics enable
```

Step 2 **Use the atm signalling diagnostics** *filter-index-number* command to configure an ATM signaling diagnostics filter number.

```
Switch(config)# atm signalling diagnostics 1
```

Step 3 In ATM signaling diagnostics mode, use the **incoming-port atm** command to configure an ATM port for filtering.

```
Switch(cfg-atmsig-diag)# incoming-port atm 0/0/0
```

Step 4 Use the **called-nsap-address** command with the 20-octet called NSAP address to configure an ATM NSAP address for filtering.

```
Switch(cfg-atmsig-diag)# called-nsap-address
47.0091.8100.0000.00e0.4fac.b401.4000.0c80.8020.00
```

Step 5 Use the **status-active** command to start capturing records for this filter.

```
Switch(cfg-atmsig-diag)# status active
```

Step 6 Exit ATM signaling diagnostic mode, and use the **show atm signalling diagnostic filter** command to check that the filter is properly configured and active.

```
Switch(cfg-atmsig-diag)# end
Switch# show atm signalling diagnostics filter 1
F I L T E R   I N D E X   1
------------------------------
Scope: all, Cast Type: all
Connection Kind:   all
Service Category:  all
Clear Cause: 0, Initial TimerValue: 600
Max Records: 20,   NumMatches: 0,   Timer expiry: 557
Incoming Port: ATM0/0/0, Outgoing Port: 0
Calling Nsap Address:NULL
Calling Address Mask:NULL
Called Nsap Address :47.00918100000000E04FACB401.40000C808020.00
Called Address Mask :NULL
Status : active
Switch#
```

Step 7 Retry to set up the SVC from the end system.

Step 8   Use the **show atm signalling diagnostic record** command to examine the first filter record (labelled as: D I S P L A Y I N D E X 1).

```
Switch# show atm signalling diagnostic records 1

<Display Omitted>

Switch#
```

Note   No signaling diagnostic records are captured if the signaling setup is successful, or if the connection is immediately released by the End System.

If no captured records appear for an unsuccessful setup, the problem is at the originating UNI, or end system.

Step 9   Check the Calling-Address field. If the address is wrong, check the end system configuration.

If no list of DTLs are shown, refer to the following section, "Debugging PNNI SVC Routing."

If there is a Crankback type listed, refer to the "Checking SVC Downstream" section on page 5-23.

Step 10   In privileged EXEC mode, use the **no atm signalling diagnostic enable** command to disable ATM signaling diagnostics.

```
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# no atm signalling diagnostics enable
```

Debugging PNNI SVC Routing

Use the following commands to debug Private Network-Network Interface (PNNI) Switched Virtual Circuit (SVC) routing:

Command	Purpose
debug atm pnni route-all atm	Confirms the SVC connection PNNI routing.
no debug all	Turns off debugging.

Follow these steps to enable PNNI routing debugging for the originating end ATM switch router UNI interface.

Step 1   Use the **debug atm pnni route-all atm** command to enable PNNI routing debugging for RemDvLs1 ATM 3/1/1.

Step 2   Retry to set up the SVC from EndSys1.

Step 3   Turn off further debug printouts with the **no debug all** command.

```
        PNNI: Rcvd UBR Route Req to addr 47.0091810000000060705BD900.123412344321.11
        PNNI: Looking For Nodes That Advertise This Prefix
        PNNI: Best Match Is 47.0091810000000060705BD900.000000000000.00/104
→    PNNI: Found 1 POAs
             priority: 2   (12 0               ) pnni-remote-internal
        PNNI: Compute On-Demand Route Based On Admin Weight
        PNNI: Found A 1 Hop Route To Destination
→    PNNI: SOURCE ROUTE
             DTL 1> 2 Nodes
             DTL 1> 56:160:47.0091811000000000613E7B2F01.00613E7B2F99.00 ATM0/1/1
             DTL 1> 56:160:47.009181100000006122222222.006122222222.00 ATM0/3/1
             DTL 2> 2 Nodes
             DTL 2> 24:40:47.009181100000000000000000.0060705BAD01.00 4276000
                        24:160:47.0091810000000060705BD900.0060705BD900.00 0
→    PNNI: Found 1 Ports To Next DTL Node 12 ATM0/1/1
→    PNNI: Send Source Route Reply To Requestor: Code PNNI_SUCCESS
```

Step 4   Check printouts for correct service class, correct target address, and for at least 1 POA (Point of Attachment) at the target node. If no best match or POAs were found, proceed to the "Checking ATM Routes" section on page 5-21.

Step 5   Check that at least one Ports to Next DTL Node *n* was found. If no ports were found, check for proper UNI/NNI interface configuration and status on the interfaces to the next indicated node *n*.

> **Note**   Use the **show atm pnni identifiers** command to determine which node the node *n* represents.

Step 6   If the initial Source Route Reply code is PNNI_SUCCESS and there are further tries with Crankback Set, the problem is downstream of this switch router. Note the original SOURCE ROUTE, shown as a list of DTLs (which are lists of node IDs and ports), as well as any calculated port list to the next node. Continue with the "Checking SVC Downstream" section on page 5-23.

If the Source Route Reply code is other than PNNI_SUCCESS, the actual code gives information about the nature of the problem when routing constraints are not met.

Checking ATM Routes

Use the following command to list the routes and destination prefixes:

Command	Purpose
show atm route	Displays the destination prefixes the originating ATM switch router has learned.

Follow these steps to list the routes learned by the *originating* end of the ATM switch router on the UNI interface:

Step 1   Use the **show atm route** command to display a list of routes learned by the originating end ATM switch router UNI interface on RemDvLs1 ATM 3/1/1 as shown in Figure 5-3.

Step 2   Confirm that a prefix matching the intended target address is shown with a ST (State) UP. If there is more than one prefix that exactly matches the corresponding prefix of the target address, PNNI will choose the longest matching prefix.

If the longest matching prefix ST is DN (Down) for a node other than node 1, it indicates that there is no connectivity to that node. Continue to the following section "Checking PNNI Topology."

> **Note**   If the State is DN for a desired prefix on node 1 (this node), then check for proper status for the terminating UNI interface on this node. The ILMI Auto-Cfg (auto configuration) status must be shown as done, or auto configuration must be turned off for the prefix state to be UP.

Step 3   Confirm that the Node *n* shown for the longest matching prefix is the terminating ATM switch router (EngFl1Ls1 for this example). If PNNI Hierarchy is being used, the node can instead be a logical group node (LGN) ancestor of the terminating ATM switch router.

> **Note**   Use the **show atm pnni identifiers** command to determine which node *n* represents.

If the wrong node is listed with a matching prefix, check for proper ATM address configuration for the destination switch router (EngFl1Ls1 in this example), as well as for its UNI interface and for any hierarchy ancestor LGN.

Step 4   If there is no matching prefix appearing in the list of prefixes reachable from the originating end switch router (RemDvLs1 in this example), use the **show atm route** command on the terminating node (EngFl1Ls1 in this example).

If the prefix appears correctly on the terminating node, continue to the following section, "Checking PNNI Topology."

Checking PNNI Topology

The **show atm pnni topology** command and **show atm pnni election peers** command display the actual topology of connected ATM switch router nodes that the originating node (RemFl1Ls1 in this example) has learned. Confirm that an unbroken path of nodes and links with the status up can be found between the originating and terminating ATM switch routers (or for hierarchy, to a terminating end ancestor LGN).

Use the following commands to examine the node PNNI topology and ATM switch router connectivity:

Command	Purpose
show atm pnni topology	Displays the actual topology of the connected nodes.
show atm pnni election peers	Displays the connectivity to a specific node within a peer group.

Follow these steps to display the actual topology of the connected nodes that the originating switch router has learned:

Step 1 Use the **show atm pnni topology** command to display the actual topology of the connected ATM switch router nodes.

Step 2 If the terminating node is not shown or if necessary links are down or missing for an unbroken path, it indicates that the originating switch router (RemDvLs1 in this example) cannot find a path to the terminating node. Either a physical problem exists at the indicated network failure location, or else PNNI is unable to update its database to reflect the actual network condition.

Step 3 Use the **show atm pnni election peers** command to confirm whether this node has connectivity to any particular node within the same peer group.

> **Note** Use the **show atm pnni identifiers** command to determine which nodes are represented by the node numbers that are internally assigned.

If a peer node is missing or is shown as NO for the Connected column, then PNNI considers that there is no path to that node.

Step 4 Check for physical problems by executing the **show atm pnni interface** command on the indicated failing nodes. If no physical problems are shown for the indicated failing nodes, proceed to the "Troubleshooting the PNNI Database" section on page 5-27.

If an unbroken path does exist based on the topology display, but debugging the PNNI routing showed that the destination was not initially PNNI_SUCCESS, it might mean that there are routing restrictions based on QoS, CAC, scope, or other path constraints that could not be met.

Checking SVC Downstream

This section is separated into two sub-sections:

- Flat Network
- Hierarchical Network

Proceed to the sub-section that best describes your PNNI network configuration.

Flat Network

Use the following commands to check ATM signaling events on the terminating ATM switch router:

Command	Purpose
debug atm sig-events atm *card/subcard/port*	Confirms the SVC connection from the destination end of the SVC.
no debug all	Turns off debugging.

> **Note**   This process also applies to troubleshooting an SVC connection downstream in a terminating end peer group in a PNNI hierarchy.

Follow these steps to enable ATM signaling events debugging for the terminating end ATM switch router UNI interface (on EngFl1Ls1 ATM 0/0/0):

Step 1   Use the **debug atm sig-events atm** *card/subcard/port* command to display signaling events at the terminating end of the ATM switch router on the UNI interface.

Step 2   Alternately, you can set up a signaling diagnostic filter using the appropriate called and calling end NSAP address and examine the diagnostic record you receive.

Step 3   Retry to set up the SVC from EndSys1.

Step 4   If no debug printouts occur on the terminating switch router (EngFl1Ls1 in this example), then the signaling messages are not reaching the terminating node. Check for valid signaling status on the NNI links interconnecting the ATM switch router nodes using the **show atm status** command and **show atm interface** command.

> **Note**   Confirm that the terminal monitor has been enabled on the switch router by entering the **terminal monitor** EXEC command.

If debug printouts are shown on the terminating switch router (EngFl1Ls1 in this example), the problem has been isolated to either the terminating ATM switch router, UNI, or the end system.

Step 5   Turn off further debug printouts with the **no debug all** command and scroll up to the beginning of the printouts to check the validity of party addresses and the occurrence of repeat events.

Step 6   Check for a valid Called Party Address and Calling Party Address (or a valid target address in the ROUTING INTERFACE information). If these are not valid, the printout might be for some other SVC setup.

If `ROUTING INTERFACE: err_code` (error codes) shows an err_code other than PNNI success, refer to the "Debugging PNNI SVC Routing" section on page 5-20 for the terminating switch router node (EngFl1Ls1 in this example).

Step 7   Check if there is an `Input Event: Rcvd Release` printout indicating a receive release and look at the cause = *reason* and *location*. This indicates that the problem is downstream on the terminating end system.

Hierarchical Network

Use the following commands to troubleshoot an SVC connection if the network supports PNNI hierarchy and the terminating node is in another peer group:

Command	Purpose
debug atm sig-events atm *card/subcard/port*	Determines the exit border node for the local peer group.
no debug all	Turns off debugging.
show atm pnni identifiers	Determines the internal node number and name corresponding to the exit border node ID.

> **Note**   To troubleshoot an SVC connection downstream at the terminating end peer group, see the previous section, "Flat Network."

Follow these steps to enable debugging ATM signaling events for the terminating end ATM switch router on the UNI interface (on EngFl1Ls1 ATM 0/0/0):

Step 1   Start debugging signaling events with the **debug atm sig-events atm** *card/subcard/port* command to display signaling events on the terminating end ATM switch router on the UNI interface.

Step 2   Retry to set up the SVC from EndSys1.

Step 3   If no debug printouts occur on the terminating switch router (EngFl1Ls1 in this example), then the signaling messages are not reaching the terminating node. Check for a valid signaling status on the NNI links interconnecting the nodes using the **show atm status** command and **show atm interface** command.

> **Note**   Confirm that the terminal monitor is enabled on the switch router by entering the **terminal monitor** EXEC command.

If debug printouts are shown on the terminating ATM switch router (EngFl1Ls1 in this example) the problem has been isolated to either the terminating ATM switch router, UNI, or the end system.

Step 4   Turn off further debug printouts with **no debug all** command.

```
EngFl1Ls1# debug atm sig-events atm 0/0/0

<Information Deleted>

PNNI: SOURCE ROUTE
        DTL 1> 2 Nodes
        DTL 1> 56:160:47.00918110000000613E7B2F01.00613E7B2F99.00 ATM0/1/1
        DTL 1> 56:160:47.00918110000000006122222222.006122222222.00 ATM0/3/1
        DTL 2> 2 Nodes
        DTL 2> 24:40:47.00918110000000000000000000.0060705BAD01.00 4276000
                24:160:47.009181000000060705BD900.0060705BD900.00 0

<Information Deleted>

EngFl1Ls1# no debug all
```

Step 5   Examine the initial SOURCE ROUTE. The last node ID listed for the lowest level DTL (shown as DTL 1>) is the exit border node for the local peer group. Make a note of the exit border node ID and port.

Follow these steps to determine the internal node number and name corresponding to the exit border node ID for the terminating end ATM switch router on the UNI interface (EngFl1Ls1 ATM 0/0/0 in this example):

Step 1   Use the **show atm pnni identifiers** command to determine the internal node number and name corresponding to the exit border node ID.

The lowest level neighbor node on the other end of the exit border port is the entry border node for the next peer group.

> **Note**   The **show atm pnni topology node** *exit-border-node-number* command shows the neighbor node name of the entry border node if the interface is up.

Step 2   After determining the next entry border node, repeat the troubleshooting steps in the following sections on that node:

- Debugging SVC Signaling, page 5-17
- Debugging PNNI SVC Routing, page 5-20
- Checking ATM Routes, page 5-21
- Checking PNNI Topology, page 5-22
- Checking SVC Downstream, page 5-23

Step 3   Repeat these steps on that node and continue until either the terminating peer group is reached or the problem is isolated.

Troubleshooting the PNNI Database

This section outlines how to troubleshoot the PTSE (PNNI Topology State Element) database. When the PNNI topology or prefixes do not accurately reflect the state of other nodes in the network, you have problems with the PTSE database. All knowledge about other PNNI nodes is contained in the PTSE databases, which exist independently for each PNNI node in the network.

This section contains the following:

- Checking PNNI Neighbor Database Synchronization
- Checking the Flat Network or the Database Within the Same Peer Group
- Checking the PNNI Hierarchy Network Database for Different Peer Groups

Checking PNNI Neighbor Database Synchronization

When a node first initializes, it exchanges PTSEs with its immediate neighbor peer nodes. The progress of the database synchronization is tracked by the neighboring peer states.

Use the following commands to check the neighbor nodes and their corresponding states:

Command	Purpose
show atm pnni neighbor	Confirms the neighbor nodes and their corresponding PNNI states.
debug atm pnni adj-event	Confirms individual PNNI events being exchanged.
debug atm pnni adj-packet	Confirms individual PNNI packets being exchanged.
no debug all	Turns off all debugging.

Follow these steps to troubleshoot PNNI neighbor database synchronization problems:

Step 1   Use the **show atm pnni neighbor** command to confirm the neighbor nodes and their corresponding PNNI states.

Step 2   Check if a neighboring peer node can reach the full state. If the neighboring peer node does not reach the full state, the following subset of neighboring peer states might indicate problems if they remain unchanged for an extended period:

- NPdown—There are no active links (for example, hello state 2way_in) to the neighboring peer. Refer to the "Checking the PNNI Lowest Level Interface" section on page 5-33 to debug a known interface to a neighbor node unable to reach the 2way_in state.

- Negotiating—During this transient state, the neighbors agree upon which is the master (for example, the higher node ID) and the DS sequence number.

- Exchanging—During this state, the node describes its database by sending database summary packets containing PTSE headers only. When both adjacent nodes have the complete list of PTSE headers from the neighbor node, they transition to another state.

- Loading—During this state, the nodes are requesting PTSEs from the neighbor, but at least one has not been received.

If the neighbor machine remains in the Negotiating, Exchanging, or Loading state, turn on debugging using the **debug atm pnni adj-event** command and **debug atm pnni adj-packet** command to see the individual events and the packets being exchanged.

Enter the **no debug all** command to turn off debug messages.

Checking the Flat Network or the Database Within the Same Peer Group

Use the following command to check the nodes in the peer group:

Command	Purpose
show atm pnni database [*internal-node-number*] [**detail**]	Confirms all nodes in the peer group with the PTSEs that each node originates.

Follow these steps to list all nodes in the peer group along with the PTSEs that each node originates:

Step 1   Use the **show atm pnni database** command to list all nodes in the peer group.

```
Switch# show atm pnni database 1
Node 1 ID 96:160:47.00918100000000E04FACB401.00E04FACB401.00 (name: Switch)
  PTSE ID   Length   Type   Seq no.    Checksum   Lifetime   Description
  1         92       97     117        37853      3143       Nodal info
  2         52       224    3331       18077      3016       Int. Reachable Address
Switch#
```

Step 2   Use the **show atm pnni database** command again with the **detail** command option.

```
Switch# show atm pnni database 1 detail
Node 1 ID 96:160:47.00918100000000E04FACB401.00E04FACB401.00 (name: Switch)
  PTSE ID   Length   Type   Seq no.    Checksum   Lifetime   Description
  1         92       97     117        37853      3135       Nodal info
    Time to refresh 1441, time to originate 0
    Type 97 (Nodal info), Length 48
    ATM address 47.00918100000000E04FACB401.00E04FACB401.00
    priority 0, leader bit NOT SET
    preferred PGL 0:0:00.000000000000000000000000.000000000000.00
  2         52       224    3331       18077      3008       Int. Reachable Address
    Time to refresh 1478, time to originate 0
    Type 224 (Int. Reachable Address), Length 32, Port 0, vp capable
    Scope (level) 0, Address info length (ail) 16, Address info count 1
    Pfx: 47.0091.8100.0000.00e0.4fac.b401..., length 104
Switch#
```

These commands should display similar information when the command is used on any other node in the same peer group.

The only differences are the internal node numbers (Node *n*), which are independently assigned by each node so that node 1 represents the node itself and other numbers are assigned as new nodes are discovered. The PTSE information might also differ for the valid case where some nodes have received more recent information than other nodes. A redisplay of the information on the node, which originally displayed older information for some PTSEs, normally shows more recent information, but might also have even newer information for other PTSEs.

In the displays from the **show atm pnni database** command, check the following:

Step 1   Check that all nodes in the peer group are shown. If no overlapping sets of partial nodes are shown for two different nodes in a peer group, it might indicate a peer group partition. Examine the interface status, using the **show atm pnni interface** card/subcard/port and **show atm pnni neighbor** commands for links and nodes that should connect to the nearest missing node to further isolate the problem.

Step 2   Check that the same PTSEs and similar sequence numbers appear on displays for different ATM switch router nodes. If not, redisplay for the node with the older seq no (sequence number) to see if it gets updated. If there are differences, use the **debug atm pnni flood-packet** command on the originating and other nodes to see when PTSEs are being sent and received, along with any error conditions detected.

Step 3   Check if topology or other specific types of information for a node are incorrect when displayed on another node. If not, use the **detail** option for the **show atm pnni database** command to display the complete PTSE contents both on the originating node and on any other node in the peer group. Determine whether the PTSE originates incorrectly or if there is a problem in synchronizing and flooding the PTSE to the other node.

Checking the PNNI Hierarchy Network Database for Different Peer Groups

A logical group node (LGN) originates PTSEs, which summarize the information from the entire child peer group it represents. The PTSEs that an LGN receives from its peer LGNs are flooded down to its child peer group leader (PGL), which then floods the PTSEs to its peers.

Use the following commands to check the PNNI hierarchy network database configuration:

Command	Purpose
show atm pnni database [*internal-node-number*] [**detail**]	Confirms that the PTSEs originated by all lowest level nodes in its peer group, its higher level ancestor LGNs, and all peers of the ancestor LGNs.
show atm pnni election local-node *node-index* **peers**	Confirms the PNNI peer group leader election process configuration.
show atm pnni database local-node [*internal-node-number*]	Confirms the contents of the PNNI topology database of the specified node.
debug atm pnni flood-packet local-node *node-index*	Debugs PNNI flood related packets for the local node.

Follow these steps to troubleshoot hierarchy database problems:

Step 1 Use the **show atm pnni database** *internal-node-number* **detail** command on the lowest level node to confirm that the PTSEs were originated by all lowest level nodes in the peer group, its higher level ancestor LGNs, and the PTSEs from all peers of the ancestor LGNs.

> **Note** Use the **show atm pnni hierarchy network** command to determine the higher level ancestors for a node.

If there are problems with nodes or PTSEs within the same peer group, refer to the troubleshooting information in the "Checking the Flat Network or the Database Within the Same Peer Group" section on page 5-28 earlier in this chapter.

If there are problems with PTSEs from higher level LGNs, confirm the following for the output display:

Step 2 In addition to its peer nodes, check that the display shows all ancestor nodes. If some ancestor nodes are missing, go to the next section, "Troubleshooting PNNI Peer Group Leaders."

Step 3 If all ancestor nodes are present, but other peer LGNs are missing at one of the higher levels, check which ATM switch router is acting as the ancestor LGN for the affected level using the **show atm pnni hierarchy network detail** command.

Step 4 Use the **show atm pnni database local-node** node-index command on the ancestor LGN ATM switch router after determining the locally assigned node number for the affected LGN node. This command shows the subset of PTSEs that the higher level LGN has in its database.

Step 5 If the peer LGNs are missing from its database, use the **show atm pnni election local-node** *node-index* **peers** command to check connectivity to the missing LGNs.

Step 6 If there is no connectivity shown for some LGNs, go to the "Troubleshooting PNNI Hierarchical Networks" section on page 5-45 to isolate problems with the child peer group leader for the missing uplink. Also, see the "Troubleshooting PNNI SVCC-RCC and Higher Level Links" section on page 5-40.

Step 7 If PTSEs originated by a higher level LGN show up incorrectly when displayed for a lowest level LGN, use the **show atm pnni database local-node** *node-index* command to display the higher level PTSEs for the ancestor LGN of the affected lowest level node and for the originating LGN node.

Step 8 If there are differences, use the **debug atm pnni flood-packet local-node** *node-index* command on the originating LGN and on any other affected LGN and child node.

This command shows when PTSEs are being sent and received, along with any error conditions detected.

Step 9 Check if topology or other specific types of information for a higher level LGN are incorrect when displayed on a lowest level node in another peer group. Use the **detail** option for the **show atm pnni database local-node** *node-index* command.

This command shows the complete PTSE contents. Determine if the PTSE originates incorrectly or a problem exists transporting the PTSE to other LGNs or to the lowest level node.

Step 10 If the PTSE contents for the LGN originator do not accurately represent its child peer group information, go to either the "Troubleshooting PNNI Hierarchical Networks" section on page 5-45 or the "Debugging Summary Addresses" section on page 5-52 depending on the type of affected PTSE.

Troubleshooting PNNI Peer Group Leaders

This section describes how to troubleshoot the PNNI peer group leader (PGL). In a PNNI network supported hierarchy, one node within the peer group is elected as the PGL. It summarizes and aggregates information from the entire peer group and passes that information to its parent LGN node, which advertises the information in PTSEs to its peer LGNs at the higher hierarchy level.

Use the following commands to check the peer group leader configuration:

Command	Purpose
show atm pnni hierarchy network [**detail**]	Confirms configured PNNI hierarchy and its status in detail.
show atm pnni election [**local-node** *node-index*]	Confirms peer group leader election process for the local node.
show atm pnni hierarchy local-configured	Confirms configured PNNI hierarchy for the local node.
show atm pnni election peers	Confirms peer group leader election priority and preferred PGL as advertised by all peers in the peer group.

Follow these steps to troubleshoot the PNNI PGL:

Step 1 Use the **show atm pnni hierarchy network detail** command to display the PGL and ancestor LGN for all higher hierarchy levels.

Step 2 If no active parent LGNs are shown, use the **show atm pnni election local-node** *node-index* command on the node (or nodes) that is configured to allow operation as the PGL. If the problem occurs for elections on a higher level, use the local-node option to specify the node index number of the higher level node.

```
Switch# show atm pnni election local-node 1
PGL Status.............: Not PGL
Preferred PGL..........: NULL
Preferred PGL Priority.: n/a
Active PGL.............: NULL
Active PGL Priority....: n/a
Active PGL For.........: n/a
Current FSM State......: PGLE Operating: Not PGL
Last FSM State.........: PGLE Calculating
Last FSM Event.........: Preferred PGL Is Not Self
Configured Priority....: 0
Advertised Priority....: 0
Conf. Parent Node Index: NONE
PGL Init Interval......: 15 secs
Search Peer Interval...: 75 secs
Re-election Interval...: 15 secs
Override Delay.........: 30 secs
Switch#
```

Step 3 Confirm that the election leadership-priority is configured to a nonzero value and that the expected primary PGL has the highest priority.

Step 4   Confirm that the peer group leader has a parent node configured that is enabled and running. Use the **show atm pnni hierarchy local-configured** command to view the locally configured parent nodes.

```
Switch# show atm pnni hierarchy local-configured
  Locally configured parent nodes:
  Node          Parent
  Index  Level  Index   Local-node Status      Node Name
  ~~~~~  ~~~~~  ~~~~~~  ~~~~~~~~~~~~~~~~~~~~  ~~~~~~~~~~~~~~~~~~~~~~
  1      96     N/A     Enabled/ Running       Switch
Switch#
```

Step 5   Use the **show atm pnni election peers** command to see which other peer nodes are known by a local node. Only those nodes listed as Connected are eligible to be the preferred PGL for a local node.

```
Switch# show atm pnni election peers
  Node No.   Priority   Connected   Preferred PGL
  ~~~~~~~~   ~~~~~~~~   ~~~~~~~~~   ~~~~~~~~~~~~~~
  1          0          Yes         NONE
Switch#
```

Step 6   If the expected leader still does not become PGL, check the current FSM state using the **show atm pnni election** command (preferably on the ATM switch router that acts as the PGL). The following subset of election states might indicate possible user correctable conditions if they remain unchanged for an extended period:

- PGLE Starting—Waiting for the first interface hello state machine to be started on a link. Be sure that at least one NNI is connected to another switch router (or LGN) and that the hello state machine on at least one interface is in a state other than down.

- PGLE Awaiting—Waiting for the first interface to reach the hello 2way_in Hierarchical state. It automatically transitions to the calculating state after waiting for the search peer interval as displayed by the **show atm pnni election** command.

- PGLE Awaiting Full, PGLE Initial Delay—Waiting for the first neighbor state machine to reach the full state and for an initial delay to allow peers to exchange election information. If the election gets stuck in the awaiting full state, proceed to the "Checking PNNI Neighbor Database Synchronization" section on page 5-27 to debug neighbor state machine problems.

- PGLE Awaiting Unanimity—This node prefers itself as PGL and is waiting for other nodes to reach unanimity. It automatically transitions to another state after waiting for the override delay as displayed by the **show atm pnni election** command.

- PGLE Hung Election: Not PGL—After waiting for the override delay, less than two-thirds of the other nodes are advertising it as their preferred PGL. This might result from a change in the topology or other network parameters. In that case, it should recover by itself. It can also indicate a defective node or link. Use the **show atm pnni election peers** command to check for the current connectivity to other nodes within the same peer group.

- PGLE Awaiting Reelection—The node has lost connectivity to the current PGL. It automatically transitions to another state after waiting for the re-election Interval as displayed with the **show atm pnni election** command. Use the **show atm pnni election peers** command to check for connectivity to the original PGL and to the other nodes within the same peer group.

- PGLE Operating: Not PGL—The node has lost the election for PGL. To force this node to be the PGL, reconfigure the election priority to a value higher than the current PGL as listed with the **show atm pnni election** command, or else lower the election priority of the current PGL.

For other PGL election problems not isolated by these steps, use the **debug atm pnni election** command to turn on debugging messages that show the election events and state changes leading up to the election outcome as well as some additional election error conditions.

Turn off debugging messages with the **no debug all** command.

Troubleshooting the PNNI Lowest Level Interface

This section describes how to troubleshoot the lowest level PNNI interface connection problems.

This section contains the following procedures:

- Checking the PNNI Lowest Level Interface
- Checking the PNNI and Signaling Control Channels
- Checking PNNI Hello Problems on Lowest Level Interfaces
- Checking PNNI Metric Troubleshooting for Lowest Level Interfaces
- Debugging PNNI Hello at the Lowest Level

Checking the PNNI Lowest Level Interface

Use the following commands to check the lowest level PNNI interface status:

Command	Purpose
show atm interface atm *card/subcard/port* [**status**]	Confirms PNNI interface and administration status plus the hello state.
show atm status	Displays status information for all of the interfaces.
show atm routing-mode	Checks the ATM switch router routing mode.
no atm routing-mode static	If needed, configures the switch router to allow PNNI operation.
show atm interface *card/subcard/port*	Confirms that the interface is configured with: • Auto configuration enabled (or as NNI) • IF-type is NNI • Signaling: Enabled

Follow these steps to troubleshoot the lowest level PNNI interface status:

Step 1   Use the **show atm interface atm** *card/subcard/port* **status** command to confirm PNNI interface and administration status plus the hello state.

> **Note**   You can use the **show atm status** command to show status information for all of the interfaces.

If the IF status and admin status are not up, make sure that the interface is not configured as shutdown. If they still do not change to the UP state, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

If the PNNI hello state is n/a or not shown for an NNI interface between two ATM switch routers, check the routing mode using the **show atm routing-mode** command. If it is static mode, use the **no atm routing-mode static** command to allow PNNI operation. If this does not work, confirm that the installed software version allows PNNI operation.

> **Note**   For UNI interfaces, the PNNI Hello protocol is not used. The Hello state is not applicable for UNI interfaces.

If the hello state reads "LoopErr," it means that the line side is connected to another port on the same ATM switch router, or to another switch router that has an identical node ID.

Step 2   Check the output of the **show atm interface atm** *card/subcard/port* command to confirm that the interface is configured with the following:

- Auto-config is enabled (or as NNI)
- IF-type is NNI
- Signaling is enabled

If the interface is port-type: vp tunnel, confirm that the VP tunnel is configured correctly at both ends. Refer to the "Troubleshooting Virtual Path Tunnel Connections" section on page 5-53.

Also confirm that the listed port adapter port-type supports ATM VCs on its line side. If not, then this interface will not be usable either as an NNI or as a UNI signaling interface.

Checking the PNNI and Signaling Control Channels

Use the following command to check the status of the PNNI Routing Control Channel (RCC) and signaling control channels:

Command	Purpose
show atm interface atm *card/subcard/port*	Confirms the PNNI signaling control channels status.

Follow these steps to check that the PNNI Routing Control Channel (RCC) and signaling control channel VCs are up:

Step 1   Use the **show atm vc interface atm** *card/subcard/port* command to confirm the status of the signaling control channels:

```
Switch# show atm vc interface ATM 0/0/1
Interface    VPI   VCI   Type    X-Interface   X-VPI X-VCI   Encap Status
ATM0/0/1     0     5     PVC     ATM2/0/0      0     43      QSAAL UP
ATM0/0/1     0     16    PVC     ATM2/0/0      0     35      ILMI  UP
ATM0/0/1     0     18    PVC     ATM2/0/0      0     107     PNNI  UP

Switch#
```

Step 2   Check the following:

If VCs with Encap (Encapsulation) types of PNNI and Q.2931 Signaling ATM Adaptation Layer (QSAAL) are not shown, check the interface configuration to confirm that signaling is enabled.

If the interface has the manual-well-known-vc mode enabled, either disable it, or if that is the preferred mode, then manually configure PVCs with encapsulation types of PNNI and QSAAL.

✎
Note   NNI interfaces require both QSAAL and PNNI PVCs, but UNI interfaces only require the QSAAL PVC along with the Interim Local Management Interface (ILMI) PVC.

If VCs with PNNI and QSAAL are shown, but the status is not UP on an interface with an IF status that is UP, confirm that the interface has the manual-well-known-VC mode disabled and that the interface is type NNI.

✎
Note   If the neighbor node has multiple hierarchy levels and if one of its higher levels matches the level and peer group ID of the lowest level local node, then it is normal for a PNNI SVCC-RCC to be set up to communicate to the same level LGN, in addition to the PNNI PVC that communicates to the lowest level PNNI node of the neighbor.

Checking PNNI Hello Problems on Lowest Level Interfaces

Use the following commands to check the PNNI PVC status:

Command	Purpose
show atm pnni interface atm *card/subcard/port* **detail**	Confirms the PNNI PVC status.
show atm pnni interface	Confirms the status of all PNNI interfaces.

Command	Purpose
show atm pnni local-node	Confirms that the lowest level peer group IDs match.
show atm pnni hierarchy network detail	Confirms that a common higher level peer group ID exists.

Follow these steps to troubleshoot the PNNI PVC status:

Step 1   Use the **show atm pnni interface atm** *card/subcard/port* **detail** command to confirm PNNI PVC status.

> **Note**   You can use the **show atm pnni interface** command to show PNNI information for all of the interfaces.

Step 2   Check the following subset of hello states. They can indicate possible user correctable conditions if they remain unchanged for an extended period:

- DOWN—Lower level protocols have indicated that the link is not usable. See the previous sections for debugging low level interface problems.

- ATTEMPT—No hello messages have been (recently) received from the neighbor, even though the PNNI RCC PVC is up. Confirm that the remote end of the line (or VP Tunnel) is connected to the correct port on the intended remote ATM switch router. Also check the status of the interface at the remote end of the line. For further analysis, see the "Debugging PNNI Hello at the Lowest Level" section on page 5-39.

- 1-WAY INSIDE—Hellos have been recently received from a neighbor in the same peer group, but the neighbor has not yet acknowledged the information sent from this end. Confirm that the remote node and remote port ID listed are correct. See the "Debugging PNNI Hello at the Lowest Level" section on page 5-39.

- 1-WAY OUTSIDE or 2-WAY OUTSIDE—Hellos have been recently received from a neighbor in another peer group, but no common higher level peer group has been found.

Step 3   If the neighbor was expected to be in the same peer group, confirm that the remote node has the expected peer group ID. Use the **show atm pnni local-node** command on this node and on the neighbor node to confirm that the lowest level peer group IDs match.

> **Note**   If the neighbor node has multiple hierarchy levels and if one of its higher levels matches the level and peer group ID of the lowest level local node, then it is normal for the Hello to the lowest level neighbor to reach the COMMON OUTSIDE state and for a PNNI SVCC-RCC to also be set up to communicate to the LGN that is at the same level as this node.

Step 4   If the neighbor was supposed to be in another peer group, but the COMMON OUTSIDE state has not been reached, use the **show atm pnni hierarchy network detail** command on this node and on the neighbor node to confirm that a common higher level peer group ID exists.

Step 5 It might take a minute or two for the higher level LGNs to come up for some hierarchy configurations that have multiple higher levels or do not have interfaces fully up yet at the higher levels. If a common higher level cannot be found after several minutes, go to the "Debugging PNNI Hello at the Lowest Level" section on page 5-39. Check that the peer group IDs appearing in the nodal hierarchy lists were sent in the individual hello messages on the outside link.

Step 6 If the peer group IDs do not have the expected values, use the **show atm pnni local-node** command on the ATM switch routers where the higher level LGNs are running to confirm that peer group IDs have the expected values. If not, verify that the peer group IDs have not been configured to nondefault values.

Step 7 Also verify that if the active ATM address has been changed on one of the ATM switch routers, that the lowest level node has been disabled and reenabled to reassign the node ID and peer group IDs based on the active ATM address (unless nondefault values are preferred).

Step 8 If common higher levels are not running, see the "Troubleshooting PNNI Peer Group Leaders" section on page 5-31.

Checking PNNI Metric Troubleshooting for Lowest Level Interfaces

Use the following commands to check the PNNI interface metric configuration:

Command	Purpose
show atm pnni interface atm *card/subcard/port*	Confirms PNNI interface metric configuration.
show running-config	Confirms administrative weight (AW) value, which shows the significant change boundaries.
show controllers atm *card/subcard/port*	Confirms minimum cell rate (MCR) value, port type, and port rate.
show atm pnni resource-info *card/subcard/port*	Confirms significant change boundaries.

Note   Some resource metrics are valid only for a subset of the service classes.

Follow these steps to troubleshoot PNNI metric configuration and resource availability information for the lowest level interfaces:

Step 1   Use the **show atm pnni interface atm** *card/subcard/port* **detail** command to confirm the PNNI interface metric configuration.

```
Switch1# show atm pnni interface atm 0/0/0 detail
PNNI Interface(s) for local-node 1 (level=96):
Port ATM0/0/0 RCC is up  , Hello state 2way_in    with node Switch Error: Port
Looped back
  Next hello occurs in 0 seconds, Dead timer fires in 68 seconds
  CBR    : AW 5040 MCR 155519 ACR 147743 CTD 154 CDV 138 CLR0 10 CLR01 10
  VBR-RT : AW 5040 MCR 155519 ACR 155519 CTD 707 CDV 691 CLR0 8 CLR01 8
  VBR-NRT: AW 5040 MCR 155519 ACR 155519 CLR0 8 CLR01 8
  ABR    : AW 5040 MCR 155519 ACR 0
  UBR    : AW 5040 MCR 155519
  Aggregation Token: configured 0 , derived 0, remote 0
Switch#
```

Step 2   Check the AW configuration. If the AW value is not what you expect, use the **show running-config** command to check the administrative-weight mode (for the ATM router PNNI configuration on this ATM switch router).

Also, check whether the AW has been configured to a nondefault value for the specific interface.

Step 3   Check MCR configuration. If the MCR value is not what you expect, check the port type and port rate with the **show controllers atm** *card/subcard/port* command (for physical interfaces only).

Step 4   Use the **show running-config** command to check the ATM pacing configuration. For VP tunnels, check the configuration of the corresponding PVP connection.

Step 5   Check available cell rate (ACR), cell transfer delay (CTD), or cell delay variation (CDV) configuration. Use the **show atm pnni resource-info** *card/subcard/port* command to see the significant change boundaries.

> **Note**   Changes that are within the significant change boundaries do not trigger updates to the hello metrics or horizontal link PTSEs.

Step 6   Check the allocated bit rates (which affect ACR) using the **show atm interface resource atm** *card/subcard/port* command.

Step 7   Check the CLR0 and CLR01 (CLR for CLP=0 and for CLP=0+1) configuration. Use the **show controllers atm** *card/subcard/port* command to see detailed error information for a specific interface.

Debugging PNNI Hello at the Lowest Level

Use the **debug atm pnni hello atm** *card/subcard/port* command at both the local end and (if possible) the remote end of the interface to see the actual hello messages being transmitted along with some additional error condition messages:

Command	Purpose
debug atm pnni hello atm *card/subcard/port*	Confirms the actual hello messages being transmitted.
no debug all	Turns off all debugging.

Follow these steps for further PNNI hello debugging at the lowest interface level:

Step 1 Use the **debug atm pnni hello atm** command at the *local* end of the interface to see the actual hello messages being transmitted with some additional error condition messages.

```
Switch1# debug atm pnni hello atm 0/0/1
<display omitted>
```

Step 2 Use the **debug atm pnni hello atm** *card/subcard/port* command at the *neighbor* node of the interface (if possible) to see the actual hello messages being transmitted.

Step 3 After the display prints out two screens full of information, turn off further printouts using the **no debug all** command.

Step 4 Scroll back up the screen display and confirm the following:

If no printouts are shown, be sure debugging is on. Confirm that this is an NNI interface and recheck interface debugging steps in the "Checking the PNNI Lowest Level Interface" section on page 5-33, the "Checking the PNNI and Signaling Control Channels" section on page 5-34, and the "Checking PNNI Hello Problems on Lowest Level Interfaces" section on page 5-35.

Step 5 Confirm that transmit messages are shown and have the expected local peer group ID and port ID. The transmit message contains the word "Tx."

Hello messages to peer group neighbors should look like this:

```
PNNI:56.1 Hello at ATM0/0/1: Tx, state 2way_in    with node Switch2
NodeId: 56:160:47.00918100000000613E7B2F01.00613E7B2F99.00 Address:
47.00918100000000613E7B2F01.00613E7B2F99.01 PgId: 56:47.0091.8100.0000.0000.0000.0000
Remote: port: ATM0/0/1 (80001000),
NodeId: 56:160:47.0091810000\0000400B0A3081.00400B0A3081.00

Local port: ATM0/0/1 (80001000)all
```

Hello messages on outside links to another peer group should have the same information as the previous example, but should include ULIA sequence number, hierarchy list, and aggregation token value.

Step 6   Confirm that receive messages are shown from the neighbor.

The receive message contains the word "Rx."

Hello messages received from peer group neighbors should look like the following:

```
PNNI:56.1 Hello at ATM0/0/1: Rx, state 2way_in    with node Switch1
NodeId: 56:160:47.00918100000000400B0A3081.00400B0A3081.00
Address: 47.00918100000000400B0A3081.00400B0A3081.01
PgId: 56:47.0091.8100.0000.0000.0000.0000
Remote: port: ATM0/0/1 (80001000), NodeId: 56:160:47.0091810000
Local port: ATM0/0/1 (80001000)
```

If no receive messages are shown on the local node, but the remote neighbor shows that it is transmitting them, there is a problem with transporting the message across the PNNI PVC.

When receive messages are shown, but do not match the transmit messages of the remote neighbor, it indicates that the line (or VP Tunnel) is connected to some remote port, but it is the wrong port.

Hello messages received on outside links from another peer group should have the same information as in the previous example, but in addition they should show a ULIA sequence number, a hierarchy list and sequence number, and an aggregation token value.

The hierarchy list can be examined to confirm whether a common peer group ID exists at some level.

Step 7   Look for other PNNI hello debugging error messages that might give further indication of internal or configuration problems.

Troubleshooting PNNI SVCC-RCC and Higher Level Links

This section describes how to troubleshoot PNNI Routing Control Channel (RCC) between LGNs.

For a network that supports PNNI hierarchy, the PNNI RCC between LGNs (or between an LGN and a lowest level node), is a special type of SVC connection (referred to as an SVCC-RCC). After the SVCC-RCC is set up between the higher level LGN peers, PNNI hello messages are sent across it.

Each hello message contains information about all of the aggregated links between the local and remote LGN. Therefore, the following three types of states are kept independently, and all are important for higher level links:

- The SVCC-RCC setup state—Tracks the progress of requests to signaling to set up the SVCC-RCC.
- The RCC Hello state—An overall hello state for the RCC link, based on hello messages sent between the local and remote LGNs.
- Horizontal link states—Kept independently for each of the aggregation tokens that exist between a pair of LGNs. There is a unique (hexadecimal) port ID assigned for each of the aggregation tokens between a pair of LGNs, even though they are included in one common hello message.

For detailed configuration information, see Chapter 10, "Configuring ATM Routing and PNNI," in the *ATM Switch Router Software Configuration Guide*.

This section contains the following procedures:

- Checking the PNNI Aggregated Horizontal Link Interface Status
- Checking SVCC-RCC Status
- Checking SVCC-RCC Hello
- Debugging SVCC-RCC

Checking the PNNI Aggregated Horizontal Link Interface Status

Use the following commands to check the status of all PNNI aggregated horizontal links and induced uplinks:

Command	Purpose
show atm pnni interface local-node *node-index*	Confirms the status of all PNNI aggregated horizontal links and induced uplinks.
show atm pnni neighbor	Verifies that the neighbor peer LGN has reached the full state for its database synchronization.

Follow these steps to troubleshoot a higher level LGN and the status of all PNNI aggregated horizontal links and induced uplinks at that level:

Step 1   Use the **show atm pnni interface local-node** *node-index* command to check all PNNI aggregated horizontal links and induced uplinks at the LGN level:

```
Switch1# show atm pnni interface local-node 2

  PNNI Interface(s) for local-node 2 (level=40):
  Local Port      Type  RCC HrzLn St Deriv Agg  Remote Port    Rem Node(No./Name)
  ~~~~~~~~~~~~~ ~~~~~ ~~~ ~~~~~~~~ ~~~~~~~~~~ ~~~~~~~~~~~~~ ~~~~~~~~~~~~~~~~~
  2C49000       HrzLn UP  2way     0          2230000       10 Switch2.2.40
  2C49003       HrzLn UP  2way     3          2230003       10 Switch2.2.40
  2276000       UpLnk -   n/a      0          FFFFFFFF      11 Switch4
  Switch1#
```

> ✎
> **Note**   You can leave off the **local-node** option to show information for interfaces at all node levels present on the ATM switch router.

If all of the expected interfaces between a pair of LGNs are missing, or if the RCC is not UP, continue with the following SVCC-RCC checks.

If the RCC is listed as UP, but ports are missing for some expected aggregation tokens, continue to the "Troubleshooting PNNI Hierarchical Networks" section on page 5-45.

For example, if the RCC is listed as UP, but the HrzLn State (Horizontal Link State) is other than 2way, the following subset of aggregated horizontal link states might indicate conditions that you can correct if they remain unchanged for an extended period:

- DOWN—No uplink PTSEs have been received that include an uplink to the neighboring peer LGN with the same aggregation value as listed in a hello message. See the "Troubleshooting PNNI Hierarchical Networks" section on page 5-45.

- ATTEMPT—Although at least one uplink PTSE has been received, including an uplink to the neighbor peer LGN with the listed aggregation token, no valid confirming information has recently been received piggybacked onto the peer hello message.

- 1 WAY—Hellos have recently been received confirming the aggregation token from a neighbor peer LGN, but the neighbor has not acknowledged the information that the local side transmitted. See the "Debugging SVCC-RCC" section on page 5-44.

Step 2   Verify that the neighbor peer LGN has reached the full state for its database synchronization by using the **show atm pnni neighbor** command. If it has not, see the "Checking PNNI Neighbor Database Synchronization" section on page 5-27. If the neighbor has reached the full state but the horizontal link remains in the attempt state, see the "Checking SVCC-RCC Status" section on page 5-42.

Checking SVCC-RCC Status

This section describes troubleshooting the status of SVCC-RCCs from a local LGN node to all of its LGN peers.

Use the following commands to confirm the status of SVCC-RCCs from a local LGN node:

Command	Purpose
show atm pnni svcc-rcc *local-node* **detail**	Confirms the status of SVCC-RCCs from a local LGN node to all of its LGN peers.
show version	Confirms the CPU card has sufficient memory to support the software version.

Follow these steps to troubleshoot the status of SVCC-RCCs from a local LGN node to all of its LGN peers:

Step 1   Use the **show atm pnni svcc-rcc** *local-node* **detail** command to confirm the status of SVCC-RCCs from a local LGN node.

Step 2   Confirm that the RCC state is UP (with SVCC setup state shown as SVCC_UP for the detailed display). Make a note of whether this is the calling side or the called side as shown on the same display line where the SVCC setup state appears.

Step 3   If the RCC state is up, but the hello state is not 2way_in, proceed to the next section, "Checking SVCC-RCC Hello." Otherwise, if the RCC state is not up, continue with these checks.

> **Note**   The LGN with the higher node ID is the calling side originator of the signaling messages that set up the SVCC-RCC.

Step 4   Confirm that the SVCC has the intended remote (LGN) node and rem-node (remote node) name. If not, verify the LGN ancestor information for the child PGL that was the intended remote LGN node.

Step 5   If for an extended period the SVCC setup state (listed for the **detail** option) is not SVCC_UP, the following subset of SVCC setup states might indicate correctable conditions:

• WAIT_INITIAL—An approximate four second delay after an uplink PTSE to a new upnode LGN with a common peer group ID has been received before the SVCC-RCC setup is attempted. The state should change automatically to another one of the setup states, and no user actions are required.

- WAIT_CONNECT, WAIT_DELAY_RETRY, or WAIT_IMMED_RETRY—An SVC setup request has been sent to signaling, but the SVC connection has either been released or the connect confirmation has not been received.

  Proceed to the "Troubleshooting SVC Connections on a PNNI Routing Network" section on page 5-12, but consider the originating interface to be the ASP interface for this node (ATM 2/0/0 for a standard ATM switch router). However, if those steps show no signaling debugging messages, go to the "Debugging SVCC-RCC" section on page 5-44.

- WAIT_SETUP—A called side node that has received an uplink PTSE to a new upnode LGN with a common PG ID, but it is still waiting for the SVC signaling setup message to arrive from the remote SVC originator LGN node. Further debugging should take place on the remote side ATM switch router where the remote LGN resides. Repeat these debugging steps for the remote side ATM switch router.

- WAIT_REL_SYS_BUSY— An internal software condition resulting from a shortage of CPU processor memory. If this condition persists or recurs, be sure that the CPU card has sufficient memory to support the software version listed by the **show version** command.

Checking SVCC-RCC Hello

Use the following command to check the SVCC-RCC hello state:

Command	Purpose
show atm pnni svcc-rcc [**local-node** *node-index*]	Confirms the SVCC-RCC hello state.

Follow these steps to check the SVCC-RCC hello state:

Step 1   Use the **show atm pnni svcc-rcc local-node** *node-index* command without the **detail** option to determine the SVCC-RCC hello state.

Step 2   Use the **show atm pnni svcc-rcc local-node** *node-index* command to check the following:

If the SVCC-RCC state is up, but the hello state is other than 2way_in, the following subset of RCC Hello States might indicate possible user correctable conditions if they remain unchanged for an extended period:

- DOWN—The SVCC-RCC has not indicated that it is up. See the previous sections for debugging SVCC-RCC setup problems.

- ATTEMPT—No hello messages have been (recently) received from the LGN peer, even though the SVCC-RCC is up. Check for correct status at the remote LGN. For further analysis, see the "Debugging SVCC-RCC" section on page 5-44.

- 1-WAY INSIDE—Hello messages have been recently received from an LGN peer, but the LGN has not yet acknowledged the information sent from this end. Confirm that the remote node listed is correct. See the following section, "Debugging SVCC-RCC."

Debugging SVCC-RCC

If the previous steps cannot isolate the cause of a problem with higher level link status, this section describes the **debug** command and **show** command that recognize the following:

- SVCC-RCC setup state transitions
- RCC hello state transitions
- Aggregated horizontal link state transitions
- Full hello message contents

Use the following commands to debug and check the SVCC-RCC setup:

Command	Purpose
debug atm pnni svcc-rcc remote-node *internal-node-number*	Confirms the SVCC-RCC setup, the RCC hello, and aggregated horizontal link state transitions, plus full hello message contents.
no debug all	Turns off all further bugging.
show atm pnni topology	Confirms if PNNI shows a route to the remote LGN.

Follow these steps to debug and check the SVCC-RCC setup:

Step 1   Use the **debug atm pnni svcc-rcc remote-node** *internal-node-number* command on the ATM switch router that has the higher numbered LGN node ID, because that is the SVC originator (for example, the calling side).

⚠

Caution   Because this debugging mode controls extensive information, it is best to filter the output by specifying either a local node or preferably the target remote node number, if it is known.

The **debug atm pnni svcc-rcc remote-node** *internal-node-number* command is normally more helpful when used on the ATM switch router that has the higher numbered LGN node ID, because that is the SVC originator (for example, the calling side). However, it is useful to display the debugging hello messages at both ends for debugging RCC hello problems.

Step 2   Wait approximately one minute to allow any SVCC setup retries to be listed and turn off debugging, using the **no debug all** command.

Step 3   Scroll to the top of the screen and confirm the following:

If the SVCC-RCC has not yet reached the SVCC_UP state, confirm that a queued ATM_SETUP line is displayed and make note of the service category. Normally the service category is VBR-NRT, except for cases where the SVC must traverse a VP tunnel or some link that does not support VBR-NRT.

When the service category changes with each attempt, release messages are being received. This indicates that no path exists for each attempted service category. Check the topology using the **show atm pnni topology** command to see if PNNI shows a route to the remote LGN.

Note   Of course, the horizontal link between these LGNs is not listed as up in the topology, but the special case of SVCC-RCC setup does not require an UP status.

Step 4   Confirm that the debugging line following the queued ATM_SETUP phrase shows the ATM address of the intended remote LGN node. If not, these messages might belong to the SVCC-RCC for another remote LGN.

If there are no setup attempts for the case where an expected SVCC-RCC has not yet reached the SVCC_UP state, proceed to the following section, "Troubleshooting PNNI Hierarchical Networks."

If there are setup attempts, but release messages are received for each attempt, note the cause code which might explain the problem. Proceed to the "Troubleshooting SVC Connections on a PNNI Routing Network" section on page 5-12, but consider the origination interface to be the CPU port.

Step 5   Note any other debugging error messages that might be printed in SVCC-RCC debugging mode.

For RCC hello FSM problems, the full hello messages are listed, along with the horizontal link extension entries for all aggregation tokens. By listing the hello messages at both ends of the SVCC-RCC, it is possible to locate where missing or mismatched information takes place.

Troubleshooting PNNI Hierarchical Networks

This section describes how to troubleshoot PNNI uplink and aggregation problems for hierarchical networks by the LGN.

Links that connect border nodes between two different peer groups are referred to as outside links. When the hello state finds a common higher level ancestor LGN on an outside link, it transitions to the common outside state. At this time each border node advertises an uplink PTSE to its peer nodes. The uplink PTSE contains the resource information for both directions of the outside link along with the node ID and peer group ID of the upnode and the aggregation token for the link.

The PGL uses the uplink PTSE information to aggregate the resource information from all outside links with the same aggregation token that connects to another peer group. The PGL notifies its parent LGN whenever there are changes to an uplink status. The parent LGN creates either an induced horizontal link or an induced uplink for each aggregation token to an upnode at the same or higher level.

For detailed configuration information, see Chapter 10, "Configuring ATM Routing and PNNI" in the *ATM Switch Router Software Configuration Guide*.

This section contains the following procedures:

- Checking Uplinks for Peer Group
- Checking Missing Upnode or Aggregation Token Pairs

Checking Uplinks for Peer Group

To see the table that summarizes all of the uplinks for a peer group, execute the **show atm pnni aggregation link** command on the ATM switch router acting as the PGL. The display also shows the port identity of the induced horizontal or uplink for the parent LGN.

Use the following command to check the uplinks for the peer group on the PGL:

Command	Purpose
show atm pnni aggregation link	Confirms the PGL summary uplink to the peer group.

Follow these steps to check the PGL uplink summaries:

Step 1   Use the **show atm pnni aggregation link** command.

```
Switch# show atm pnni aggregation link

    PNNI link aggregation for local-node 2 (level=40, name=Switch5.2.40)
      Upnode Number: 10  Upnode Level: 40  Upnode Name: Switch7.2.40
       AggToken  InducPort BorderPort    Border Node(No./Name)
      ~~~~~~~~~~ ~~~~~~~~~ ~~~~~~~~~~~~~ ~~~~~~~~~~~~~~~~~~~~~~
       0         2C49000   ATM0/1/0       9 Switch6
                           ATM0/1/2       1 Switch5
       3         2C49003   ATM0/0/0       11 Switch3

      Upnode Number: 11  Upnode Level: 24  Upnode Name: Switch8.3.24
       AggToken  InducPort BorderPort    Border Node(No./Name)
      ~~~~~~~~~~ ~~~~~~~~~ ~~~~~~~~~~~~~ ~~~~~~~~~~~~~~~~~~~~~~
       0         2276000   ATM0/1/1       9 Switch6
```

Step 2   If an expected Upnode and AggToken (Aggregation Token) pair is missing from the PGL uplink summaries table, continue with the following section "Checking Missing Upnode or Aggregation Token Pairs" to determine whether or not the PGL knows about an uplink PTSE originated by one or more known border nodes.

Checking Missing Upnode or Aggregation Token Pairs

Use the following commands to check the uplink PTSEs and derived aggregation token configuration:

Command	Purpose
show atm pnni database [*internal-node-number*] [**detail**]	Confirms uplink PTSEs for the border nodes.
show atm pnni interface atm *card/subcard/port* [**detail**]	Confirms the hello state and derived aggregation token value on the node.

Follow these steps to troubleshoot missing upnode and aggregation token pairs on border nodes:

Step 1   Use the **show atm pnni database** command to check the PGL for uplink PTSE originated by border nodes.

```
Switch# show atm pnni database 1
Node 1 ID 96:160:47.00918100000000E04FACB401.00E04FACB401.00 (name: Switch)
  PTSE ID  Length  Type  Seq no.   Checksum  Lifetime   Description
  1        92      97    117       37853     3143       Nodal info
  2        52      224   3331      18077     3016       Int. Reachable Address
Switch#
```

Step 2   Check if an expected upnode and aggregation token pair is missing from the table listed on the PGL. Also check if the PGL receives an uplink PTSE originated by one or more of the known border nodes.

Step 3   Use the *internal-node-number* option and the **detail** option to examine the contents of the uplink PTSE for a border node.

```
Switch# show atm pnni database 1
Node 1 ID 96:160:47.00918100000000E04FACB401.00E04FACB401.00 (name: Switch)
  PTSE ID  Length  Type  Seq no.   Checksum  Lifetime   Description
  1        92      97    117       37853     3143       Nodal info
  2        52      224   3331      18077     3016       Int. Reachable Address
Switch# show atm pnni database 1 detail
Node 1 ID 96:160:47.00918100000000E04FACB401.00E04FACB401.00 (name: Switch)
  PTSE ID  Length  Type  Seq no.   Checksum  Lifetime   Description
  1        92      97    117       37853     3135       Nodal info
    Time to refresh 1441, time to originate 0
    Type 97 (Nodal info), Length 48
    ATM address 47.00918100000000E04FACB401.00E04FACB401.00
    priority 0, leader bit NOT SET
    preferred PGL 0:0:0.00000000000000000000000000.000000000000.00
  2        52      224   3331      18077     3008       Int. Reachable Address
    Time to refresh 1478, time to originate 0
    Type 224 (Int. Reachable Address), Length 32, Port 0, vp capable
    Scope (level) 0, Address info length (ail) 16, Address info count 1
    Pfx: 47.0091.8100.0000.00e0.4fac.b401..., length 104
Switch#
```

Step 4   If an expected uplink PTSE is missing, execute the same command on the border node ATM switch router.

Step 5   If the uplink PTSE is present in the border node database but not in the PGL database, go to the "Troubleshooting the PNNI Database" section on page 5-27 for further debugging.

Step 6   If the uplink PTSE is missing from the border node database, use the **show atm pnni interface atm** command to verify the hello state for the interface to the other peer group.

```
Switch# show atm pnni interface atm 10/0/0
PNNI Interface(s) for local-node 1 (level=96):
Port ATM10/0/0 RCC is up  , Hello state 2way_in    with node Switch Error: Port
Looped back
  Next hello occurs in 2 seconds, Dead timer fires in 67 seconds
Switch#
```

Step 7   If a lower level outside link interface is not in the common outside state, proceed to the "Checking the PNNI Lowest Level Interface" section on page 5-33.

Step 8   If the missing interface is a higher level induced uplink, perform the same checks at the next lower hierarchy level on the ATM switch router acting as the LGN (and child PGL) node.

Step 9 If the derived aggregation token does not have the expected value, use the **detail** option to show additional interface information.

```
Switch# show atm pnni interface atm 10/0/0 detail
PNNI Interface(s) for local-node 1 (level=96):
Port ATM10/0/0 RCC is up  , Hello state 2way_in    with node Switch Error: Port
Looped back
  Next hello occurs in 6 seconds, Dead timer fires in 69 seconds
  CBR    : AW 5040 MCR 155519 ACR 147743 CTD 154 CDV 138 CLR0 10 CLR01 10
  VBR-RT : AW 5040 MCR 155519 ACR 155519 CTD 707 CDV 691 CLR0 8 CLR01 8
  VBR-NRT: AW 5040 MCR 155519 ACR 155519 CLR0 8 CLR01 8
  ABR    : AW 5040 MCR 155519 ACR 0
  UBR    : AW 5040 MCR 155519
 Aggregation Token: configured 0 , derived 0, remote 0
Switch#
```

Step 10 Check for correct Aggregation Token local and remote configuration.

> ✎
>
> **Note** Mismatched aggregation configuration results in a derived aggregation token value of zero.

Step 11 Verify the expected upnode node ID and common peer group ID.

Checking the Induced Port on the LGN

If the induced port value is missing or does not appear to be functional for an aggregate token and upnode combination, use the following command to check the higher level interfaces for the parent LGN local node.

Use the following command to check the induced port on the LGN:

Command	Purpose
show atm pnni interface local-node *node-index*	Confirms the higher level interfaces for the parent LGN local node configuration.

Follow these steps to troubleshoot the port on the LGN:

Step 1 Use the **show atm pnni interface local-node** *node-index* command to check the induced port on the LGN.

Step 2 If the interface port does not appear up, go to the "Troubleshooting PNNI SVCC-RCC and Higher Level Links" section on page 5-40.

Checking Link Aggregation

Use the following commands to check link aggregation:

Command	Purpose
show atm pnni aggregation link border-detail	Confirms per service class aggregation mode (best-link or aggressive).
show atm pnni database *internal-node-number* **detail**	Confirms uplink PTSEs.

Follow these steps to troubleshoot the aggregated metrics along with the border node interface metrics for each aggregation token:

Step 1 Use the **show atm pnni aggregation link border-detail** command to confirm per-service class aggregation mode.

Step 2 Check the per-service class aggregation mode (best-link or aggressive). The aggregation mode can be changed to control the resulted aggregated metrics.

If the aggregated metrics are inaccurate because of the contribution of one or more border node interfaces that are significantly different from all others, new aggregation tokens can be configured to treat those aggregated links separately at the higher level.

If the contribution from a border node interface is not as expected, check the border node uplink PTSE using the **show atm pnni database** *n* **detail** command where *n* is the node number of the border node.

Step 3 Use the same **show atm pnni database** *n* **detail** command executed on the border node ATM switch router to verify the same uplink PTSE information.

If the two **show atm pnni database** *n* **detail** commands display significantly different information, go to the "Troubleshooting the PNNI Database" section on page 5-27. Otherwise, see "Checking PNNI Metric Troubleshooting for Lowest Level Interfaces" section on page 5-37.

If the border node is a higher level LGN that has an induced uplink, check the link aggregation at the next lower hierarchy level on the ATM switch router acting as the border node.

Troubleshooting PNNI Addresses and Address Summarizations

This section describes how to troubleshoot PNNI address and address summarization problems. Summary addresses can be used to decrease the amount of information advertised by a PNNI node, and thereby contribute to scaling in large networks.

This section contains the following procedures:

- Checking PNNI Address Prefix Configurations
- Debugging Summary Addresses

Checking PNNI Address Prefix Configurations

A single default summary address is configured for each logical group node in the PNNI hierarchy. The length of that summary for any LGN equals the level of the child peer group, and its value is equal to the first level bits of the child peer group identifier. This address prefix is advertised into the peer group LGN.

Use the following commands to check PNNI address prefix configuration:

Command	Purpose
show atm route	Confirms the list of all prefixes known by the node.
show atm address	Confirms that the correct prefix is present for the active ATM Address.
show atm pnni database *internal-node-number ptse-id* **detail**	Confirms the actual prefixes being advertised.
show atm pnni hierarchy network detail	Confirms which ATM switch router is acting as the ancestor LGN.
show atm route	Confirms that the child PGL is up and that the scope is appropriate to allow advertising at the higher level.
show atm pnni scope	Confirms the configuration of the UNI scope map.

Follow these steps to troubleshoot PNNI address prefix configuration:

Step 1   Use the **show atm route** command to confirm the list of all prefixes known by the node.

```
Switch# show atm route
Codes: P - installing Protocol (S - Static, P - PNNI, R - Routing control),
       T - Type (I - Internal prefix, E - Exterior prefix, SE -
                 Summary Exterior prefix, SI - Summary Internal prefix,
                 ZE - Suppress Summary Exterior, ZI - Suppress Summary Internal)
P  T Node/Port       St Lev Prefix
~ ~~ ~~~~~~~~~~~~~~~~ ~~ ~~~ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
P SI 1    0          UP 0   47.0091.8100.0000.00e0.4fac.b401/104
R  I 1    ATM10/1/0  UP 0   47.0091.8100.0000.00e0.4fac.b401.0080.1c93.8060/152
R  I 1    ATM10/0/1  UP 0   47.0091.8100.0000.00e0.4fac.b401.00e0.4fac.b030/152
R  I 1    ATM10/0/1  UP 0   47.0091.8100.0000.00e0.4fac.b401.00e0.4fac.b031/152
R  I 1    ATM10/0/1  UP 0   47.0091.8100.0000.00e0.4fac.b401.00e0.4fac.b032/152
R  I 1    ATM13/0/0  UP 0   47.0091.8100.0000.00e0.4fac.b401.00e0.4fac.b401/152
R  I 1    ATM13/0/0  UP 0   47.0091.8100.0000.00e0.4fac.b401.00e0.4fac.b402/152
R  I 1    ATM13/0/0  UP 0   47.0091.8100.0000.00e0.4fac.b401.00e0.4fac.b403/152
R  I 1    ATM13/0/0  UP 0   47.0091.8100.0000.00e0.4fac.b401.00e0.4fac.b404/152
R  I 1    ATM13/0/0  UP 0   47.0091.8100.0000.00e0.4fac.b401.00e0.4fac.b405/152
R  I 1    ATM13/0/0  UP 0   47.0091.8100.0000.00e0.4fac.b401.4000.0c/128
Switch#
```

Step 2   Verify that any expected address, prefix, or summary address is in the list of prefixes.

If the interface addresses do not have the expected prefix, verify that the correct prefix is present for the active ATM address, using the **show atm address** command.

Step 3 To see the actual prefixes being advertised by a local node, use the **show atm pnni database** *internal-node-number* command to get the PTSE ID number for the internal reachable address PTSE.

Step 4 Use the **show atm pnni database** *internal-node-number ptse-id* **detail** command to see the full contents of the PTSE.

```
Switch# show atm pnni database 1 1 detail
  1        92      97      551        37417     2116        Nodal info
     Time to refresh 646, time to originate 0
     Type 97 (Nodal info), Length 48
     ATM address 47.00918100000000E04FACB401.00E04FACB401.01
     priority 0, leader bit NOT SET, restricted transit bit NOT SET
     complex node bit NOT SET, restricted branching bit NOT SET
     non-transit for PGL election bit NOT SET
     preferred PGL 0:0:00.000000000000000000000000.000000000000.00
     Type 640 (System Capabilities Info), Length 24
     System Type: ls1010, Major Version: 11, Minor Version: 3
     System Name: Switch
Switch#
```

Step 5 To see if a prefix is being advertised at higher levels, determine which ATM switch router is acting as the ancestor LGN by using the **show atm pnni hierarchy network detail** command.

Step 6 Use the **show atm pnni database** *internal-node-number ptse-id* **detail** command on the ATM switch router acting as the ancestor LGN.

Step 7 If the expected prefix is not being advertised at the higher level, display the same information for the child PGL. If it is not present at the child PGL level, but was present at the originating node, see the "Troubleshooting the PNNI Database" section on page 5-27.

Step 8 If the prefix is present at the child PGL, but is missing for the parent LGN, verify that it is listed as up using the **show atm route** command.

> **Note** It is normal for prefixes to be missing at the higher level if there is a matching summary or a suppressed summary present at its level.

Step 9 Verify that the scope (level) is appropriate to advertise at the desired higher levels.

Step 10 If the scope (level) does not have the expected value for a local prefix, check the configuration of the UNI scope map using the **show atm pnni scope** command. If it is not the desired map, the mode can be changed to manual, and the desired scope translation levels can be configured.

It is normal for the prefixes to be missing if there is a shorter matching summary prefix configured at its level. The summary prefix will be advertised instead of any longer prefixes that match.

However, if the summary prefix is configured for suppress, none of the prefixes that match it will be advertised.

Debugging Summary Addresses

Use the following commands to show summary addresses:

Command	Purpose
show atm pnni summary [**local-node** *node-index*]	Confirms summary information advertised by PNNI node.
show running-config	Confirms that no auto summary is not configured and summary address has not been manually configured.
show atm addresses	Confirms active and no active switch router addresses.
show atm pnni local-node	Confirms node and peer group IDs of higher local nodes.

Follow these steps to troubleshoot summary addresses and suppressed summary addresses for all of the local nodes on an ATM switch router:

Step 1   Use the **show atm pnni summary** command to display the PNNI summary address configuration.

Step 2   Check if any expected summary addresses appear in the list for the expected local node for the correct Int (Internal) or Ext (External) type with the expected suppressed or non suppressed attribute.

Step 3   Verify that all longer prefixes and addresses matching any summary addresses are reachable at the local node or at a node in a child peer group. Otherwise, some addresses might be unreachable.

Step 4   Verify that the scope (level) is appropriate to advertise at all desired higher levels.

Step 5   If the default switch router address summary is missing, use the **show running-config** command to make sure that no auto summary is not configured for the affected local node.

Step 6   If an automatically generated ATM summary address is not the expected address, use the **show atm address** command to show the configured active and nonactive switch router addresses.

Step 7   Use the **show atm pnni local-node** command to check the node IDs and peer group IDs of higher level local nodes. If they are not based on the prefix of the ATM address, verify that no other peer group IDs have been manually configured. Also, verify that the lowest level node on the ATM switch router has been disabled and reenabled since the last time the active switch router ATM address was reconfigured.

Step 8   If an unexpected summary address appears in the list, use the **show running-config** command to make sure that the summary address has not been manually configured.

If a summary prefix has been configured, but it is not possible to route to the summarized addresses from another peer group, check for an overlapping summary address within the other peer group. If the overlapping summary is for an automatically generated prefix, it could mean the ATM node addresses need to be modified to give unique prefixes for the ancestors of the two peer groups.
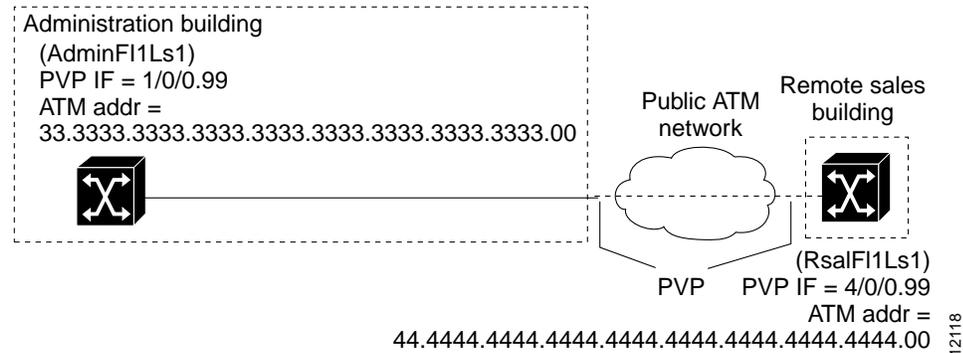
Troubleshooting Virtual Path Tunnel Connections

This section describes how to troubleshoot virtual path (VP) tunnels. VP tunnels are used primarily between private ATM networks across public ATM networks, such as telecom carriers, that do not yet support ATM signaling. Signaling traffic is mapped into the VP tunnel and the switch routers that allocate virtual channel connections (VCCs) on that VP instead of the default VP=0. With these connections, signaling can travel transparently through the public network.

In the example network in Figure 5-4, the PVC tunnel connection configured between the ATM switch router on Floor 1 of the administration building and the ATM switch router on Floor 1 of the remote sales building has the following interface and subinterface numbers:

- AdminFl1ls1, ATM interface 1/0/0, PVP 99
- RsalFl1Ls1, ATM interface 4/0/0, PVP 99

Figure 5-4   PVP Tunnel Test in the Example Network

This section contains the following procedures:

- Checking Virtual Path Tunnel Configuration
- Checking Virtual Path PVP Configuration
- Debugging VP Tunnel Connection Management

For detailed configuration information, see Chapter 17, "Configuring Interfaces," in the *ATM Switch Router Software Configuration Guide*.

Checking Virtual Path Tunnel Configuration

If the permanent virtual path (PVP) subinterface numbers do not match on both ends of the VP tunnel, the connection is not established.

To show the ATM virtual interface configuration, use the following command:

Command	Purpose
show atm interface [**atm** *card/subcard/port*[.*vpt#*]]	Shows the ATM interface configuration.

Follow these steps to troubleshoot VP tunnel connections:

Step 1   Use the **show atm interface atm** *card/subcard/port* command to display the configuration of ATM switch router AdminFl1Ls1, located in the headquarters building at subinterface 1/0/0.99.

```
AdminFl1Ls1# show atm interface atm 1/0/0.99

Interface:      ATM1/0/0.99    Port-type:   vp tunnel
IF Status:      UP             Admin Status: up
Auto-config:    enabled        AutoCfgState: waiting for response from peer
IF-Side:        Network        IF-type:     UNI
Uni-type:       Private        Uni-version: V3.0
Max-VPI-bits:   0              Max-VCI-bits: 14
Max-VP:         0              Max-VC:      16383
Signalling:     Enabled
ATM Address for Soft VC: 44.4444.4444.4444.4444.4444.4444.4444.4444.00
Configured virtual links:
  PVCLs SoftVCLs  SVCLs  Total-Cfgd  Installed-Conns  4      0      0      4
4

AdminFl1Ls1#
```

Step 2   Check the IF Status field to confirm the interface is up. If not, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

Step 3   Check the Admin Status field to confirm that the interface is up. If not, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

Step 4   Check the interface and ATM Address for Soft VC fields. These values indicate that the virtual path tunnel is configured correctly.

Step 5   Use the **show atm interface atm** *card/subcard/port* command to display the configuration of the ATM switch router RsalFl1Ls1, located in the remote sales building at subinterface 4/0/0.99:

```
RsalFl1Ls1# show atm interface atm 4/0/0.99

Interface:      ATM4/0/0.99    Port-type:   vp tunnel
IF Status:      UP             Admin Status: up
Auto-config:    enabled        AutoCfgState: waiting for response from peer
IF-Side:        Network        IF-type:     UNI
Uni-type:       Private        Uni-version: V3.0
Max-VPI-bits:   0              Max-VCI-bits: 14
Max-VP:         0              Max-VC:      16383
Signalling:     Enabled
ATM Address for Soft VC: 33.3333.3333.3333.3333.3333.3333.3333.3333.00
Configured virtual links:
  PVCLs SoftVCLs  SVCLs  Total-Cfgd  Installed-Conns  4      0      0      4
4

RsalFl1Ls1#
```

Step 6   Check the IF Status field to confirm the interface is up. If not, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

Step 7 Check the Admin Status field to confirm the interface is up. If not, refer to Chapter 4, "Troubleshooting ATM Switch Router Interface Connections."

Step 8 Check the Interface and ATM address for Soft VC fields. These values indicate that the virtual path tunnel is configured correctly.

If you determine that the PVP is not configured correctly, refer to Chapter 6, "Configuring Virtual Connections," in the *ATM Switch Router Software Configuration Guide*.

Continue with the next phase of VP tunnel troubleshooting if you still have not determined the problem.

Checking Virtual Path PVP Configuration

To confirm the ATM virtual circuit interface configuration, use the following command:

Command	Purpose
show atm vc interface atm *card/subcard/port*	Shows the ATM VC interface configuration.

The following example shows how to confirm the configuration of ATM subinterface 1/0/0.99 on the ATM switch router AdminFl1Ls1 located in the administration building:

```
AdminFl1Ls1# show atm vc interface atm 1/0/0
Interface    VPI    VCI    Type    X-Interface    X-VPI  X-VCI   Encap Status
ATM1/0/0     0      5      PVC     ATM2/0/0       0      41      QSAAL  UP
ATM1/0/0     0      16     PVC     ATM2/0/0       0      33      ILMI   UP
ATM1/0/0     99     40     PVC     ATM4/0/0.99    99     50      UP
AdminFl1Ls1#
```

The interface ATM 1/0/0 field indicates that the cross-connect is configured correctly.

The following example shows how to confirm the configuration of ATM subinterface 1/0/0.99 on the ATM switch router RsalFl1Ls1 located in the remote sales building:

```
RsalFl1Ls1# show atm vc interface atm 4/0/0
Interface    VPI    VCI    Type    X-Interface    X-VPI  X-VCI   Encap Status
ATM4/0/0     0      5      PVC     ATM2/0/0       0      41      QSAAL  UP
ATM4/0/0     0      16     PVC     ATM2/0/0       0      33      ILMI   UP
ATM4/0/0     99     40     PVC     ATM1/0/0.99    99     50             UP
RsalFl1Ls1#
```

The interface ATM 4/0/0 field indicates that the cross-connect is configured correctly.

If you determine that the PVP is not configured correctly, refer to Chapter 6, "Configuring Virtual Connections," in the *ATM Switch Router Software Configuration Guide* for configuration information.

Debugging VP Tunnel Connection Management

Use the following commands to debug the VP tunnel connection management:

| Command	Purpose
debug atm conn errors	Enables connection management error debugging.
debug atm conn events	Enables connection management event debugging.
no debug all	Disables all debugging.

Troubleshooting Dropped Connections

This section describes how to troubleshoot the PVC traffic being dropped. In the example network in Figure 5-5, the connection between the DNS and e-mail servers and the ATM switch router on Floor 1 of the administration building and the Catalyst 5000 switch on Floor 1 of the manufacturing building is dropping cells at some node in the connection.

This connection includes the following interfaces:

- AdminFl1Ls1, ATM interface 1/0/0
- ManuFl1Ls1, ATM interface 0/1/0
- ManuFl1Ls1, ATM interface 4/0/0
- ManuFl1CaS1, ATM LANE interface 1/1
- AdminFl1Ls1.ATM interface 4/0/1

Figure 5-5   PVC VPI and VCI Test in the Example Network
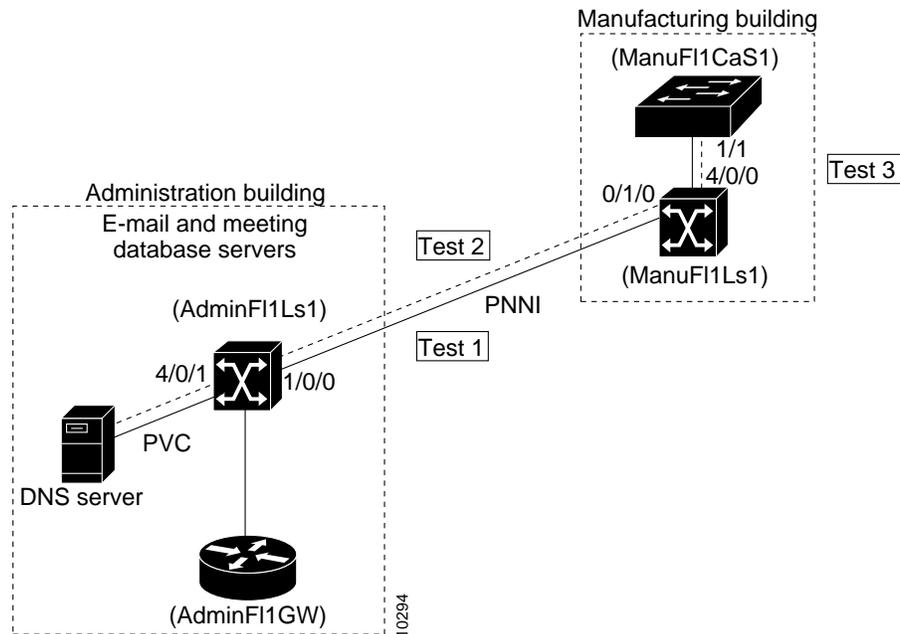
This section contains the following procedures:

- Determining Circuit Drop Location
- Checking Line and Circuit Oversubscription
- Checking Traffic Priority
- Checking Network Circuit Timing

For detailed configuration information see Chapter 8, "Configuring Resource Management," in the *ATM Switch Router Software Configuration Guide*.

Determining Circuit Drop Location

Use the following command to determine where the cells are being dropped.

.

Command	Purpose
show atm vc traffic interface atm *card*/*subcard*/*port*	Checks the virtual circuits for interface where cells are being dropped.

> **Note**   The recommended procedure is to start at the center of the circuit and work outward until you find an ATM switch router with mismatched receive and transmit cell counts.

Follow these steps to troubleshoot a virtual connection to determine where the cells are being dropped along the length of the circuit:

Step 1   Use the **show atm vc traffic interface atm** command to look for mismatching numbers on both ends of the cable starting with the backbone interface connection at the ATM switch router in the administration building and ending with the backbone interface connection at the manufacturing building.

```
AdminFl1Ls1# show atm vc traffic interface atm 1/0/0
Interface    VPI    VCI     Type      rx-cell-cnts    tx-cell-cnts
ATM1/1/0     0      5       PVC         672286          672286
ATM1/1/0     0      16      PVC             45              45
ATM1/1/0     0      18      PVC         730020          730155
ATM1/1/0     12     67      PVC              0               0
AdminFl1Ls1#
```

Step 2   Use the same command to look for mismatching numbers on the interface connection at the ATM switch router in the manufacturing building.

```
ManuFl1Ls1# show atm vc traffic interface atm 0/1/0
Interface    VPI    VCI     Type      rx-cell-cnts    tx-cell-cnts
ATM0/1/0     0      5       PVC         672286          672286
ATM0/1/0     0      16      PVC             45              45
ATM0/1/0     0      18      PVC         730020          730155
ATM0/1/0     12     67      PVC              0               0
ManuFl1Ls1#
```

Step 3   Use the same command to look for mismatching numbers on the interface connection between the ATM switch router and the Catalyst 5000 Fast Ethernet switch in the manufacturing building.

```
ManuFl1Ls1# show atm vc traffic interface atm 4/0/0
Interface    VPI    VCI      Type      rx-cell-cnts       tx-cell-cnts
ATM4/0/0     0      5        PVC           672286             672286
ATM4/0/0     0      16       PVC               45                 45
ATM4/0/0     0      18       PVC           730020                155
ATM4/0/0     12     67       PVC                0                  0
ManuFl1Ls1#
```

Notice that the number of received and transmitted cell counts are vastly different, which indicates that this is the interface where the cells are being dropped.

Continue with the next phase of troubleshooting to determine why the cells are being dropped.

Checking Line and Circuit Oversubscription

Use the following commands to check the line and circuit under test for oversubscription:

Command	Purpose
show interfaces atm *card*/*subcard*/*port*	Checks to see if the line is oversubscribed.
show atm interface atm *card*/*subcard*/*port*	Checks to see if the circuit is oversubscribed.

Follow these steps to troubleshoot a virtual connection to check the line and circuit under test for oversubscription:

Step 1   Use the **show interface atm** command to check ATM interface 1/0/0 for oversubscription.

Step 2   Use the **show atm interface atm** command to check ATM interface 4/0/0 for oversubscription.

If the line or circuit is oversubscribed, causing cells to be dropped, add more interfaces or circuits between the switch routers.

If you determine that the line or circuit is oversubscribed, refer to Chapter 6, "Configuring Virtual Connections," in the *ATM Switch Router Software Configuration Guide*.

Continue with the next phase of troubleshooting if you still have not determined why the cells are being dropped.

Checking Traffic Priority

If a circuit is configured with multiple traffic types and some have a higher priority or QoS, cells with a lower priority are going to be dropped on a congested circuit.

For detailed configuration information, see Chapter 8, "Configuring Resource Management," in the *ATM Switch Router Software Configuration Guide*.

Use the following commands to determine the configuration cell traffic priority and policing:

Command	Purpose
show atm interface resource atm *card/subcard/port*	Confirms the configuration of resource management looking for traffic priority conflicts.
show atm vc interface atm *card/subcard/port vpi vci*	Confirms the configuration of the VC looking for policing conflicts.

Follow these steps to determine the configuration cell traffic priority and policing:

Step 1   Use the **show atm interface resource atm** command to confirm traffic priority.

Step 2   Use the **show atm vc interface atm** command to confirm traffic policing.

If you determine that traffic priority or policing is causing cells to be dropped refer to Chapter 8, "Configuring Resource Management," in the *ATM Switch Router Software Configuration Guide*.

Continue with the next phase of troubleshooting dropped cells if you still have not determined the cause of the problem.

Checking Network Circuit Timing

If the network timing is misconfigured, the network clock can become unsynchronized and the switch router can start dropping cells.

For detailed configuration information, see Chapter 3, "Initially Configuring the ATM Switch Router," in the *ATM Switch Router Software Configuration Guide*.

Use the following commands to determine the clocking configuration of the interface:

Command	Purpose
show network-clocks	Shows the network clocking configuration.
show running-config	Shows the interface clock source configuration.
show controllers [**atm** *card/subcard/port*]	Shows the interface controller status.

Follow these steps to determine the clocking configuration of the interface:

Step 1   Use the **show network** command to display the clock source configuration.

```
ManuFl1Ls1# show network-clocks
Priority 1 clock source: ATM0/0/0
Priority 2 clock source: ATM0/0/3
Priority 3 clock source: ATM1/0/0
Priority 4 clock source: No clock
Priority 5 clock source: System clock

Current clock source: ATM0/0/0, priority: 1

ManuFl1Ls1#
```

Step 2   Make note of the interface configured as Priority 1 clock source.

Step 3   Use the **show running-config** command to display the clock source configuration of
ATM interface 4/0/0.

```
ManuFl1Ls1# show running-config
Building configuration...

Current configuration:
!
version 11.2
no service pad
service udp-small-servers
service tcp-small-servers
!
hostname Switch
!
boot bootldr bootflash:/tftpboot/ls1010-wp-mz.112-1.4.WA3.0.15
!
network-clock-select 2 ATM3/1/0

<Information Deleted>


!
interface ATM4/0/0
 no keepalive
 atm manual-well-known-vc
 atm access-group tod1 in
 atm pvc 0 35 rx-cttr 3 tx-cttr 3  interface  ATM2/0/0 0 any-vci  encap qsaal
 atm route-optimization soft-vc interval 360 time-of-day 18:0 5:0
 clock-source network-derived
!

<Information Deleted>

ManuFl1Ls1#
```

The clock source field indicates the clocking configuration of ATM interface 4/0/0.

Step 4   Use the **show controllers atm** *card/subcard/port* command to display the interface controller status of ATM interface 4/0/0.

```
ManuFl1Ls1# show controllers atm 4/0/0
IF Name: ATM4/0/0    Chip Base Address: A8808000
Port type: 155UTP    Port rate: 155 Mbps    Port medium: UTP
Port status:SECTION LOS    Loopback:None    Flags:8300
TX Led: Traffic Pattern    RX Led: Traffic Pattern  TX clock source:  network-derived
Framing mode:  sts-3c
Cell payload scrambling on
Sts-stream scrambling on
OC3 counters:
  Key: txcell - # cells transmitted    rxcell - # cells received    b1    - # section
BIP-8 errors    b2    - # line BIP-8 errors    b3    - # path BIP-8 errors    ocd    -
# out-of-cell delineation errors - not implemented    g1    - # path FEBE errors    z2
- # line FEBE errors    chcs  - # correctable HEC errors    uhcs  - # uncorrectable HEC
errors

<Information Deleted>

phy_tx_cnt:0, phy_rx_cnt:0
ManuFl1Ls1#
```

Step 5   Check the TX clock source field. This field indicates that the clocking configuration of the interface is either internal or network derived.

If you determine that the clock configuration is causing cells to be dropped, refer to Chapter 3, "Initially Configuring the ATM Switch," in the *ATM Switch Router Software Configuration Guide*.