Passport 15000, 20000

Ethernet Service Operations Configuration

241-1501-850

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General availability. Contains information on Passport 15000 and Passport 20000 for the PCR5.2 GA release.

Contents

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About this document

This guide describes the Ethernet service.

The following topics are discussed in this section:

Who should read this document and why

This guide is for persons who perform the following tasks for Ethernet interworking:

- planning
- engineering
- installing and configuring
- provisioning
- operating and maintaining
- troubleshooting

What you need to know

This guide assumes that you understand the Passport network architecture. You can learn more about Passport by reading 241-5701-400 *Passport 7400, 15000, 20000 Networking Overview*.

How this document is organized

The 241-1501-850 *Passport 15000, 20000 Ethernet Service Operations Configuration* contains the following sections:

What’s new in this document

There were no new features added to this document.

Other changes made to this document include the following:

- adding the PEC NTHW44 to the table “FPs supporting the Ethernet over ATM (EoAtm) service” (page 62)
- clarified that the procedure “Configuring Ethernet over ATM software” (page 25) applies only to the 4-port Gigabit Ethernet FP

Text conventions

This document uses the following text conventions:

- `nonproportional spaced plain type`

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

- **`nonproportional spaced bold type`**

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

- *italics*

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

  Words that appear in italics in text are for naming.

- `[optional_parameter]`

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

- `<general_term>`

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

- UPPERCASE,lowercase

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

- |

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

- ...

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

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

Related documents

For the complete list of documents contained in the Passport documentation library, see 241-5701-001 *Passport 7400, 15000, 20000 Documentation Guide*.

See the following Passport documents for information related to Ethernet interworking:

- 241-5701-005 *Passport 7400, 15000, 20000 List of Terms*
- 241-5701-060 *Passport 7400, 15000, 20000 Components*
- 241-5701-400 *Passport 7400, 15000, 20000 Networking Overview*
- 241-5701-500 *Passport 6400, 7400, 15000, 20000 Alarms*
- 241-5701-615 *Passport 7400, 15000, 20000 FP Configuration Reference*
- 241-5701-700 *Passport 7400, 15000, 20000 ATM Overview*
- 241-5701-702 *Passport 7400, 15000, 20000 ATM Routing and Signaling Fundamentals*
- 241-5701-705 *Passport 7400, 15000, 20000 ATM Traffic Management Fundamentals*
- 241-5701-706 *Passport 7400, 15000, 20000 ATM Traffic Shaping and Policing*
- 241-5701-707 *Passport 7400, 15000, 20000 ATM Queuing and Scheduling*
- 241-5701-708 *Passport 7400, 15000, 20000 ATM CAC and Bandwidth Management*
- 241-5701-710 *Passport 7400, 15000, 20000 ATM Configuration Guide*
- 241-5701-715 *Passport 7400, 15000, 20000 ATM Monitoring and Troubleshooting Guide*

How to get more help

For information on training, problem reporting, and technical support, see the “Nortel Networks support services” section in the product overview document.

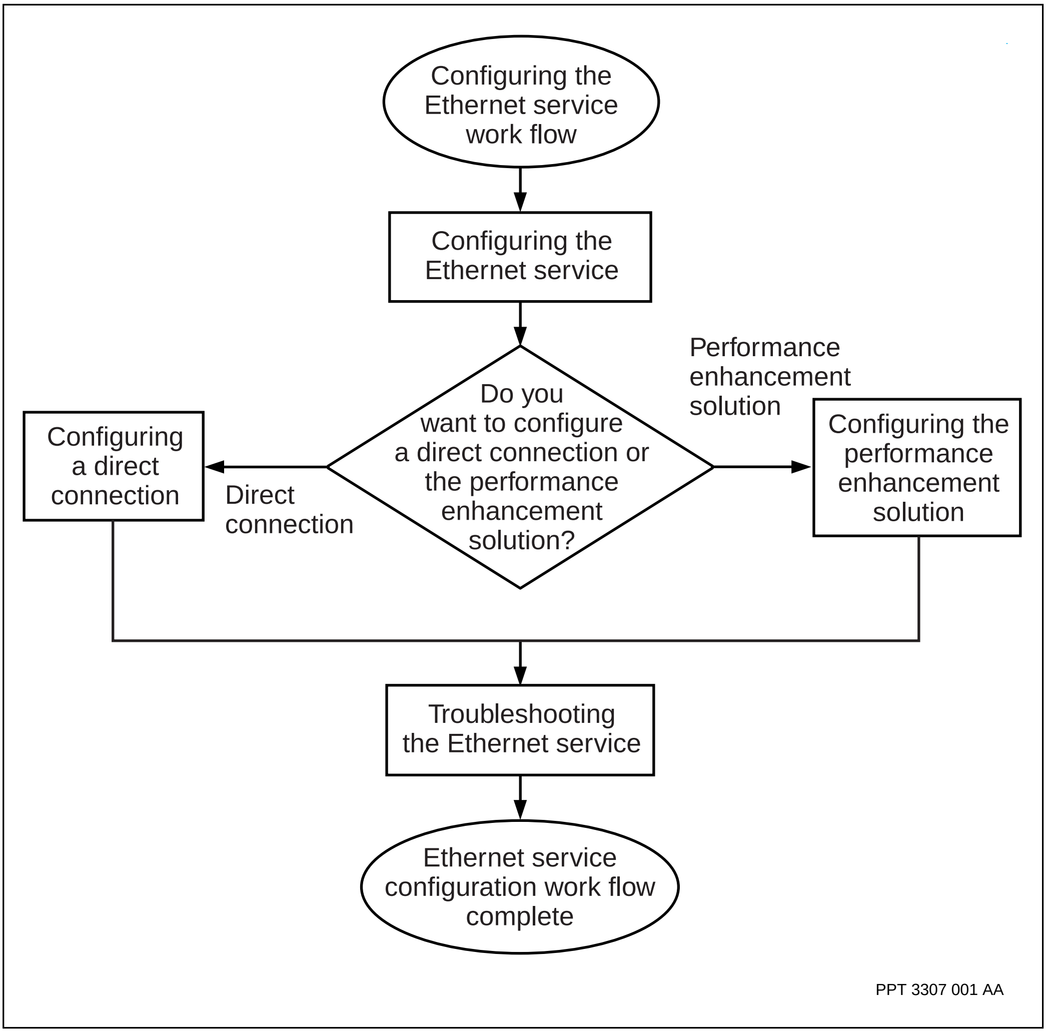
Chapter 1
Ethernet service configuration work flow

Configure the Ethernet service to tunnel Ethernet traffic between Ethernet physical media over a dedicated LAN SPVC across an ATM backbone network.

Ethernet service work flow

This task flow shows you the sequence of procedures you perform to configure the Ethernet service over ATM. To link to any procedure, go to “Work flow navigation” (page 20).

Figure 1
Ethernet service work flow



Work flow navigation

- “Configuring the Ethernet service” (page 23)
- “Configuring a direct connection” (page 29)
- “Configuring the performance enhancement solution” (page 35)

- “Troubleshooting the Ethernet service” (page 45)

Chapter 2
Configuring the Ethernet service

Configure the Ethernet service to provide transparent tunneling of Ethernet traffic between gigabit Ethernet (GigE) ports over a dedicated LAN SPVC.

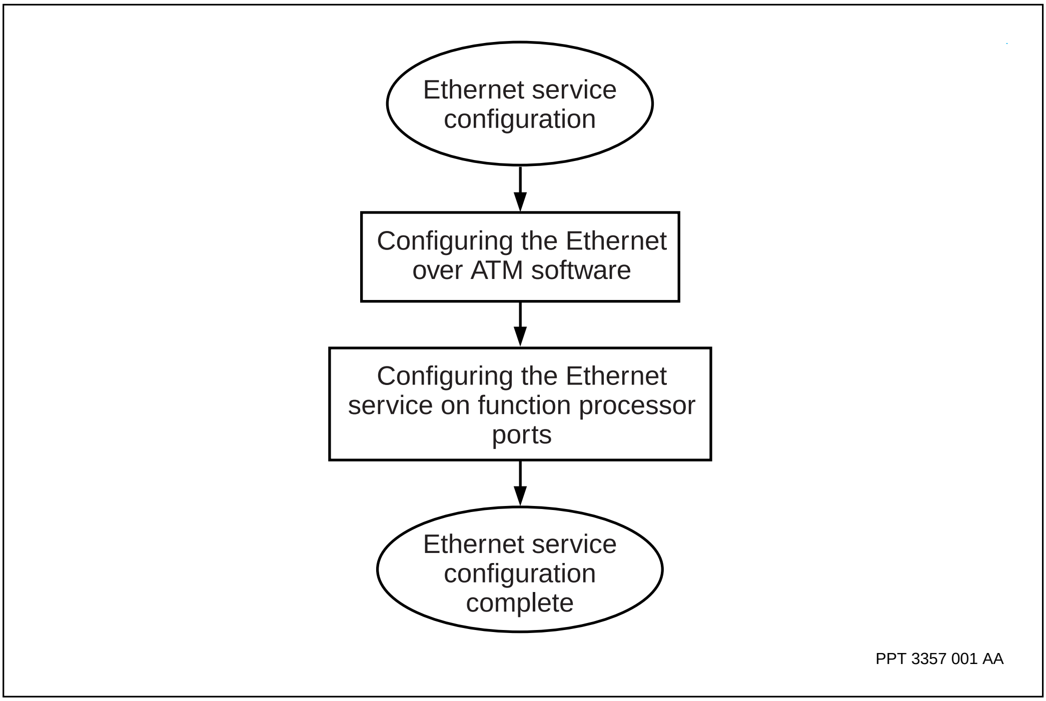
Prerequisites to configuring the Ethernet service

- The 4pGe function processor must be configured, as well as the physical Ethernet ports. See 241-5701-615 *Passport 7400, 15000, 20000 FP Configuration Reference*.
- Ensure the ATM network, including PNNI, is installed on the node. See 241-5701-710 *Passport 7400, 15000, 20000 ATM Configuration Guide*.

Ethernet service configuration task flow

This task flow shows you the sequence of procedures you perform to configure the Ethernet service. To link to any procedure, go to "Task flow navigation" (page 24).

Figure 2
Ethernet service configuration task flow



Task flow navigation

- “Configuring Ethernet over ATM software” (page 25)
- “Configuring the Ethernet service on function processor ports” (page 26)

Configuring Ethernet over ATM software

Configure the Ethernet over ATM software that is required for the Ethernet service on the 4-port Gigabit Ethernet FP (also known as 4pGe or NTHW49).

Procedure steps

1 Add a software logical processor type.

```
add sw lpt/<s>
```

2 Set the feature list.

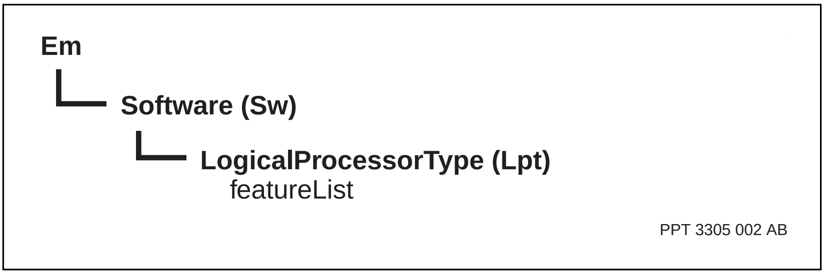
```
set sw lpt/<s> featureList EoAtm
```

Variable definitions

Variable	Value
<s>	Name of the logical processor type.

Procedure job aid

Figure 3
Configuring Ethernet over ATM software component hierarchy



Configuring the Ethernet service on function processor ports

Configure the Ethernet service on function processor ports to link the service to the physical ports.

Procedure steps

1. Add a LAN application.

   add la/<p>

2. Link the LAN application to the GigE port.

   set la/<p> framer interfaceName lp/<m> Ethernet/<n>

3. Add the LAN transport for the GigE port.

   add la/<p> transport

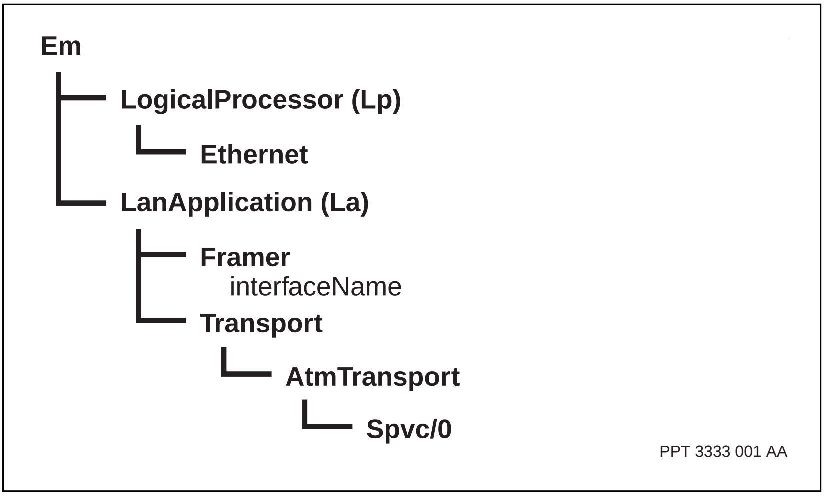
   When you add the LAN transport component for the GigE port, the AtmTransport and AtmTr Spvc/0 sub-components are automatically added.

Variable definitions

Variable	Value
<m>	Instance value of the logical processor with a value from 2 to 15.
<n>	Instance value of the logical processor port with a value from 0 to 3.
<p>	Instance value of the LanApplication with a value from 0 to 255.

Procedure job aid

Figure 4
Configuring the Ethernet service on function processor ports component hierarchy



Chapter 3
Configuring a direct connection

Configure a direct connection to provide transparent tunneling of Ethernet traffic between gigabit Ethernet (GigE) ports over a dedicated LAN SPVC.

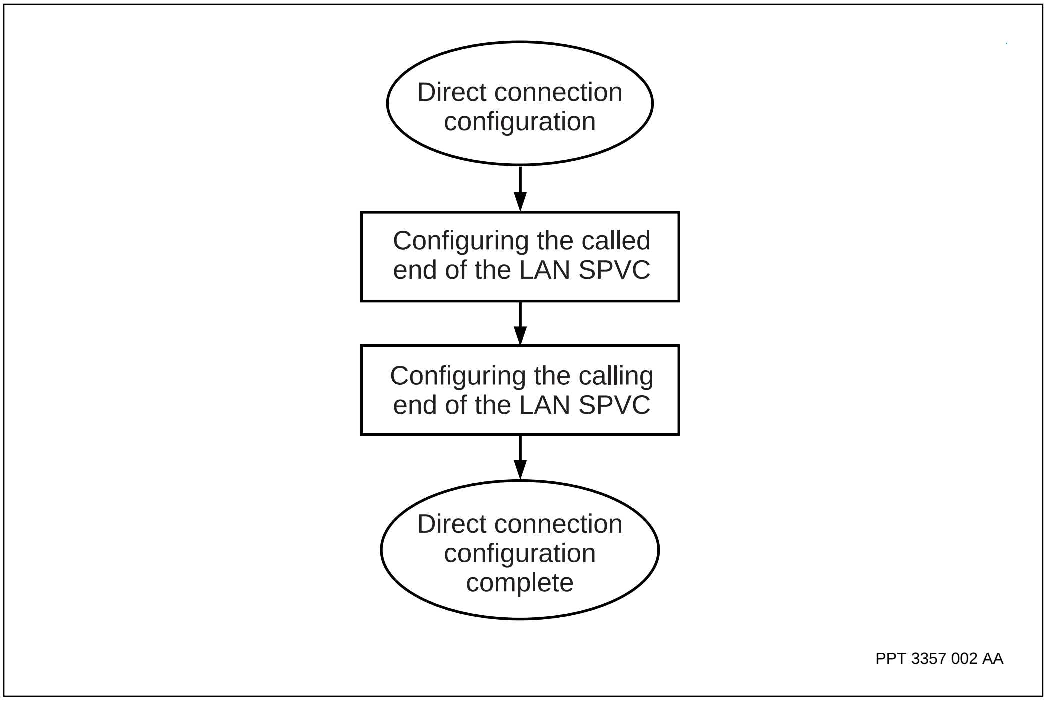
Prerequisites to configuring a direct connection

- The Ethernet service must be configured. See “Configuring the Ethernet service” (page 23) for details.

Direct connection configuration task flow

This task flow shows you the sequence of procedures you perform to configure a direct connection. To link to any procedure, go to “Task flow navigation” (page 30).

Figure 5
Direct connection configuration task flow



Task flow navigation

- "Configuring the called end of the LAN SPVC" (page 31)
- "Configuring the calling end of the LAN SPVC" (page 32)

Configuring the called end of the LAN SPVC

Configure the called end of the LAN SPVC to enable a direct connection at the other end of the network.

Procedure steps

1 Optionally, set the local address of the GigE port.

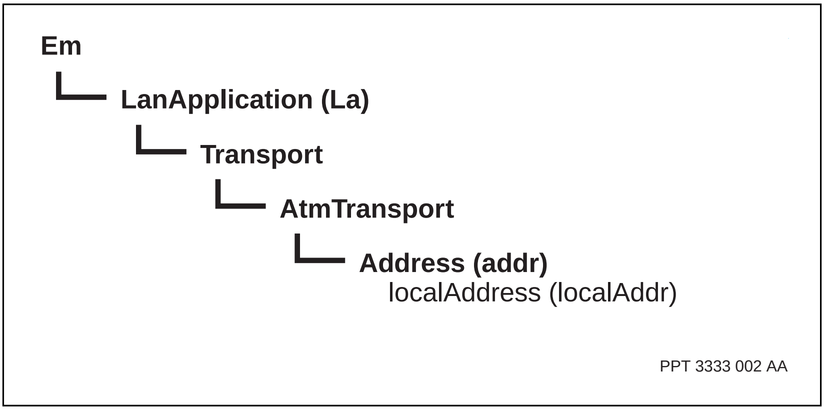
```
set la/<p> transport atmTransport addr localAddr
<nsapA>
```

Variable definitions

Variable	Value
<nsapA>	Local NSAP address of the Ethernet port (for example, called endpoint) within the ATM network.
<p>	Instance value of the LanApplication with a value from 0 to 255.

Procedure job aid

Figure 6
Configuring the called end of the LAN SPVC component hierarchy



Configuring the calling end of the LAN SPVC

Configure the calling end of the LAN SPVC to enable a direct connection at one end of the network.

Prerequisites

- If the default local address is used at the called end, the called end must be in-service before configuring the remote address of the calling end.

Procedure steps

1 Optionally, set the local address on the calling end.

```
set la/<p> transport atmTransport addr localAddr
<nsapB>
```

2 Set the LAN SPVC endpoint to be the calling end.

```
set la/<p> transport atmTransport spvc/0 endPoint
calling
```

3 Determine the local <nsapA> address of the called end.

```
display la/<q> transport atmTransport addr
```

4 Set the remote address on the calling end to match the local address of the called end.

```
set la/<p> transport atmTransport spvc/0 remoteAddress
<nsapA>
```

5 Optionally, set the LAN SPVC call setup retry period when the connection fails.

```
set la/<p> transport atmTransport spvc/0 retryperiod
<timer>
```

6 Optionally, specify the LAN SPVC bandwidth.

```
set la/<p> transport atmTransport spvc/0 TM bandwidth
<bandwidth>
```

7 Optionally, specify the average frame size.

```
set la/<p> transport atmTransport spvc/0 TM
averageFrameSize <afs>
```

8 Optionally, set the service category for the connection.

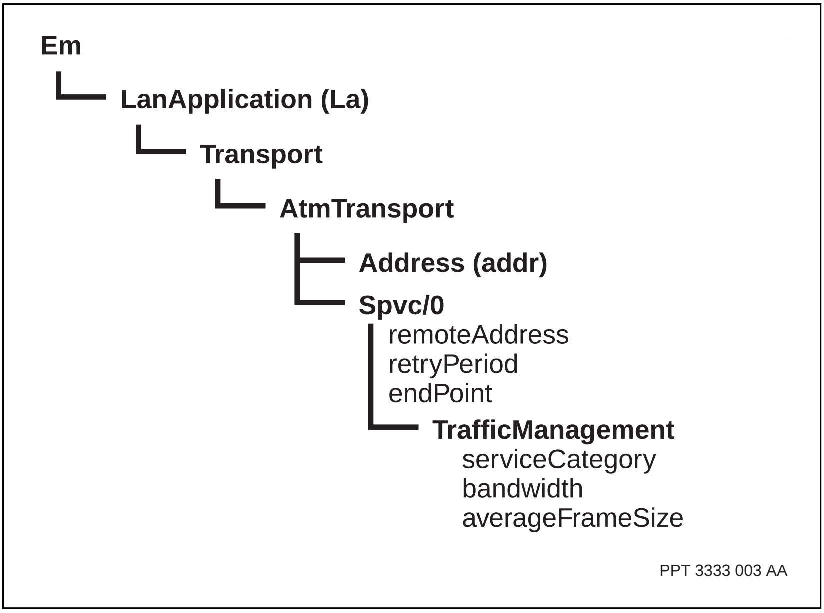
```
set la/<p> transport atmTransport spvc/0 TM
serviceCategory <sc>
```

Variable definitions

Variable	Value
<afs>	Average frame size needs to be synchronized with the remote end value. Default value is 1500 bytes.
<bandwidth>	Bandwidth in bits/s for the connection. This attribute is ignored if the value of the *endPoint* attribute is set to *called*. Default value is 100 Mbits/s.
<nsapA>	NSAP address of the remote Ethernet port (for example, called endpoint).
<nsapB>	Local NSAP address of the Ethernet port (for example, calling endpoint).
<p>	Instance value of the LanApplication at the calling end with a value from 0 to 255.
<q>	Instance value of the LanApplication at the called end with a value from 0 to 255.
<sc>	ATM service category for the connection may be VBR-nrt or UBR. Default value is VBR-nrt.
<timer>	Interval time between call setup attempts after a connection fails. This value ranges from 10 to 3600 seconds. The default setup retry period is 20 seconds.

Procedure job aid

Figure 7
Configuring the calling end of the LAN SPVC component hierarchy



Chapter 4
Configuring the performance enhancement solution

Configure the performance enhancement solution (hairpin solution) to police and shape Ethernet traffic and protect the integrity of the ATM network.

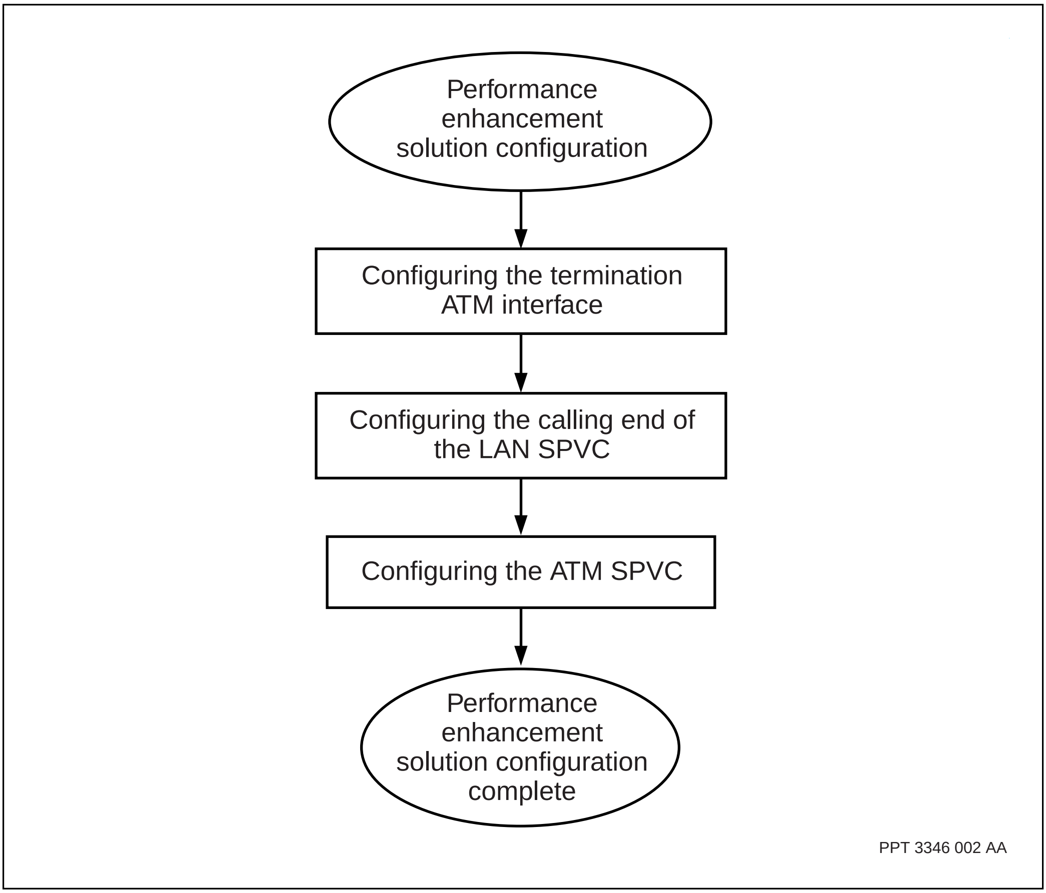
Prerequisites to configuring the performance enhancement solution

- The Ethernet service must be configured. See “Configuring the Ethernet service” (page 23) for details.

Performance enhancement solution configuration task flow

This task flow shows you the sequence of procedures you perform to configure the performance enhancement solution. To link to any procedure, go to “Task flow navigation” (page 36).

Figure 8
Performance enhancement solution configuration task flow



Task flow navigation

- “Configuring the termination ATM interface” (page 37)
- “Configuring the calling end of the LAN SPVC” (page 39)
- “Configuring the ATM SPVC” (page 42)

Configuring the termination ATM interface

Configure the ATM interface to be the termination point for the LAN SPVC on a physical hairpin.The physical port on the ATM termination point must be physically looped back to the port on the other end of the ATM interface.

Procedure steps

1 Add the ATM termination interface for the LAN SPVC.

add atmIf/<a>

2 Link the ATM interface to the sonet or sdh port.

set atmIf/<a> interfaceName lp/<b> sonet/<c> sts/0

OR

set atmIf/<a> interfaceName lp/<b> sdh/<c> vc4/0

3 Add the UNI to the ATM interface.

add atmIf/<a> uni

4 Add an ATM interface at the other end of the hairpin.

add atmIf/<e>

5 Link the ATM interface to the sonet or sdh port.

set atmIf/<e> interfaceName lp/<b> sonet/<f> sts/0

OR

set atmIf/<e> interfaceName lp/<b> sdh/<f> vc4/0

6 Add the UNI to the ATM interface.

add atmIf/<e> uni

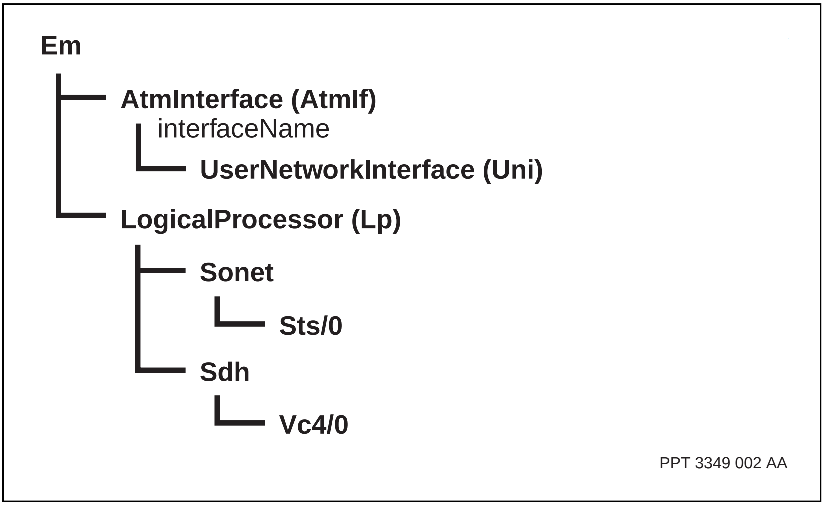
Variable definitions

Variable	Value
<a>	The instance value of the ATM interface.
<b>	The instance value of the logical processor.
<c>	The instance value of the sonet or sdh port.
(Sheet 1 of 2)	

Variable	Value
<e>	The instance value of the other ATM interface.
<f>	The instance value of the sonet or sdh port at the other end of the hairpin.
(Sheet 2 of 2)	

Procedure job aid

Figure 9
Configuring the termination ATM interface component hierarchy



Configuring the calling end of the LAN SPVC

Configure the LAN SPVC to terminate on an ATM interface. This is a requirement in configuring the performance enhancement solution.

Procedure steps

1 Set the remote connection identifier for the LAN SPVC.

```
set la/<p> transport atmTransport spvc/0 remoteCi
<remoteCi>
```

2 Set the remote address for the LAN SPVC to the local address of the ATM interface.

```
set la/<p> transport atmTransport spvc/0 remoteAddress
<remoteAddress>
```

3 Set the LAN SPVC endpoint to calling.

```
set la/<p> transport atmTransport spvc/0 endpoint
calling
```

4 Optionally, set the LAN SPVC call setup retry period when the connection fails.

```
set la/<p> transport atmTransport spvc/0 retryperiod
<timer>
```

5 Optionally, set the service category for the connection.

```
set la/<p> transport atmTransport spvc/0 tm
serviceCategory <sc>
```

6 Optionally, set the LAN SPVC bandwidth.

```
set la/<p> transport atmTransport spvc/0 tm bandwidth
<bandwidth>
```

7 Optionally, specify the average frame size.

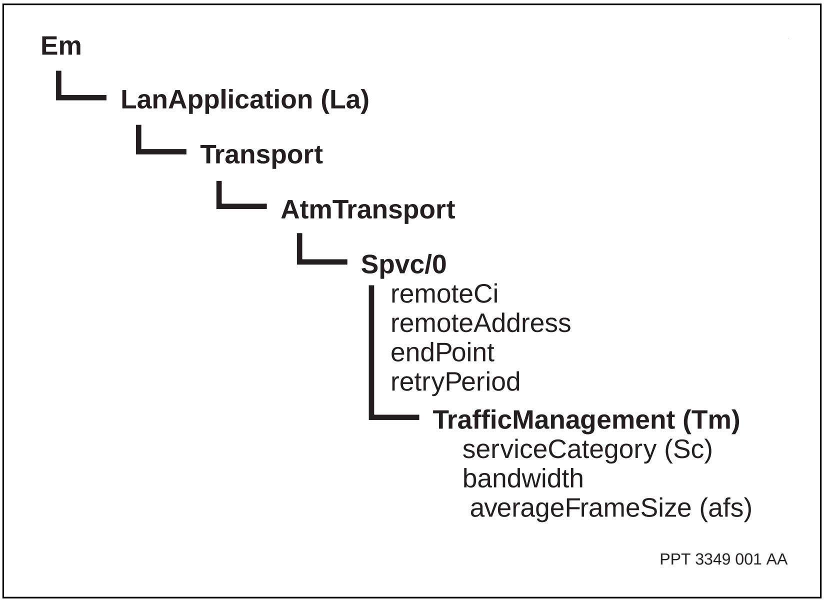
```
set la/<p> transport atmTransport spvc/0 tm
averageFrameSize <afs>
```

Variable definitions

Variable	Value
<afs>	Average frame size needs to be synchronized with the remote end value. Default value is 1500 bytes.
<bandwidth>	Bandwidth in bits/s for the connection. This attribute is ignored if the value of the *endPoint* attribute is set to *called*. Default value is 100 Mbits/s.
<p>	Instance value of the LanApplication with a value from 0 to 255.
<remoteAddress>	The local address of the ATM interface of the physical hairpin.
<remoteCi>	The instance value of the remoteConnectionIdentifier. Indicates an ATM vpi.vci logical channel number.
<sc>	ATM service category for the connection. The value can be set to VBR-nrt or UBR. Default value is VBR-nrt.
<timer>	Interval time between call setup attempts after a connection fails. This value ranges from 10 to 3600 seconds. The default setup retry period is 20 seconds.

Procedure job aid

Figure 10
Configuring the calling end of the LAN SPVC component hierarchy



Configuring the ATM SPVC

Configure the ATM SPVC to call the ATM interface on the remote hairpin.

Procedure steps

1 Add the VCC.

```
add atmIf/<e> vcc/<remoteCi>
```

2 Add the ATM interface VCC Src.

```
add atmIf/<e> vcc/<remoteCi> Src
```

3 Set the VCC to call the ATM interface of the remote hairpin.

```
set atmIf/<e> vcc/<remoteCi> Src calledAddress
<remoteNsapAddress>
```

4 Set the VCC to use a specific VPI.VCI at the ATM interface of the remote hairpin.

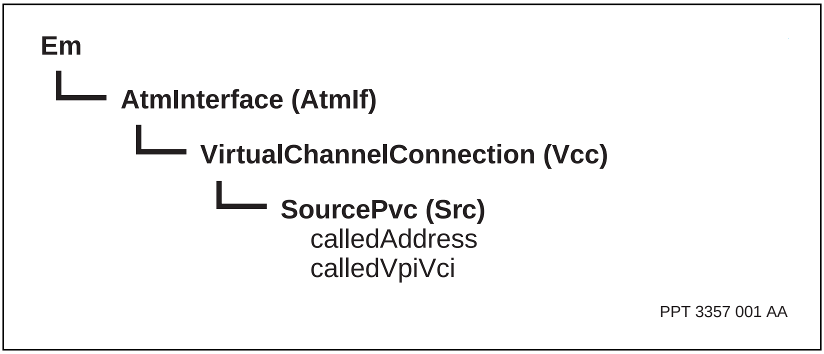
```
set atmIf/<e> vcc/<remoteCi> Src calledVpiVci
<remoteCi>
```

Variable definitions

Variable	Value
<e>	The instance value of the other ATM interface.
<remoteCi>	The instance value of the remoteConnectionIdentifier of the peer hairpin AtmIf. Indicates an ATM vpi.vci logical channel number.
<remoteNsapAddress>	The local address of the called end (also known as the remote address of the calling end).

Procedure job aid

Figure 11
Configuring the ATM SPVC component hierarchy



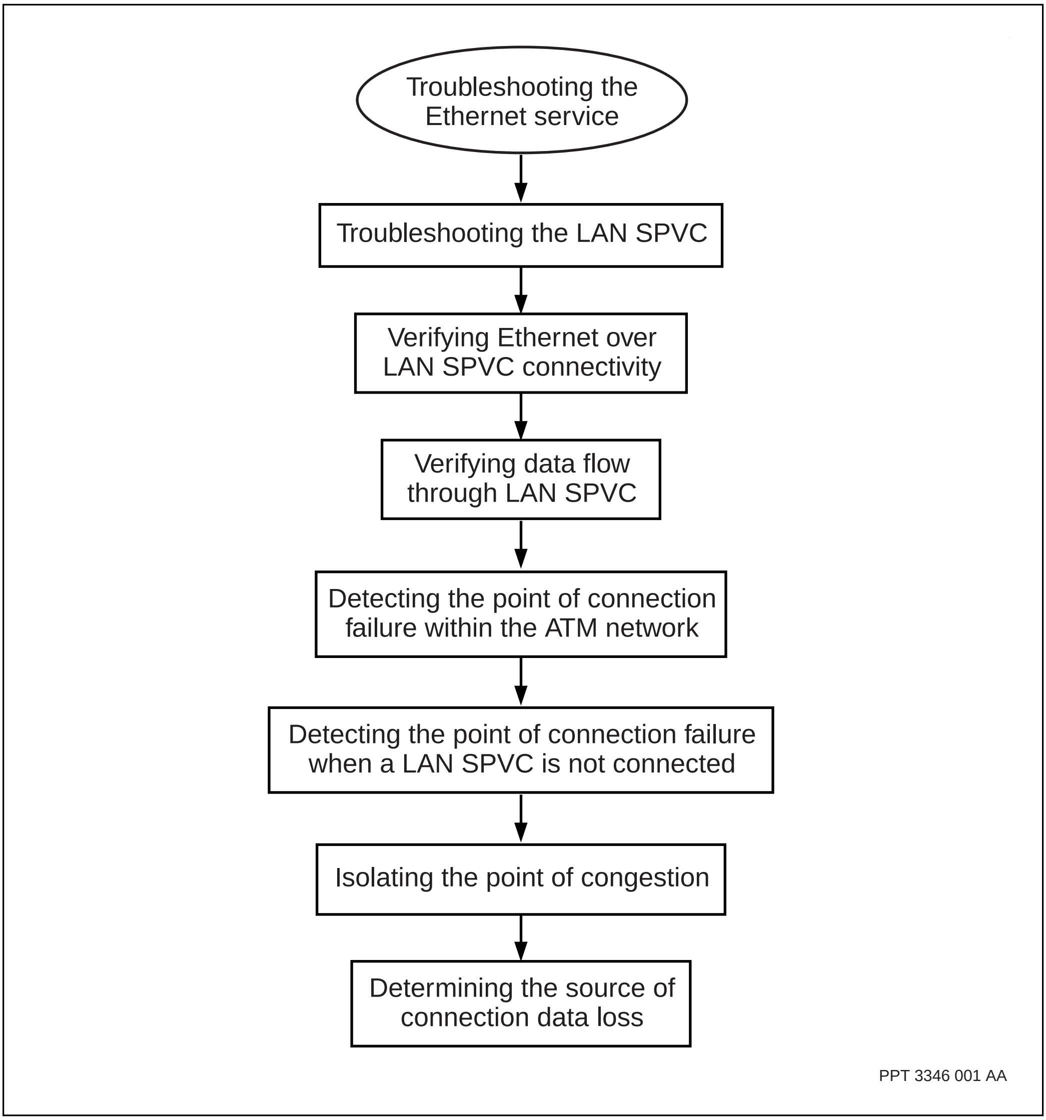
Chapter 5
Troubleshooting the Ethernet service

Troubleshoot the Ethernet service to determine the possible reasons behind connection failure, congestion, and data loss.

Troubleshooting the Ethernet service task flow

This task flow shows you the procedures you perform to troubleshoot the Ethernet service. To link to any procedure, go to “Task flow navigation” (page 46).

Figure 12
Troubleshooting the Ethernet service task flow



Task flow navigation

- “Troubleshooting the LAN SPVC” (page 47)

Troubleshooting the LAN SPVC

Isolate a problem within a specific portion of the network. The generic troubleshooting guidelines are described below.

1 Analyze alarms generated by Passport components. See 241-5701-500 *Passport 6400, 7400, 15000, 20000 Alarms*.

2 Display and analyze LAN SPVC service level operational statistics. See 241-5701-702 *Passport 7400, 15000, 20000 ATM Routing and Signaling Fundamentals*.

3 Identify corrective actions by referring to 241-5701-700 *Passport 7400, 15000, 20000 ATM Overview*.

4 Identify the ATM related cause codes by referring to 241-5701-715 *Passport 7400, 15000, 20000 ATM Monitoring and Troubleshooting Guide*

Verifying Ethernet over LAN SPVC connectivity

Verify the status of a connection by observing the *spvcStatus* under the SPVC component.

Procedure steps

1 Verify the status of the connection.

```
display La/<o> transport atmTransport spvc/0
```

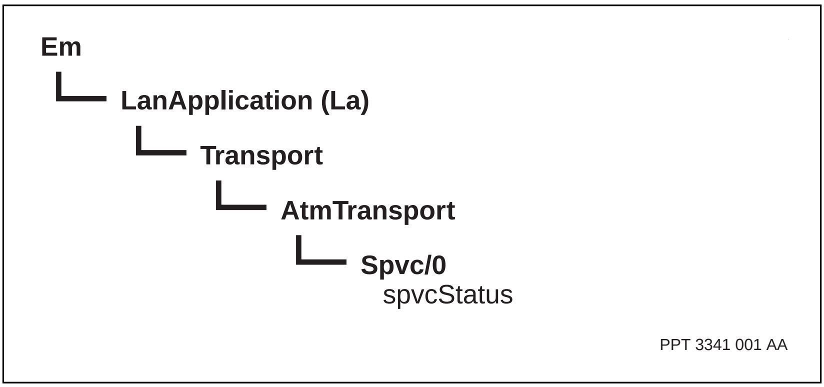
2 If the SPVC status is not connected, see "Detecting the point of connection failure within the ATM network" (page 53).

Variable definitions

Variable	Value
<o>	Instance value of the LAN application.

Procedure job aid

Figure 13
Verifying Ethernet over LAN SPVC connectivity component hierarchy



Verifying data flow through the LAN SPVC

You can observe the traffic flow by monitoring the LAN SPVC and ATM interface statistics.

Procedure steps

1 Verify that data is received on the Ethernet port.

```
display Lp/<m> Ethernet/<n>
```

Observe that the *frameReceived* is increasing.

2 Verify to which *atmConnection* this switched connection is established.

```
display La/<o> transport atmTransport spvc/0
atmConnection
```

This provides the *AtmIf/<n> Vcc/<vpi.vci>* component name.

3 Verify that data is received by every *AtmIf* in the path, assuming that traffic flow is bidirectional.

```
display AtmIf/<p> Vcc/<vpi.vci> statistics
```

Observe that the *txCell/rxCell* count is increasing by the cell count.

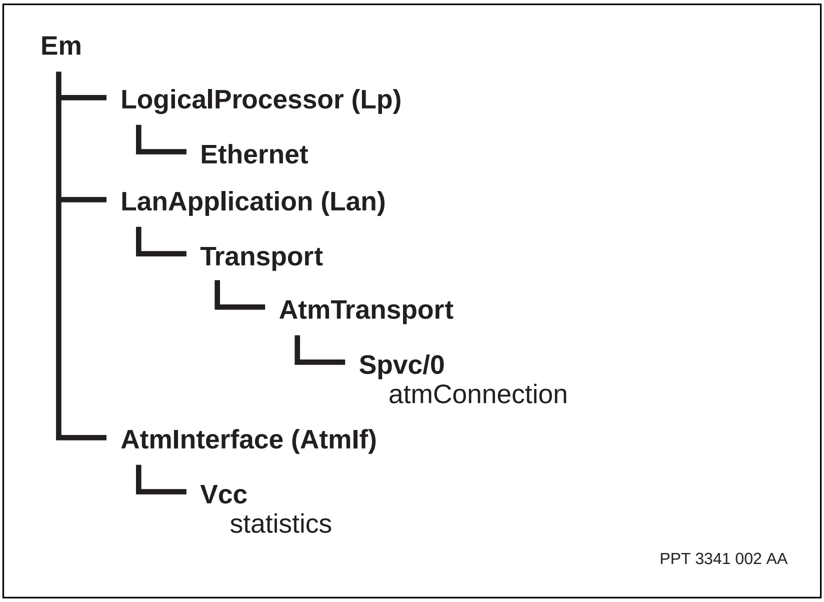
Note: If the counts are not increasing as expected, refer to the sections that follow.

Variable definitions

Variable	Value
<m>	Instance value of the logical processor.
<n>	Instance value of the Ethernet port.
<o>	Instance value of the LAN application.
<p>	Instance value of the ATM interface.
<vpi.vci>	Instance value of the virtual path and connection identifiers.

Procedure job aid

Figure 14
Verifying data flow through LAN SPVC component hierarchy



Detecting the point of connection failure when a LAN SPVC is not connected

Detect the point of connection failure where data loss is occurring. Usually when data loss is detected, the connection status is the first thing to check. Make sure that every component is unlocked.

Procedure steps

1 Check the status at the calling end of the LAN SPVC.

```
display La/<o> transport atmTransport spvc/0
spvcStatus
```

Observe if the state is not connected.

2 Check the status of both ends to determine whether the *La* component is locked.

```
display La/<o> adminState
```

3 Check the status of both ends to determine whether the *Ethernet* component is locked.

```
display Lp/<m> ethernet/<n> adminState
```

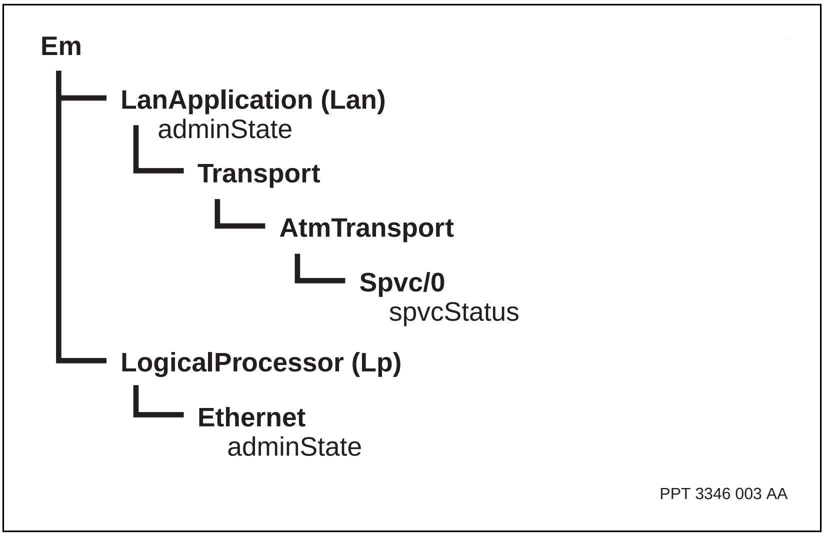
If the connection failure is caused by a failure on the ATM network of the connection, see “Detecting the point of connection failure within the ATM network” (page 53).

Variable definitions

Variable	Value
<m>	Instance value of the logical processor.
<n>	Instance value of the Ethernet port.
<o>	Instance value of the LAN application.

Procedure job aid

Figure 15
Detecting the point of connection failure when a LAN SPVC is not connected component hierarchy



Detecting the point of connection failure within the ATM network

Detect the point of connection failure when data loss is occurring within the ATM network.

Procedure steps

1 Determine the cause of the SPVC failure.

```
display La/<o> transport atmTransport spvc/0
lastSetupFailureCause
```

```
display La/<o> transport atmTransport spvc/0
lastTearDownCause
```

Note: See table “Ethernet over ATM cause codes” (page 54) for a list of possible cause codes and their description.

2 Verify that the *vccDownDiscards* attribute increases.

```
display La/<o> transport atmTransport vccDownDiscards
```

Note: This attribute indicates the number of frames received from the interface that have been discarded due to the *VCC* being inactive. The attribute value increases if traffic is being received on the GigE port for that LAN application.

Variable definitions

Variable	Value
<o>	Instance value of the LAN application.

Procedure job aid

Figure 16
Detecting the point of a connection failure within the ATM network component hierarchy

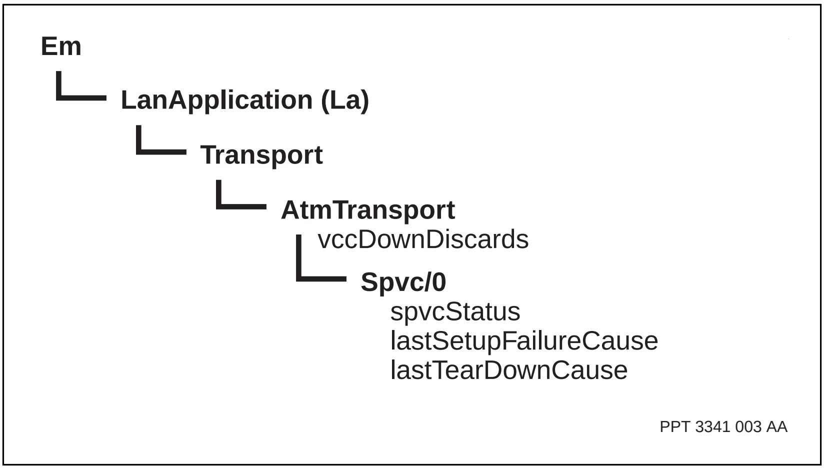


Table 1
Ethernet over ATM cause codes

Cause code name	Cause code	Description
napCauseNoRouteToDest_c	3	The provisioned called address does not match the NSAP address of the terminating ATM interface or the called party can not be reached because the network through which the call has been routed does not serve the destination required.
napCauseUserBusy_c	17	The called end is either already connected or waiting to be connected.
napCauseCallRejected_c	21	Unable to allocate resources for the Setup, connection, or release PDU.
(Sheet 1 of 2)		

Table 1 (continued)
Ethernet over ATM cause codes

Cause code name	Cause code	Description
napCauseNormalUnSpec_c	31	Invalid configuration. Called end can not launch Setup.
napCauseCelRateUnavail_c	37	Insufficient outbound bandwidth or invalid traffic management configuration.
napCauseTempFailure_c	41	Call rejected or released because NAPI is not in Ready state.
napCauseResourceUnavail_c	47	Setup PDU was not successfully sent because of insufficient resource availability.
napCauseTrafParmUnSupp_c	73	Invalid traffic management configuration.
Note: If a cause code is not included in this table, refer to 241-5701-715 *Passport 7400, 15000, 20000 ATM Monitoring and Troubleshooting Guide*.		
(Sheet 2 of 2)		

Isolating the point of congestion

You can isolate the point of congestion when data loss is observed on a LAN SPVC connection, as well as when the ATM network is congested and the congestion is moving towards the LAN interface. Use statistics on the LAN interface and ATM to detect data loss.

Procedure steps

1 Determine whether frames from the interface have been discarded due to congestion.

```
display La/<o> transport atmTransport congDiscFromIf
```

Note: This attribute indicates the number of frames received from the interface that have been discarded due to congestion. Observe whether *congDiscFromIf* is increasing.

2 Find the *atmConnection* to which this switched connection is established.

```
display La/<o> transport atmTransport spvc/0
atmConnection
```

Note: This provides the *AtmIf/<n> Vcc/<vpi.vci>* component name.

3 Check data loss:

```
display AtmIf/<n> Vcc/<vpi.vci> Statistics
```

Note: If *txDiscard* is increasing, data loss is occurring in the direction towards the ATM link. If the *rxDiscard* is increasing, data loss is occurring in the direction towards the ATM node.

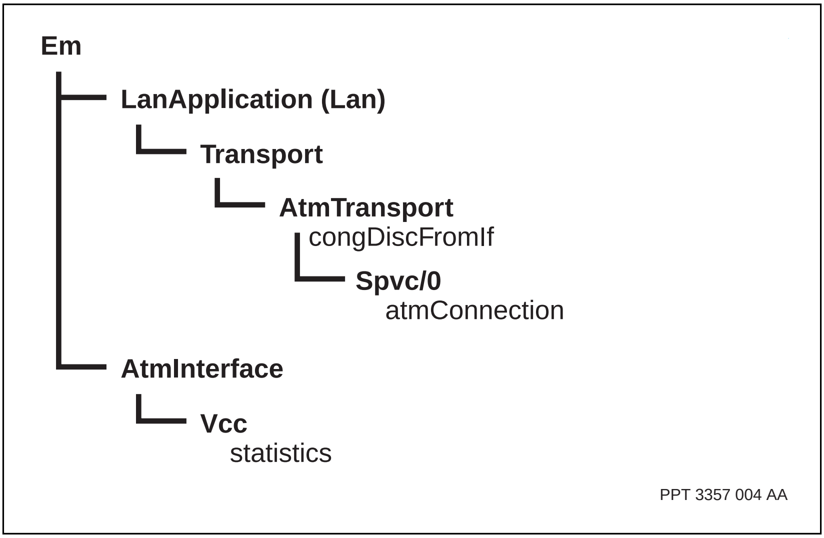
4 Repeat step 3 to check data loss at every connection hop.

Variable definitions

Variable	Value
<o>	Instance value of the LAN application.
<n>	Instance value of the ATM interface.
<vpi.vci>	Instance value of the virtual path and connection identifiers.

Procedure job aid

Figure 17
Isolating the point of congestion component hierarchy



Determining the source of connection data loss

Determine the source of data loss when congestion has been ruled out.

Procedure steps

1 Determine the validity of the traffic coming into the Ethernet port.

```
display lp/<m> Ethernet/<n>
```

If *framesTooLong* is increasing, data loss is caused by corrupted data which is too long.

2 Find the *atmConnection* to which the switched connection is connected.

```
display La/<o> transport atmTransport spvc/0
atmConnection
```

3 Check data loss.

```
display AtmIf/<p> Vcc/<vpi.vci> Statistics
```

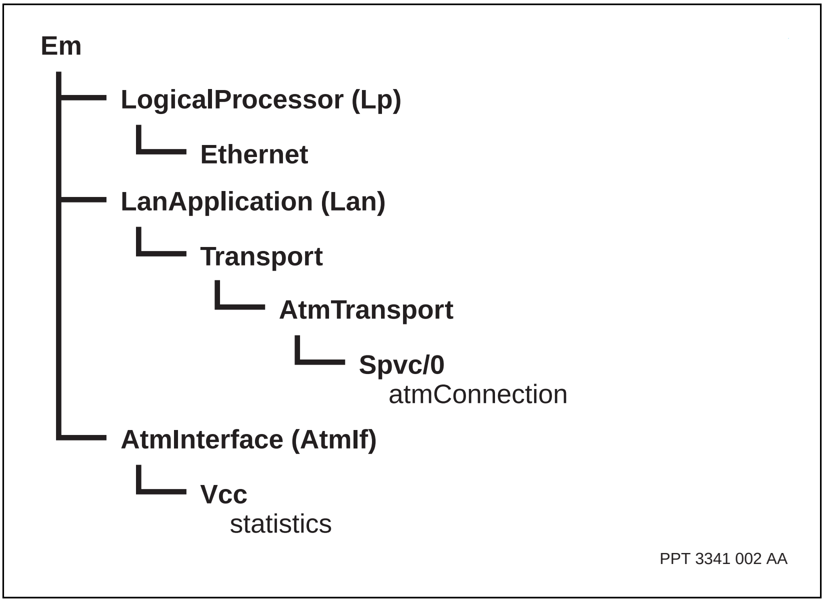
Note: If *rxDiscard* or *droppedRxCell* is increasing and there is no congestion, data loss is caused by AAL5 reassembly.

Variable definitions

Variable	Value
<m>	Instance value of the logical processor.
<n>	Instance value of the Ethernet port.
<o>	Instance value of the LAN application.
<p>	Instance value of the ATM interface.
<vpi.vci>	Instance value of the virtual path and connection identifiers.

Procedure job aid

Figure 18
Determining the source of connection data loss component hierarchy



Chapter 6
Ethernet service overview

The ATM over Ethernet service on Passport 15000 and 20000 provides transparent tunneling of Ethernet traffic between gigabit Ethernet (GigE) ports over a dedicated ATM soft permanent virtual circuit (SPVC). Each GigE port is logically linked to a single, dedicated ATM VCC, so that the port-to-port peer relationship can be established.

Why use the Ethernet service?

Ethernet is emerging as both an important service offer for implementing VPNs within a local Metro area and an access mechanism for higher layer services with local and wide area scope. However, it often becomes a challenge to extend the Ethernet VPN service over the WAN between pockets of Metro Ethernet, or delivering Ethernet-based end customers to layer 3 service points of presence outside of the local Metro. The Ethernet over ATM service makes use of well-established ATM networks in the WAN as an Ethernet transport vehicle.

How does the Ethernet service work?

Frame-based layer 2 Ethernet traffic is transported with null VC encapsulation and carried as AAL5 frames across the ATM network. In this document, the null VC encapsulation is the same format as that defined in RFC1483 for VC multiplexing of bridged protocols, but without the two padding octets in front of the Ethernet frame. In effect, it is the MAC frame directly over standard AAL5.

The AAL5 segmentation and reassembly (SAR) function is provided by the ATM FP. For frames egressing onto the ATM link, the ATM FP segments the AAL5 frames. For cells ingressing from the ATM link, the ATM FP reassembles the AAL5 frames. The layer 2 Ethernet headers remain unaltered by and between the peer 4pGe FPs. For detailed information about the frame data flow, see the section “Frame data flows” (page 69).

There is no layer 2 bridging or layer 3 routing provided or supported by this feature. Therefore, auto-discovery of peer layer 2 circuits is not required. Each GigE port is directly linked to its own ATM VCC.

Operation of the Ethernet over ATM service is shown in figure “Ethernet service direct connection end-to-end view” (page 64).

> ***Note:*** The Ethernet service does not support edge-based routing (EBR) for the SPVC.

Supported cards

Table “FPs supporting the Ethernet over ATM (EoAtm) service” (page 62) lists the function processors (FPs) that are recommended when configuring the Ethernet over ATM service.

Table 2
FPs supporting the Ethernet over ATM (EoAtm) service

FP card type	PEC
1-port OC-48/STM-16 ATM (PQC2)	NTHW01C, NTHW01EA
4-port OC-12/STM-4 ATM (PQC12)	NTHW86BA
(Sheet 1 of 2)	

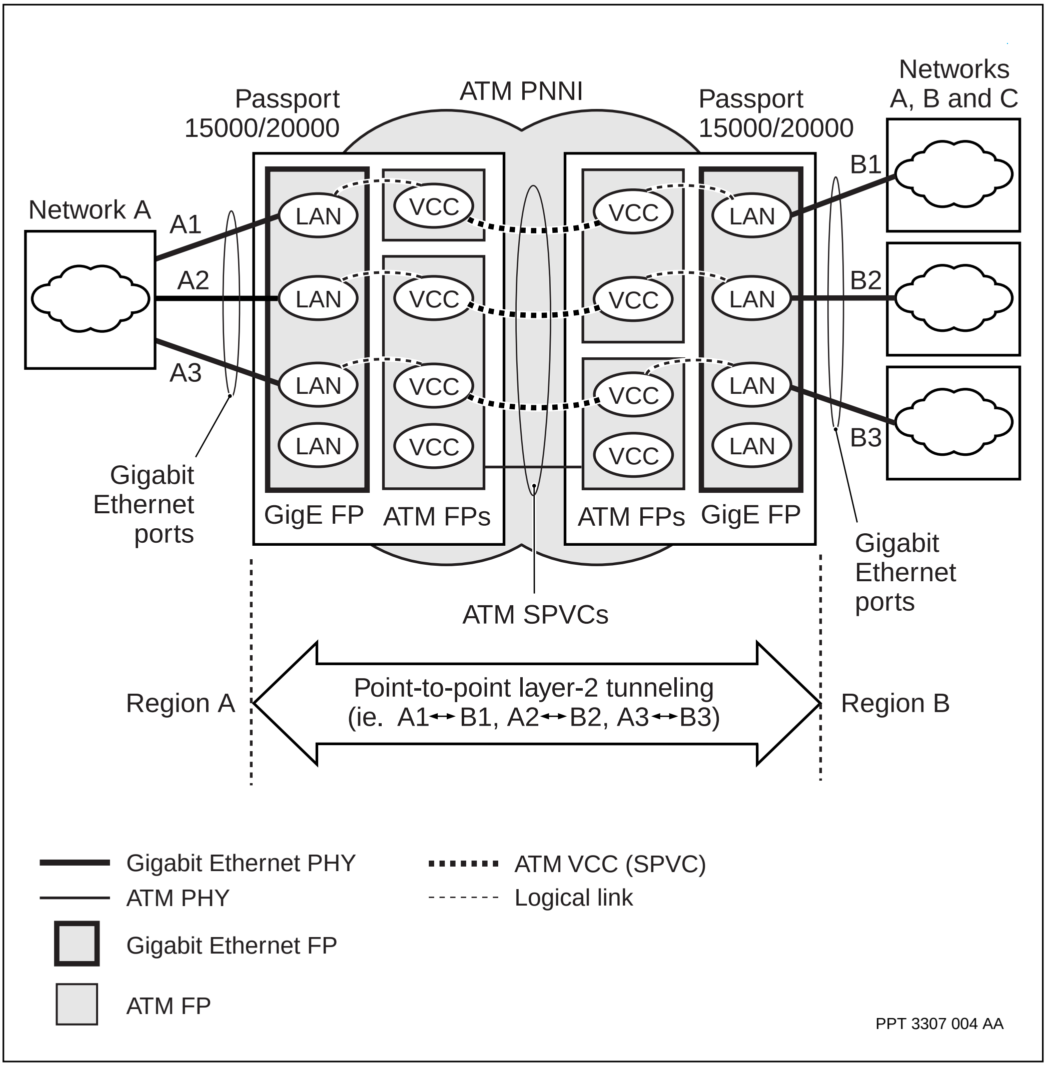
Table 2 (continued)
FPs supporting the Ethernet over ATM (EoAtm) service

FP card type	PEC
4-port OC-3/STM-1 ATM (PQC2)	NTHR17, NTHR21
16-port OC-3/STM-1 ATM	NTHW21, NTHW31
16-port OC-3/STM-1 POS and ATM	NTHW44
(Sheet 2 of 2)	

Physical network

On the physical network, connectivity of Ethernet LAN segments is typically collocated with the bridge, router, or switch that links the segments together. If these segments are not collocated, but in disparate locations, interconnecting segments typically require customer equipment to connect to the WAN DCE using a frame relay or ATM layer 2 media. This feature enables customer equipment to connect to the WAN DCE using native Ethernet layer 2 media while maintaining the existing ATM core network as the transport technology. See figure “Ethernet service direct connection end-to-end view” (page 64) for more information.

Figure 19
Ethernet service direct connection end-to-end view



Carrier grade functionality

The carrier grade functionality supported by this feature includes:

- CP switchover behavior: supported in cold standby mode only. Administrative states of all relevant components are reset to their default upon CPSO. Operational states will, however, reflect the current operational status of the component.
- FP switchover behavior: ATM FP switchovers are not impacted.
- Software upgrade behavior: hitless software migration (HSM) is not supported.
- Line automatic protection switching is not supported.

Timers

The LAN SPVC that interconnects GigE ports supports resiliency during ATM network failures. The VCC attempts the initial call setup once the LanApplication service has received all of its provisioning data. If the first call setup attempt fails, the LAN SPVC retries to connect to the remote endpoint indefinitely. If a call fails after the VCC has been successfully established, the LAN SPVC attempts to reconnect to the remote called endpoint indefinitely, every 20 seconds by default (SPVC retry timer). A holding time is used to handle the failure cases when receiving a release.

The SPVC retry timer is provisionable per module. This timer is started after a release message is received by the LAN application. Upon its expiry, LAN starts the connection setup procedures. The timer is used by the LAN that has provisioned SPVC components as a calling endpoint.

Addressing

In Passport ATM networks, the only address format used is the one that adheres to OSI network service access point (NSAP) format. NSAP is a 40-digit long (20 bytes) address that follows a certain format.

The EoAtm SPVC feature interworking with ATM uses NSAP addressing. It is necessary that the address mapping performs for LAN interwork with ATM using SPVCs. The NSAP address combined with a connection ID uniquely identifies any LAN SPVC connection in the PNNI1.0 network.

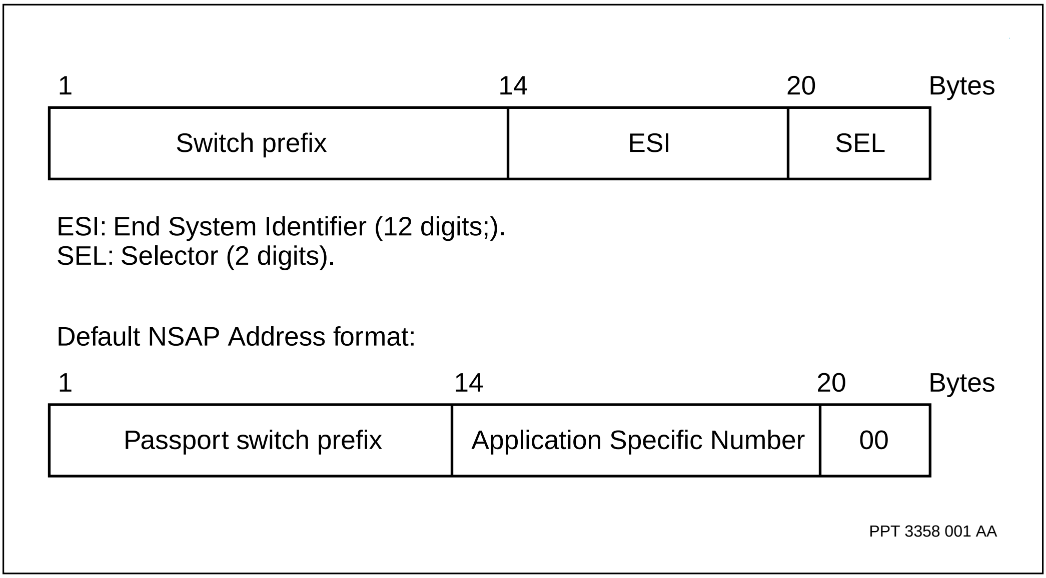
The address is constructed using binary-coded decimal (BCD) encoding (each two digits occupy one byte). The first two digits of the NSAP address contains an Authority and Format Identifier (AFI) value. AFI indicates the type of address encapsulated inside this NSAP address (i.e. DCC, ICD, or E.164). The last byte is a Selector (SEL) byte which has local significance. The ESI (End System Identifier) can be a MAC address. All other values of the AFI byte are reserved. This means that if an ATM switch receives a call request with an address that begins with a value of AFI other than the ones defined (39 for DDC; 47 for ICD) it can reject the call without violating ATMF standards compliance.

The NSAP address can be provisioned per LanApplication, but it is recommended that the LAN application generate the default NSAP address. Here is how the default NSAP address is built:

- Switch prefix (13 bytes) - the Passport switch prefix, as configured under the *Rtg* component.
- End System identifier (ESI) - the application specific number. The 7 bytes are constructed from the following:
  - 4 bytes magic number (0x0020480d)
  - 4 bits application ID (0x08)
  - 12 bits application instance
  - 1 byte selector set to 0

For a breakdown of the NSAP address, see figure “NSAP address format” (page 67).

Figure 20
NSAP address format



Chapter 7
Frame data flows

The Ethernet service provides a cut-through frame data flow from gigabit Ethernet port to ATM VCC and from ATM VCC to gigabit Ethernet port.

- “Ingress datapath (GigE port to ATM VCC)” (page 69)
- “Egress datapath (ATM VCC to GigE port)” (page 71)

Ingress datapath (GigE port to ATM VCC)

The ingress framer function block of the gigabit Ethernet FP performs frame delineation and validation, keeping numerous counts of both good and error frames. Statistics collected by the ingress framer are also provided.

The PHY device checks the FCS of the Ethernet frames and strips the FCS before forwarding the frame onto the ingress framer pre-classification block.

The pre-classification function block on the ingress datapath assigns a fixed internal QoS corresponding to emission priority (EP) 0 and discard priority (DP) 2 for all received frames.

The ingress network processor (NP) uses a configured one-to-one port to VCC mapping to determine the egress VCC on the egress ATM FP.

If the ingress NP cannot forward a frame because either the VCC is down or the egress ATM FP is congested, the frame is discarded by the NP and statistics are collected.

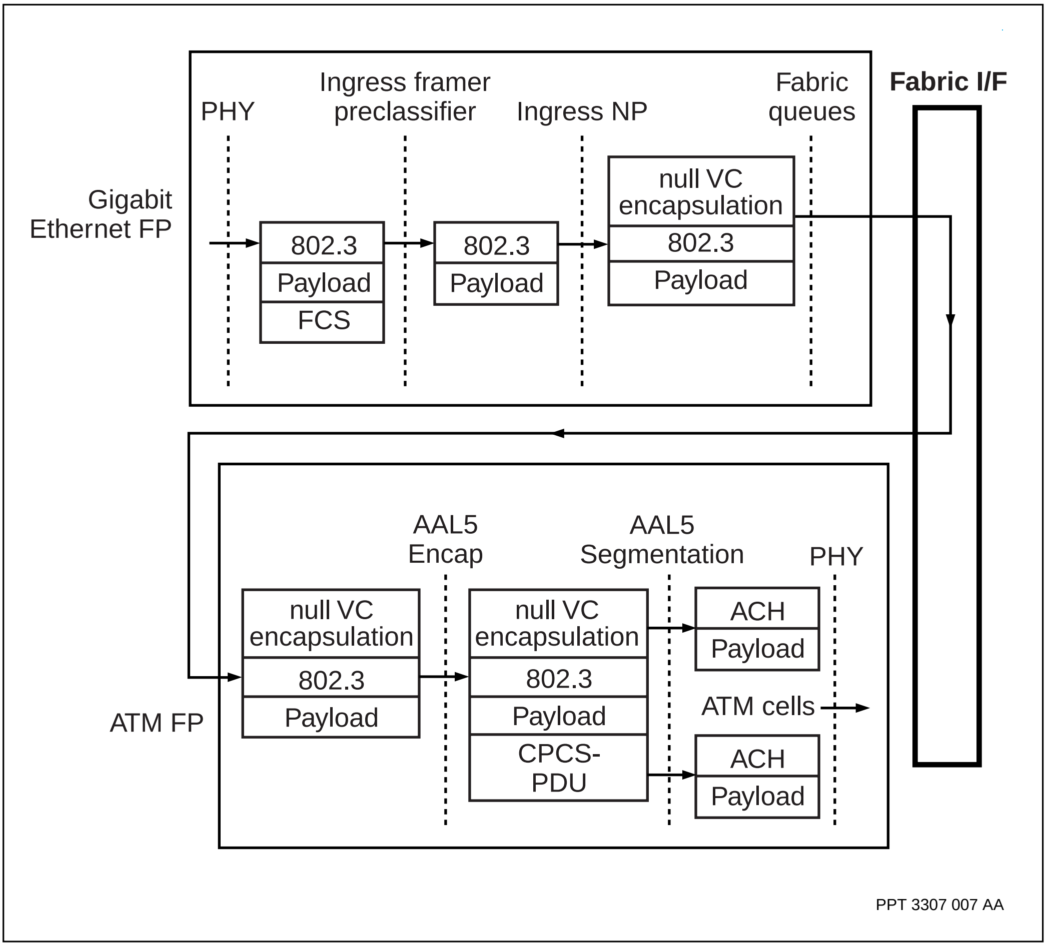
If the ingress NP can forward a frame, the frame is encapsulated using null VC encapsulation.

On the ATM FP, frames are encapsulated with an AAL5 CPCS-PDU trailer and segmented into ATM cells by the AAL5 segmentation functional block by Passport queue controller (PQC) ASIC.

The resulting ATM cells are placed on the outgoing VCC via the ATM traffic management device.

See figure “Ingress frame flow” (page 70) for more information.

Figure 21
Ingress frame flow



Egress datapath (ATM VCC to GigE port)

ATM VCC on the ATM FP is configured with internal forwarding information pointing to the GigE port associated with the ingress VCC. Received cells on this VCC go through the AAL5 reassembly function block of egress PQC and assembled frames are forwarded through the fabric to the egress network processor (NP) on the 4pGe FP.

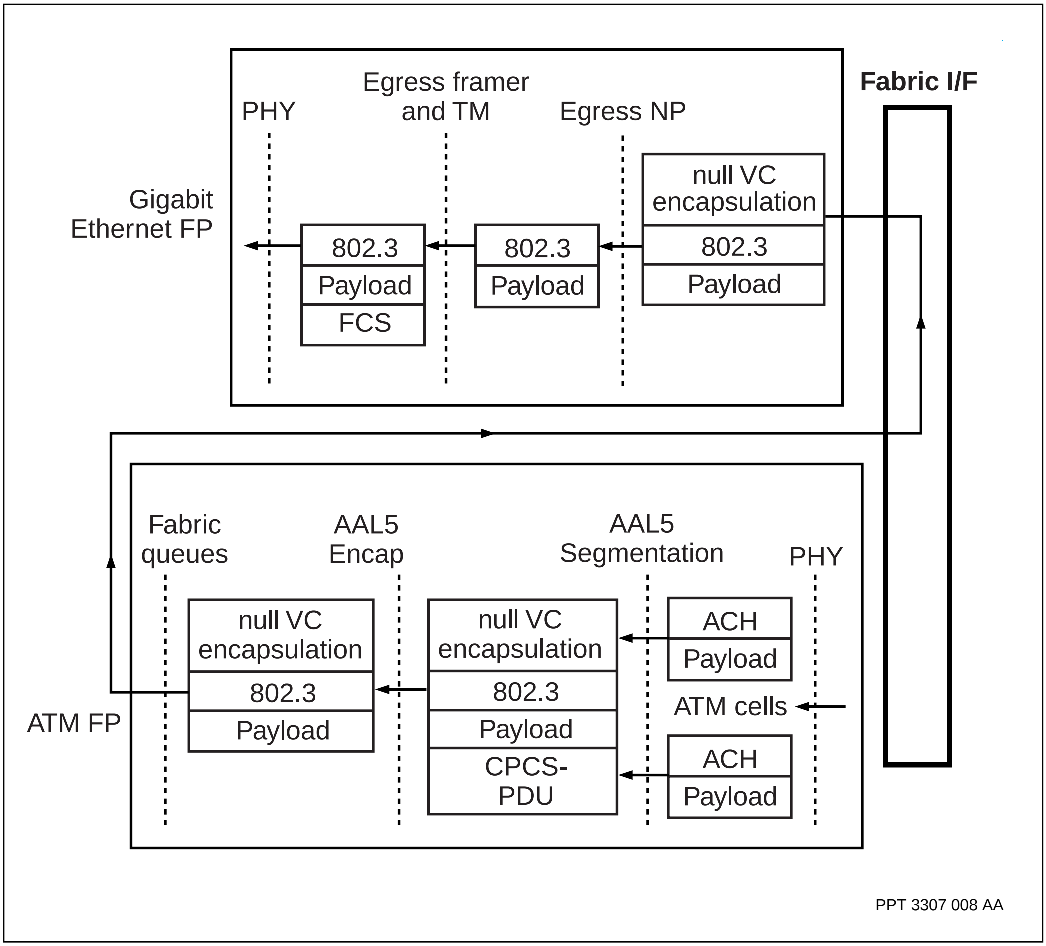
The egress NP removes the null VC encapsulation from the frame and forwards the resulting Ethernet frame to the GigE port associated with the ingress ATM VCC. The egress PHY recalculates the FCS before sending the frame out to the interface.

The host processor on the GigE FP and on the ATM FP is not involved in frame forwarding. It executes the control function by performing the following:

- LAN SPVC setup
- frame datapath configuration
- statistics collection and aggregation

Refer to figure “Egress frame flow” (page 72) for a visual representation of egress traffic and the path it takes.

Figure 22
Egress frame flow



Chapter 8
Performance enhancement solution

The performance enhancement solution, otherwise referred to as the hairpin solution, provides policing for the 4pGe FP by taking advantage of ATM ingress policing within the network. The performance enhancement solution also provides shaping by taking advantage of ATM egress shaping. To allow for the performance enhancement solution, the interworking functionality of the SPVC must terminate on an AtmIf instead of a GigE port.

Benefits of the performance enhancement solution

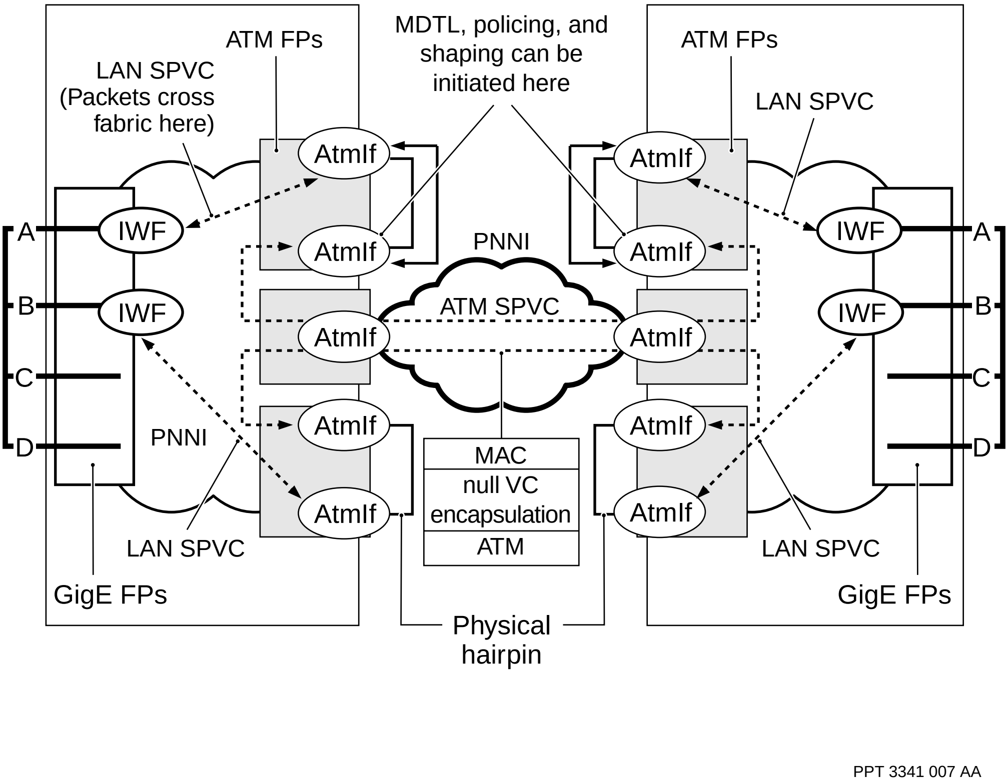
The performance enhancement solution offers a variety of benefits. Firstly, the AtmIf configuration takes advantage of the policing and shaping features offered by the ATM function processor (FP). The policing and shaping of Ethernet traffic enforces bandwidth subscriptions and protects the integrity of the ATM network.

Secondly, source and destination ATM SPVC segment endpoints (MDTL) can be selected manually. MDTL can be used to specify the AtmIf-to-AtmIf VCC segment. For more information, see 241-5701-702 *Passport 7400, 15000, 20000 ATM Routing and Signaling Fundamentals*.

Thirdly, the maximum throughput for ATM connections is supported.

Refer to figure “Performance enhancement solution” (page 74) for a graphical representation of the performance enhancement solution.

Figure 23
Performance enhancement solution



For information on configuring the performance enhancement solution, see “Configuring the performance enhancement solution” (page 35).

Chapter 9
Traffic management

This section describes the relationship between the traffic management performed by the Gigabit Ethernet (GigE) FP and the ATM FP.

Proper network engineering

Proper network engineering is critical in ensuring optimal use of network resources while minimizing undesirable packet discards by the network. The offered load by the 4pGe FP should not exceed the capacity of an ATM FP. It is essential to engineer the ingress Ethernet traffic in such a way that it maximizes the efficiency of the ATM FPs, while minimizing Ethernet discards by the 4pGe FP or the ATM FP due to congestion.

Traffic management features

The 4pGe FP supports the following traffic management features:

- one internal QoS for all ingress traffic on all ports
- one configurable service category for each LAN SPVC for per-port differentiation across the ATM network
- congestion management for ingress Ethernet traffic

> ***Note:*** In addition to traffic shaping and policing, congestion management and network engineering are performed by the ATM FP. For information about traffic shaping or policing, see 241-5701-706 *Passport 7400, 15000, 20000 ATM Traffic Shaping and Policing*.

Stages of congestion management

There are five stages of traffic flow that occur incrementally and sequentially until congestion on an ATM FP ends.

The first stage occurs at the network level. Overall end-to-end traffic management is managed through VCC traffic descriptor configuration.

The second stage occurs at the ATM trunk FP. To avoid access FPs from congesting the shared ATM resource, the traffic management device provides implicit notification to the upstream devices to reduce their offered load.

The third stage occurs at the fabric. An appropriate amount of back pressure is provided to all access FPs sending traffic to the congested ATM FP.

The fourth stage occurs at the 4pGe access FP to avoid discarding traffic.

The fifth stage occurs at the gigabit Ethernet port level. It avoids receiving more traffic than can be transported across the ATM network.

> ***Note:*** The second, third, and fourth stages involve an existing Passport 15000 and 20000 back pressure mechanism in the ingress direction (towards the network). See “Back pressure notification mechanism” (page 76) for more information.

Congestion does not occur on the 4pGe FP in the egress direction of data flow (from the network) because the capacity of any one ATM VCC can not exceed the capacity of a single 4pGe port. As a result, congestion management mechanisms on the 4pGe are not necessary.

Back pressure notification mechanism

Traffic policing and shaping are supported by the ATM VCC based on its configured ATM service category (SC). Under conditions of network congestion, the ATM VCC provides congestion management and notification.

When the ATM FP becomes congested, it applies an existing back pressure notification mechanism to the GigE FP. The access GigE FP then performs its own throttling until congestion abates or it becomes congested. When the access GigE FP becomes congested, it commences discarding newly arriving Ethernet traffic that cannot be forwarded to the egress ATM FP.

Conversion from Ethernet to ATM traffic parameters

Ethernet and ATM use different parameters and units to characterize the traffic on a given connection.

Ethernet uses the following parameters:

- IfSpeed: interface speed (linkRate) in bits/second
- AFS: average frame size in bytes
- BW: bandwidth in bits/second

ATM uses the following parameters:

- PCR: peak cell rate in cells/second
- SCR: sustainable cell rate in cells/second
- MBS: maximum burst size in cells/second (a value of 2083 is assigned to allow GigE SPVC connections to establish on a 1-port OC-48/STM-16 ATM function processor for a direct call)

The conversion from one set of parameters to the other can not be exact because each set of parameters describes a given connection differently. However, one set of parameters can be used to estimate the equivalent of the other set.

The following equations can be used to map Ethernet parameters to the ATM equivalent, assuming that the ATM connections have a service category of either UBR or VBR-nrt ATM, respectively:

UBR:

- PCR_{0+1} = (BW / 424) * overheadFactor

VBR-nrt:

- PCR_{0+1} = (600Mbps / 424) * overheadFactor
  SCR_0 = BW / 424 * overheadFactor
  MBS_0 = 2083

Where:
600Mbps is used to accommodate the 4pOC12 line rate.

> ***Note 1:*** If these parameters are going to be used for UPC traffic policing, maximum frame sizes should be used. For information on configuring the maximum frame size, see the 4pGe section of the 241-5701-615 *Passport 7400, 15000, 20000 FP Configuration Reference*.

> ***Note 2:*** It is assumed that the ATM link rate is greater or equal to the Ethernet access rate. If the ATM link rate is less than the Ethernet access rate then the computed PCR value should not be less than the BW or SCR.

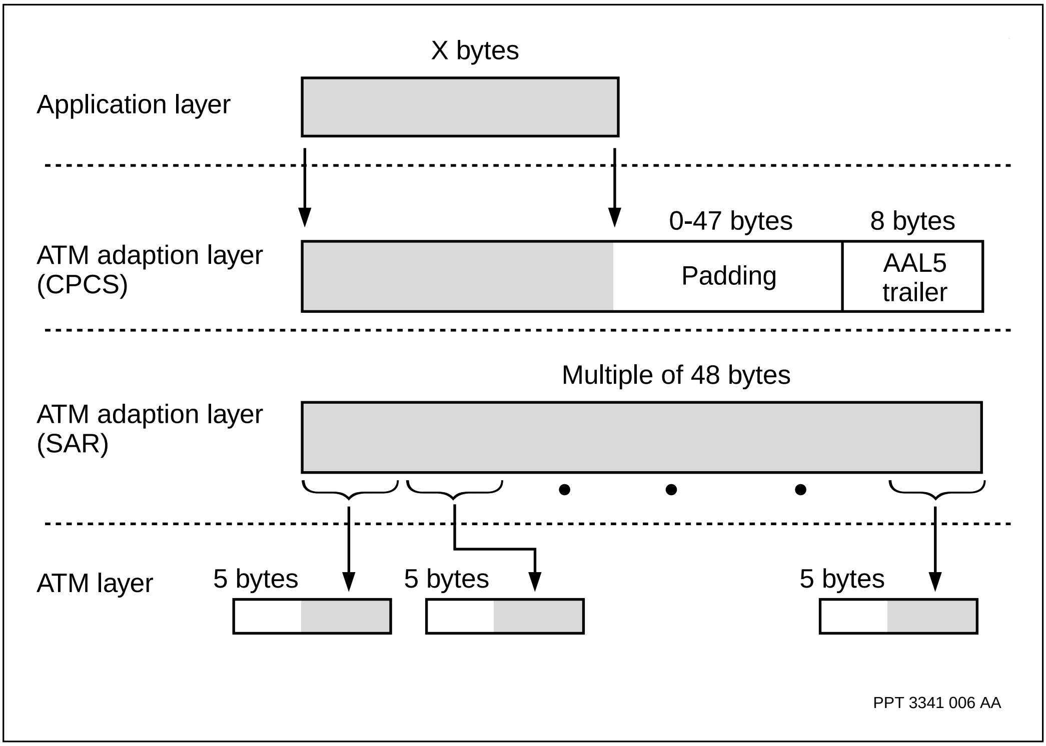
Overhead

Due to the overhead difference between Ethernet and ATM, an overhead factor is necessary when converting from one set of traffic parameters to the other. The encapsulation of an application layer frame into ATM cells at the ATM layer encounters the following types of overhead:

- ATM Adaptation layer (common part convergence sublayer (CPCS)) overhead is responsible for adding 0-47 bytes of padding and an 8 byte trailer to the frame. The amount of padding results in the total length of the CPCS layer frame size to be a multiple of 48.
- ATM Adaptation layer (segmentation and reassembly sublayer (SAR)) is responsible for partitioning the CPCS layer frame into 48 byte payloads and does not add additional overhead.
- ATM layer is responsible for appending a 5 byte ATM header that includes the VPI and VCI fields to the 48 byte payload.

See figure “Overhead encountered for frame-based services using AAL5” (page 79) for more information.

Figure 24
Overhead encountered for frame-based services using AAL5



An overhead summary for selected frame sizes based on the equations below is presented in table “Ethernet-ATM service interworking overhead summary” (page 80).

Overhead factor = (n + total ATM overhead) / n

Total ATM overhead = Total ATM cell overhead + AAL5 Trailer + padding

Total ATM cell overhead = ceiling ((n + 8) / 48) * 5

Padding = ceiling ((n + 8) / 48) * 48 - n - 8

Number of cells = ceiling ((n + 8) / 48) n = average frame size

Where:
ceiling represents the ceiling function, which gives the value n rounded up to the nearest integer.

Table 3
Ethernet-ATM service interworking overhead summary

Frame size (bytes)	Total ATM overhead (bytes)	ATM overhead (%)	Overhead factor (n)
64	42	39.60	1.6563
128	31	19.50	1.2422
256	62	19.50	1.2422
512	71	12.20	1.1387
1024	142	12.20	1.1387
1500	196	11.60	1.1307
1600	202	11.20	1.1263

Passport 15000, 20000

Ethernet Service Operations Configuration

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