



Nortel Networks Multiservice Switch

7400/15000/20000

Operations: Ethernet Service

NN10600-580



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Nortel Networks Multiservice Switch 7400/15000/20000

# **Operations: Ethernet Service**

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## Publication history

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### November 2004

6.1S2 Standard

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



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## About this document

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This guide describes the Ethernet virtual line service (EVLS).

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

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

This guide assumes that you understand the Nortel Networks Multiservice Switch network architecture.

## What's new in this document

The following features were added to this document:

- “Ethernet virtual line service (EVLS)” (page 18)
- “Virtual IP router (VIPR) on 4-port Gigabit Ethernet FP, 4-port and 8-port 10/100 BaseT Ethernet FPs” (page 18)
- “Virtual LAN (VLAN) on 4-port Gigabit Ethernet FP, 4-port and 8-port 10/100 BaseT Ethernet FPs” (page 18)
- “Link aggregation (LAG) on 4-port Gigabit Ethernet” (page 19)

Other changes made to this document include the following:

- The terms Passport and PVG have been rebranded in conjunction with the new Nortel Networks' brand simplified naming format. Passport is now referred to as the Nortel Networks Multiservice Switch, and PVG is now Media Gateway 7480/15000. For more information on the product rebranding, refer to NN10600-000 *Nortel Networks Multiservice Switch 7400/15000/20000 What's New in PCR6.1*.
- The product name for this Nortel Networks technical publication (NTP) was updated to include all three Multiservice Switch platforms: 7400, 15000, and 20000. Because of enhanced product development, the content of this NTP is now valid for all three platforms.
- The section "Carrier grade functionality" (page 136) was updated with information regarding the operational state of the *protocol port (mpe)* component after CP switchover.

### **Ethernet virtual line service (EVLS)**

This entire document was updated for this feature.

### **Virtual IP router (VIPR) on 4-port Gigabit Ethernet FP, 4-port and 8-port 10/100 BaseT Ethernet FPs**

The following section was added for this feature:

- "Configuring an Ethernet interface in port mode" (page 27)

The following section was updated for this feature:

- "Ethernet configuration" (page 23)

### **Virtual LAN (VLAN) on 4-port Gigabit Ethernet FP, 4-port and 8-port 10/100 BaseT Ethernet FPs**

The following section was added for this feature:

- "Changing an Ethernet interface to VLAN mode" (page 31)

The following section was updated for this feature:

- "Configuring an Ethernet interface in port mode" (page 27)

## Link aggregation (LAG) on 4-port Gigabit Ethernet

The following sections were added for this feature:

- “Link Aggregation (LAG) on the 4-port Gigabit Ethernet FP” (page 189)
- “Configuring Ethernet LAG” (page 35)
- “Configuring Ethernet LAG on function processor ports” (page 37)

## Text conventions

This document uses the following text conventions:

- `nonproportional spaced plain type`

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

- `nonproportional spaced bold type`

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

- *italics*

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

Words that appear in italics in text are for naming.

- `[optional_parameter]`

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

- `<general_term>`

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

- UPPERCASE, lowercase

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

- |

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

- ...

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

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

## Related documents

For the complete list of documents contained in the Nortel Networks Multiservice Switch documentation library, see NN10600-001 *Nortel Networks Multiservice Switch 7400/15000/20000 Basics: Using the Documentation*.

See the following documents for information related to Ethernet interworking:

- NN10600-005 *Nortel Networks Multiservice Switch 7400/15000/20000 Terminology*
- NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*
- NN10600-030 *Nortel Networks Multiservice Switch 7400/15000/20000 Overview*

- NN10600-500 *Nortel Networks Multiservice Switch 6400/7400/15000/20000 Alarms Reference*
- NN10600-551 *Nortel Networks Multiservice Switch 7400/15000/20000 FP Configuration Reference*
- NN10600-700 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Technology Fundamentals*
- NN10600-702 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*
- NN10600-705 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Management Fundamentals*
- NN10600-706 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals*
- NN10600-707 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Queuing and Scheduling Fundamentals*
- NN10600-708 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM CAC and Bandwidth Fundamentals*
- NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*
- NN10600-715 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*

## 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 configuration

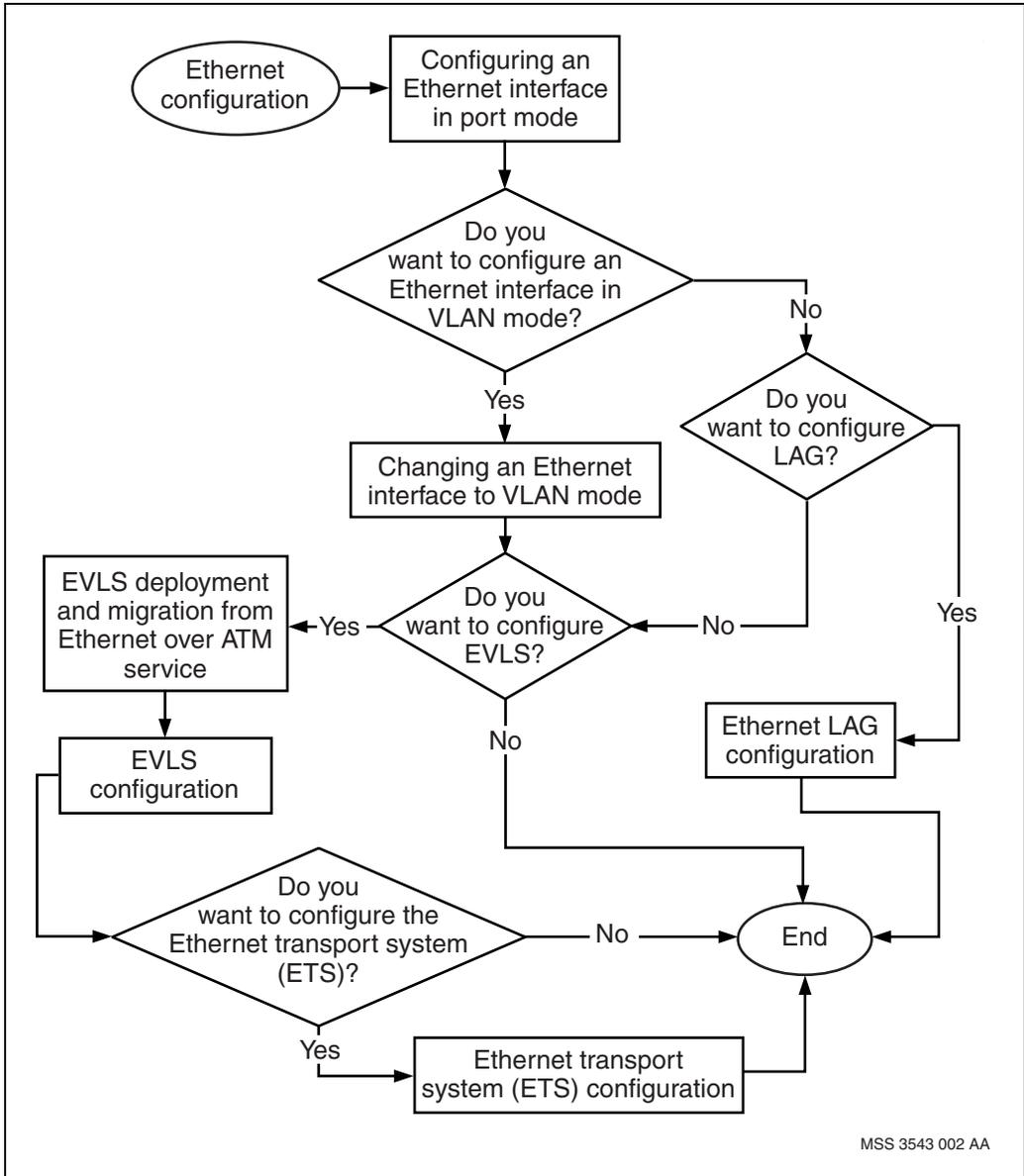
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Configure the Ethernet interface to carry Ethernet traffic to and from the Ethernet physical media for IP and IP VPN solutions as well as for the Ethernet virtual line service (EVLS).

### Ethernet configuration tasks

This work flow shows you the sequence of tasks you perform to configure the Ethernet interface. To link to any procedure, go to “Ethernet configuration task navigation” (page 25).

**Figure 1**  
**Ethernet configuration tasks**



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## **Ethernet configuration task navigation**

- “Configuring an Ethernet interface in port mode” (page 27)
- “Changing an Ethernet interface to VLAN mode” (page 31)
- “Ethernet LAG configuration” (page 33)
- “EVLS deployment and migration from the Ethernet over ATM service” (page 39)
- “EVLS configuration” (page 45)
- “Ethernet transport system (ETS) configuration” (page 67)



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## Chapter 2

# Configuring an Ethernet interface in port mode

---

Configure an Ethernet interface in port mode to provide an Ethernet connection between a Nortel Networks Multiservice Switch node and the customer edge (CE) device.

### Prerequisites

- To download the required IP Ethernet software applications, refer to the chapter on downloading software from the software distribution site to the node in NN10600-270 *Nortel Networks Multiservice Switch 7400/15000/20000 Software Installation*.
- You must add an Ethernet port to the *LogicalProcessor (Lp)* component. Refer to the chapter on logical processor, port, and channel configuration in NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

### Procedure steps

- 1 Add a *LanApplication* component. The *Framer* subcomponent is added automatically.

```
add La/<x>
```

- 2 Link the *LanApplication* component to a physical port.

If you are configuring the 2-port 100 BaseT Ethernet function processor (FP), complete this step:

```
set La/<x> Framer interfaceName Lp/<y> Eth100/<z>
```

If you are configuring the 6-port 10 BaseT Ethernet FP, complete this step:

```
set La/<x> Framer interfaceName Lp/<y> Enet/<z>
```

If you are configuring the 4-port 10/100 BaseT Ethernet FP, 8-port 10/100 BaseT Ethernet FP or the 4-port gigabit Ethernet FP, complete this step:

```
set La/<x> Framer interfaceName Lp/<y> Eth/<z>
```

- 3 Optionally, set the *unknownVlanIdTreatment* attribute for the *EthernetPolicy* component.

Setting the *unknownVlanIdTreatment* attribute is dependant upon the solution you are implementing in your network.

For the Ethernet virtual line service (EVLS) solution, refer to “Configuring the Ethernet service on function processor ports” (page 42).

For the virtual IP router (VIPR) and RFC2547 solutions, default values are used and configuration of the *EthernetPolicy* component is ignored.

- 4 Optionally, link the Ethernet interface to setup access to an IP service.

If you want to link the Ethernet interface in port mode to setup port access to an IP service for the VIPR solution, see the chapter on VR Ethernet access media configuration in NN10600-801 *Nortel Networks Multiservice Switch 7400/15000/20000 IP Configuration Management*.

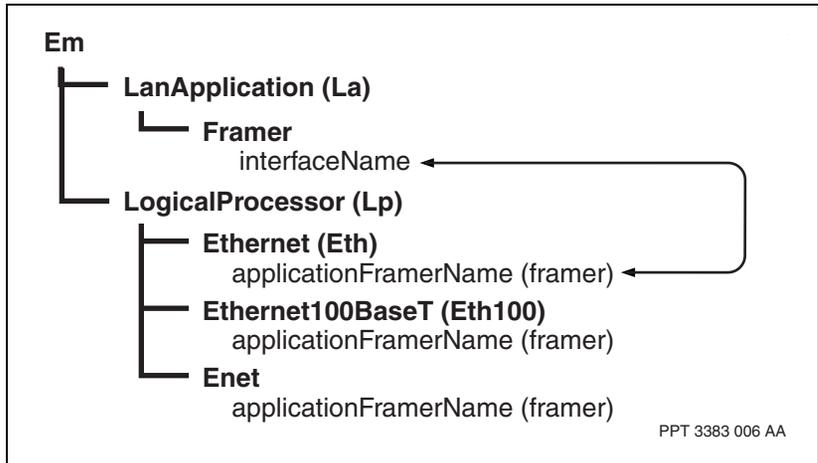
If you want to link the Ethernet interface in port mode to setup port access to an IP service for the RFC2547 solution, see the chapter on VRF and access configuration in NN10600-582 *Nortel Networks Multiservice Switch 7400/15000/20000 VPN Configuration Management*.

## Variable definitions

Variable	Value
<x>	is the number of the <i>LanApplication</i> instance.
<y>	is the number of the logical processor instance.
<z>	is the number of the FP port to which the <i>LanApplication</i> attaches.

## Procedure job aid

Figure 2  
Ethernet interface component hierarchy





---

## Chapter 3

# Changing an Ethernet interface to VLAN mode

---

Change an Ethernet interface to virtual local area network (VLAN) mode in order to:

- provide a virtual connection to Ethernet virtual line services (EVLS) or to an IP solution.
- enable different virtual LANs (VLANs) on the same physical Ethernet port to be mapped to different network solutions.
- provide customer traffic identification.

Multiple VLANs can be configured within an Ethernet port to optimize port usage and port bandwidth.

*Note:* Ethernet interfaces in VLAN mode are supported on the following function processors (FPs) only: 4-port 10/100 BaseT Ethernet, 8-port 10/100 BaseT Ethernet, and 4-port gigabit Ethernet.

## Prerequisites

- Ensure that an Ethernet interface has been configured in port mode. For information, see “Configuring an Ethernet interface in port mode” (page 27).

## Procedure steps

- 1 Add the *VirtualLanIdentifier* component to the *LanApplication* component.  
`add La/<x> vlan/<y>`
- 2 Set the *maxFrameSize* attribute.

```
set Lp/<w> Eth/<v> maxFrameSize <frame_value>
```

**3** Link the Ethernet VirtualLanIdentifier to setup access to an IP solution.

If you want to link the Ethernet interface in VLAN mode to setup VLAN access to an IP service for the VIPR solution, see the chapter on VR Ethernet access media configuration in NN10600-801 *Nortel Networks Multiservice Switch 7400/15000/20000 IP Configuration Management*.

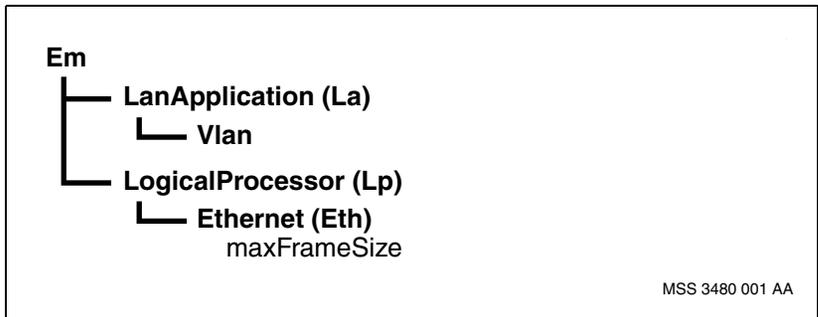
If you want to link the Ethernet interface in VLAN mode to setup VLAN access to an IP service for the RFC2547 solution, see the chapter on VRF and access configuration in NN10600-582 *Nortel Networks Multiservice Switch 7400/15000/20000 VPN Configuration Management*.

## Variable definitions

Variable	Value
<frame_value>	specifies the maximum frame size.
<v>	is the number of the Ethernet port on the function processor.
<w>	is the number of the logical processor instance.
<x>	is the number of the <i>LanApplication</i> instance.
<y>	is the number of the <i>vlan</i> instance.

## Procedure job aid

**Figure 3**  
Ethernet interface in VLAN mode component hierarchy



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## Chapter 4

# Ethernet LAG configuration

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Configure Ethernet link aggregation (LAG) to allow grouping of several Ethernet ports to be handled as a single port.

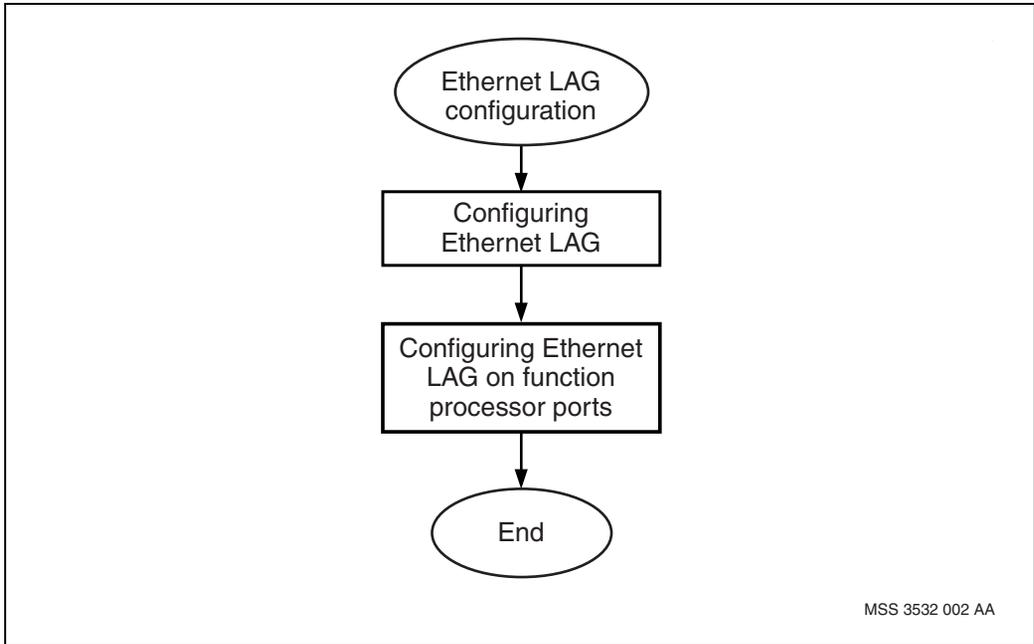
### Prerequisites to configuring Ethernet LAG

- For LAG conceptual information, see “Link Aggregation (LAG) on the 4-port Gigabit Ethernet FP” (page 189).

### Ethernet LAG configuration procedures

This task flow shows you the sequence of procedures you perform to configure Ethernet LAG. To link to any procedure, go to “Ethernet LAG configuration procedure navigation” (page 34).

**Figure 4**  
**Ethernet LAG configuration procedures**



**Ethernet LAG configuration procedure navigation**

- “Configuring Ethernet LAG” (page 35)
- “Configuring Ethernet LAG on function processor ports” (page 37)

## Configuring Ethernet LAG

Configure the Ethernet over link aggregation (LAG) software that is required for the LAG Ethernet service on the 4-port Gigabit Ethernet FP.

### Procedure steps

- 1 Set the software logical processor type (*lpt*) feature list.

```
set sw lpt/LAG featureList lag
```

- 2 Set the logical processor (*lp*) to the software logical processor type (*lpt*).

```
set lp/<lp_number> lpt sw lpt/LAG
```

- 3 Add the Ethernet port.

```
add lp/<lp_number> ethernet/<ethernet_port_number>
```

- 4 Add the LAG component.

```
add lp/<lp_number> lag/<lag_number>
```

- 5 Add the LAG logical links.

```
add lp/<lp_number> lag/<lag_number> link/<link_number>
```

- 6 Set the *LAG Link interfaceName* to the Ethernet ports.

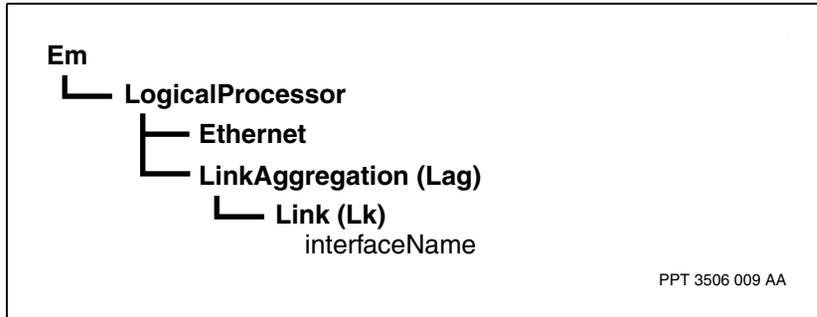
```
set lp/<lp_number> lag/<lag_number> link/<link_number>  
interfaceName lp/<lp_number> ethernet/  
<ethernet_port_number>
```

### Variable definitions

Variable	Value
<ethernet_port_number>	is the instance value of the Ethernet port. with a value from 0 to 3.
<lag_number>	is the instance value of the LAG component with a value from 0 to 1631.
<link_number>	is the instance value of the logical link with a value from 0 to 31.
<lp_number>	is the instance value of the logical processor with a value from 2 to 15.

## Procedure job aid

**Figure 5**  
**Ethernet LAG software component hierarchy**



## Configuring Ethernet LAG on function processor ports

Configure the Ethernet link aggregation (LAG) 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 LAG group.

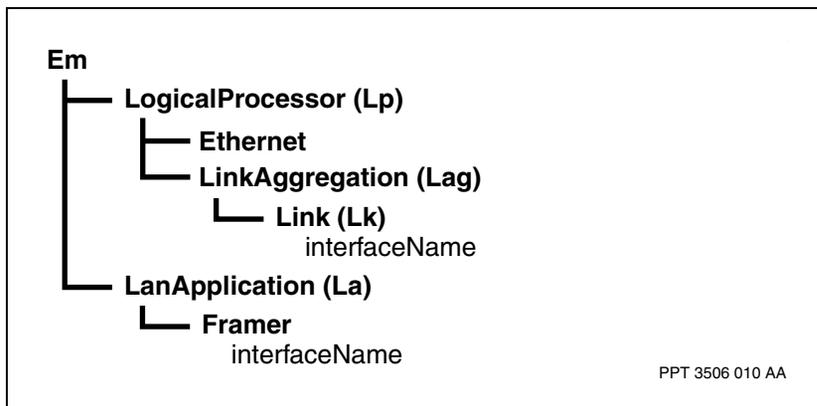
```
set La/<p> framer interfaceName ! lp/<lp_number> lag/
<lag_number>
```

### Variable definitions

Variable	Value
<lag_number>	is the instance value of the LAG component with a value from 0 to 1631.
<lp_number>	is the instance value of the logical processor with a value from 2 to 15.
<p>	is the instance value of the lanApplication with a value from 0 to 255.

### Procedure job aid

Figure 6  
Ethernet LAG on function processor ports component hierarchy





## Chapter 5

# EVLS deployment and migration from the Ethernet over ATM service

---

EVLS is a replacement for the previously available Ethernet over ATM (EoAtm) feature. If the EoAtm feature has been deployed, an upgrade from EoAtm to EVLS is mandatory. In order to deploy the Ethernet virtual line service (EVLS) feature, the software must be upgraded and the EVLS feature must be turned on.

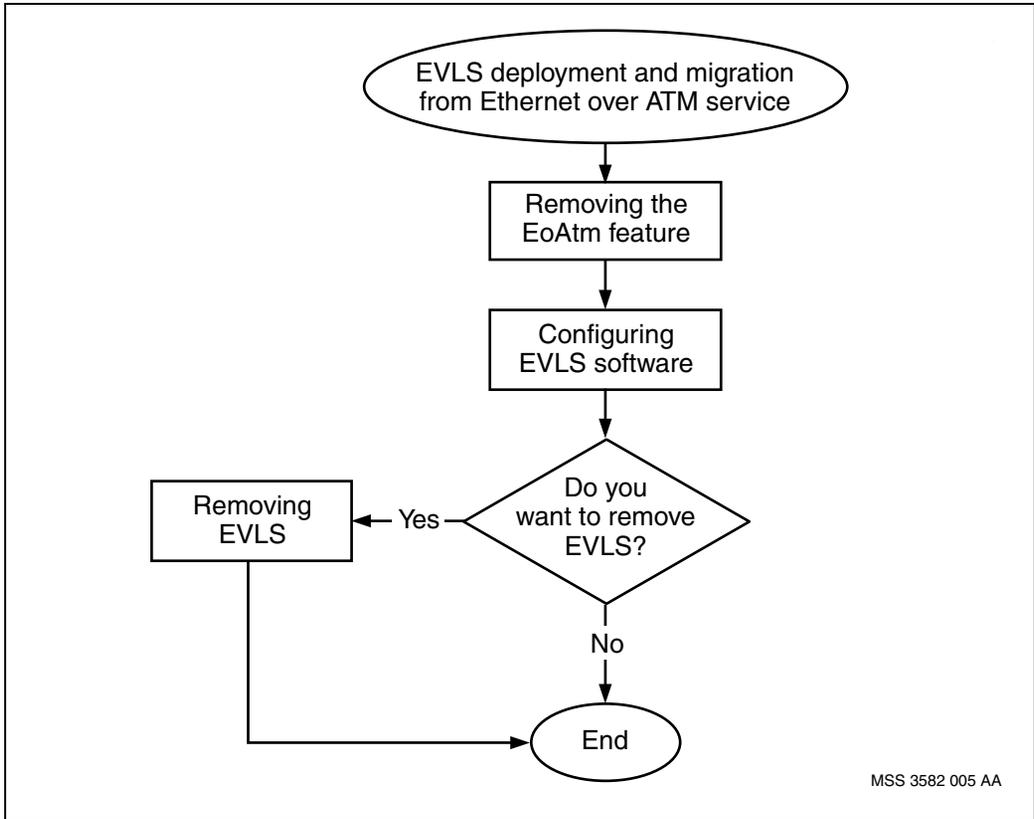
## Prerequisites to EVLS deployment and migration from the Ethernet over ATM service

- The software needs to be updated on the shelf. See NN10600-272 *Nortel Networks Multiservice Switch 7400/15000/20000 Upgrading Software*.

## EVLS deployment and migration from the Ethernet over ATM service procedures

This task flow shows you the sequence of procedures you perform deploy EVLS and migrate from the Ethernet over ATM service. To link to any procedure, go to “EVLS migration and deployment procedure navigation” (page 40).

**Figure 7**  
**EVLS deployment and migration from the Ethernet over ATM service**



### **EVLS migration and deployment procedure navigation**

- “Removing the EoAtm feature” (page 41)
- “Configuring EVLS software” (page 42)
- “Removing EVLS” (page 43)

## Removing the EoAtm feature

If you have the Ethernet over ATM (EoAtm) feature configured, you need to remove this feature before adding the EVLS feature.

### Procedure steps

- 1 Remove the Transport from all LanApplications on the FP.

```
delete La/<p> Transport
```

- 2 Remove the Ethernet over ATM feature.

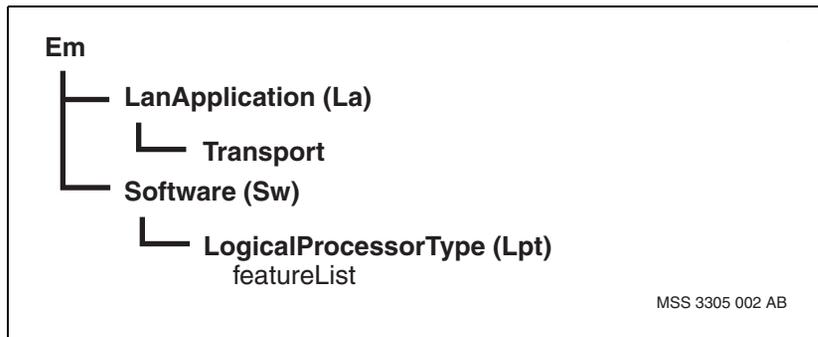
```
set Sw Lpt/<q> featureList ~eoaam
```

### Variable definitions

Variable	Value
<lpt_value>	is the instance value of the logical processor type.
<p>	is the instance value of the LanApplication.

### Procedure job aid

Figure 8  
Removing the EoAtm feature component hierarchy



## Configuring EVLS software

Configure the Ethernet FP to load Ethernet virtual line service (EVLS) software on a single Multiservice Switch node.

### Procedure steps

- 1 Add a software logical processor type to a new Ethernet FP. If the Ethernet FP already exists, proceed to step 2.

```
add Sw Lpt/<lpt_value>
```

- 2 Associate the logical processor type with the Ethernet FP.

```
set Lp/<lp_value> logicalProcessorType Sw Lpt/  
<lpt_value>
```

- 3 Set the feature list to a new logical processor type.

```
set Sw Lpt/<lpt_value> featureList Evls
```

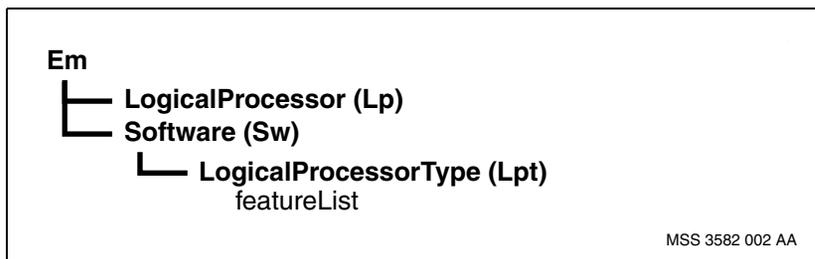
- 4 Repeat steps 1 through 3 on a second Multiservice Switch node.

### Variable definitions

Variable	Value
<lp_value>	is the instance value of the logical processor.
<lpt_value>	is the instance value of the logical processor type.

### Procedure job aid

Figure 9  
Configuring EVLS software component hierarchy



## Removing EVLS

Remove this feature if you no longer want to take advantage of the Ethernet virtual line service (EVLS) functionality. The removal of this feature causes the shelf to reset.

### Procedure steps

- 1 Delete EVLS from all LanApplications on the FP.

```
delete La/<p> Evls
```

- 2 Remove EVLS software from the Ethernet FP.

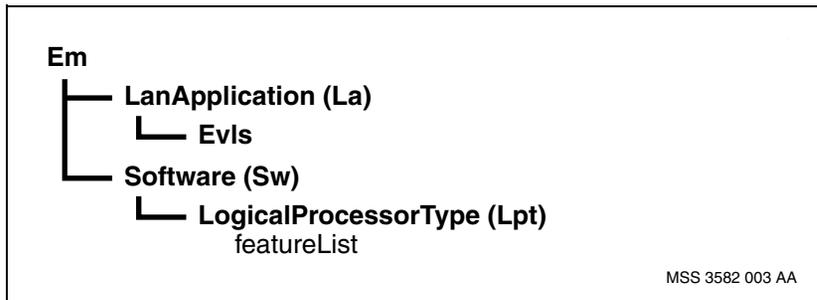
```
set Sw Lpt/<lpt_value> featureList ~evls
```

### Variable definitions

Variable	Value
<p>	is the instance value of the LanApplication
<lpt_value>	is the instance value of the logical processor type.

### Procedure job aid

Figure 10  
Removing EVLS component hierarchy





## Chapter 6

# EVLS configuration

---

Configure the Ethernet virtual line service (EVLS) to offer one or more users the ability to connect to another Ethernet interface, via single-ended or end-to-end connections, across an ATM network.

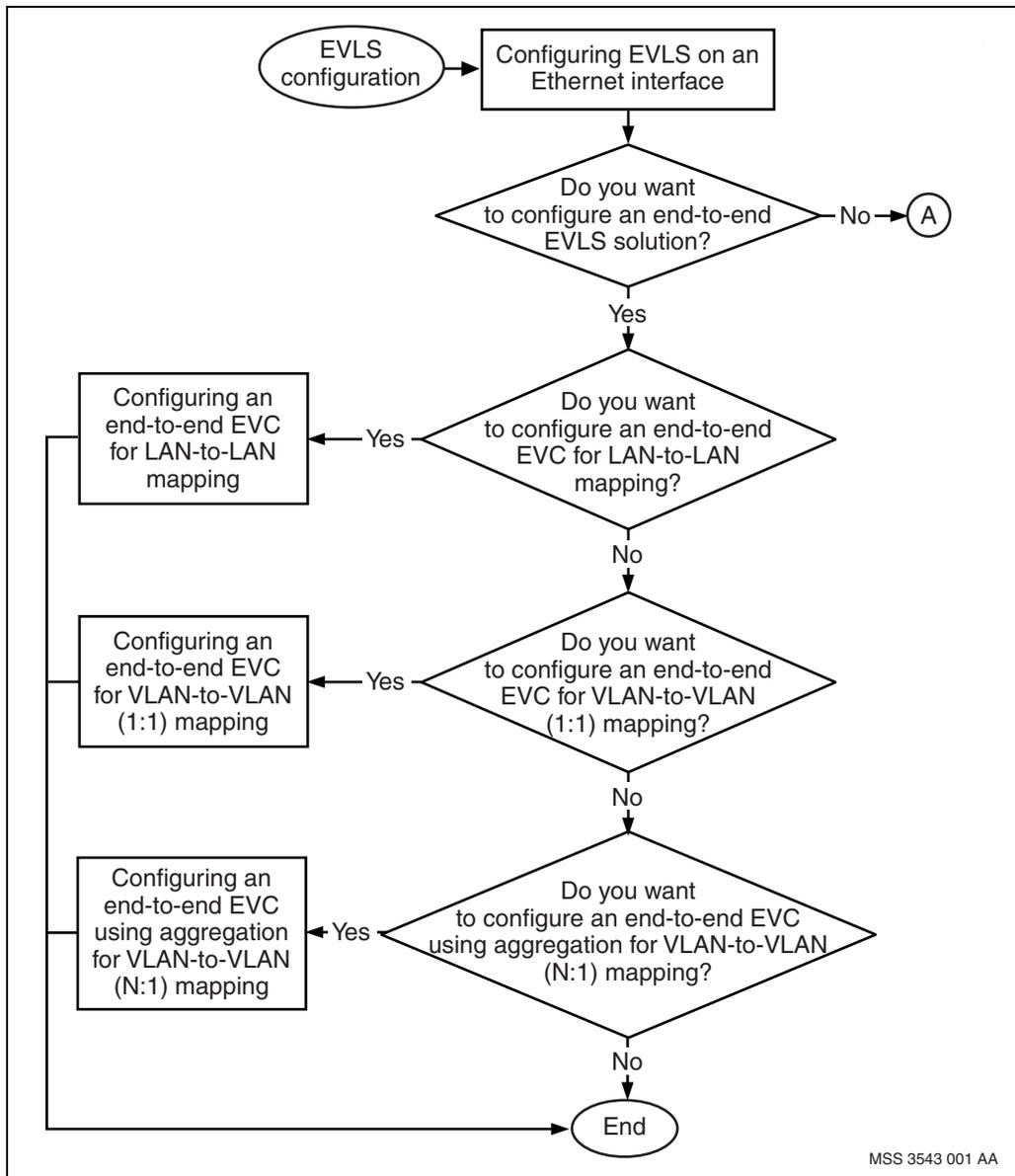
### Prerequisites to EVLS configuration

- The Ethernet function processor must be configured, as well as the physical Ethernet ports. See NN10600-551 *Nortel Networks Multiservice Switch 7400/15000/20000 FP Configuration Reference*.
- Logical processor must be added and linked to the Ethernet FP. See NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.
- Ensure the ATM network, including PNNI and UNI, is installed on the node. See NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

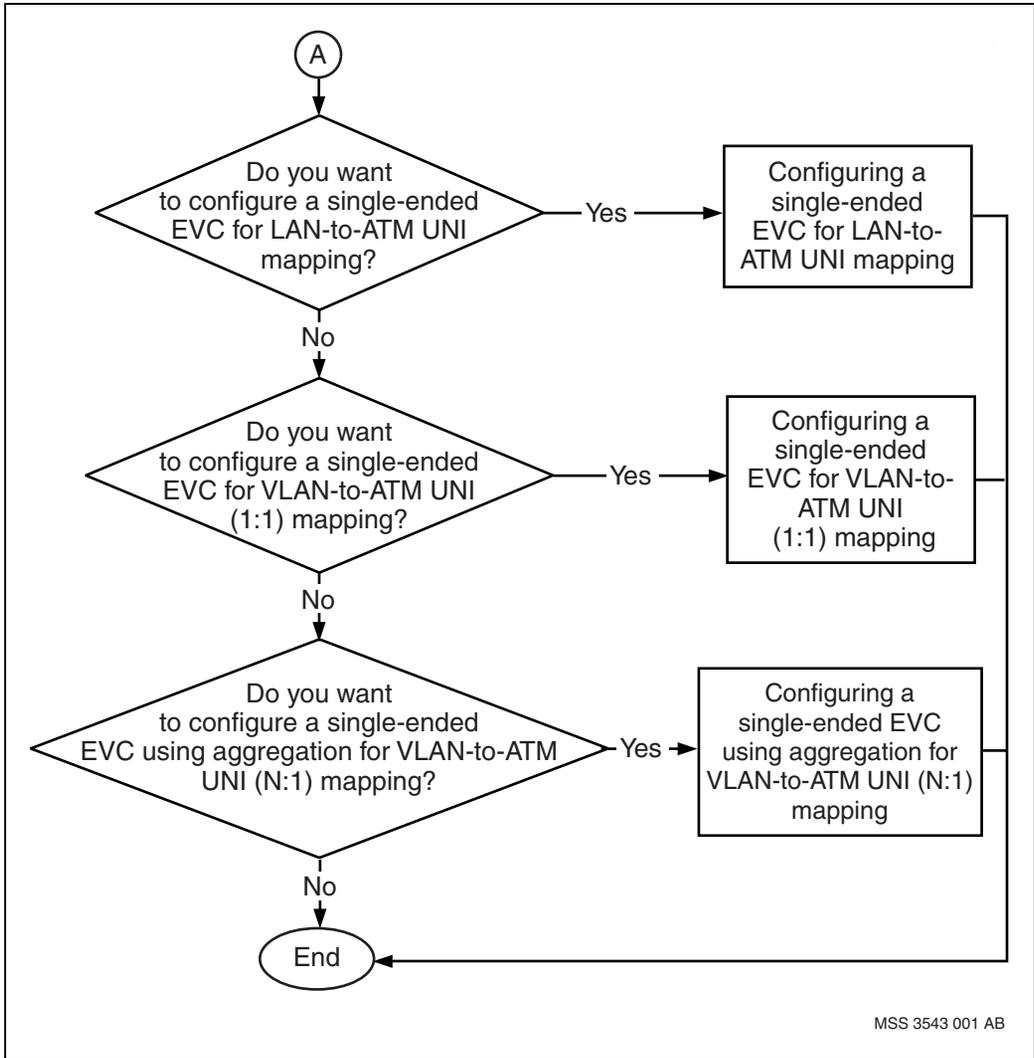
### EVLS configuration procedures

This task flow shows you the sequence of procedures you perform to configure the EVLS. To link to any procedure, go to “EVLS configuration procedure navigation” (page 47).

**Figure 11**  
**EVLS configuration procedures: Part 1 of 2**



**Figure 12**  
**EVLS configuration procedures: Part 1 of 2**



### EVLS configuration procedure navigation

- “Configuring EVLS on an Ethernet interface” (page 49)
- “Configuring an end-to-end EVC for LAN-to-LAN mapping” (page 51)

- “Configuring an end-to-end EVC for VLAN-to-VLAN (1:1) mapping” (page 54)
- “Configuring an end-to-end EVC using aggregation for VLAN-to-VLAN (N:1) mapping” (page 57)
- “Configuring a single-ended EVC for LAN-to-ATM UNI mapping” (page 59)
- “Configuring a single-ended EVC for VLAN-to-ATM UNI (1:1) mapping” (page 62)
- “Configuring a single-ended EVC using aggregation for VLAN-to-ATM UNI (N:1) mapping” (page 65)

## Configuring EVLS on an Ethernet interface

Configure the Ethernet virtual line service (EVLS) on an Ethernet interface.

### Procedure steps

- 1 Add the Ethernet virtual line service (EVLS) to the Ethernet interface.

```
add La/<p> Evls
```

The LocalAddr component is automatically added. The default LocalAddr is provided.

- 2 Optionally, set the LocalAddr.

```
set La/<p> Evls LocalAddr nsapAddress <nsapA>
```

- 3 Optionally, add the Ethernet policy.

```
add La/<p> Policy
```

- 4 Optionally, set the unknown VLAN ID treatment.

```
set La/<p> Policy unknownVlanIdTreatment  
<unknownVlanIdTreatment>
```

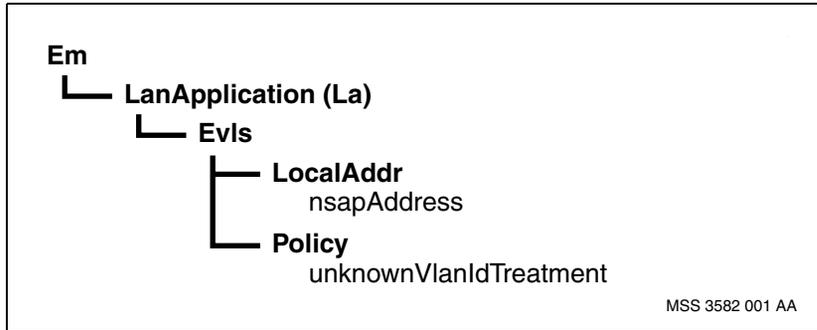
### Variable definitions

Variable	Value
<nsapA>	is the address of the Ethernet interface. This address is displayed under Artg Dna/*.
<p>	is the instance value of the LanApplication with a value from 0 to 255.
<unknownVlanIdTreatment>	is the instance value of the LanApplication with a value from 0 to 255.

## Procedure job aid

Figure 13

Configuring EVLS on an Ethernet interface component hierarchy



## Configuring an end-to-end EVC for LAN-to-LAN mapping

Configure the Ethernet virtual line service (EVLS) in LAN-to-LAN mode to establish a LAN-to-LAN Ethernet virtual circuit (EVC) between the calling end and the called end.

### Procedure steps

- 1 Add an Ethernet virtual circuit (EVC) to the LAN application.  

```
add La/<p> Evc
```
- 2 Follow steps 3 to 10 to configure the calling end.
- 3 Add an SPVC.  

```
add La/<p> Evc Spvc/<Spvc>
```
- 4 Add the source EVC.  

```
add La/<p> Evc SrcEvc
```
- 5 Set the remote address.  

```
set La/<p> Evc SrcEvc remoteAddress <remoteAddress>
```

The remote address should represent the NSAP address of the remote EVLS (for example, the called endpoint) within the ATM network.
- 6 Add the Ethernet quality of service (QoS).  

```
add La/<p> Evc EQoS/<QoS_value>
```
- 7 Set the Ethernet per-hop-behavior (ePHB). The ePhb attribute represents the Ethernet PHB for both directions of the connection.  

```
set La/<p> Evc EQoS/<QoS_value> ePhb <Phb>
```
- 8 Set the bandwidth of the Ethernet traffic to be shaped and/or policed within the ATM network.  

```
set La/<p> Evc EQoS/<QoS_value> cir <cir>
```

```
set La/<p> Evc EQoS/<QoS_value> eir <eir>
```

```
set La/<p> Evc EQoS/<QoS_value> cbs <cbs>
```
- 9 Set the average frame size of the Ethernet traffic to be shaped and/or policed within the ATM network.  

```
set La/<p> Evc EQoS/<QoS_value> afs <afs>
```
- 10 Optionally, set the partial packet discard.

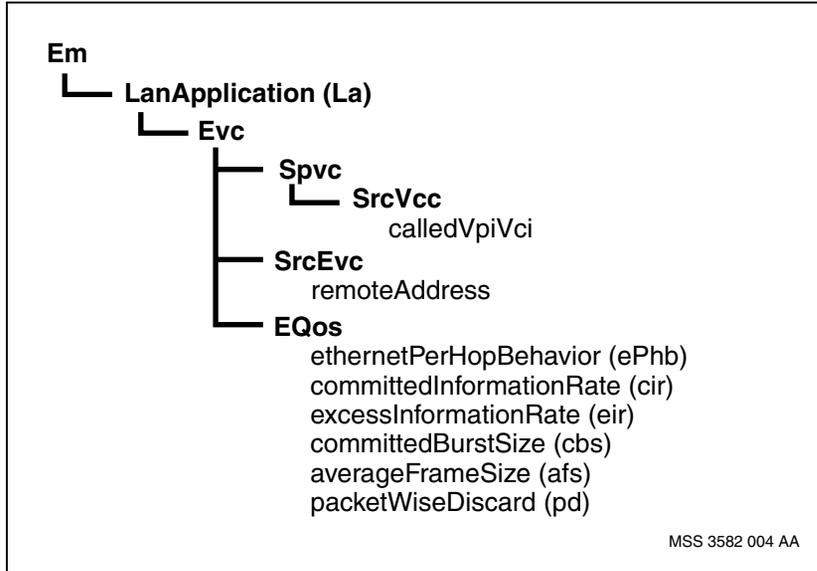
```
set Ia/<p> Evc EQoS/<QoS_value> packetWiseDiscard <pd>
```

## Variable definitions

Variable	Value
<afs>	is the average frame size needs to be synchronized with the far end EVC value. Default value is 512 bytes.
<pbs>	represents the maximum number of bits available for use by sequential service frames sent at the Ethernet interface speed to remain CIR conformant.
<cir>	represents the average rate up to which the network delivers service frames and meets the performance objectives defined by the Ethernet per hop behavior of this connection.
<eir>	represents the average rate up to which the network delivers service frames without any performance objectives.
<Phb>	is the instance value of the Ethernet PHB with a value of either EF, AF31, AF21, or DF. DF is the default value. This attribute specifies a mapping from a PHB attribute value to ATM service categories.
<p>	is the instance value of the LanApplication with a value from 0 to 255.
<pd>	is the packetWiseDiscard function for the VC. The default value is disabled.
<QoS_value>	represents the quality of service assigned to the Ethernet virtual circuit (EVC).
<remoteAddress>	is the remote address of the far end Ethernet interface to which the EVC is connected.
<Spvc>	is the instance value of the SPVC.

## Procedure job aid

**Figure 14**  
**Configuring an end-to-end EVC for LAN-to-LAN mapping component hierarchy**



## Configuring an end-to-end EVC for VLAN-to-VLAN (1:1) mapping

Configure a VLAN to connect an EVC SPVC to another VLAN across an ATM PNNI network.

### Prerequisites

- Ensure the VLAN component is added to both the calling and called ends.

### Procedure steps

- 1 Add the EVC to the VLAN.

```
add La/<p> Vlan/<vlan> Evc
```

- 2 Perform the remaining steps for the calling end of the connection.

- 3 Add the EVC SPVC.

```
add La/<p> Vlan/<vlan> Evc Spvc/<Spvc>
```

- 4 Add source EVC.

```
add La/<p> Vlan/<vlan> Evc SrcEvc
```

- 5 Set the remote address.

```
set La/<p> Vlan/<vlan> Evc SrcEvc remoteAddress  
<remoteAddress>
```

- 6 Set the remote VLAN ID.

```
set La/<p> Vlan/<vlan> Evc SrcEvc remoteVlanId  
<remoteVlanId>
```

- 7 Add the Ethernet quality of service (EQoS).

```
add La/<p> Vlan/<vlan> Evc EQoS/<QoS_value>
```

- 8 Set the Ethernet perHopBehavior (PHB).

```
set La/<p> Vlan/<vlan> Evc EQoS/<QoS_value> ePhb <Phb>
```

- 9 Set the bandwidth for traffic shaping and/or policing of the Ethernet traffic within the ATM network.

```
set La/<p> Vlan/<vlan> Evc EQoS/<QoS_value> cir <cir>
```

```
set La/<p> Vlan/<vlan> Evc EQoS/<QoS_value> eir <eir>
```

```
set La/<p> Vlan/<vlan> Evc EQoS/<QoS_value> cbs <cbs>
```

- 10 Set the average frame size for traffic shaping and/or policing of the Ethernet traffic within the ATM network.

```
set La/<p> Vlan/<vlan> Evc EQoS/<QoS_value> afs <afs>
```

- 11 Optionally, set the partial packet discard.

```
set La/<p> Evc EQoS/<QoS_value> packetWiseDiscard <pd>
```

## Variable definitions

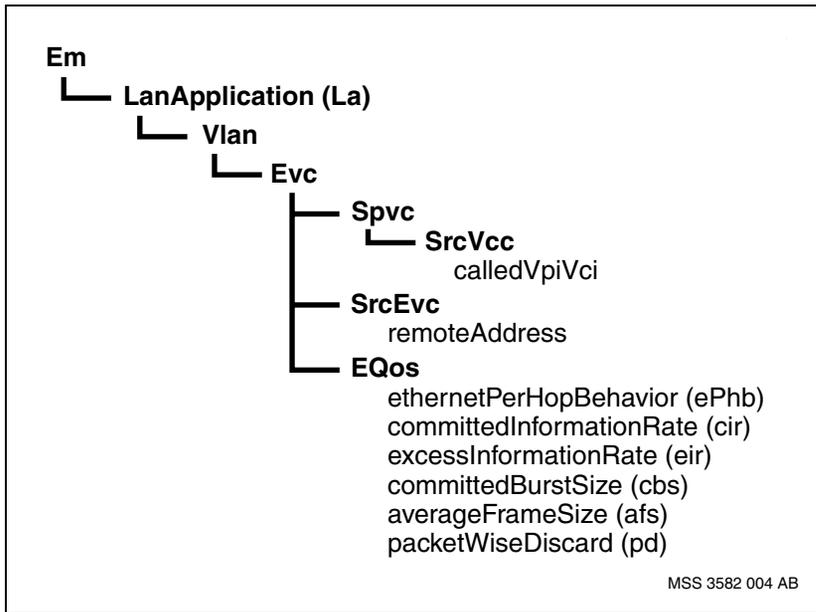
Variable	Value
<afs>	is the average frame size needs to be synchronized with the far end EVC value. Default value is 512 bytes.
<cbs>	represents the maximum number of bits available for use by sequential service frames sent at the Ethernet interface speed to remain CIR conformant.
<cir>	represents the average rate up to which the network delivers service frames and meets the performance objectives defined by the QoS attribute.
<eir>	represents the average rate up to which the network delivers service frames without any performance objectives.
<Phb>	is the instance value of the Ethernet PHB with a value of either EF, AF31, AF21, or DF. DF is the default value. This attribute specifies a mapping from a PHB attribute value to ATM service categories.
<p>	is the instance value of the LanApplication with a value from 0 to 255.
<pd>	is the packetWiseDiscard function for the VC. The default value is disabled.
<QoS_value>	specifies the quality of service assigned to the Ethernet virtual circuit (EVC).
<remoteAddress>	is the remote address of the far end Ethernet interface.
<remoteVlanId>	is remote address of the VLAN on the far end Ethernet interface to which the EVC is to be established.

(Sheet 1 of 2)

Variable	Value
<Spvc>	is the instance value of the SPVC.
<vlan>	is the instance value of the VLAN.
(Sheet 2 of 2)	

### Procedure job aid

**Figure 15**  
**Configuring an end-to-end EVC for VLAN-to-VLAN (1:1) mapping**  
**component hierarchy**



## Configuring an end-to-end EVC using aggregation for VLAN-to-VLAN (N:1) mapping

The LanApplication at both ends of the network is configured as a calling end. The Ethernet virtual circuit (EVC) SPVC is established using the Ethernet transport system (ETS). The ETS must be configured to establish the VCC on the ATM trunk

### Prerequisites

- Configure the Ethernet transport system (ETS). See “Ethernet transport system (ETS) configuration” (page 67).
- Steps for configuring an end-to-end EVC for VLAN-to-VCC mapping (1:1) must be performed. See “Configuring an end-to-end EVC for VLAN-to-VLAN (1:1) mapping” (page 54).

### Procedure steps

- 1 Set the VLAN to terminate on the Ethernet transport system (ETS).  

```
set La/<p> Vlan/<vlan> Evc aggregation enable
```
- 2 Repeat step 1 for each additional VLAN.
- 3 Repeat step 1 and step 2 to configure the other calling end on a second Multiservice Switch node.

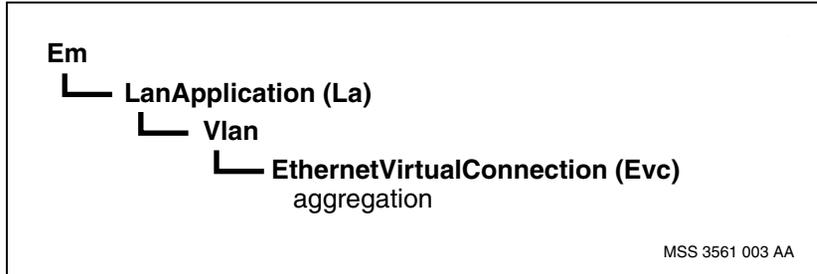
### Variable definitions

Variable	Value
<p>	is the instance value of the LanApplication with a value from 0 to 255.
<vlan>	is the instance value of the VLANs aggregating on the VCC.

## Procedure job aid

Figure 16

Configuring an end-to-end EVC using aggregation for VLAN-to-VLAN (N:1) mapping component hierarchy



## Configuring a single-ended EVC for LAN-to-ATM UNI mapping

Configure the Ethernet virtual circuit (EVC) SPVC to terminate on an ATM interface in LAN-to-ATM UNI mode. Both LAN application components are configured as calling ends.

### Prerequisites

- The ATM UNI must be configured. See NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

### Procedure steps

- 1 Add an Ethernet virtual circuit (EVC) to the LAN application.

```
add La/<p> Evc
```

- 2 Add an SPVC.

```
add La/<p> Evc Spvc/<Spvc>
```

- 3 Add the source EVC.

```
add La/<p> Evc SrcEvc
```

- 4 Set the remote address.

```
set La/<p> Evc SrcEvc remoteAddress <remoteAddress>
```

The remote address should represent the NSAP address of the far end ATM UNI (for example, the called endpoint) within the ATM network.

- 5 Add the source VCC to the SPVC.

```
add La/<p> Evc Spvc/<Spvc> SrcVcc
```

- 6 Set the Vpi.Vci for the far end ATM UNI.

```
set La/<p> Evc Spvc/<Spvc> SrcVcc calledVpiVci  
<calledVpiVci>
```

- 7 Add the Ethernet quality of service (QoS).

```
add La/<p> Evc EQoS/<QoS_value>
```

- 8 Set the Ethernet per-hop-behavior (ePHB). The ePhb attribute represents the Ethernet PHB for both directions of the connection.

```
set La/<p> Evc EQoS/<QoS_value> ePhb <Phb>
```

- 9 Set the bandwidth of the Ethernet traffic to be shaped and/or policed within the ATM network.

```
set La/<p> Evc EQoS/<QoS_value> cir <cir>
```

```
set La/<p> Evc EQoS/<QoS_value> eir <eir>
```

```
set La/<p> Evc EQoS/<QoS_value> cbs <cbs>
```

- 10 Set the average frame size of the Ethernet traffic to be shaped and/or policed within the ATM network.

```
set La/<p> Evc EQoS/<QoS_value> afs <afs>
```

- 11 Optionally, set the partial packet discard.

```
set La/<p> Evc EQoS/<QoS_value> packetWiseDiscard <pd>
```

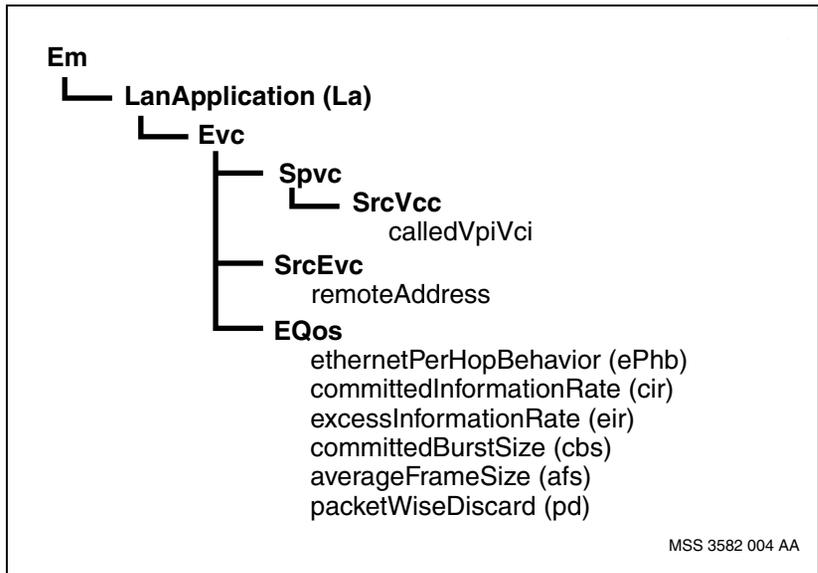
## Variable definitions

Variable	Value
<afs>	is the average frame size needs to be synchronized with the far end EVC value. Default value is 512 bytes.
<calledVpiVci>	is the attribute that specifies the far end ATM UNI VCC that is the called end of this EVC.
<cbs>	represents the maximum number of bits available for use by sequential service frames sent at the Ethernet interface speed to remain CIR conformant.
<cir>	represents the average rate up to which the network delivers service frames and meets the performance objectives defined by the QoS attribute.
<eir>	represents the average rate up to which the network delivers service frames without any performance objectives.
<Phb>	is the instance value of the Ethernet PHB with a value of either EF, AF31, AF21, or DF. DF is the default value. This attribute specifies a mapping from a PHB attribute value to ATM service categories.
<p>	is the instance value of the LanApplication with a value from 0 to 255.
<pd>	is the packetWiseDiscard function for the VC. The default value is disabled.
<QoS_value>	represents the quality of service assigned to the Ethernet virtual circuit (EVC).
(Sheet 1 of 2)	

Variable	Value
<remoteAddress>	is the remote address of the far end Ethernet interface.
<Spvc>	is the instance value of the SPVC.
(Sheet 2 of 2)	

## Procedure job aid

**Figure 17**  
**Configuring a single-ended EVC for LAN-to-ATM UNI mapping**  
**component hierarchy**



## Configuring a single-ended EVC for VLAN-to-ATM UNI (1:1) mapping

Configure the EVLS EVC to terminate on an ATM interface in VLAN-to-ATM UNI (1:1) mode.

### Procedure steps

- 1 Add the EVC to the VLAN.

```
add La/<p> Vlan/<vlan> Evc
```

- 2 Add the EVC SPVC.

```
add La/<p> Vlan/<vlan> Evc Spvc/<Spvc>
```

- 3 Add source EVC.

```
add La/<p> Vlan/<vlan> Evc SrcEvc
```

- 4 Set the remote address.

```
set La/<p> Vlan/<vlan> Evc SrcEvc remoteAddress  
<remoteAddress>
```

The remote address should represent the NSAP address of the far end ATM UNI (for example, the called endpoint) within the ATM network.

- 5 Set the remote VLAN ID to 1.

```
set La/<p> Vlan/<vlan> Evc SrcEvc remoteVlanId 1
```

- 6 Add the source VCC to the SPVC.

```
add La/<p> Vlan/<vlan> Evc Spvc/<Spvc> SrcVcc
```

- 7 Set the Vpi.Vci for the far end ATM UNI.

```
set La/<p> Vlan/<vlan> Evc Spvc/<Spvc> SrcVcc  
calledVpiVci <calledVpiVci>
```

- 8 Add the Ethernet quality of service (EQoS).

```
add La/<p> Vlan/<vlan> Evc EQoS/<QoS_value>
```

- 9 Set the Ethernet perHopBehavior (PHB).

```
set La/<p> Vlan/<vlan> Evc EQoS/<QoS_value> ePhb <Phb>
```

- 10 Set the bandwidth for traffic shaping and/or policing of the Ethernet traffic within the ATM network.

```
set La/<p> Vlan/<vlan> Evc EQoS/<QoS_value> cir <cir>
```

```
set La/<p> Vlan/<vlan> Evc EQoS/<QoS_value> eir <eir>
```

```
set La/<p> Vlan/<vlan> Evc EQoS/<QoS_value> cbs <cbs>
```

- 11 Set the average frame size for traffic shaping and/or policing of the Ethernet traffic within the ATM network.

```
set La/<p> Vlan/<vlan> Evc EQoS/<QoS_value> afs <afs>
```

- 12 Optionally, set the partial packet discard.

```
set La/<p> Evc EQoS/<QoS_value> packetWiseDiscard <pd>
```

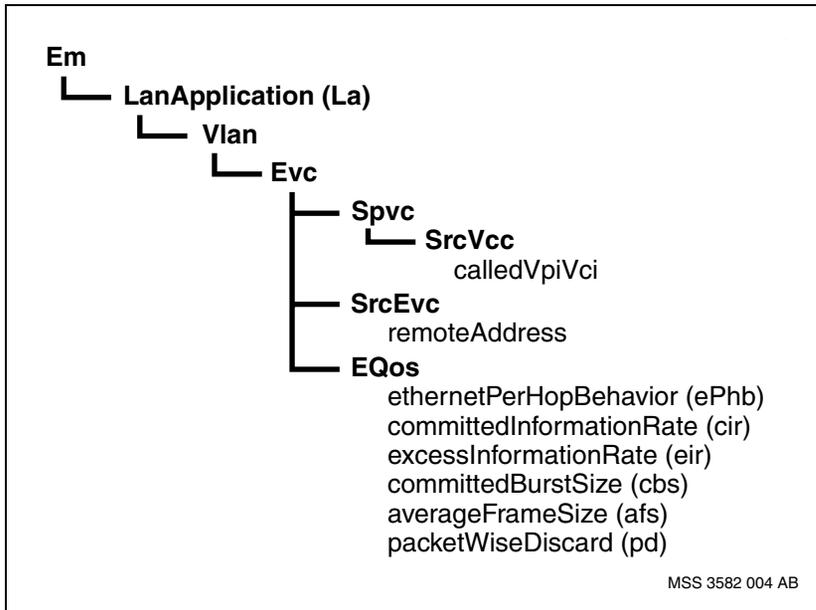
## Variable definitions

Variable	Value
<afs>	is the average frame size needs to be synchronized with the remote end value. Default value is 512 bytes.
<calledVpiVci>	is the attribute that specifies the far end ATM UNI VCC that is the called end of this EVC.
<cbs>	represents the maximum number of bits available for use by sequential service frames sent at the UNI speed to remain CIR conformant.
<cir>	represents the average rate up to which the network delivers service frames and meets the performance objectives defined by the CoS service attribute.
<eir>	represents the average rate up to which the network delivers service frames without any performance objectives.
<nsapA>	is the address of the ATM interface on the first Multiservice Switch node. This address is displayed under Artg Dna/*.
<pd>	is the packetWiseDiscard function for the VC. The default value is disabled.
<Phb>	is the instance value of the Ethernet PHB with a value of either EF, AF31, AF21, or DF. DF is the default value. This attribute specifies a mapping from a PHB attribute value to ATM service categories.
<p>	is the instance value of the LanApplication with a value from 0-255.

Variable	Value
<QoS_value>	represents the quality of service assigned to the Ethernet virtual circuit (EVC).
<remoteAddress>	is the remote address of the far end Ethernet interface.
<Spvc>	is the instance value of the SPVC.

### Procedure job aid

**Figure 18**  
**Configuring a single-ended EVC for VLAN-to-ATM UNI (1:1) mapping**  
**component hierarchy**



## Configuring a single-ended EVC using aggregation for VLAN-to-ATM UNI (N:1) mapping

Configure the EVLS Ethernet virtual circuit (EVC) to terminate on an ATM interface in VLAN aggregation mode.

### Prerequisites

- Ensure that “Configuring ETS for single-ended EVLS ATM transport” (page 76) has been completed.

### Procedure steps

- 1 Add a LAN application and its subcomponents on one Multiservice Switch node.

```
add La/<p> Vlan/<vlan> Evc Spvc/<spvc>
```

```
add La/<p> Vlan/<vlan> Evc SrcEvc
```

```
set La/<p> Vlan/<vlan> Evc aggregation enabled
```

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

```
set La/<p> Vlan/<vlan> Evc SrcEvc remoteAddress  
<nsapA>
```

- 3 Set the remote VLAN ID to 1.

```
set La/<p> Vlan/<vlan> Evc SrcEvc remoteVlanId 1
```

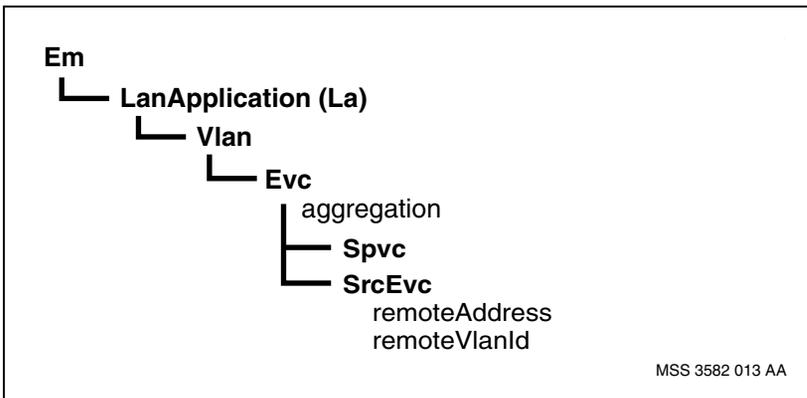
### Variable definitions

Variable	Value
<nsapA>	is the address of the ATM interface on the first Multiservice Switch node. This address is displayed under Artg Dna/*.
<p>	is the instance value of the LanApplication with a value from 0-255.
<spvc>	is the instance value of the SPVC.
<vlan>	is the instance value of the VLANs aggregating on the VCC.

## Procedure job aid

Figure 19

Configuring a single-ended EVC using aggregation for VLAN-to-ATM UNI mapping (N:1) component hierarchy



## Chapter 7

# Ethernet transport system (ETS) configuration

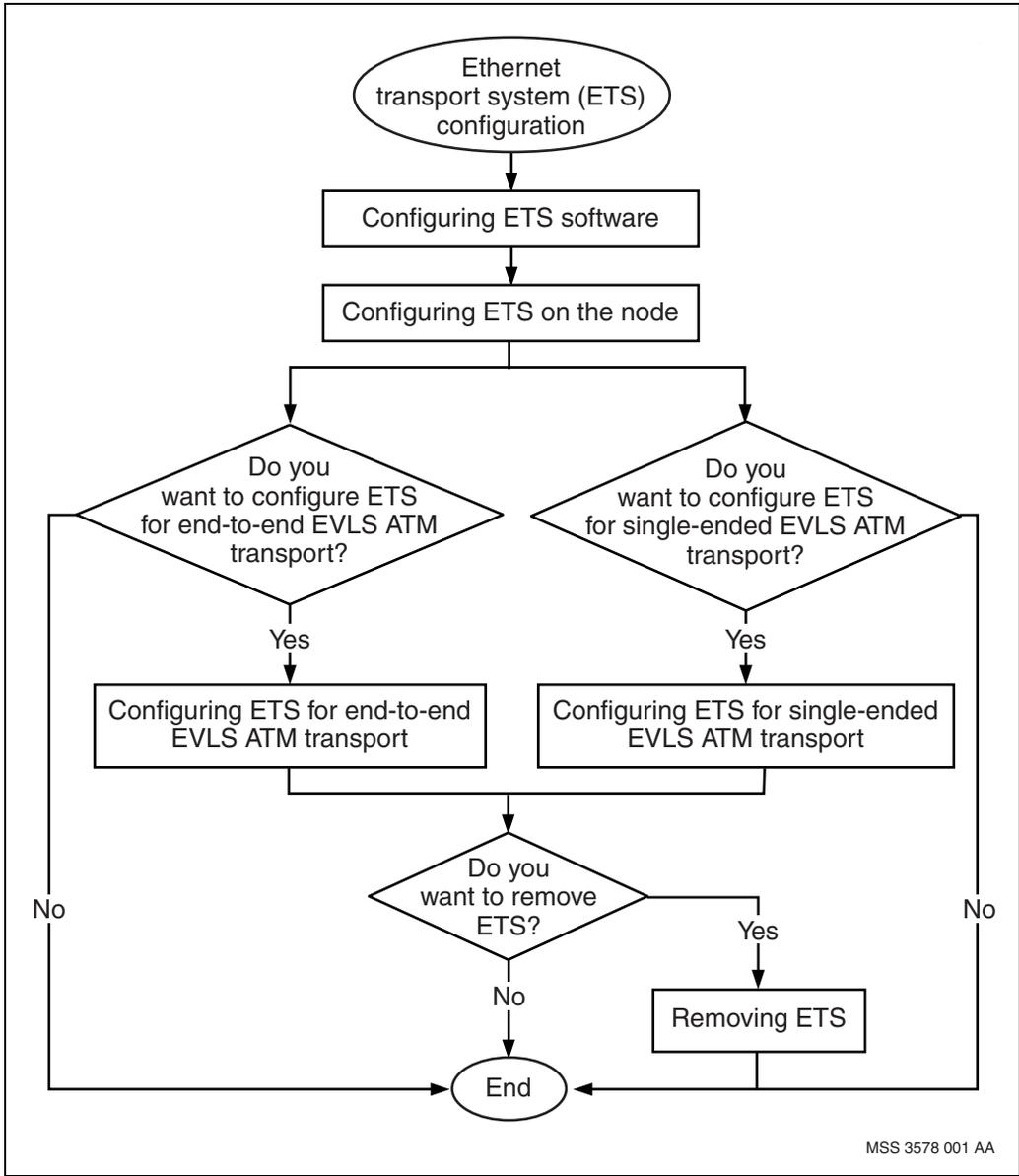
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The Ethernet transport system (ETS) is a requirement if you want to configure Ethernet virtual circuits (EVC) to take advantage of VLAN aggregation. ETS is only fully supported on CP3.

### **Ethernet transport system (ETS) configuration procedures**

This task flow shows you the sequence of procedures you perform to configure the Ethernet transport system (ETS). To link to any procedure, go to “Ethernet transport system (ETS) procedure navigation” (page 69).

**Figure 20**  
**Ethernet transport system (ETS) configuration procedures**



## **Ethernet transport system (ETS) procedure navigation**

- “Configuring ETS software” (page 70)
- “Configuring ETS on the node” (page 71)
- “Configuring ETS for end-to-end EVLS ATM transport” (page 72)
- “Configuring ETS for single-ended EVLS ATM transport” (page 76)
- “Removing ETS” (page 80)

## Configuring ETS software

Configure the CP to load the ETS software on a single Multiservice Switch node.

### Procedure steps

- 1 Provision the feature set on the CP.

```
set Sw Lpt/CP featureList Ets
```

### Procedure job aid

Figure 21  
Configuring ETS software component hierarchy



## Configuring ETS on the node

Configure the Ethernet transport system to provide aggregation of traffic from multiple VLANs on a single Ethernet interface across a single ATM VCC.

### Procedure steps

- 1 Add the ETS to the node.

```
add Ets
```

- 2 Optionally, set the local NSAP address of the ETS within the ATM network.

```
set Ets nsapAddr <nsapA>
```

### Variable definitions

Variable	Value
<nsapA>	is the instance value that represents the local address of the ETS (for example, the called endpoint) within the ATM network. If no NSAP address is provisioned, a default value is used.

### Procedure job aid

Figure 22

#### Configuring ETS on the node component hierarchy



MSS 3582 014 AA

## Configuring ETS for end-to-end EVLS ATM transport

Configure an end-to-end EVLS ATM transport to provide aggregation of traffic from multiple VLANs between a pair of peer Ethernet interfaces across a single ATM VCC. The initial portion of this procedure involves configuring the called end of the ETS on the second Multiservice Switch node. The entire procedure involves configuring the calling end of the ETS on the first Multiservice Switch node.

### Procedure steps

- 1 Add the EVLS ATM transport component.

```
add Ets EAtmTrsp/<transport>
```

- 2 Set the LAN application for the EVLS ATM transport component.

```
set Ets EAtmTrsp/<transport> lanApplication La/<p>
```

- 3 Set the prefix NSAP address for the EVLS ATM transport component.

```
set Ets EAtmTrsp/<transport> prefixNsapAddress  
<prefixNsapA>
```

- 4 Repeat steps 1 through 3 and proceed with steps 5 through 10 for the calling end only.

- 5 Add the source EVLS ATM transport component to the EVLS ATM transport.

```
add Ets EAtmTrsp/<transport> SrcEAtmTrsp
```

- 6 Set the remote address.

```
set Ets EAtmTrsp/<transport> SrcEAtmTrsp remoteAddress  
<remoteAddress>
```

- 7 Set the remote EVLS ATM transport ID.

```
set Ets EAtmTrsp/<transport> SrcEAtmTrsp rEAtmTrspId  
<remoteEAtmTrspId>
```

- 8 Optionally, set the retryPeriod for the SPVC.

```
set Ets EAtmTrsp/<transport> SrcEAtmTrsp retryPeriod  
<retryPeriod>
```

- 9 Add the SPVC component.

```
add Ets EAtmTrsp/<transport> Spvc/<Spvc>
```

- 10 Set the SPVC Tm parameters.

```

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm
trafficDescParm <trafficDescParm>

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm
atmServiceCategory <atmServiceCategory>

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm
bearerClassBbc <bearerClassBbc>

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm
transferCapabilityBbc <transferCapabilityBbc>

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm bestEffort
<bestEffort>

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm
txPacketWiseDiscard <txPacketWiseDiscard>

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm
rxPacketWiseDiscard <rxPacketWiseDiscard>

```

## Variable definitions

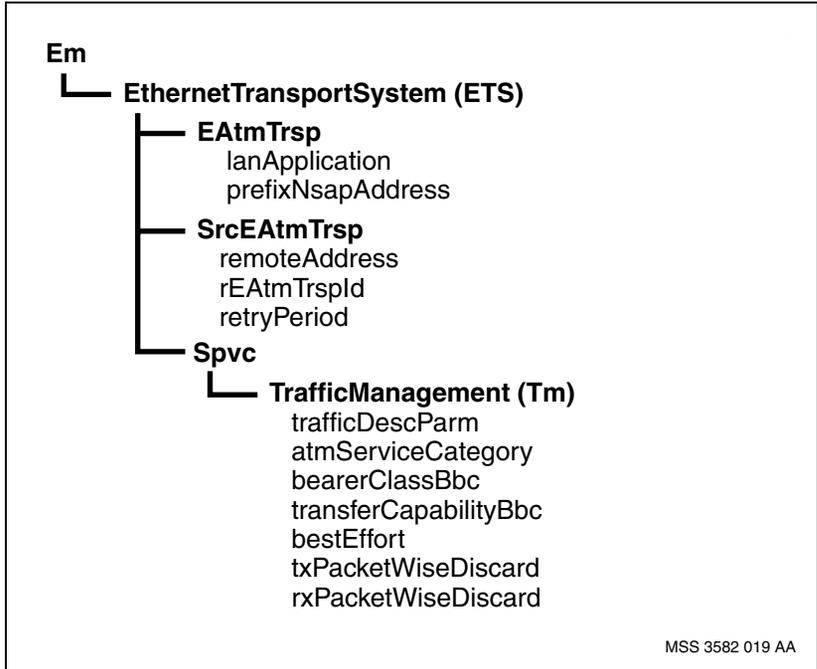
Variable	Value
<atmServiceCategory>	is the instance value of the ATM service category for both directions of the connection.
<bearerClassBbc>	is the instance value of the bearer capability for this connection.
<bestEffort>	is the instance value of the best effort parameter in the ATM traffic descriptor information element.
<p>	is the instance value of the LanApplication with a value from 0 to 255.
<prefixNsapA>	is the instance value of the SPVC.
<remoteAddress>	is the instance value of the NSAP address of the far end ETS to which the EVLS Atm Transport is to be established.
<remoteEAtmTrspId>	is the instance value of the EvlsAtmTransport component on the far end ETS to which this Atm transport is established.
<retryPeriod>	is the interval at which an SPVC connection attempts to re-establish after calling end of the SPVC initiates the setup request and receives a release message.
(Sheet 1 of 2)	

<b>Variable</b>	<b>Value</b>
<rxPacketWiseDiscard>	is the instance value that indicates whether packet wise discard functions are enabled or disabled in the receive data direction for this connection.
<spvc>	is the instance value of the SPVC.
<trafficDescParm>	is one of five transmit traffic parameters: peak cell rate (PCR), sustained cell rate (SCR), minimum cell rate (MCR), actual cell rate (ECR), and actual shaping rate.
<transferCapabilityBbc>	is the instance value of the transfer capability for this connection.
<transport>	is the instance value of the LanApplication with a value from 0 to 255.
<txPacketWiseDiscard>	is the instance value that indicates whether packet wise discard functions are enabled or disabled in the transmit data direction for this connection.
(Sheet 2 of 2)	

## Procedure job aid

Figure 23

Configuring ETS for end-to-end EVLS ATM transport component hierarchy



## Configuring ETS for single-ended EVLS ATM transport

Configure a single-ended EVLS ATM transport to provide aggregation of traffic from multiple VLANs from a single Ethernet interface to an ATM UNI across a single ATM VCC. The entire procedure involves configuring the calling end of the ETS on the Multiservice Switch node.

### Procedure steps

- 1 Add the EVLS ATM transport component.

```
add Ets EAtmTrsp/<transport>
```

- 2 Set the LAN application for the EVLS ATM transport component.

```
set Ets EAtmTrsp/<transport> lanApplication La/<p>
```

- 3 Set the prefix NSAP address for the EVLS ATM transport component.

```
set Ets EAtmTrsp/<transport> prefixNsapAddress  
<prefixNsapA>
```

- 4 Add the source EVLS ATM transport component to the EVLS ATM transport.

```
add Ets EAtmTrsp/<transport> SrcEAtmTrsp
```

- 5 Set the remote address.

```
set Ets EAtmTrsp/<transport> SrcEAtmTrsp remoteAddress  
<remoteAddress>
```

- 6 Set the remote EVLS ATM transport ID.

```
set Ets EAtmTrsp/<transport> SrcEAtmTrsp rEAtmTrspId  
<remoteEAtmTrspId>
```

- 7 Optionally, set the retryPeriod for the SPVC.

```
set Ets EAtmTrsp/<transport> SrcEAtmTrsp retryPeriod  
<retryPeriod>
```

- 8 Add the SPVC component.

```
add Ets EAtmTrsp/<transport> Spvc/<spvc>
```

- 9 Set the SPVC Tm parameters.

```
set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm  
trafficDescParm <trafficDescParm>
```

```

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm
atmServiceCategory <atmServiceCategory>

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm
bearerClassBbc <bearerClassBbc>

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm
transferCapabilityBbc <transferCapabilityBbc>

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm bestEffort
<bestEffort>

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm
txPacketWiseDiscard <txPacketWiseDiscard>

set Ets EAtmTrsp/<transport> Spvc/<spvc> Tm
rxPacketWiseDiscard <rxPacketWiseDiscard>

```

- 10 Add the source VCC to the ETS component.

```
add Ets EAtmTrsp/<transport> Spvc/<spvc> SrcVcc
```

- 11 Set the VPI.VCI for the ATM UNI.

```
set Ets EAtmTrsp/<transport> Spvc/<spvc> SrcVcc
calledVpiVci <calledVpiVci>
```

## Variable definitions

Variable	Value
<atmServiceCategory>	is the instance value of the ATM service category for both directions of the connection.
<bearerClassBbc>	is the instance value of the bearer capability for this connection.
<bestEffort>	is the instance value of the best effort parameter in the ATM traffic descriptor information element.
<calledVpiVci>	is the attribute that specifies the far end ATM UNI VCC that is the called end of this EVC.
<p>	is the instance value of the LanApplication with a value from 0 to 255.
<prefixNsapA>	is the instance value of the SPVC.
<remoteAddress>	is the instance value of the NSAP address of the far end ETS to which the EVLS Atm Transport is to be established.
(Sheet 1 of 2)	

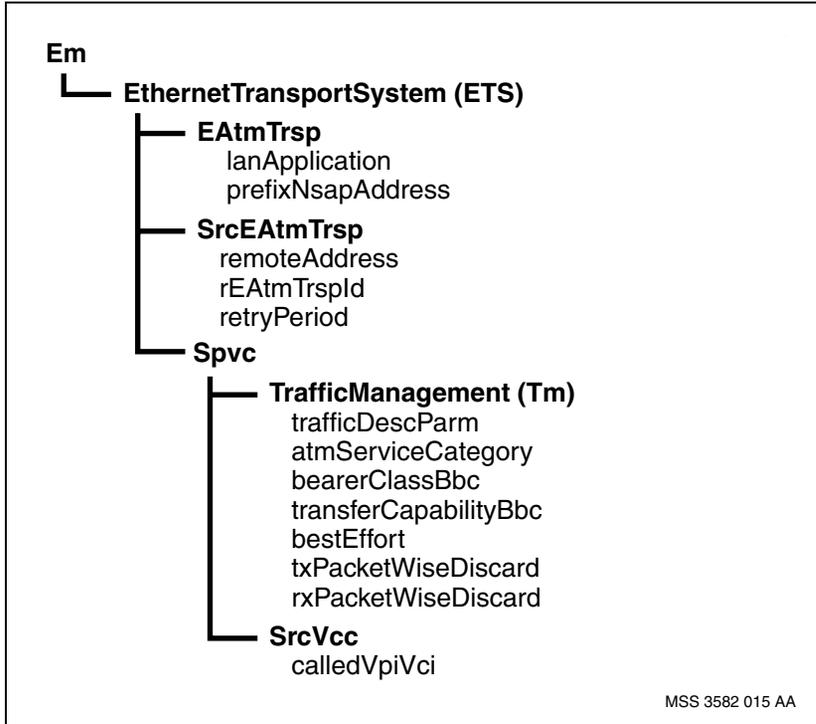
<b>Variable</b>	<b>Value</b>
<remoteEAtmTrspld>	is the instance value of the EvlsAtmTransport component on the far end ETS to which this Atm transport is established.
<retryPeriod>	is the interval at which an SPVC connection attempts to re-establish after calling end of the SPVC initiates the setup request and receives a release message.
<rxPacketWiseDiscard>	is the instance value that indicates whether packet wise discard functions are enabled or disabled in the receive data direction for this connection.
<spvc>	is the instance value of the SPVC.
<trafficDescParm>	is one of five transmit traffic parameters: peak cell rate (PCR), sustained cell rate (SCR), minimum cell rate (MCR), actual cell rate (ECR), and actual shaping rate.
<transferCapabilityBbc>	is the instance value of the transfer capability for this connection.
<transport>	is the instance value of the LanApplication with a value from 0 to 255.
<txPacketWiseDiscard>	is the instance value that indicates whether packet wise discard functions are enabled or disabled in the transmit data direction for this connection.

(Sheet 2 of 2)

## Procedure job aid

Figure 24

Configuring ETS for single-ended EVLS ATM transport component hierarchy



MSS 3582 015 AA

## Removing ETS

Remove this feature if you no longer want to take advantage of Ethernet transport system (ETS) functionality. The removal of this feature causes the shelf to reset.

### Procedure steps

- 1 Delete the Ethernet transport system (ETS) from the node.

```
delete Ets
```

- 2 Disable aggregation for all VLAN EVCs on the node.

```
set La/<p> Vlan/<vlan> Evc aggregation disabled
```

- 3 Remove the Ethernet transport system (ETS) from the CP.

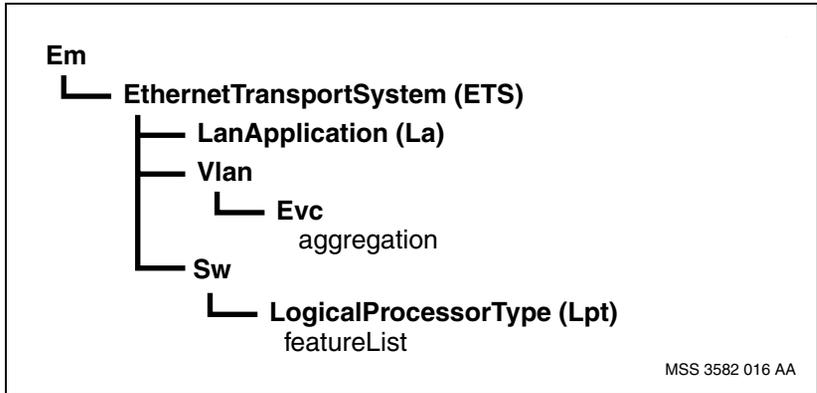
```
set Sw Lpt/<CP> featureList ~ets
```

### Variable definitions

Variable	Value
<CP>	is the instance value of the CP.
<p>	is the instance value of the LanApplication with a value from 0 to 255.
<vlan>	is the instance value of the VLANs aggregating on the VCC.

## Procedure job aid

Figure 25  
Removing ETS component hierarchy





## Chapter 8

# Troubleshooting EVLS

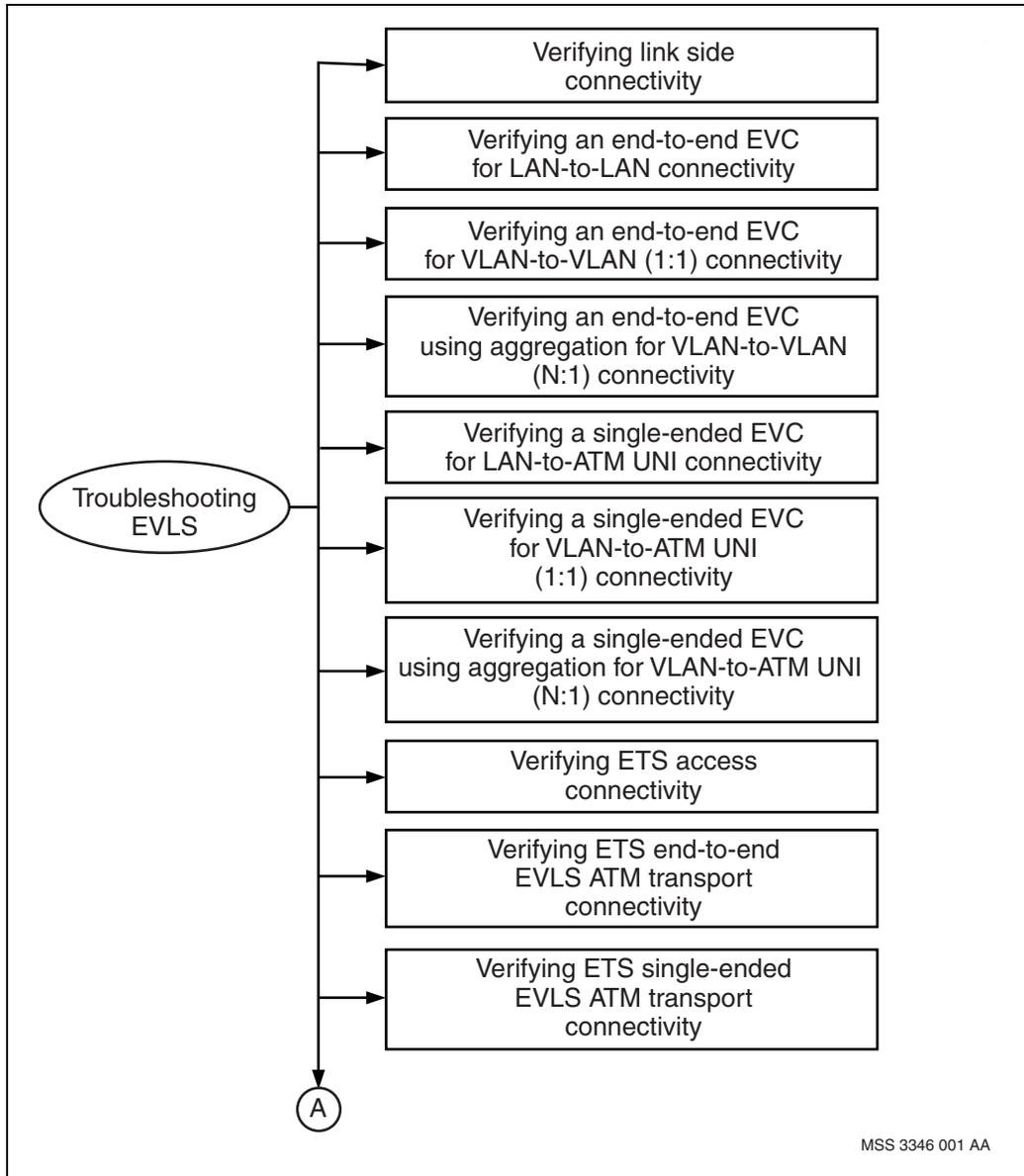
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Troubleshoot the Ethernet virtual line services (EVLS) to determine the possible reasons behind connection failure, congestion, and data loss.

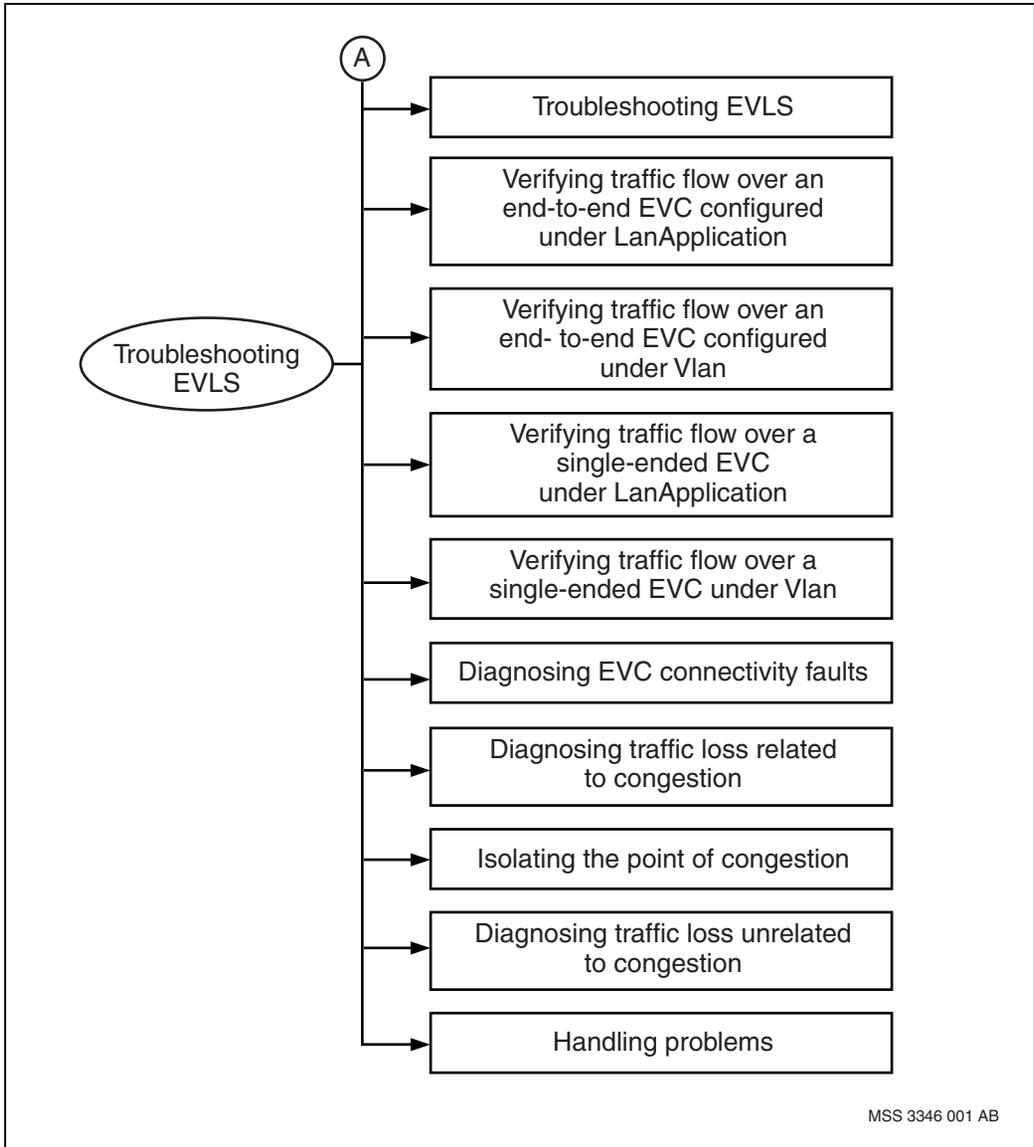
### Troubleshooting EVLS procedures

This task flow shows you the procedures you perform to troubleshoot EVLS. To link to any procedure, go to “Troubleshooting EVLS procedure navigation” (page 86).

**Figure 26**  
**Troubleshooting EVLS procedures: Part 1 of 2**



**Figure 27**  
**Troubleshooting EVLS procedures: Part 2 of 2**



## Troubleshooting EVLS procedure navigation

- “Troubleshooting EVLS” (page 88)
- “Verifying link side connectivity” (page 89)
- “Verifying an end-to-end EVC for LAN-to-LAN connectivity” (page 90)
- “Verifying an end-to-end EVC for VLAN-to-VLAN (1:1) connectivity” (page 92)
- “Verifying an end-to-end EVC using aggregation for VLAN-to-VLAN (N:1) connectivity” (page 94)
- “Verifying a single-ended EVC for LAN-to-ATM UNI connectivity” (page 96)
- “Verifying a single-ended EVC for VLAN-to-ATM UNI (1:1) connectivity” (page 98)
- “Verifying a single-ended EVC using aggregation for VLAN-to-ATM UNI (N:1) connectivity” (page 100)
- “Verifying ETS access connectivity” (page 102)
- “Verifying ETS end-to-end EVLS ATM transport connectivity” (page 104)
- “Verifying ETS single-ended EVLS ATM transport connectivity” (page 106)
- “Verifying traffic flow over an end-to-end EVC configured under LanApplication” (page 108)
- “Verifying traffic flow over an end-to-end EVC configured under Vlan” (page 110)
- “Verifying traffic flow over a single-ended EVC configured under LanApplication” (page 112)
- “Verifying traffic flow over a single-ended EVC configured under Vlan” (page 114)
- “Diagnosing EVC connectivity faults” (page 116)
- “Diagnosing traffic loss related to congestion” (page 118)
- “Isolating the point of congestion” (page 120)

- “Diagnosing traffic loss unrelated to congestion” (page 122)
- “Handling problems” (page 124)

## Troubleshooting EVLS

Since a LAN connection spans both a LAN and an ATM network, you need to isolate the problem to the specific portion of the network. The generic troubleshooting guidelines are described below:

- 1 Analyze alarms generated by Nortel Networks Multiservice Switch components. See NN10600-500 *Nortel Networks Multiservice Switch 6400/7400/15000/20000 Alarms Reference*.
- 2 Display and analyze LAN service level operational statistics. See NN10600-702 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*.
- 3 Identify corrective actions by referring to NN10600-700 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Technology Fundamentals*.
- 4 Use Test and Loop capability if third party equipment is being used.
- 5 Identify the ATM related cause codes by referring to NN10600-715 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*

## Verifying link side connectivity

Ensure that the PE Ethernet interface is connected to the CE Ethernet interface.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.

### Procedure steps

- 1 Ensure that the Ethernet interface and VLANs are operational.

```
display La/<p> operationalState
```

```
display La/<p> Vlan/<vlan> operationalState
```

### Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.

### Procedure job aid

Figure 28

Verifying link side connectivity component hierarchy



## Verifying an end-to-end EVC for LAN-to-LAN connectivity

Verify that an EVC configured for LAN-to-LAN connectivity is operational.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.

### Procedure steps

- 1 Ensure that either of the two end-to-end EVCs are operational.

```
display La/<p> Evc usageState
```

- 2 Verify that the EVC SPVC is connected.

```
display La/<p> Evc Spvc/<spvc> spvcStatus
```

- 3 Verify that an AtmCon subcomponent exists under the configured EVC SPVC.

```
list La/<p> Evc Spvc/<spvc>
```

- 4 Determine which ATM connection is connected to the SPVC.

```
display La/<p> Evc Spvc/<spvc> AtmCon
```

- 5 Determine the far end EVC that is connected to this EVC.

```
display La/<p> Evc remoteAddress, remoteVlanId
```

- 6 Repeat steps 1 and 2 to verify that the far end EVC is connected.

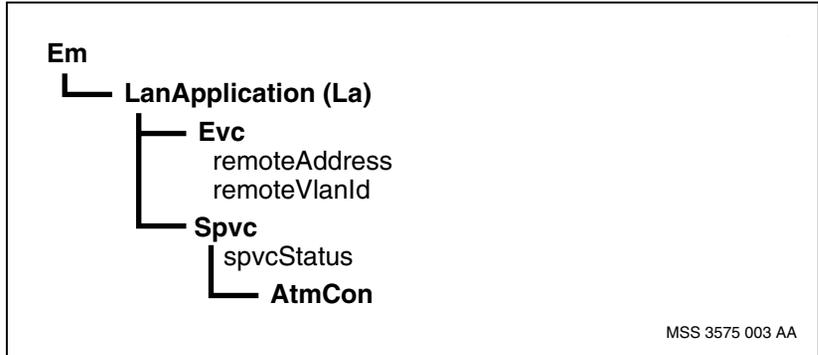
### Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<spvc>	s the instance value of the SPVC.

## Procedure job aid

Figure 29

Verifying an end-to-end EVC for LAN-to-LAN connectivity component hierarchy



## Verifying an end-to-end EVC for VLAN-to-VLAN (1:1) connectivity

Verify that an EVC configured for VLAN-to-VLAN connectivity is operational.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.

### Procedure steps

- 1 Ensure that either of the two end-to-end VLAN EVCs are operational.

```
display La/<p> Vlan/<vlan> Evc usageState
```

- 2 Verify that the EVC SPVC is connected.

```
display La/<p> Vlan/<vlan> Evc Spvc/<spvc> spvcStatus
```

- 3 Verify that an AtmCon subcomponent exists under the configured EVC SPVC.

```
list La/<p> Vlan/<vlan> Evc Spvc/<spvc>
```

- 4 Determine which ATM connection is connected to the SPVC.

```
display La/<p> Vlan/<vlan> Evc Spvc/<spvc> AtmCon
```

- 5 Determine the far end EVC that is connected to this EVC.

```
display La/<p> Vlan/<vlan> Evc remoteAddress,  
remoteVlanId
```

- 6 Repeat steps 1 and 2 to verify that the far end EVC is connected.

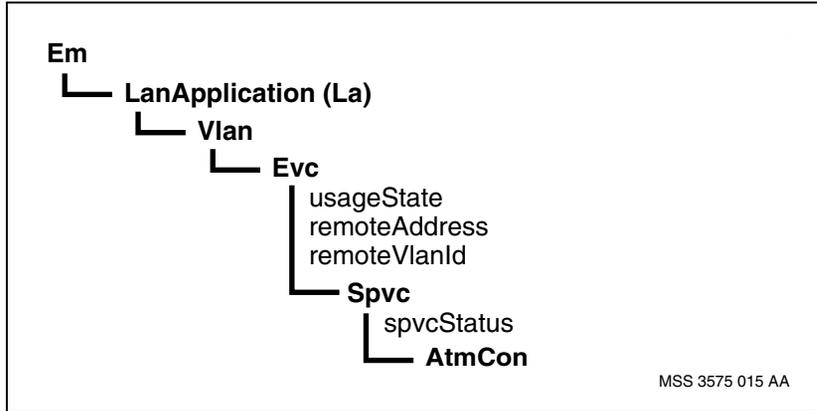
### Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<spvc>	is the instance value of the SPVC.
<vlan>	is the instance value of the VLANs aggregating on the VCC.

## Procedure job aid

Figure 30

Verifying an end-to-end EVC for VLAN-to-VLAN (1:1) connectivity  
component hierarchy



## Verifying an end-to-end EVC using aggregation for VLAN-to-VLAN (N:1) connectivity

Verify that the end-to-end EVC configured for aggregation is operational.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.
- Verify ETS connectivity. See “Verifying ETS access connectivity” (page 102) and “Verifying ETS end-to-end EVLS ATM transport connectivity” (page 104).

### Procedure steps

- 1 Ensure that either of the two end-to-end VLAN EVCs are operational.  
**display La/<p> Vlan/<vlan> Evc usageState**
- 2 Verify the status of the EVC SPVC is aggregationConnected.  
**display La/<p> Vlan/<vlan> Evc Spvc/<spvc> aggregationStatus**
- 3 Verify that an EtsTrspCon subcomponent exists under the configured EVC SPVC.  
**list La/<p> Vlan/<vlan> Evc Spvc/<spvc>**
- 4 Determine the ETS EVLS ATM transport that has admitted the EVC.  
**display La/<p> Vlan/<vlan> Evc Spvc/<spvc> EtsTrspCon**
- 5 Determine the far end Ethernet interface.  
**display La/<p> Vlan/<vlan> Evc remoteAddress, remoteVlanId**
- 6 Repeat steps 1 through 4 for the far end EVC.
- 7 Verify that an EtsTrspCon subcomponent exists under the configured EVC SPVC.  
**list La/<p> Vlan/<vlan> Evc Spvc/<spvc>**

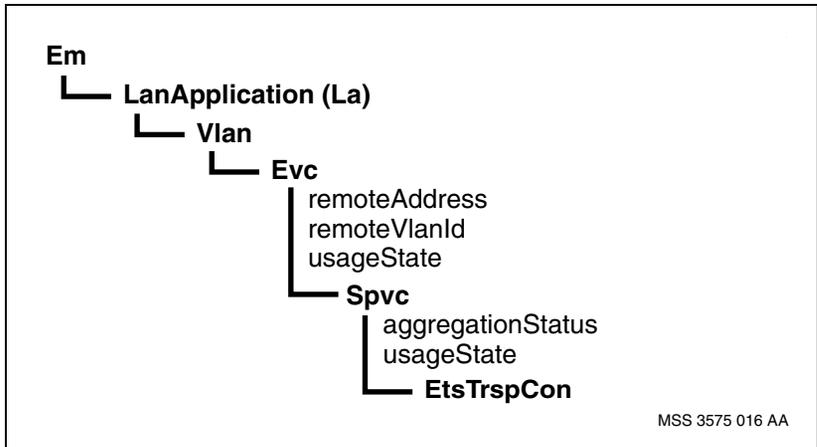
## Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<spvc>	is the instance value of the SPVC.
<vlan>	is the instance value of the VLANs aggregating on the VCC.

## Procedure job aid

Figure 31

Verifying an end-to-end EVC using aggregation for VLAN-to-VLAN (N:1) connectivity component hierarchy



## Verifying a single-ended EVC for LAN-to-ATM UNI connectivity

Verify that the single-ended EVC configured for LAN-to-ATM UNI connectivity is operational.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.

### Procedure steps

- 1 Ensure that the single-ended LAN EVC is operational.

```
display La/<p> Evc usageState
```

- 2 Verify that the EVC SPVC is connected.

```
display La/<p> Evc Spvc/<spvc> spvcStatus
```

- 3 Verify that an AtmCon subcomponent exists under the configured EVC SPVC.

```
list La/<p> Evc Spvc/<spvc>
```

- 4 Determine which ATM connection is connected to the SPVC.

```
display La/<p> Evc Spvc/<spvc> AtmCon
```

- 5 Verify ATM network connectivity. See NN10600-715 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.

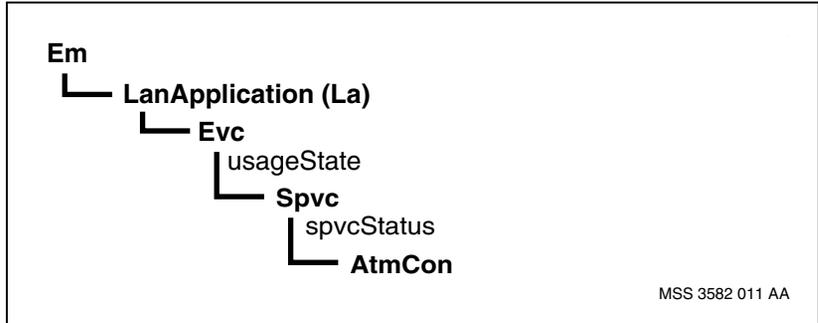
### Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<spvc>	is the instance value of the SPVC.

## Procedure job aid

Figure 32

Verifying a single-ended EVC for LAN-to-ATM UNI connectivity  
component hierarchy



## Verifying a single-ended EVC for VLAN-to-ATM UNI (1:1) connectivity

Verify that the single-ended EVC configured for VLAN-to-ATM UNI (1:1) connectivity is operational.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.

### Procedure steps

- 1 Ensure that the single-ended VLAN EVC is operational.

```
display La/<p> Vlan/<vlan> Evc usageState
```

- 2 Verify that the EVC SPVC is connected.

```
display La/<p> Vlan/<vlan> Evc Spvc/<spvc> spvcStatus
```

- 3 Verify that an AtmCon subcomponent exists under the configured EVC SPVC.

```
list La/<p> Vlan/<vlan> Evc Spvc/<spvc>
```

- 4 Determine which ATM connection is connected to the SPVC.

```
display La/<p> Vlan/<vlan> Evc Spvc/<spvc> AtmCon
```

- 5 Verify ATM network connectivity. See NN10600-715 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.

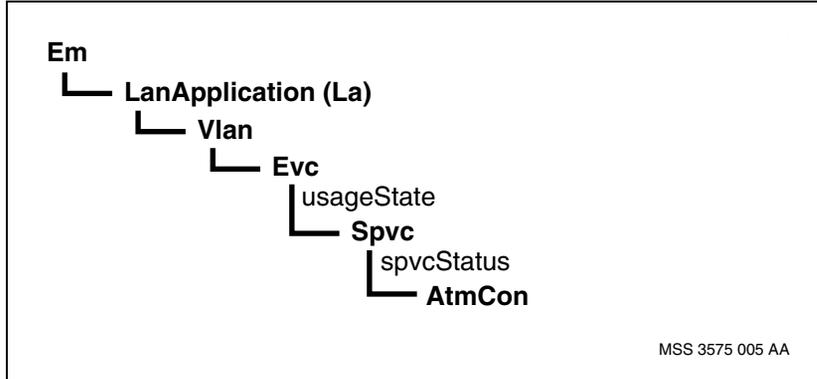
### Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<spvc>	is the instance value of the SPVC.
<vlan>	is the instance value of the VLANs aggregating on the VCC.

## Procedure job aid

Figure 33

Verifying a single-ended EVC for VLAN-to-ATM UNI (1:1) connectivity component hierarchy



## Verifying a single-ended EVC using aggregation for VLAN-to-ATM UNI (N:1) connectivity

Verify that the single-ended EVC configured for VLAN-to-ATM UNI (N:1) connectivity is operational.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.

### Procedure steps

- 1 Ensure that the single-ended VLAN EVC is operational.  
`display La/<p> Vlan/<vlan> Evc usageState`
- 2 Verify the status of the EVC SPVC is aggregationConnected.  
`display La/<p> Vlan/<vlan> Evc Spvc/<spvc> aggregationStatus`
- 3 Verify that an EtsTrspCon subcomponent exists under the configured EVC SPVC.  
`list La/<p> Vlan/<vlan> Evc Spvc/<spvc>`
- 4 Determine the ETS EVLS ATM transport that has admitted the EVC.  
`display La/<p> Vlan/<vlan> Evc Spvc/<spvc> EtsTrspCon`
- 5 Verify ETS access connectivity. See ["Verifying ETS access connectivity" \(page 102\)](#).
- 6 Verify ETS single-ended EVLS ATM transport connectivity. See ["Verifying ETS single-ended EVLS ATM transport connectivity" \(page 106\)](#).

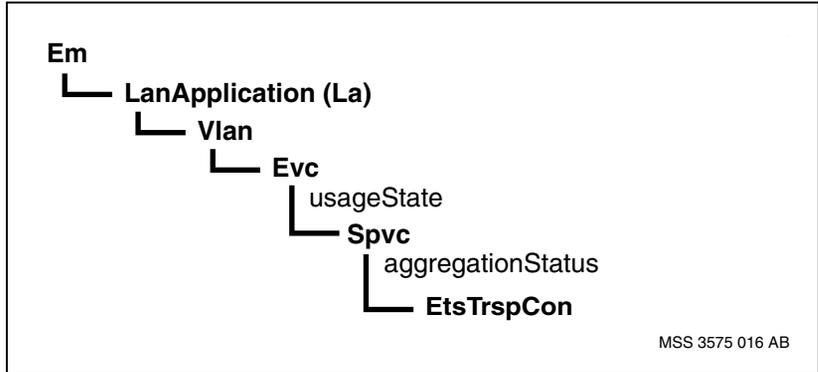
### Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<spvc>	is the instance value of the SPVC.
<vlan>	is the instance value of the VLANs aggregating on the VCC.

## Procedure job aid

Figure 34

Verifying a single-ended EVC for VLAN-to-ATM UNI connectivity (N:1)  
component hierarchy



## Verifying ETS access connectivity

Verify that an EVC has established connectivity over an ETS EVLS ATM transport.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.

### Procedure steps

- 1 Verify that an EtsTrspCon subcomponent exists under the EVC SPVC.  
`list La/<p> Vlan/<vlan> Evc Spvc/<spvc>`
- 2 Verify that the ETS has incremented its totalAdmittedConnections by 1.  
`display Ets totalAdmittedConnections`
- 3 Repeat steps 1 and 2 at the far end ETS.

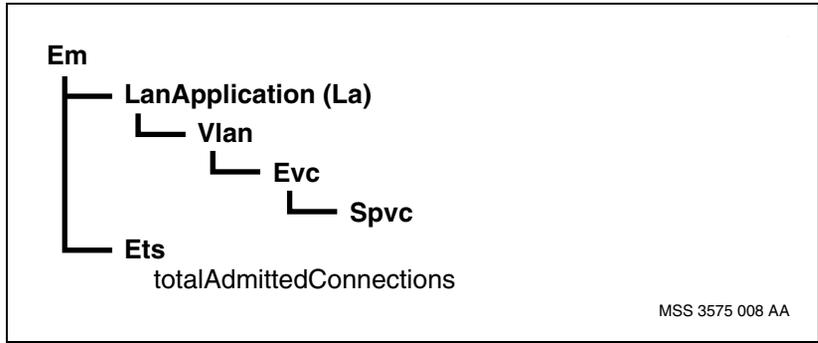
### Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<spvc>	is the instance value of the SPVC.
<vlan>	is the instance value of the VLANs aggregating on the VCC.

## Procedure job aid

Figure 35

Verifying ETS access connectivity component hierarchy



## Verifying ETS end-to-end EVLS ATM transport connectivity

Verify that the ETS EVLS ATM transport establishes end-to-end connectivity to another ETS EVLS ATM transport on another node over an ATM network.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.

### Procedure steps

- 1 Verify that the status of the EVLS ATM transport SPVC is connected.

```
display Ets EvlsAtmTransport/<transport> Spvc/<spvc>
spvcStatus
```

- 2 Verify that the AtmConnection component exists under each of the EvlsAtmTransport Spvc components.

```
list Ets EvlsAtmTransport/<transport> Spvc/<spvc>
```

- 3 Determine which ATM connection is connected to the SPVC.

```
display Ets EvlsAtmTransport/<transport> Spvc/<spvc>
AtmConnection
```

- 4 Choose one of the SPVCs from step 2 above to determine the far end EvlsAtmTransport to which this EvlsAtmTransport component is connected.

```
display Ets EvlsAtmTransport/<transport>
remoteAddress, remoteEvlsAtmTransportId
```

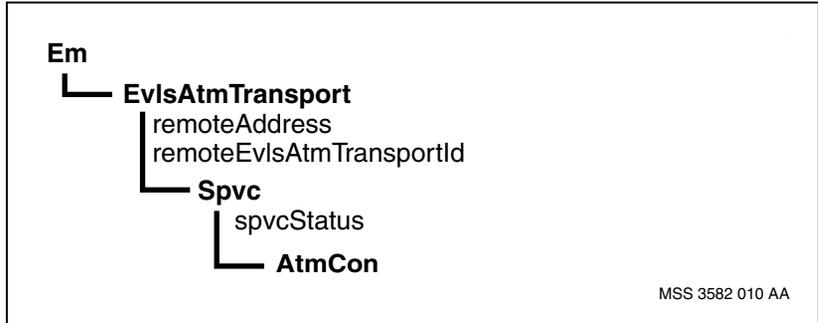
### Variable definitions

Variable	Value
<spvc>	is the instance value of the SPVC.
<transport>	is the instance value of the EVLS ATM transport.

## Procedure job aid

Figure 36

Verifying ETS end-to-end EVLS ATM transport connectivity component hierarchy



## Verifying ETS single-ended EVLS ATM transport connectivity

Verify that a single-ended ETS-to-ATM UNI is operational.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.

### Procedure steps

- 1 Verify that the status of the EVLS ATM transport SPVC is connected.

```
display Ets EvlsAtmTransport/<transport> Spvc/<spvc>
spvcStatus
```

- 2 Verify that the AtmConnection subcomponent exists under each of the configured EvlsAtmTransport SPVCs.

```
list Ets EvlsAtmTransport/<transport> Spvc/<spvc>
```

- 3 Determine which ATM connection is connected to the SPVC.

```
display Ets EvlsAtmTransport/<transport> Spvc/<spvc>
AtmConnection
```

- 4 Verify ATM network connectivity. See NN10600-715 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.

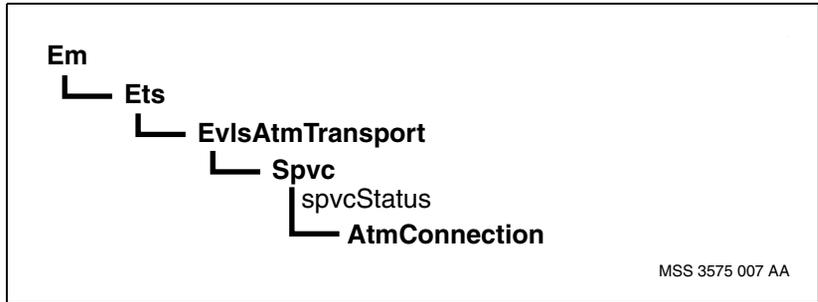
### Variable definitions

Variable	Value
<spvc>	is the instance value of the SPVC.
<transport>	is the instance value of the EVLS ATM transport.

## Procedure job aid

Figure 37

Verifying ETS single-ended EVLS ATM transport component hierarchy



## Verifying traffic flow over an end-to-end EVC configured under LanApplication

Compare the rxFrames of the local EVC against the txFrames of the far end EVC. After the traffic has stopped, make sure the txFrames is equal to the rxFrames, then continue to do the other direction.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.
- Verify that the end-to-end EVC for LAN-to-LAN connectivity is connected. See “Verifying an end-to-end EVC for LAN-to-LAN connectivity” (page 90).

### Procedure steps

- 1 Choose one of the two end-to-end EVCs and verify the received frames from the local EVC statistics.

```
display La/<p> Stats rxFrames
```

- 2 Verify transmission frames from the far end EVC statistics.

```
display La/<p> Stats txFrames
```

- 3 Ensure that the rxFrames of the local EVC displayed in step 1 are the same as the txFrames of the far end EVC displayed in step 2.
- 4 Repeat steps 1 through 3 for the other traffic direction.

### Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.

## Procedure job aid

**Figure 38**

**Verifying traffic flow over an end-to-end EVC configured under  
LanApplication component hierarchy**



## Verifying traffic flow over an end-to-end EVC configured under Vlan

Compare the rxFrames of the local EVC against the txFrames of the far end EVC. After the traffic has stopped, make sure the txFrames is equal to the rxFrames, then continue to do the other direction.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.
- Verify that the end-to-end EVC for (1:1) or (N:1) VLAN-to-VLAN connectivity is connected. See “Verifying an end-to-end EVC for VLAN-to-VLAN (1:1) connectivity” (page 92) or “Verifying an end-to-end EVC using aggregation for VLAN-to-VLAN (N:1) connectivity” (page 94).

### Procedure steps

- 1 Choose one of the two end-to-end EVCs and verify the rxFrames of the local EVC statistics.

```
display La/<p> Vlan/<vlan> Stats rxFrames
```

- 2 Verify txFrames of the far end EVC statistics.

```
display La/<p> Vlan/<vlan> Stats txFrames
```

- 3 Ensure that the rxFrames of the local EVC displayed in step 1 are the same as the txFrames of the far end EVC displayed in step 2.
- 4 Repeat steps 1 through 3 for the other traffic direction.

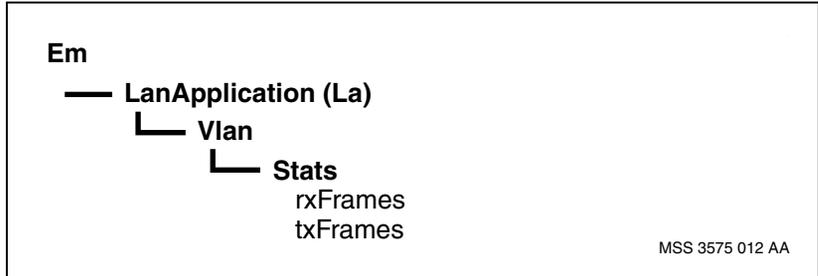
### Variable definitions

Variable	Value
<p>	is the instance value of the LanApplication.
<vlan>	is the instance value of the virtual LanApplication.

## Procedure job aid

Figure 39

Verifying traffic flow over an end-to-end EVC configured under Vlan component hierarchy



## Verifying traffic flow over a single-ended EVC configured under LanApplication

Compare the rxFrames of the local EVC against the txFrames of the far end EVC. After the traffic has stopped, convert the received frames to cells and make sure the rxFrames correspond to the txCell.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.
- Verify that the single-ended EVC for LAN-to-ATM UNI connectivity is connected. See “Verifying a single-ended EVC for LAN-to-ATM UNI connectivity” (page 96).

### Procedure steps

- 1 Determine the rxFrames of the EVC statistics.  
**display La/<p> Stats rxFrames**
- 2 Determine which ATM connection is connected to the SPVC.  
**display La/<p> Evc Spvc/<spvc> AtmCon**
- 3 Determine the txCell of the far end ATM UNI VCC statistics.  
**display AtmIf/<atmif> Vcc/<vcc> Stats txCell**
- 4 Calculate the frames into their respective number of cells according to “Conversion from Ethernet to ATM traffic parameters” (page 179). Ensure the rxFrames value corresponds to the txCell value.

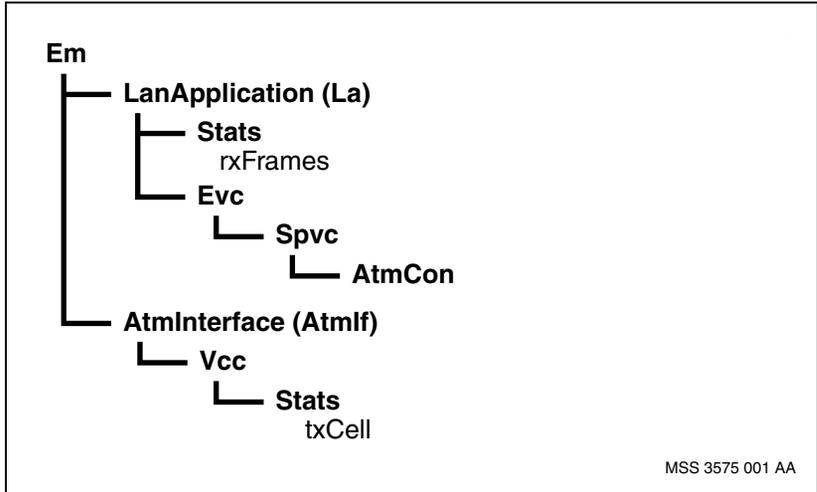
### Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<spvc>	is the instance value of the SPVC.
<vcc>	is the instance value of the VCC.

## Procedure job aid

Figure 40

Verifying traffic flow over a single-ended EVC configured under LanApplication component hierarchy



## Verifying traffic flow over a single-ended EVC configured under Vlan

Compare the rxFrames of the local EVC against the txFrames of the far end EVC. After the traffic has stopped, convert the received frames to cells and make sure the rxFrames correspond to the txCell.

### Prerequisites

- Verify that the Ethernet port is physically connected to the CE device and is operational.

### Procedure steps

- 1 Determine the rxFrames of the EVC statistics.  
**display La/<p> Vlan/<vlan> Stats rxFrames**
- 2 Determine which ATM connection is connected to the SPVC.  
**display La/<p> Vlan/<vlan> Evc Spvc/<spvc> AtmCon**
- 3 Determine the txCell of the far end ATM UNI VCC statistics.  
**display AtmIf/<atmif> Vcc/<vcc> Stats txCell**
- 4 Calculate the frames into their respective number of cells according to “Conversion from Ethernet to ATM traffic parameters” (page 179). Ensure the rxFrames value corresponds to the txCell value.

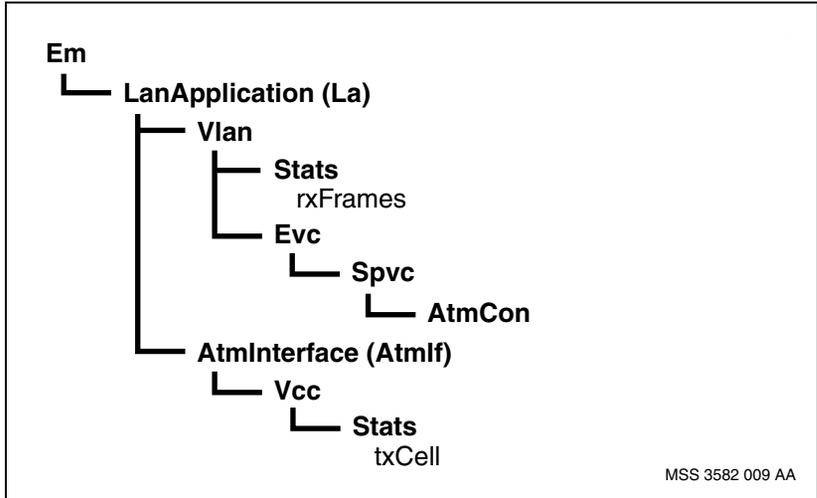
### Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<spvc>	is the instance value of the SPVC.
<vcc>	is the instance value of the VCC.
<vlan>	is the instance value of the VLAN.

## Procedure job aid

Figure 41

Verifying traffic flow over a single-ended EVC configured under Vlan component hierarchy



## Diagnosing EVC connectivity faults

When traffic loss is occurring, check the EVC status first. Since the SPVC is automatically created in the called end, SPVC information can not be used in the called end. The calling end is the only source of information in this case.

For an EVC under the La component, perform the commands for the La component. For an EVC under the Vlan component, perform the commands for the Vlan component.

### Procedure steps

- 1 Verify that an SPVC subcomponent exists under the EVC.

```
list La/<p> Evc Spvc/<spvc>
```

```
list La/<p> Vlan/<vlan> Evc Spvc/<spvc>
```

- 2 Determine whether the endpoint of the connection is the calling end.

```
display La/<p> Evc Spvc/<spvc> endPoint
```

```
display La/<p> Vlan/<vlan> Evc Spvc/<spvc> endPoint
```

If this endpoint is determined not to be the calling end, repeat steps 1 and 2 on the other Multiservice Switch node and proceed with the remaining steps.

- 3 Check the SPVC status.

```
display La/<p> Evc Spvc/<spvc> spvcStatus
```

```
display La/<p> Vlan/<vlan> Evc Spvc/<spvc> spvcStatus
```

- 4 If the spvcStatus is serviceNotReady, check the administrative control for all components used to establish the EVC. Ensure all components used to establish the EVC are unlocked.

If the spvcStatus is setupFailed, there are two possible causes. One is caused by an ATM network problem. See NN10600-715 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*. Another possible cause is that the Ethernet interface at the far end is inactive.

- 5 Determine the lastTearDownCause.

```
display La/<p> Evc Spvc/<spvc> lastTearDownCause
```

```
display La/<p> Vlan/<vlan> Evc Spvc/<spvc>  
lastTearDownCause
```

6 See “Handling problems” (page 124) for a list of possible solutions.

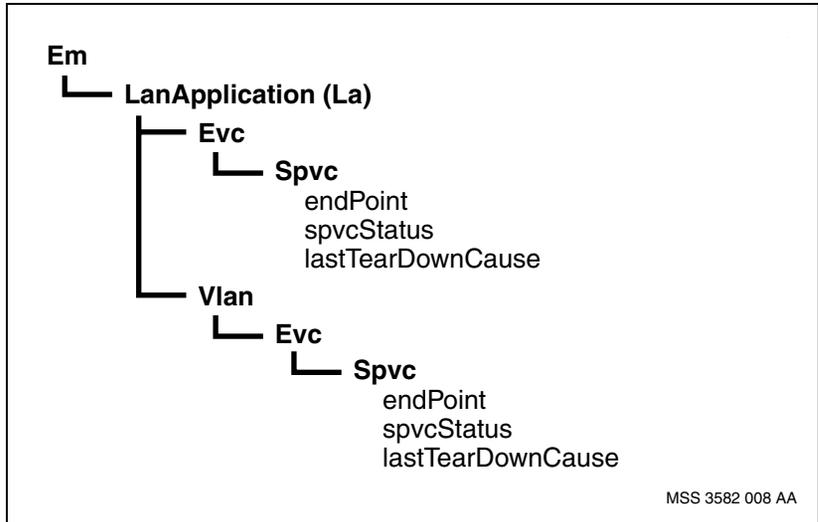
## Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<spvc>	is the instance value of the SPVC.
<vlan>	is the instance value of the VLAN.

## Procedure job aid

Figure 42

Diagnosing EVC connectivity faults component hierarchy



## Diagnosing traffic loss related to congestion

Determine whether traffic loss is due to link or network congestion. Use statistics on the Ethernet interface and ATM network to detect traffic loss.

For an EVC under the La component, perform the commands for the La component. For an EVC under the Vlan component, perform the commands for the Vlan component.

### Procedure steps

- 1 Verify the LanApplication statistics for discards in the direction from the Ethernet interface.

```
display La/<p> Stats rxDiscFrames, txDiscFrames
```

```
display La/<p> Vlan/<vlan> Stats rxDiscFrames,  
txDiscFrames
```

If the local Ethernet interface is congested, it can be diagnosed that FP congestion causes Ethernet interface queue congestion resulting in potential traffic loss.

- 2 Determine the number of frames received by the local EVC.

```
display La/<p> Stats rxFrames
```

```
display La/<p> Vlan/<vlan> Stats rxFrames
```

- 3 Determine the number of frames transmitted by the far end EVC.

```
display La/<p> Stats txFrames
```

```
display La/<p> Vlan/<vlan> Stats txFrames
```

- 4 Compare the rxFrames of the local EVC against the txFrames of the far end EVC. After the traffic is stopped, if the txFrames is less than rxFrames, traffic loss may be due to ATM network congestion.
- 5 If traffic loss is determined to be a result of congestion, see “Isolating the point of congestion” (page 120).

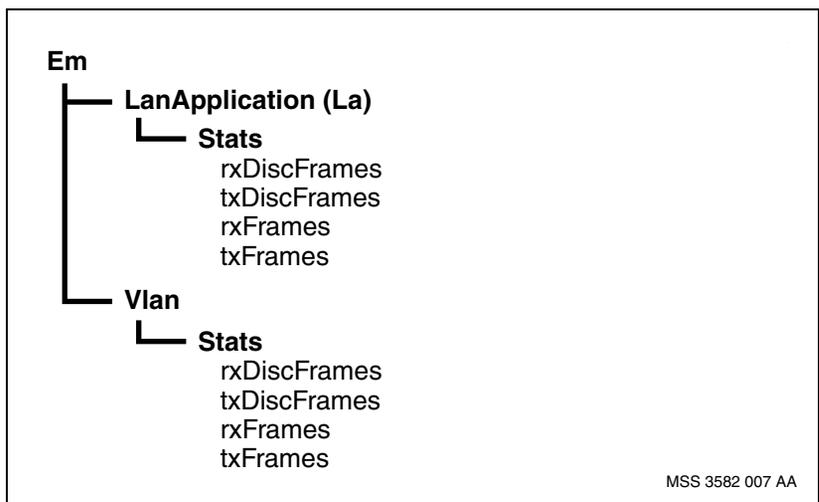
## Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<vlan>	is the instance value of the VLAN.

## Procedure job aid

Figure 43

### Diagnosing traffic loss related to congestion component hierarchy



## Isolating the point of congestion

You can isolate the point of congestion when data loss is observed on an EVC connection. Use statistics on the Ethernet interface and ATM network to detect traffic loss.

For an EVC under the La component, perform the commands for the La component. For an EVC under the Vlan component, perform the commands for the Vlan component.

### Prerequisites

- You must determine whether traffic loss is due to congestion. See “Diagnosing traffic loss related to congestion” (page 118).

### Procedure steps

- 1 Determine to which ATM next hop this SPVC is established.  

```
display La/<p> Evc Spvc/<spvc> AtmCon nextHop
```

```
display La/<p> Vlan/<vlan> Evc Spvc/<spvc> AtmCon nextHop
```
- 2 Diagnose ATM network traffic loss starting at the ATM next hop determined above by referring to NN10600-715 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.

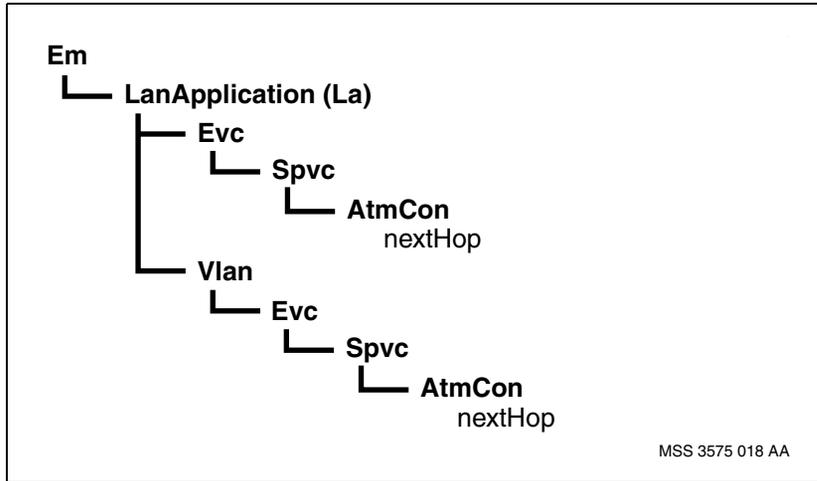
### Variable definitions

Variable	Value
<p>	is the instance value of the LAN application.
<spvc>	is the instance value of the SPVC.
<vlan>	is the instance value of the VLAN.

## Procedure job aid

Figure 44

Isolating the point of congestion component hierarchy



## Diagnosing traffic loss unrelated to congestion

There are a number of possible causes for traffic loss when congestion has been eliminated. Some possible causes are that the La or Vlan component is not operational, the SPVC connection is down, the maximum frame size on the Ethernet interface is misconfigured, or the unknownVlanIdTreatment attribute is misconfigured.

### Procedure steps

- 1 For an end-to-end configuration, determine whether the La or Vlan component is locked. If it is locked, the rxDiscFrames attribute value increments.

```
display La/<p> Stats rxFrames, rxDiscFrames
```

```
display La/<p> Vlan/<vlan> Stats rxFrames, rxDiscFrames
```

- 2 Determine whether the traffic is being sent to the other end by performing this command on the far end Ethernet interface.

```
display La/<p> Stats rxFrames, txFrames
```

```
display La/<p> Vlan/<vlan> Stats rxFrames, txFrames
```

- 3 Determine whether connectivity fault is due to an inactive SPVC under the La or Vlan component.

```
display La/<p> Evc vcDownDiscards
```

```
display La/<p> Vlan/<vlan> Evc vcDownDiscards
```

- 4 Determine whether the frames are too long.

```
display Lp/<a> Ethernet/<ethernet> framesTooLong
```

- 5 Determine whether the Ethernet policy is influencing the traffic loss.

```
display La/<p> Stats EthIfStatsOper
```

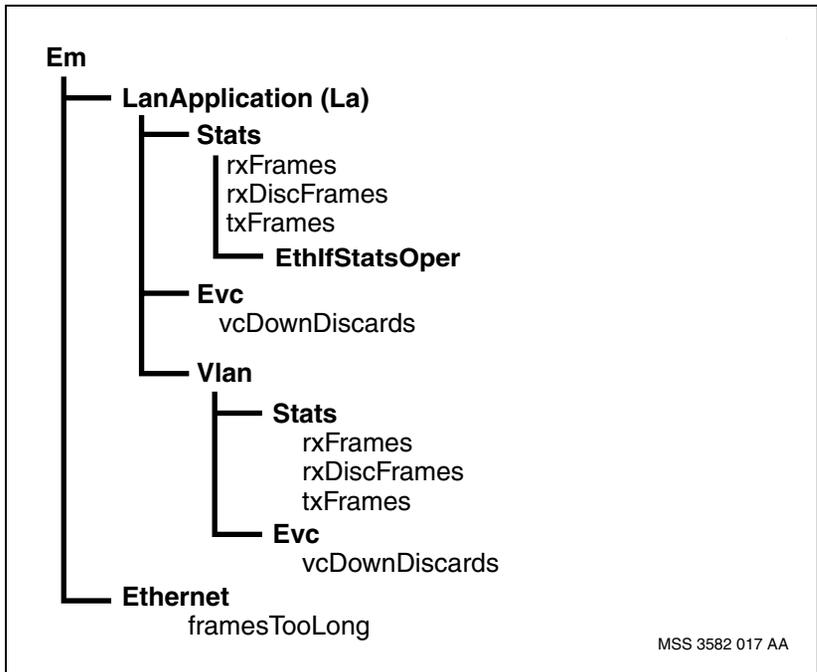
### Variable definitions

Variable	Value
<a>	is the instance value of the logical processor.
(Sheet 1 of 2)	

Variable	Value
<p>	is the instance value of the LAN application.
<vlan>	is the instance value of the VLAN.
(Sheet 2 of 2)	

## Procedure job aid

**Figure 45**  
**Diagnosing traffic loss unrelated to congestion component hierarchy**



## Handling problems

The table “Handling problems” (page 124) provides guidelines on how to respond to problems that may occur with EVC connections.

**Table 1**  
**Handling problems**

<b>Problem</b>	<b>Probable causes</b>	<b>Corrective measures</b>
Ethernet port physically connected to the CE device is not operational	There is an operational affecting condition	Ensure that the Ethernet port is unlocked. Refer to NN10600-520 <i>Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting.</i>
	Faulty cable Port configuration does not match CE port configuration	Ensure that the Ethernet port is unlocked. Refer to NN10600-520 <i>Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting.</i>
(Sheet 1 of 6)		

**Table 1 (continued)**  
**Handling problems**

<b>Problem</b>	<b>Probable causes</b>	<b>Corrective measures</b>
La Evc or Vlan Evc can not establish connectivity	<p>Ethernet port, La, or Vlan component is locked</p> <p>Under Evc Spvc component: lastTearDownCause=3 (No route to destination)</p> <p>Under Evc Spvc component: lastTearDownCause=17 (User is busy)</p> <p>Under Evc Spvc component: lastTearDownCause=21 (Call is rejected)</p> <p>Under Evc Spvc component: lastTearDownCause=45 (No vpi.vci is available)</p>	<p>Ensure that all components used to establish the EVC are unlocked.</p> <p>Ensure that the called end Ethernet interface is configured.</p> <p>Ensure that there is a path between the Ethernet interfaces. Refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i>.</p> <p>Ensure that the calling end EVC is configured with the correct NSAP and remoteVlanId of the called end EVC.</p> <p>Ensure that the called end has not accepted another call.</p> <p>Ensure that there is no failure in the ATM network. Refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i>.</p> <p>Ensure that the call is made to a called end instead of a calling end.</p> <p>Ensure that the called end is an EVLS.</p> <p>Ensure that there is no failure in the ATM network. Refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i>.</p> <p>Ensure that the called vpi.vci value is available under the ATM interface.</p> <p>Ensure that there is no failure in the ATM network. Refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i>.</p>
(Sheet 2 of 6)		

**Table 1 (continued)**  
**Handling problems**

<b>Problem</b>	<b>Probable causes</b>	<b>Corrective measures</b>
La Evc or VlanEvc can not establish connectivity	<p>Under Evc Spvc component: lastTearDownCause=37 (Cell rate is unavailable)</p> <p>Under Evc Spvc component: lastTearDownCause=49 (QoS is unavailable)</p> <p>For other cause codes, refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i></p>	<p>Ensure that the parameter configured under EQoS component can be accepted in the tandem ATM card.</p> <p>Provide additional resource in the ATM network. Refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i>.</p>
La Evc or Vlan Evc connectivity failure	<p>Under Evc Spvc component: lastTearDownCause=18 (No user response)</p> <p>Under Evc Spvc component: lastTearDownCause=21 (call is rejected)</p> <p>For other cause codes, refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i>.</p>	<p>Ensure that the called end Ethernet interface is configured.</p> <p>Ensure that all components used to establish the EVC are unlocked.</p>
(Sheet 3 of 6)		

**Table 1 (continued)**  
**Handling problems**

<b>Problem</b>	<b>Probable causes</b>	<b>Corrective measures</b>
ETS EvlSAtmTransport can not establish connectivity	<p>EvlSAtmTransport component is locked</p> <p>Under Spvc component: LastTearDownCause=3 (no route to destination)</p> <p>Under Spvc component: lastTearDownCause=17 (user is busy)</p> <p>Under Spvc component: lastTearDownCause=21 (call is rejected)</p>	<p>Ensure that the EvlSAtmTransport component is unlocked.</p> <p>Ensure that the called end Ets is configured. Ensure that the calling end Ets EvlSAtmTrsp is configured with the correct NSAP and remote EvlSAtmTrspId of the called end Ets. Ensure that there is a path between the Ets endpoints. Refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i>.</p> <p>Ensure that the called end has not accepted the call. Ensure that there is no failure in the ATM network. Refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i>.</p> <p>Ensure that the call is made to a called end instead of a calling end. Ensure that there is no failure in the ATM network. Refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i>.</p>
(Sheet 4 of 6)		

**Table 1 (continued)**  
**Handling problems**

<b>Problem</b>	<b>Probable causes</b>	<b>Corrective measures</b>
ETS EvlSAtmTransport cannot establish connectivity	Under Spvc component: lastTearDownCause=45 (No vpi.vci is available)	Ensure that the called vpi.vci value is available under the ATM interface.
	Under Spvc component: lastTearDownCause=37 (cell rate is unavailable)	Ensure that the parameter configured under Tm component can be accepted on the tandem ATM card.
	Under Spvc component: lastTearDownCause=49 (QoS is available)	Provide additional resource in ATM. Refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i> .
	For other cause codes, refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i> .	
EVC using aggregation can not establish connectivity	Aggregation is not enabled in the access EVC	Set the EVC aggregation attribute to enabled.
	aggregationLastFailureCause = noNsapPrefixMatch	Configure an EvlSAtmTransport with a prefixNsapAddress that matches the EVC remoteAddress. Ensure that the EVC remoteAddress is configured with the activeNsapAddress of the far end Ethernet interface.
	aggregationLastFailureCause = etsNotReady	This is a transient condition. Wait for Ets to become ready.
	aggregationLastFailureCause = spvcNotAvail	Ensure that the Ets EvlSAtmTransport Spvc is operational.
	aggregationLastFailureCause = noServiceCategoryMatch	Configure an EvlSAtmTransport with a serviceCategory that matches the EVC Ethernet per hop behavior.
(Sheet 5 of 6)		

**Table 1 (continued)**  
**Handling problems**

<b>Problem</b>	<b>Probable causes</b>	<b>Corrective measures</b>
Traffic is discarded due to congestion	Ingress Ethernet interface congestion	Reduce the amount of traffic sent to network from CE. Increase the network capacity to support more offered load.
	Egress Ethernet interface congestion	Re-engineering the network to reduce traffic to the port. Reduce the number of VLANs by moving some VLANs to another port or FP.
	ATM network congestion	Check for traffic loss in the ATM portion of the network. For details, refer to NN10600-715 <i>Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management</i> .
Traffic is discarded due to non-congestion conditions	La or Vlan component is not operational	Ensure that all components used to establish the EVC are unlocked.
	EVC SPVC is not connected	Follow the fault recovery procedures for EVC connectivity failures. Refer to end-to-end and single-ended troubleshooting procedures within this chapter.
	Traffic is discarded by the port.	Refer to NN10600-520 <i>Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting</i> .
	Ethernet policy to treat unknown VLAN traffic is configured to discard	Ensure that the correct VLAN is configured on the Ethernet interface. Ensure that the unknownVlanIdTreatment attribute value is set to accept and an EVC is configured under the La component.
(Sheet 6 of 6)		



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## Chapter 9

# EVLS overview

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The Ethernet virtual line service (EVLS) provides transparent tunneling of both IEEE 802.3 and Ethernet v2.0 traffic over a dedicated Ethernet virtual circuit (EVC). The EVC can be established between a pair of Ethernet LANs, or a pair of Ethernet virtual LANs (VLANs), or between an Ethernet LAN or VLAN and a tandem ATM interface. Each Ethernet LAN or VLAN is logically associated with the EVC, such that either of the following connections can be established:

- LAN-to-LAN or VLAN-to-VLAN peer connectivity can be established using the end-to-end EVC configuration
- LAN-to-ATM UNI or VLAN-to-ATM UNI connectivity can be established using the single-ended configuration.

See the following sections for more detailed conceptual information about EVLS:

- “Why use EVLS?” (page 132)
- “How does EVLS work?” (page 132)
- “Carrier grade functionality” (page 136)
- “Timers” (page 136)
- “Addressing” (page 137)

## Why use EVLS?

Ethernet has emerged 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. Ethernet virtual line service (EVLS) provides the ability to extend LAN/MAN/WAN reachability via Ethernet across a resilient ATM WAN. ATM network infrastructure is leveraged to cost effectively transport Ethernet traffic between a pair of Ethernet LANs and between a pair of Ethernet VLANs on Ethernet interfaces.

EVLS offers the following additional benefits:

- enables customer devices to view the core network as a single point-to-point Ethernet wire
- provides multiple users on a single Ethernet interface connectivity to another Ethernet interface via LANs across an ATM network, enabling optimization of Ethernet resource utilization.
- introduces the Ethernet transport system (ETS) to provide aggregation of traffic from multiple VLANs on a single port across a single ATM VCC
- provides flexibility to interoperate with third party equipment at the remote access point of the ATM network by encapsulating Ethernet frames using RFC2684
- enables other services to co-exist on the same Ethernet interface. With the use of VLANs, EVLS, IP, and IP VPN services can be offered to provide a rich suite of network solutions to address both layer 2 and layer 3 needs.
- provides transparent tunnelling of IEEE 802.3 and Ethernet v2.0 traffic

## How does EVLS work?

Ethernet virtual line service (EVLS) establishes an Ethernet virtual circuit (EVC) between ports or virtual local area networks (VLANs) using an ATM soft permanent virtual circuit (SPVC) VCC. The ATM SPVC can be configured to terminate on either another EVC or on a tandem ATM interface. For a list of the function processors (FPs) supporting EVLS, see table “FPs supporting EVLS” (page 134). If the ATM SPVC is configured to terminate

on another EVC it is referred to as an end-to-end EVLS solution. If the ATM SPVC is configured to terminate on a tandem ATM interface, it is referred to as a single-ended EVLS solution.

The Ethernet virtual circuit (EVC) uses an ATM VCC to transport layer 2 Ethernet traffic with RFC2684 bridged mode LLC/SNAP encapsulation, which is then carried as AAL5 frames across the ATM network. The AAL5 segmentation and reassembly (SAR) function is provided by the tandem ATM FPs. 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 ATM tandem FPs. The Ethernet frames are then transmitted to the Ethernet interface unaltered from the way they arrived at the ingress Ethernet interface, with one exception. For a VLAN-to-VLAN EVC, the VLAN identifier (VID) that is received by the EVC ingress is swapped with the VID to which it is transmitted at the EVC egress. For information on data flow, see “Frame data flows” (page 139).

The Ethernet transport system (ETS) provides aggregation of traffic from multiple VLANs on a single port across a single ATM VCC. The traffic that is aggregated on any single ETS *EvlAtmTransport* SPVC is all from the same Ethernet interface. Each VLAN can be configured to use aggregation.

When a VLAN solicits for transport, ETS searches first for an *EvlAtmTransport* with matching *lanApplication* and *prefixNsapAddress* attributes. If a match is found, then the VLAN is successfully linked to that *EvlAtmTransport* instance. If there is an SPVC with a matching service category under the *EvlAtmTransport* instance, then the VLAN can also send traffic across the SPVC.

EVLS is supported on Ethernet interfaces in both port-mode and VLAN-mode. When services are configured on dedicated VLANs, EVLS can coexist with other Ethernet services on an Ethernet interface in VLAN-mode.

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 Ethernet port and VLAN is directly linked to its own dedicated EVC.

The EVC SPVC that interconnects Ethernet ports and VLANs supports resiliency during ATM network failures. The EVC SPVC attempts the initial call setup after the LanApplication service has received all of its provisioning data.

Operation of EVLS is shown in figure “EVLS end-to-end view” (page 135).

*Note:* EVLS does not support edge-based routing (EBR) for the SPVC.

## Supported cards

Table “FPs supporting EVLS” (page 134) lists the function processors (FPs) that are recommended when configuring EVLS.

**Table 2**  
**FPs supporting EVLS**

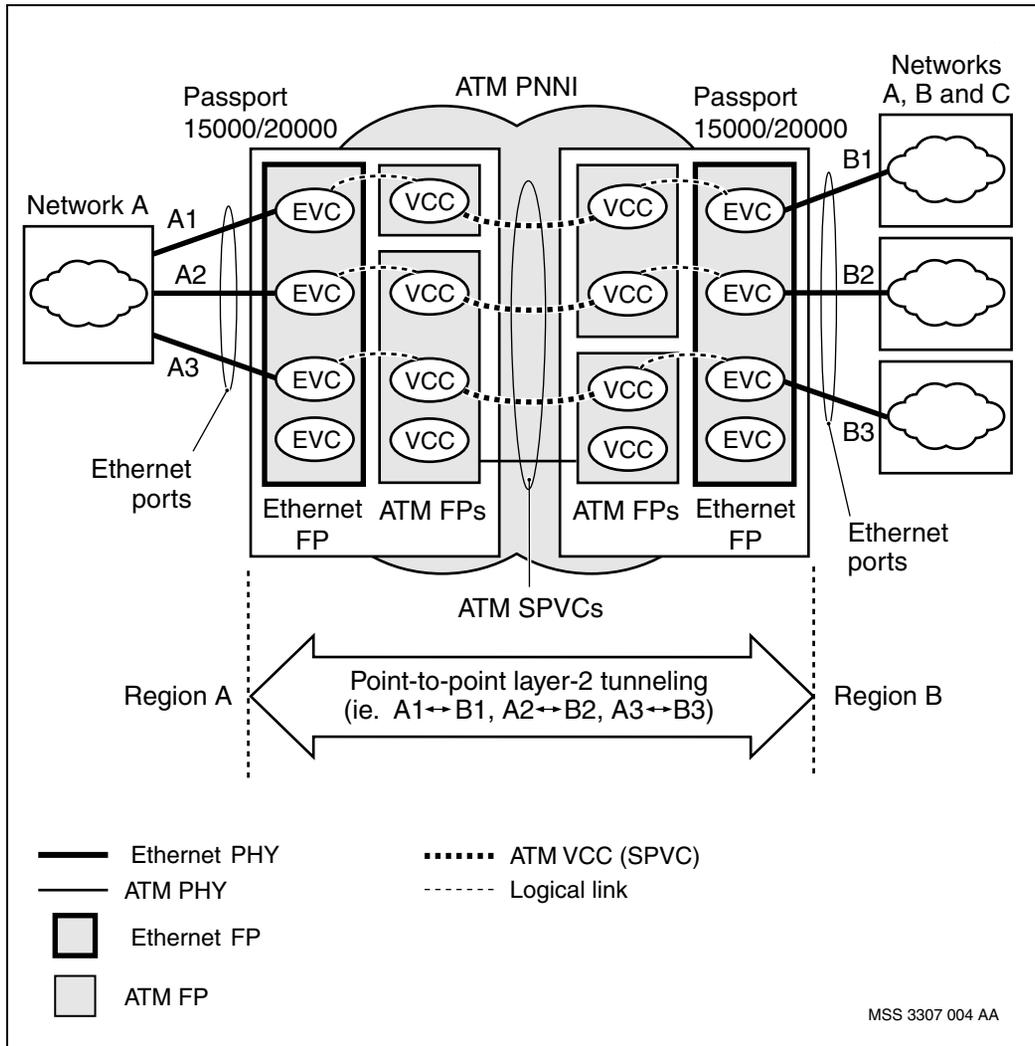
FPs supported	PEC
<b>Ethernet FPs</b>	NTHW49
4-port gigabit Ethernet (GQM)	NTHW49
<b>Tandem ATM FPs</b>	
1-port OC-48/STM-16 ATM (PQC2)	NTHW01EA, NTHW01FA
4-port OC-3/STM-1 ATM (PQC12)	NTHW05, NTHW15
4-port OC-12/STM-4 ATM (PQC12)	NTHW86BA, NTHW86CA, NTHW86CB
16-port OC-3/STM-1 ATM	NTHW21AA-09+, NTHW21AB

## 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 “EVLS end-to-end view” (page 135) for more information.

**Figure 46**  
**EVLS 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.
- After a CP switchover, the *AtmMpe* component may briefly indicate that it is disabled when it may be providing some service.
- The *Vr ProtocolPort* component may also indicate that it is briefly disabled.
- FP switchover behavior: ATM FP switchovers are not impacted.
- Software upgrade behavior: hitless software migration (HSM) is not supported for EVLS.
- Line automatic protection switching is not supported.

## Timers

The Ethernet virtual circuit (EVC) SPVC that interconnects Ethernet 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 EVC SPVC retries to connect to the remote endpoint indefinitely. If a call fails after the VCC has been successfully established, the EVC 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 EVC SPVC retry timer is provisioned per module. This timer is started after a release message is received by the LAN application. Upon its expiry, EVC starts the connection setup procedures. The timer is used by the EVC that has provisioned SPVC components as a calling endpoint.

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## Addressing

In Nortel Networks Multiservice Switch 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 Ethernet virtual line service (EVLS) feature uses NSAP addressing. It is necessary that the address mapping performs for EVC interwork with ATM using SPVCs. Only PNNI.0 dynamic routing and signalling is used to setup SPVCs. The NSAP address combined with a connection ID uniquely identifies any Ethernet virtual circuit (EVC) SPVC connection in the PNNI.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.

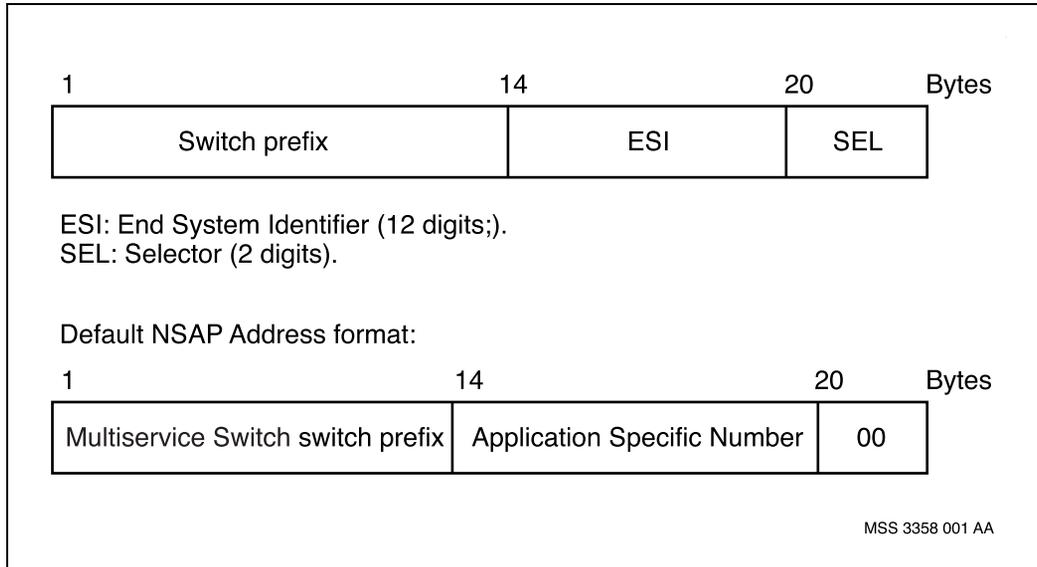
The NSAP address can be provisioned per LanApplication and per Ets, but it is recommended to allow EVLS and the ETS to generate the default NSAP address. Here is how the default NSAP address is built:

- Switch prefix (13 bytes) - the Multiservice Switch node 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-LanApplication and EthTransportSystem magic number (0x0020480d)
  - 4 bits application ID-LanApplication ID (0x8), EthTransportSystem ID (0x8)
  - 12 bits application instance-not applicable for EthTransportSystem

— 1 byte selective set to 0

For a breakdown of the NSAP address, see figure “NSAP address format” (page 138).

**Figure 47**  
**NSAP address format**



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## Chapter 10

# Frame data flows

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The frame formats of Ethernet traffic are solution dependent.

- “Frame data flows for VIPR and RFC2547 solutions” (page 139)
- “Frame data flows for EVLS” (page 139)

### Frame data flows for VIPR and RFC2547 solutions

Both Ethernet v2.0 and IEEE 802.3 frame formats are supported by the Ethernet interface on reception. Only Ethernet v2.0 frame formats are transmitted to the Ethernet interface.

### Frame data flows for EVLS

The Ethernet service provides a cut-through frame data flow from an Ethernet LAN to an ATM VCC and from an ATM VCC to an Ethernet LAN. See the following sections for more information:

- “EVLS frame formats” (page 140)
- “Ingress datapath (Ethernet LAN to ATM VCC)” (page 142)
- “Egress datapath (ATM VCC to Ethernet LAN)” (page 144)
- “Ingress datapath (VLAN-to-VCC (1:1) mapping)” (page 146)
- “Egress datapath (VLAN-to-VCC 1:1 mapping)” (page 148)
- “Ingress frame flow (VLAN-to-VCC N:1 mapping): Part 1 of 2” (page 151)
- “Egress frame flow (VLAN-to-VCC N:1 mapping): Part 1 of 2” (page 154)

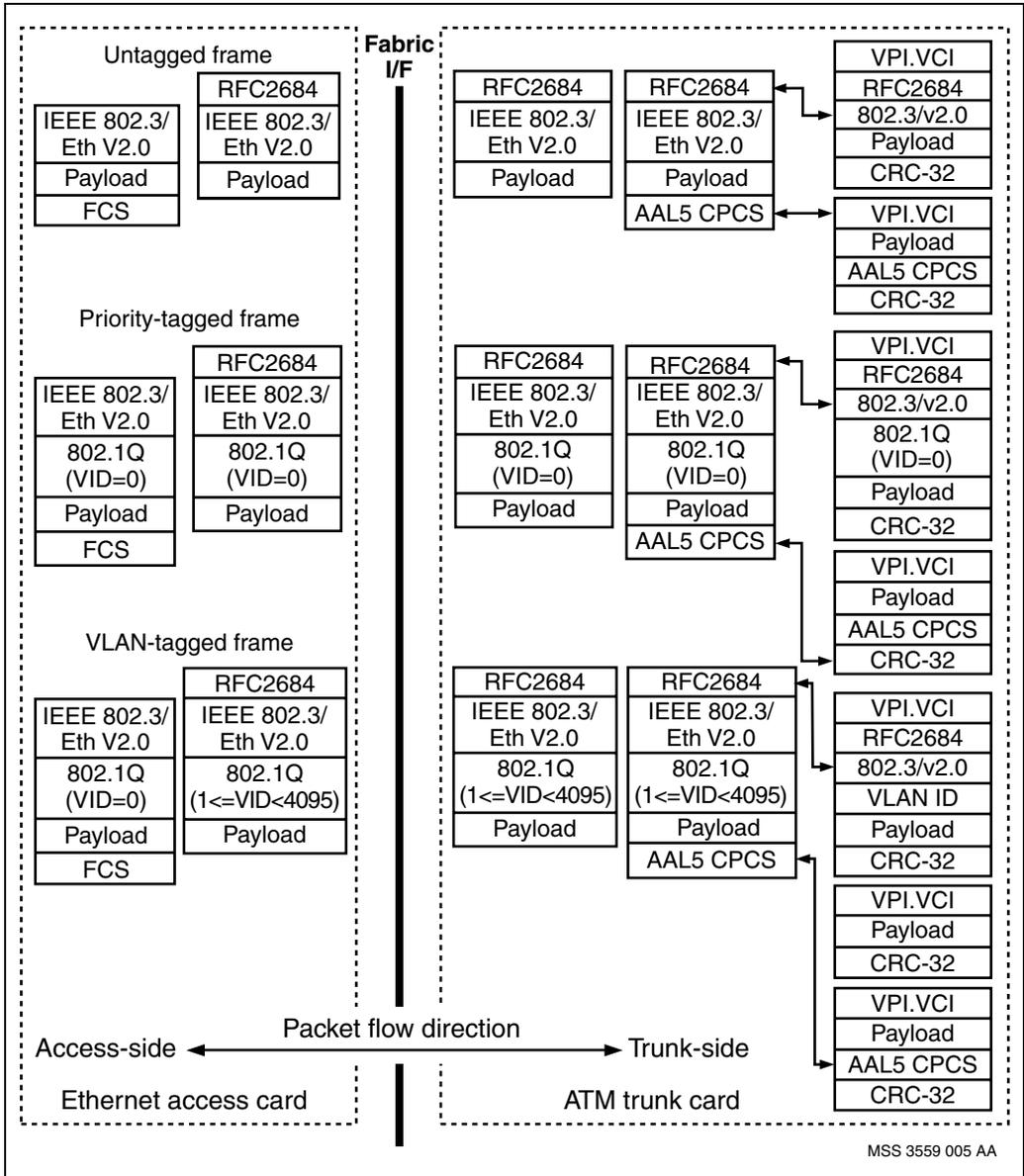
- “Packet modification and RFC2684 encapsulation” (page 156)

### **EVLS frame formats**

On reception of traffic from an Ethernet interface, both Ethernet v2.0 and IEEE 802.3 layer 2 header encapsulation are accepted. On transmission of traffic to the interface, Ethernet v2.0 and IEEE 802.3 layer 2 header encapsulation is sent.

See figure “EVLS frame formats” (page 141) for the data flow for all three types of frame formats.

**Figure 48**  
**EVLS frame formats**



## Ethernet policy rules

When EVLS is configured on a port-mode Ethernet interface, the *unknownVlanIdTreatment* attribute should be set to accept. In this case, all traffic received from the Ethernet interface is accepted. If the *unknownVlanIdTreatment* attribute is not set to accept, the default behavior is to discard all VLAN-tagged traffic, and to accept only untagged and priority-tagged traffic.

In VLAN mode the default behavior for the *unknownVlanIdTreatment* is to discard traffic received for a VLAN that is not configured on the Ethernet interface.

For more information about Ethernet policy rules, see the IP fundamentals chapter of NN10600-800 *Nortel Networks Multiservice Switch 7400/15000/20000 IP Technology Fundamentals*.

## Ingress datapath (Ethernet LAN to ATM VCC)

The ingress framer function block of the 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 compares the MAC Destination Address of the frame with the local port MAC address. If the addresses match, the frame is silently discarded. If the addresses do not match, the frame is further classified. The pre-classification function block assigns a fixed internal QoS corresponding to an emission priority (EP) and discard priority (DP) based on Ethernet perHopBehavior (PHB) for all received traffic per EVC.

The ingress network processor (NP) uses a configured single LAN or single VLAN to a single VCC (1:1) mapping to determine the 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.

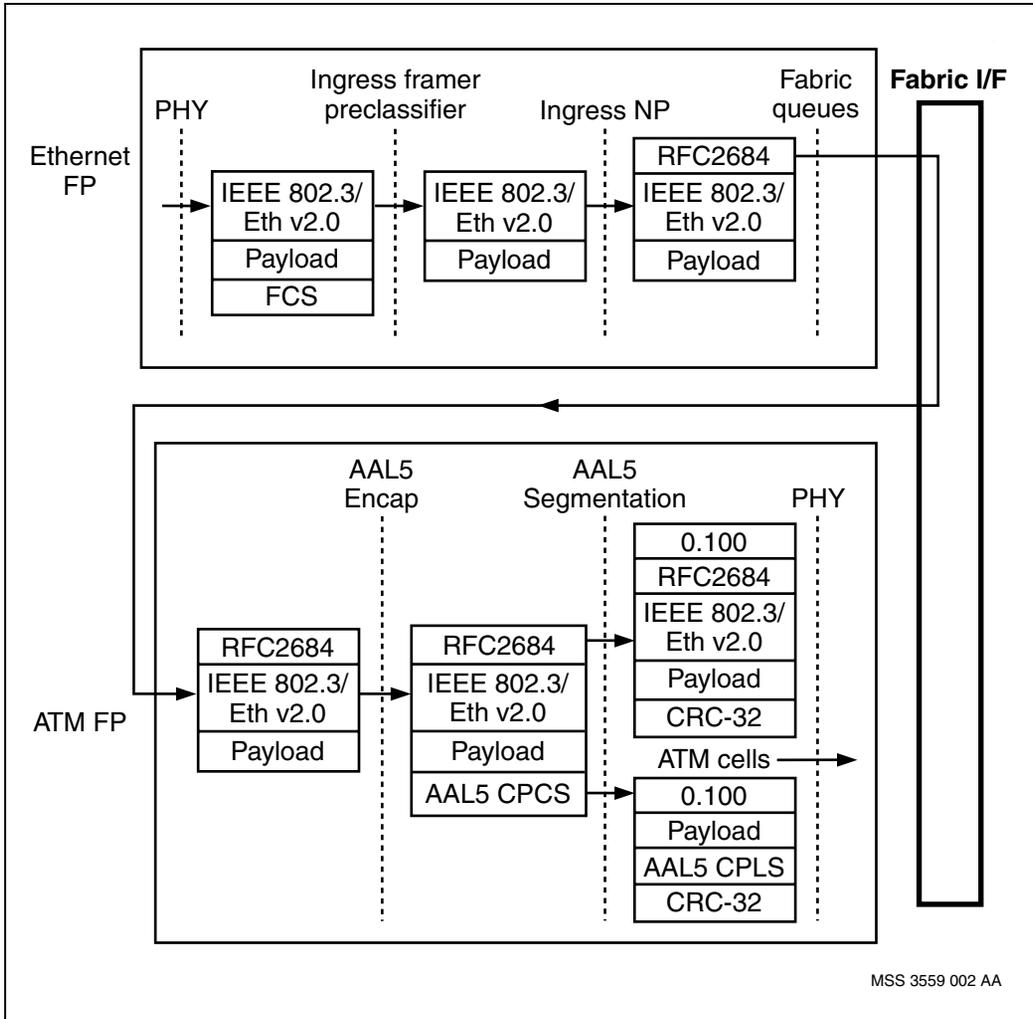
If the ingress NP can forward a frame, the frame is encapsulated using RFC2684 LLC encapsulation for bridged protocols.

On the ATM FP, frames are encapsulated with an AAL5 CPCS-PDU trailer and segmented into ATM cells by the AAL5 segmentation functional block of the Nortel Networks Multiservice Switch 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 (Ethernet LAN to ATM VCC)” (page 144) for more information.

**Figure 49**  
**Ingress frame flow (Ethernet LAN to ATM VCC)**



**Egress datapath (ATM VCC to Ethernet LAN)**

The ATM VCC on the ATM FP is configured to forward traffic to the egress Ethernet FP. Received cells on this VCC go through the AAL5 reassembly function block and assembled frames are forwarded to the LAN EVC on the egress Ethernet FP.

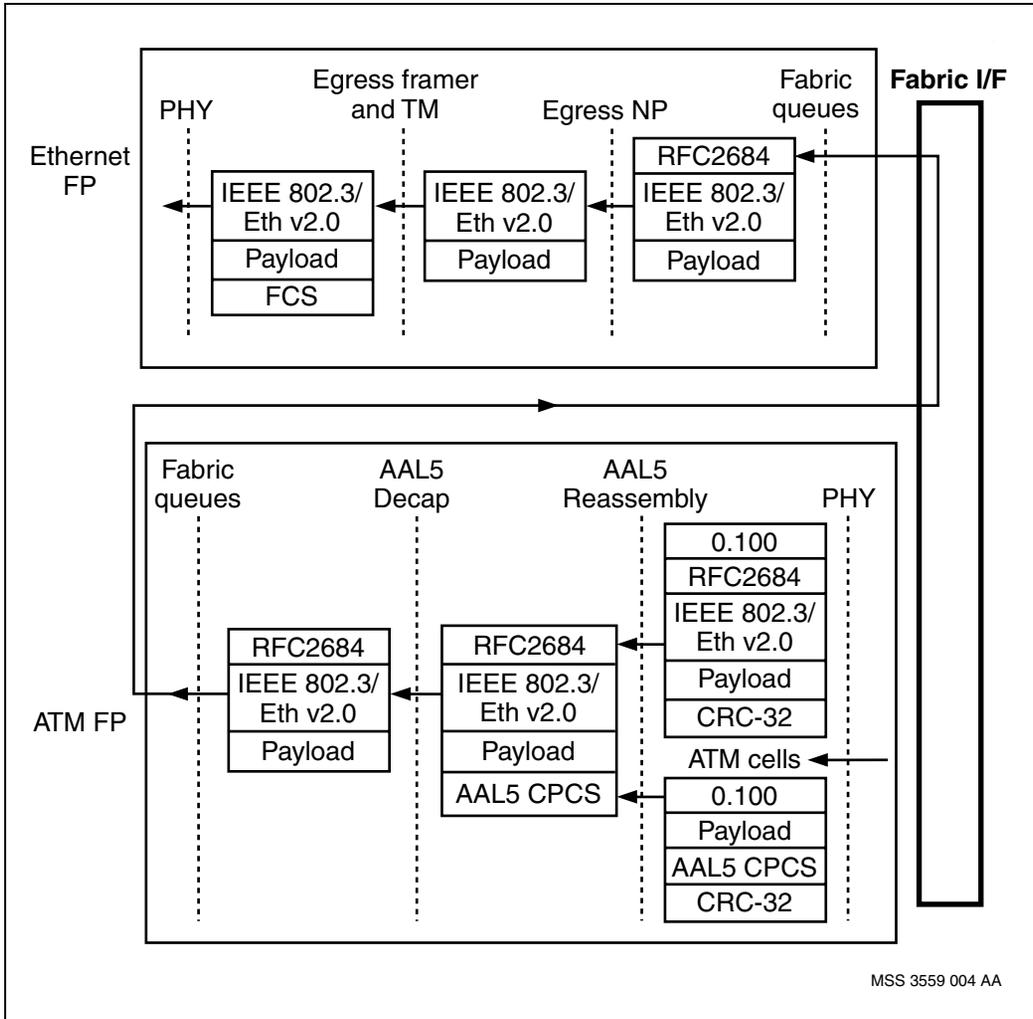
The egress NP removes the RFC2684 encapsulation and forwards the resulting packet to the Ethernet interface. The egress PHY device recalculates and adds the FCS to the packet before transmitting the frame on the port.

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

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

Refer to figure “Egress frame flow (ATM VCC to Ethernet LAN)” (page 146) for a visual representation of egress traffic and the path it takes.

**Figure 50**  
**Egress frame flow (ATM VCC to Ethernet LAN)**



### Ingress datapath (VLAN-to-VCC (1:1) mapping)

The ingress framer function block of the Ethernet FP perform frame delineation and validation, keeping numerous counts of both good and errored frames.

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

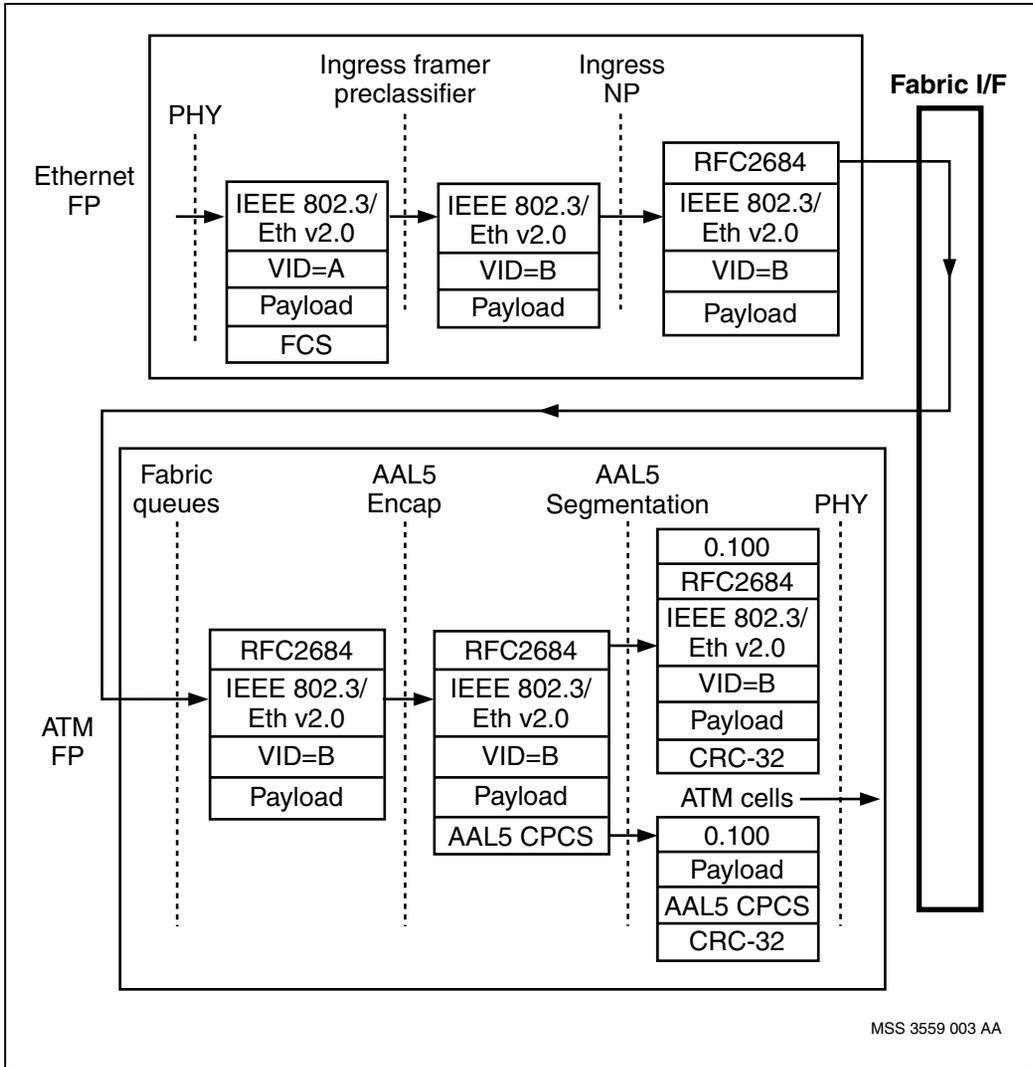
The pre-classification function block on the ingress datapath compares the MAC Destination Address of the frame with the local port MAC address. If the addresses match, the frame is silently discarded. If the addresses do not match, the frame is further classified. The pre-classification function block assigns a fixed internal QoS corresponding to an emission priority (EP) and discard priority (DP) based on Ethernet perHopBehavior (PHB) for all received traffic per EVC.

The ingress network processor (NP) uses a configured one-to-one VLAN to VCC on the tandem ATM FP. If the ingress NP can not forward a frame because either the VCC is down or the egress ATM FP is congested, the frame is discarded by the NP. If the ingress NP can forward a frame, it is encapsulated using RFC2684 LLC encapsulation for bridged protocols.

On the ATM FP, frames are encapsulated with an AAL5 CPCS-PDU trailer and segmented into ATM cells by the AAL5 segmentation functional block. The resulting ATM cells are placed on the outgoing VCC via the ATM traffic management device.

See figure “Ingress frame flow (VLAN-to-VCC 1:1 mapping)” (page 148).

**Figure 51**  
**Ingress frame flow (VLAN-to-VCC 1:1 mapping)**

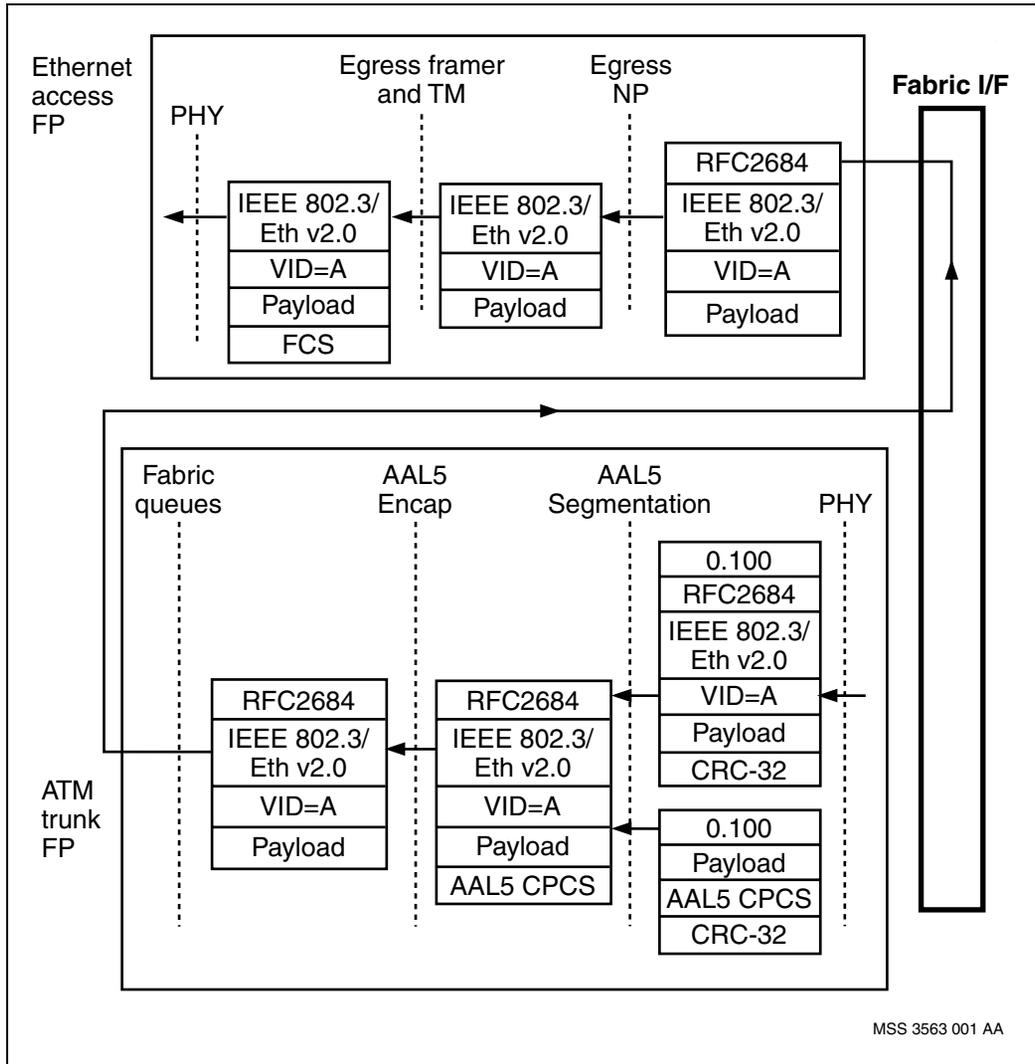


**Egress datapath (VLAN-to-VCC 1:1 mapping)**

ATM VCC on the ATM FP is configured with internal forwarding information pointing to VLAN associated with the ingress VCC.

See “Egress frame flow (VLAN-to-VCC 1:1 mapping)” (page 149) for more information.

**Figure 52**  
Egress frame flow (VLAN-to-VCC 1:1 mapping)



## **Ingress datapath (VLAN-to-VCC N:1 mapping)**

The ingress framer function block of the Ethernet FP perform frame delineation and validation, keeping numerous counts of both good and errored frames.

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

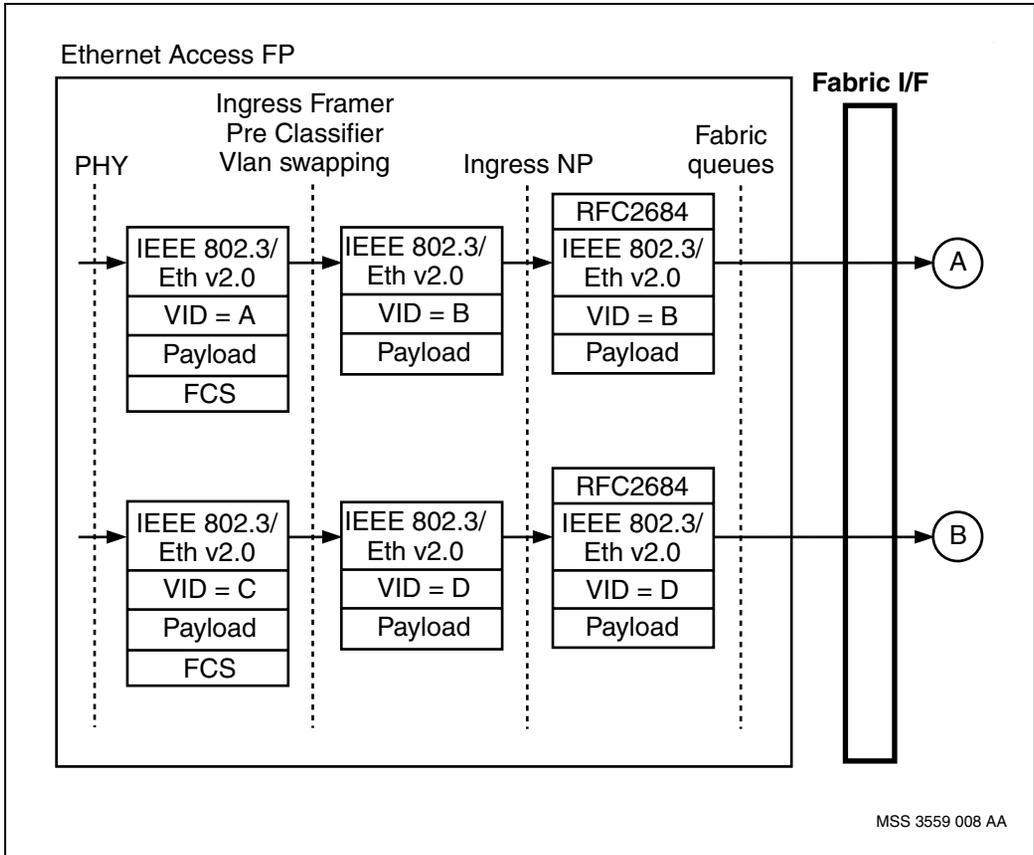
The pre-classification function block on the ingress datapath compares the MAC Destination Address of the frame with the local port MAC address. If the addresses match, the frame is silently discarded. If the addresses do not match, the frame is further classified. The pre-classification function block assigns a fixed internal QoS corresponding to an emission priority (EP) and discard priority (DP) based on Ethernet perHopBehavior (PHB) for all received traffic per EVC.

The ingress network processor (NP) uses a configured VLAN to VCC mapping to determine the egress VCC on the egress ATM FP. If the ingress NP can not forward a frame because either the VCC is down or the egress ATM FP is congested, the frame is discarded by the NP. If the ingress NP can forward a frame, it is encapsulated using RFC2684 LLC encapsulation for bridged protocols.

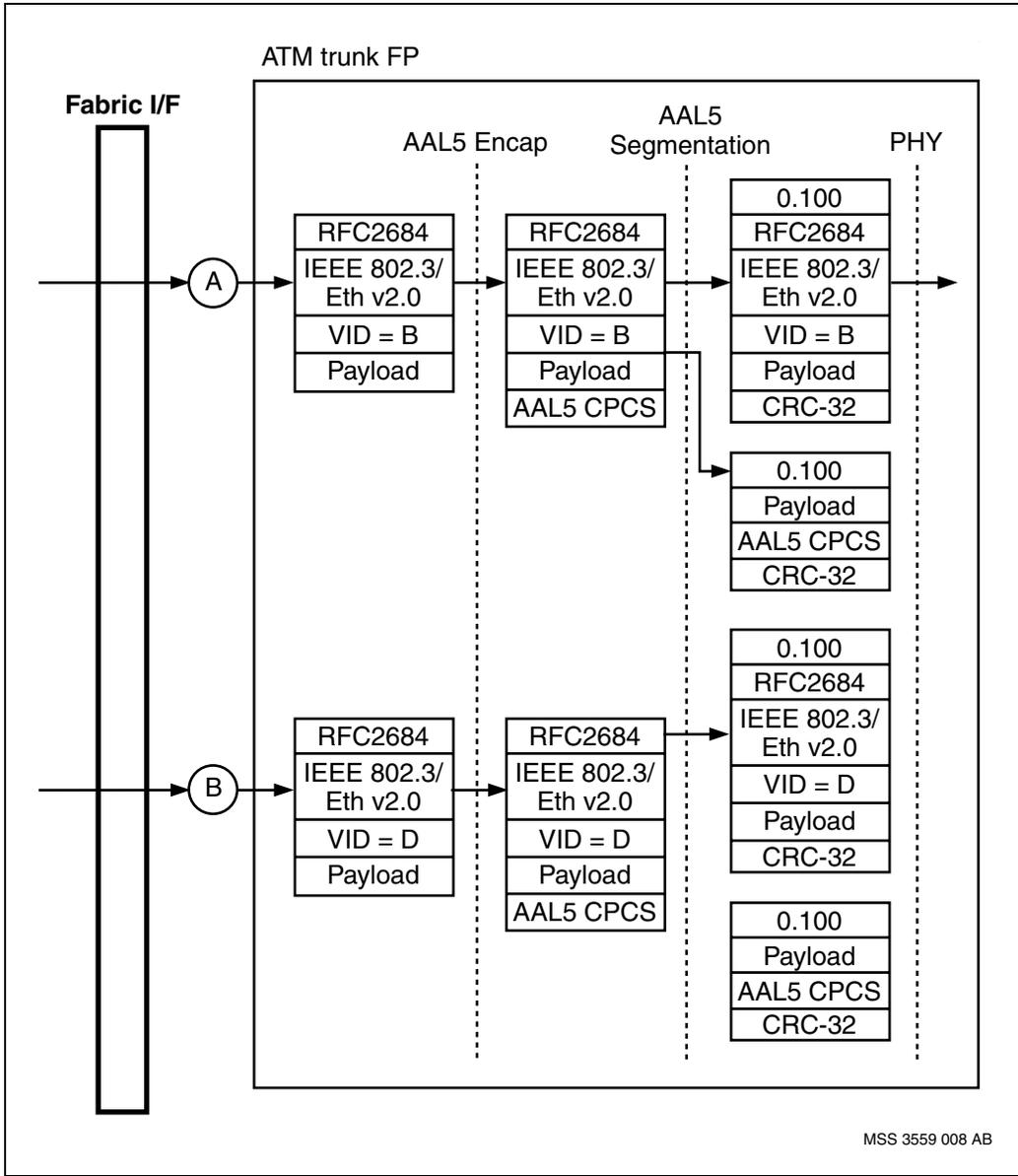
On the ATM FP, frames are encapsulated with an AAL5 CPCS-PDU trailer and segmented into ATM cells by the AAL5 segmentation functional block. The resulting ATM cells are placed on the outgoing VCC via the ATM traffic management device.

See figure “Ingress frame flow (VLAN-to-VCC N:1 mapping): Part 1 of 2” (page 151).

**Figure 53**  
**Ingress frame flow (VLAN-to-VCC N:1 mapping): Part 1 of 2**



**Figure 54**  
**Ingress frame flow (VLAN-to-VCC mapping N:1): Part 2 of 2**



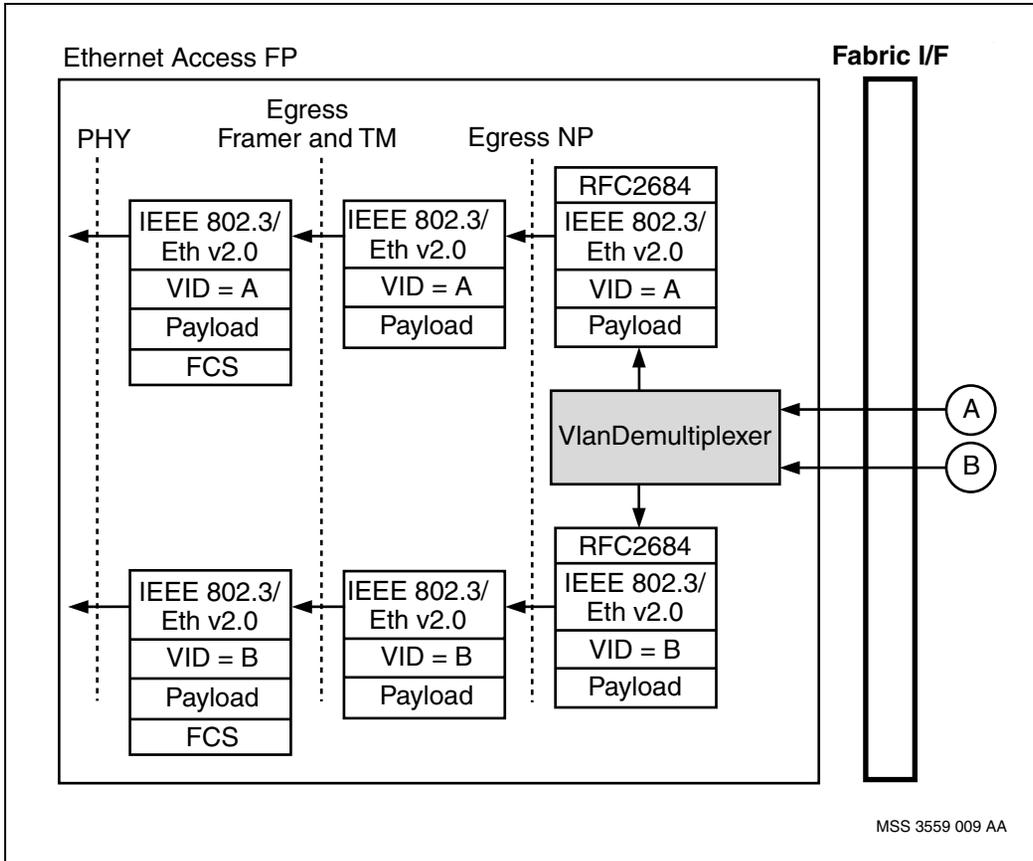
## **Egress datapath (VLAN-to-VCC N:1 mapping)**

The ATM transport VCC on the ATM FP is configured to forward AAL5 reassembled frames to the Ethernet FP. Received cells are processed by the AAL5 reassembly function block. Assembled frames are forwarded to the egress network processor (NP) on the Ethernet FP. The NP uses the EVLS VLAN demultiplexing table to identify and forward VLAN traffic to the corresponding VLAN EVC on the Ethernet interface.

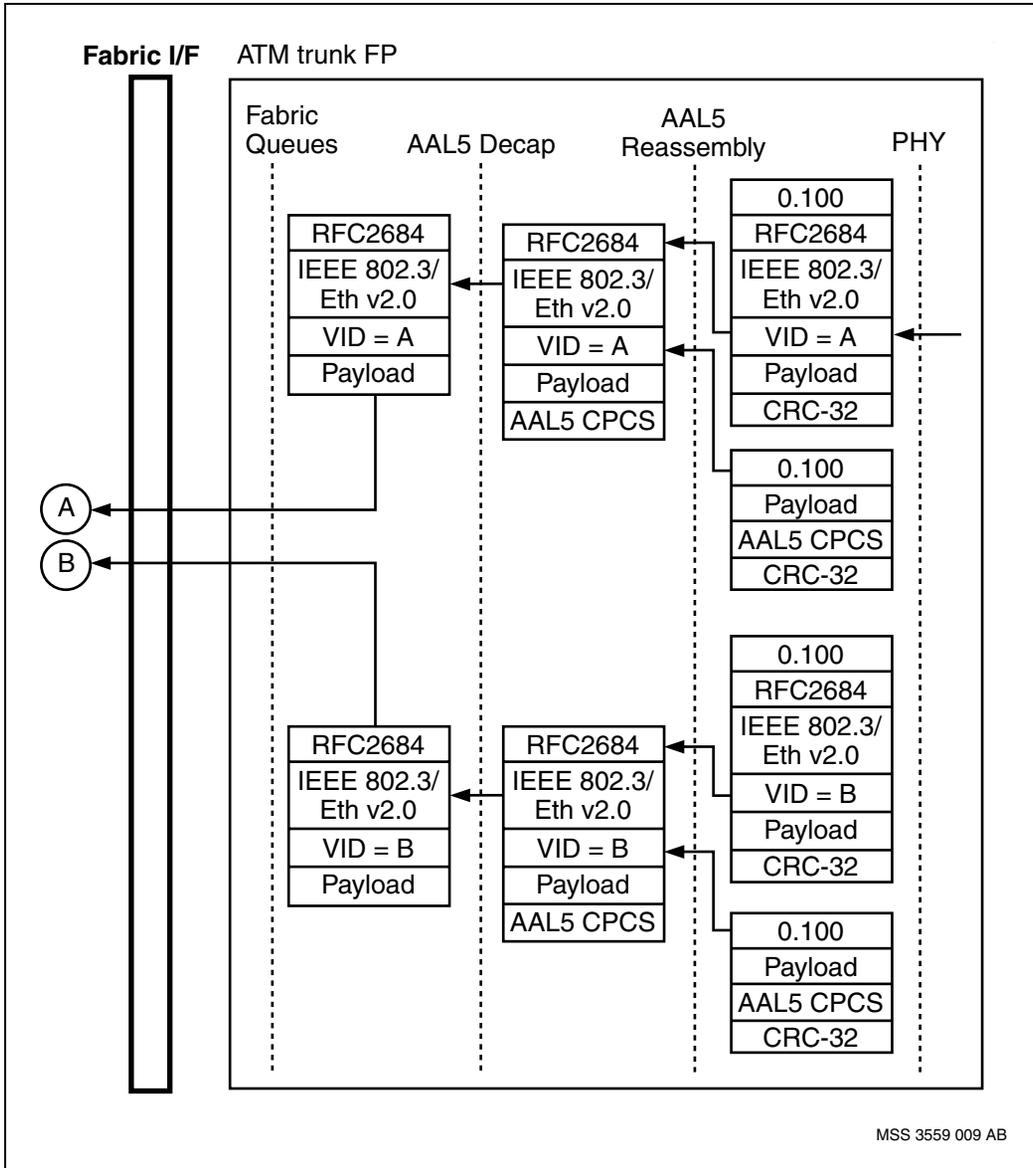
The egress FP removes the RFC2684 encapsulation and forwards the resulting packet to the Ethernet interface. The egress PHY device recalculates and adds the FCS to the packet before transmitting the frame on the port.

See “Egress frame flow (VLAN-to-VCC N:1 mapping): Part 1 of 2” (page 154) for more information.

**Figure 55**  
**Egress frame flow (VLAN-to-VCC N:1 mapping): Part 1 of 2**



**Figure 56**  
Egress frame flow (VLAN-to-VCC N:1 mapping) Part 2 of 2



## Packet modification and RFC2684 encapsulation

When an Ethernet frame is received from an Ethernet interface, the FCS is validated and stripped. The remainder of the frame may be further manipulated by EVLS based on the frame format and the Ethernet interface operating mode. EVLS uses RFC2684 LLC encapsulation for bridged PDUs to encapsulate the packet. The RFC2684 encapsulated packet is then forwarded to the ATM trunk FP for AAL5 transport. Each of these stages is described here.

RFC2684 describes two encapsulation methods for carrying network interconnect traffic over AAL5 ATM VCCs. Only one of these two methods is currently supported. This method is needed when more than one protocol might be carried over the same VC. With this method, the receiver requires that each AAL5 CPCS PDU explicitly identify the protocol of the routed or bridged PDU. This method is called LLC encapsulation and is the supported encapsulation method used by EVLS in this release. LLC encapsulation specifies both routed and bridged PDU formats. EVLS uses the bridged PDU format exclusively. See “LLC encapsulation for bridged protocols” (page 156) for more information on the supported encapsulation method.

### LLC encapsulation for bridged protocols

EVLS uses LLC encapsulation for bridged PDUs which requires that the SNAP header follow the LLC header. In the table “Frame format for bridged Ethernet/802.3 PDUs without FCS” (page 157), the LLC header is encoded as 0xAA-AA-03. The OUI value in the SNAP header is encoded as 0x00-80-C2 to represent the IEEE 802.1 organization code for MAC bridged PDUs. EVLS transports IEEE 802.3/Ethernet frames without FCS. As such, the type of the bridged media specified by the two octet PID in the SNAP header is encoded as 0x00-07. See “Frame format for bridged Ethernet/802.3 PDUs without FCS” (page 157).

**Table 3**  
**Frame format for bridged Ethernet/802.3 PDUs without FCS**

LLC 0xAA-AA-03
OUI 0x00-80-C2
PID 0x00-07
PAD 0x00-00
MAC destination address (remainder of MAC frame)



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## Chapter 11

# End-to-end EVLS solution

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The end-to-end Ethernet virtual line service (EVLS) solution, formerly known as the direct connection solution, establishes an Ethernet virtual circuit (EVC) between a pair of Ethernet interfaces. This solution originates and terminates the EVC on an Ethernet interface.

- “What is the end-to-end EVLS solution?” (page 159)
- “Benefits of the end-to-end EVLS solution” (page 159)
- “Configurations of the end-to-end EVLS solution” (page 160)

### What is the end-to-end EVLS solution?

The end-to-end EVLS solution establishes an Ethernet virtual circuit (EVC) using an ATM soft permanent virtual circuit (SPVC) VCC. The EVC originates and terminates on an Ethernet interface. The following configurations are supported for this solution:

- “LAN-to-LAN peer relationship” (page 160) (also known as Ethernet LAN-to-VCC mapping)
- “VLAN-to-VLAN (1:1) peer relationship” (page 161)
- “VLAN-to-VLAN (N:1) peer relationship” (page 163)

### Benefits of the end-to-end EVLS solution

The end-to-end EVLS solution offers the following benefits:

- 1 Ethernet virtual line service leverages existing ATM network infrastructure to cost effectively transport Ethernet traffic between a pair of Ethernet ports and a pair of Ethernet VLANs on Ethernet interfaces.

- 2 EVLS enables customer devices linked to this service to view the core network as a single point-to-point Ethernet wire.
- 3 EVLS provides the ability to offer many users on a single Ethernet interface connectivity to another Ethernet interface, via VLANs, across an ATM network. This enables the optimization of Ethernet resource utilization. Scalability of the ATM network is enhanced by enabling the aggregation of multiple VLANs at the access across the ATM network using shared VCCs.
- 4 Encapsulation of Ethernet frames using RFC2684 provides flexibility to interoperate with third party equipment at the remote access point of the ATM network.

## Configurations of the end-to-end EVLS solution

The following subsections describe three possible configurations available for the end-to-end EVLS solution.

### LAN-to-LAN peer relationship

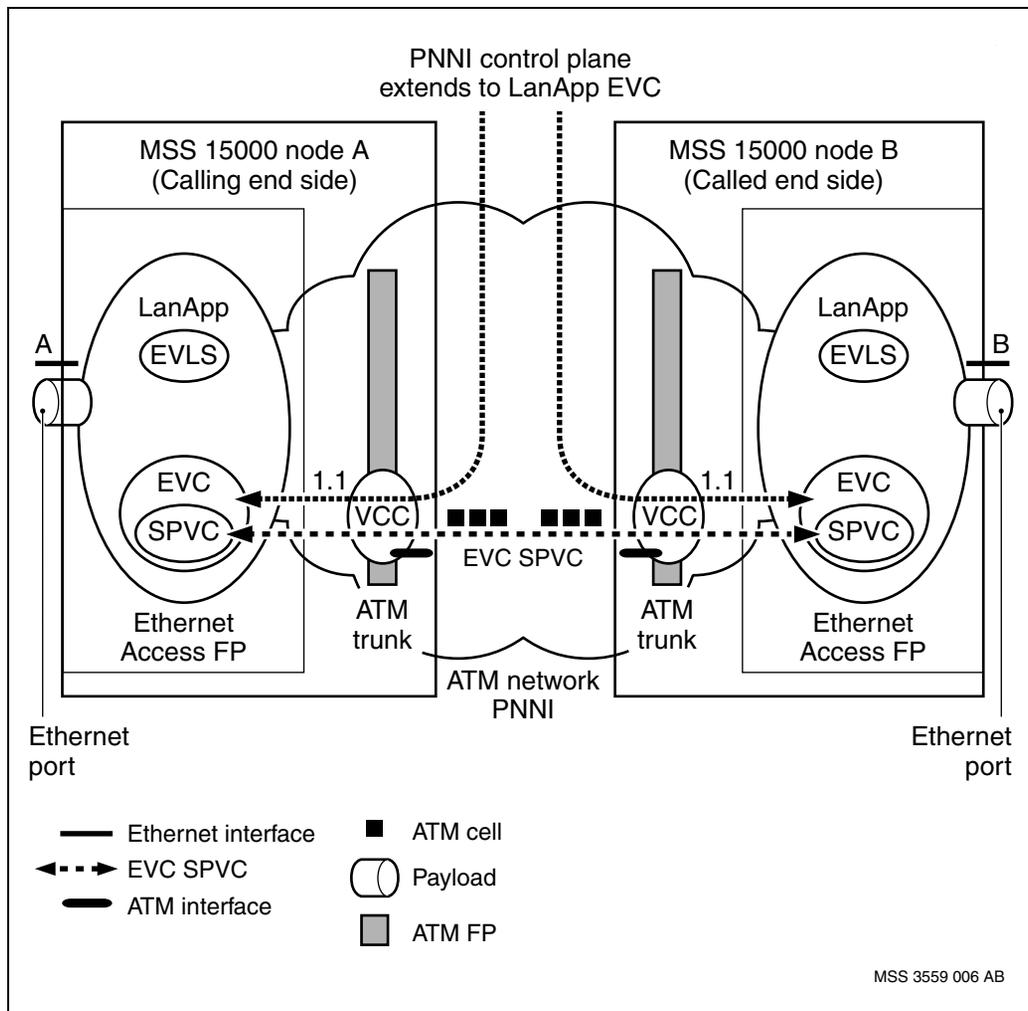
The Ethernet LAN-to-LAN mapping configuration establishes an EVC using a single ATM SPVC VCC, referred to as an EVC SPVC. This EVC SPVC is configured to originate on an Ethernet interface operating in port-mode and terminate on another Ethernet interface also operating in port-mode.

Up to 28 EVC SPVCs can be configured on a single Multiservice Switch 15000 or Multiservice Switch 20000 node. The maximum number of EVC SPVCs corresponds to the number of ports on the Ethernet FP. This implies that each EVC instance can only support one ATM service category because each EVC can only support on SPVC.

The *LanApp Evc SrcEvc remoteAddress* attribute is used to specify the EVC called end, at the provisioned EVC calling end. The *remoteAddress* attribute specifies the far end Ethernet interface.

See figure “LAN-to-LAN mapping” (page 161).

**Figure 57**  
LAN-to-LAN mapping



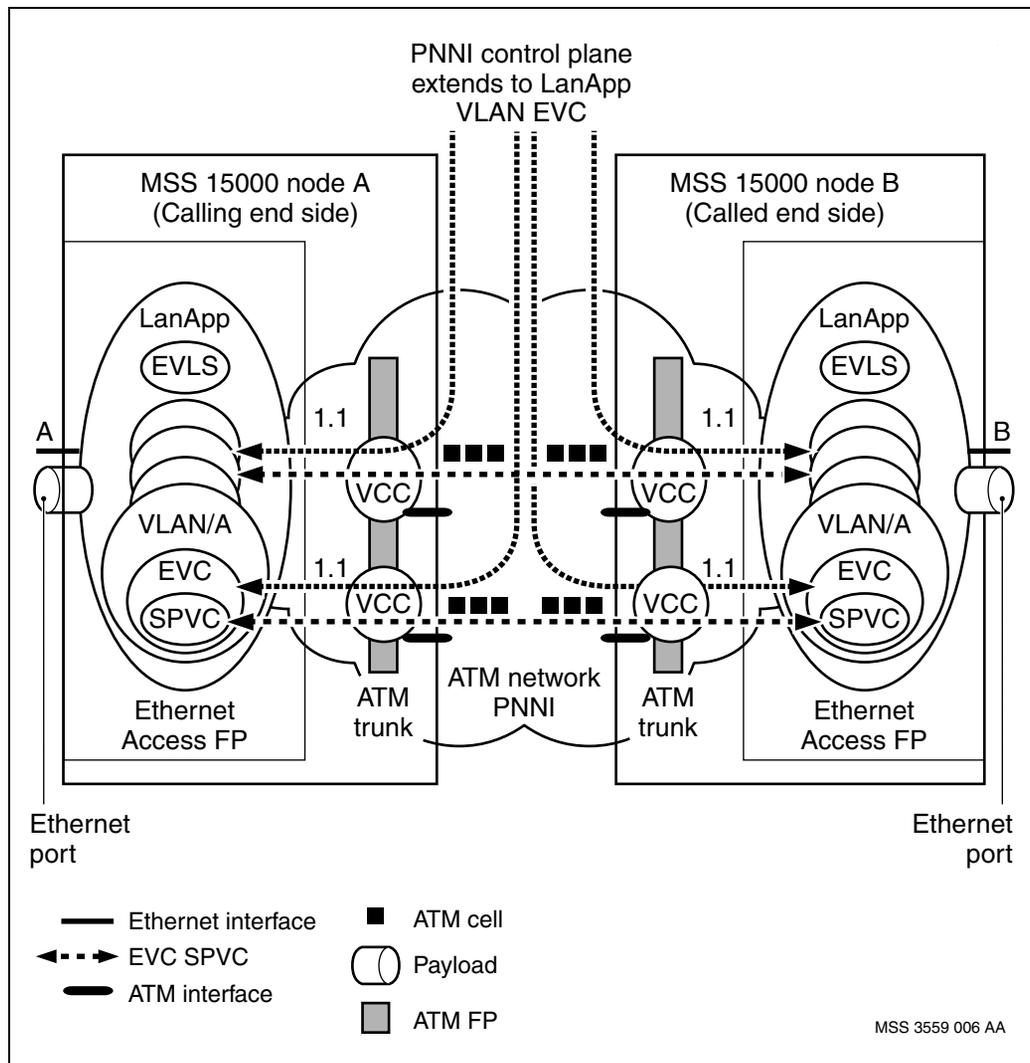
### VLAN-to-VLAN (1:1) peer relationship

An Ethernet virtual circuit (EVC) SPVC can be configured on each VLAN. Each EVC instance supports exactly one ATM service category because it is established using exactly one ATM SPVC. The *LanApp Vlan Evc SrcEvc* component is used to specify the EVC called end, at the provisioned EVC

calling `nd`. The *remoteAddress* attribute specifies the far end Ethernet interface. The *remoteVlanId* attribute specifies the LAN or VLAN identifier at the far end Ethernet interface that terminates the EVC. For the VLAN-to-VCC (1:1) mapping option, the *remoteVlanId* attribute must be set to the value of the far end VLAN identifier.

See figure “VLAN-to-VLAN (1:1) mapping” (page 163).

**Figure 58**  
**VLAN-to-VLAN (1:1) mapping**



### VLAN-to-VLAN (N:1) peer relationship

The Ethernet transport system (ETS) provides aggregation of traffic from multiple VLANs on a single Ethernet interface across a single ATM VCC. Figure “VLAN-to-VLAN (N:1) mapping” (page 165) illustrates a scenario in

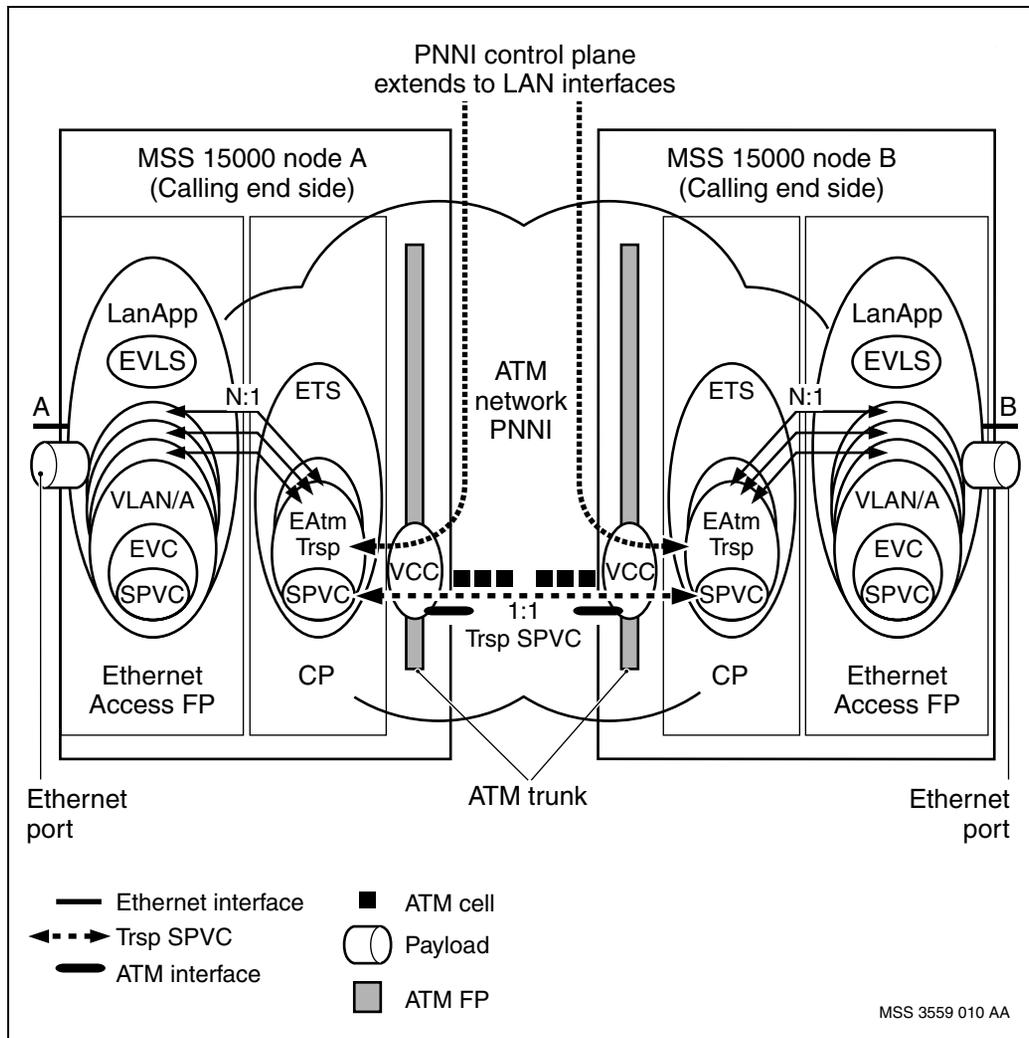
which traffic from multiple VLANs on a single Ethernet interface is aggregated by ETS onto a single VCC. All traffic that is aggregated onto a single ETS SPVC originates from the same Ethernet interface.

Each *EvlSAtmTransport* instance supports exactly one ATM service category because it is established using exactly one SPVC. Each *EvlSAtmTransport* instance is linked to exactly one Ethernet interface, represented by a *LanApplication* component instance, through the *EvlSAtmTransport lanApplication* attribute. This attribute defines which set of VLANs on a single Ethernet interface can use the *EvlSAtmTransport Spvc* as transport. The *EvlSAtmTransport SrcEAtmTransport remoteAddress* and *remoteAtmEvcId* attributes are used to define the called end of a provisioned calling SPVC. The *remoteAddress* attribute defines the ETS (node) for which the SPVC is destined and the *remoteEvlSAtmTransport* attribute defines the *EvlSAtmTransport* instance the dynamic called SPVC is created under.

VLANs are configured to use aggregation by setting the *LanApplication Vlan Evc aggregation* attribute to enabled. When aggregation is enabled for a VLAN, that VLAN solicits the ETS for a transport VC to carry its traffic to the configured destination with the specified Ethernet quality of service (QoS). If a transport VC is found, the VLAN is successfully linked to that transport VC. A match is found when the EVC originates from a *LanApplication* that matches the *lanApplication* linked to the *EvlSAtmTransport*, and the *remoteAddress* of the EVC matches the *prefixNsapAddress* of the *EvlSAtmTransport* exactly. When that ATM transport VC is configured with an ATM service category that can satisfy the specified EVC Ethernet per hop behavior (PHB), then the VLAN can send its traffic using that ATM transport VC. Since each *EvlSAtmTransport* instance has a unique *lanApplication-prefixNsapAddress* pair, the VLAN search for transport can only provide at most one match. Even if there is no enabled SPVC, or the SPVC has a non-matching service category, the VLAN is linked to the *EvlSAtmTransport* instance if a match is found.

See figure “VLAN-to-VLAN (N:1) mapping” (page 165).

**Figure 59**  
**VLAN-to-VLAN (N:1) mapping**





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## Chapter 12

# Single-ended EVLS solution

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The single-ended EVLS solution allows the transport of Ethernet frames between an Ethernet interface and an ATM UNI. This solution is achieved by configuring the Ethernet virtual circuit (EVC) SPVC to terminate on an ATM interface (AtmIf) instead of an Ethernet interface (LanApplication). This solution was formerly known as the hairpin solution.

- “What is the single-ended EVLS solution?” (page 167)
- “Benefits of the single-ended EVLS solution” (page 169)
- “Configurations of the single-ended EVLS solution” (page 169)

### What is the single-ended EVLS solution?

The single-ended EVLS solution establishes an Ethernet virtual circuit (EVC) using an ATM soft permanent virtual circuit (SPVC) VCC. The EVC is configured to terminate on a tandem ATM interface. The following configurations are supported for this solution:

- “LAN-to-ATM UNI mapping” (page 169)
- “VLAN-to-ATM UNI mapping (1:1)” (page 171)
- “VLAN-to-ATM UNI mapping (N:1)” (page 173)

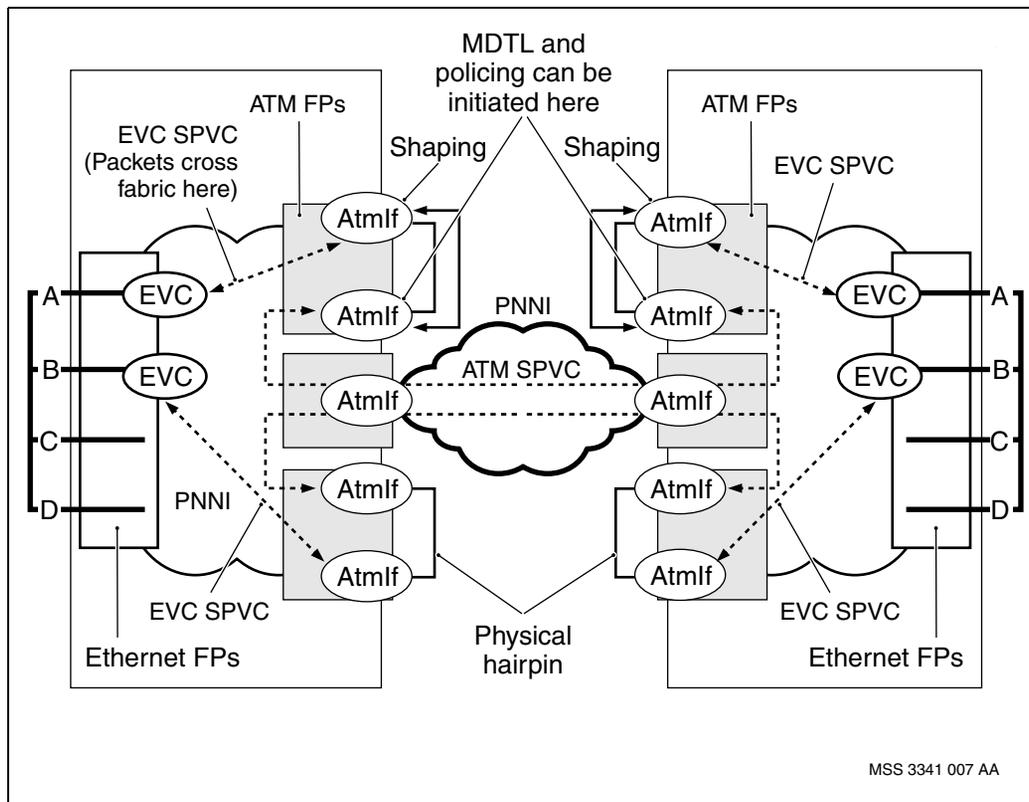
### Performance enhancement solution

A performance enhancement solution can be achieved by using the single-ended EVLS solution. The EVC must terminate on an ATM interface that is hairpinned to a second ATM interface. Both sides of the hairpinned

interface must be configured as ATM UNI interfaces. With this configuration, MDTL, EBR/DBR, and policing of Ethernet traffic based on ATM cell rates are supported at the hairpinned ATM interface.

See figure “EVLS performance enhancement solution” (page 168) for a graphical representation of this solution.

**Figure 60**  
**EVLS performance enhancement solution**



Failure in an EVC segment or the tandem ATM segment(s) is not relayed between the segments. As a result, traffic accepted by an EVC may be discarded in the network.

Proper network engineering of this solution requires that both configured EVCs ATM SPVC traffic management parameters, and the configured tandem ATM VCC(s) traffic management parameters all match.

## Benefits of the single-ended EVLS solution

The single-ended EVLS solution offers the following benefits:

- 1 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.
- 2 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 NN10600-702 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*.
- 3 The maximum throughput for ATM connections is supported.

## Configurations of the single-ended EVLS solution

The Ethernet transport system (ETS) provides aggregation of traffic from multiple VLANs on a single Ethernet interface across a single ATM VCC. Figure “VLAN-to-ATM UNI (N:1) mapping” (page 175) illustrates a scenario in which traffic from multiple VLANs on a single Ethernet interface is aggregated by ETS onto a single VCC. All traffic that is aggregated onto a single ETS SPVC originates from the same Ethernet interface.

### LAN-to-ATM UNI mapping

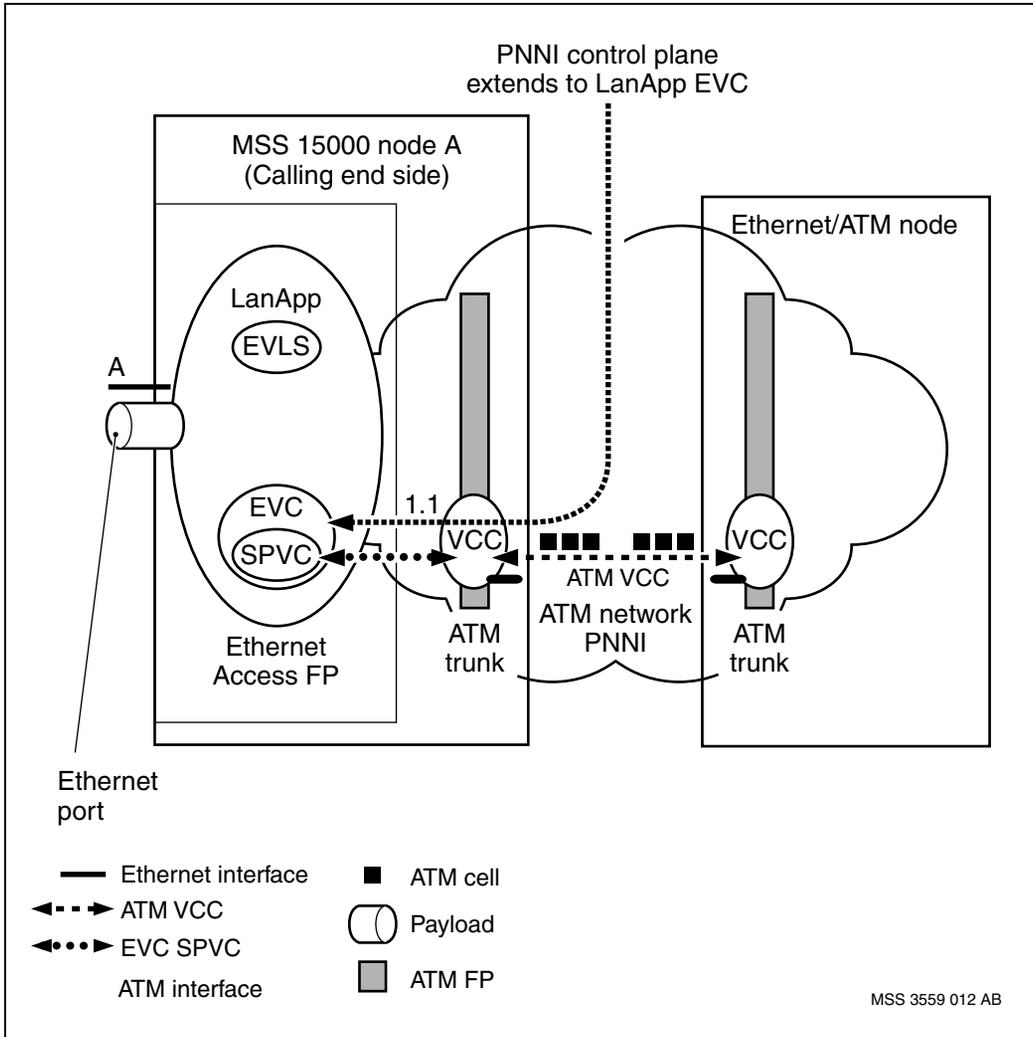
The Ethernet LAN-to-ATM UNI mapping configuration establishes an EVC using a single ATM SPVC VCC, referred to as an EVC SPVC. This EVC SPVC is configured to originate on an Ethernet interface operating in port-mode and terminate on ATM UNI interface.

Up to 28 EVC SPVCs can be configured on a single Multiservice Switch 15000 or Multiservice Switch 20000 node. The maximum number of EVC SPVCs corresponds to the number of ports on the Ethernet FP. This implies that each EVC instance can only support one ATM service category because each EVC can only support one SPVC.

The *LanApp Evc SrcEvc remoteAddress* attribute is used to specify the ATM UNI at the far end, at the provisioned EVC calling end. The *remoteAddress* attribute specifies the far end ATM UNI interface.

See figure “LAN-to-ATM UNI mapping” (page 171).

**Figure 61**  
**LAN-to-ATM UNI mapping**



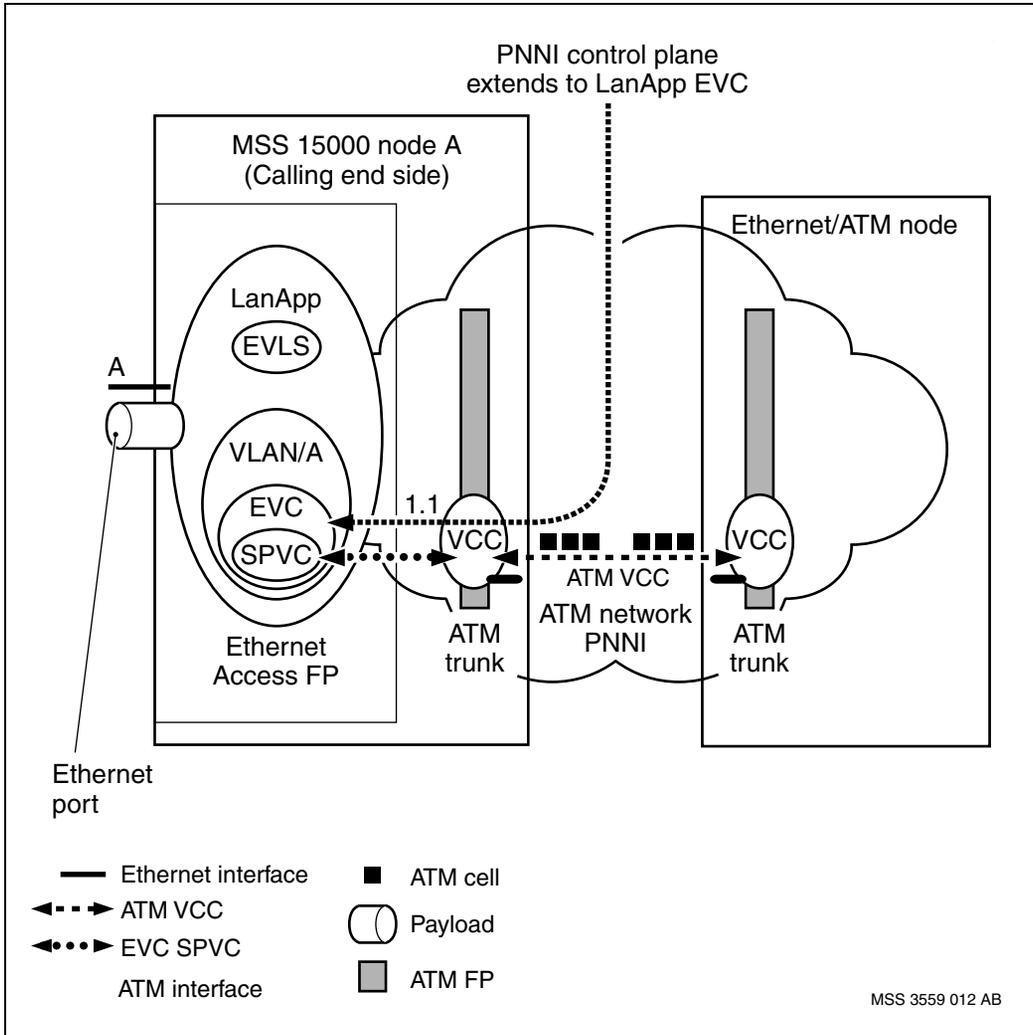
### VLAN-to-ATM UNI mapping (1:1)

An Ethernet virtual circuit (EVC) SPVC can be configured on each VLAN. Each EVC instance supports exactly one ATM service category because it is established using exactly one ATM SPVC. The *LanApp Vlan Evc SrcEvc*

component is used to specify the EVC called end, at the provisioned EVC calling end. The *remoteAddress* attribute specifies the far end ATM UNI interface. The *remoteVlanId* attribute does not have a default value and therefore needs to be provisioned.

See figure “VLAN-to-ATM UNI (1:1) mapping” (page 173).

**Figure 62**  
**VLAN-to-ATM UNI (1:1) mapping**



### VLAN-to-ATM UNI mapping (N:1)

The Ethernet transport system (ETS) provides aggregation of traffic from multiple VLANs on a single Ethernet interface across a single ATM VCC. Figure “VLAN-to-ATM UNI (N:1) mapping” (page 175) illustrates a

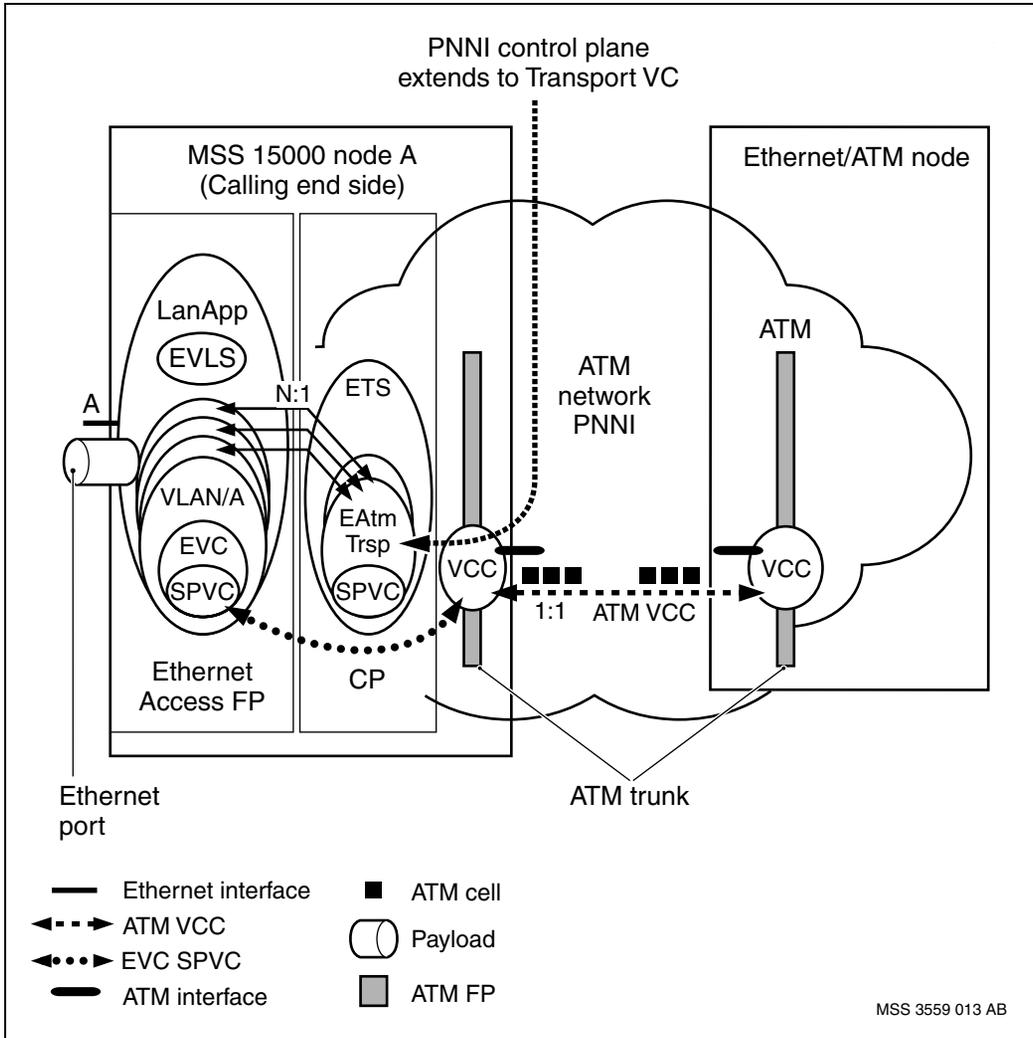
scenario in which traffic from multiple VLANs on a single Ethernet interface is aggregated by ETS onto a single VCC. All traffic that is aggregated onto a single ETS SPVC originates from the same Ethernet interface.

Each *EvlSAtmTransport* instance supports exactly one ATM service category because it is established using exactly one SPVC. Each *EvlSAtmTransport* instance is linked to a exactly one Ethernet interface, represented by a *LanApplication* component instance, through the *EvlSAtmTransport lanApplication* attribute. This attribute defines which set of VLANs on a single Ethernet interface can use the *EvlSAtmTransport Spvc* as transport. The *remoteAddress* attribute is used to define the called end of a provisioned calling SPVC. The *remoteAddress* attribute defines the remote ATM UNI interface for which the SPVC is destined.

VLANs are configured to use aggregation by setting the *LanApplication Vlan Evc aggregation* attribute to enabled. When aggregation is enabled for a VLAN, that VLAN solicits the ETS for a transport VC to carry its traffic to the configured destination with the specified Ethernet quality of service (QoS). If a transport VC is found, the VLAN is successfully linked to that transport VC. A match is found when the EVC originates from a *LanApplication* that matches the *lanApplication* linked to the *EvlSAtmTransport*, and the *remoteAddress* of the EVC matches the *prefixNsapAddress* of the *EvlSAtmTransport* exactly. When that ATM transport VC is configured with an ATM service category that can satisfy the specified EVC Ethernet per hop behavior (PHB), then the VLAN can send its traffic using that ATM transport VC. Since each *EvlSAtmTransport* instance has a unique *lanApplication-prefixNsapAddress* pair, the VLAN search for transport can only provide at most one match. Even if there is no enabled SPVC, or the SPVC has a non-matching service category, the VLAN is linked to the *EvlSAtmTransport* instance if a match is found.

See figure “VLAN-to-ATM UNI (N:1) mapping” (page 175).

**Figure 63**  
**VLAN-to-ATM UNI (N:1) mapping**





## Chapter 13

# Traffic management and Ethernet-ATM interworking

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This section describes the relationship between the traffic management performed by the Ethernet FP and the ATM FP.

- “Proper network engineering” (page 177)
- “Traffic management features” (page 177)
- “Stages of congestion management” (page 178)
- “Back pressure notification mechanism” (page 179)
- “Conversion from Ethernet to ATM traffic parameters” (page 179)

### 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 Ethernet FP can 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 Ethernet FP or the ATM FP due to congestion.

### Traffic management features

The Ethernet FP supports the following traffic management features:

- one internal QoS per Ethernet virtual circuit (EVC) for all ingress traffic on all Ethernet ports. A maximum of four internal QoS per port is supported.

- one configurable service category for each Ethernet virtual circuit (EVC) 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 NN10600-706 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals*.

EVLS introduces the following capabilities:

- RFC2684 LLC encapsulation for bridged protocols
- VLAN EVC
- configurable single QoS per EVC
- aggregation of VLAN EVCs between a pair of Ethernet interfaces
- alignment of traffic management parameters with the MEF draft
- single-ended configuration of ATM SPVCs in non-aggregated mode

## Stages of congestion management

Traffic management is handled by four functions: traffic policing, congestion management, traffic shaping, and network engineering. The first three of these four functions operate at five different stages of traffic flow. These five stages occur incrementally and sequentially until congestion on an ATM FP ends.

- 1 The first stage occurs at the network level. Overall end-to-end traffic management is managed through VCC traffic descriptor configuration.
- 2 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.
- 3 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.

- 4 The fourth stage occurs at the Ethernet access FP to avoid discarding traffic.
- 5 The fifth stage occurs at the 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 Nortel Networks Multiservice Switch 15000 or Multiservice Switch 20000 node's back pressure mechanism in the ingress direction (towards the network). See "Back pressure notification mechanism" (page 179) for more information.

Congestion does not occur on the Ethernet 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 Ethernet port. As a result, congestion management mechanisms on the Ethernet FP are not necessary. However, congestion may occur on the ATM FP, therefore triggering the back pressure mechanism. For information on the back pressure mechanism, see "Back pressure notification mechanism" (page 179).

## 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 Ethernet FP. The access Ethernet FP then performs its own throttling until congestion abates or it becomes congested. When the access Ethernet FP becomes congested, it commences discarding newly arriving Ethernet traffic that cannot be forwarded to the egress ATM FP.

*Note:* All access FPs that are generating traffic towards the congested ATM FP are throttled in an attempt to abate the congestion condition on the 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. A summary of the traffic parameter mapping options is provided in Figure "Ethernet to ATM traffic mapping options"

(page 181). For all of the options presented in this figure, it is assumed that the ATM connections will have a service category of either nrt-vbr or ubr. The calculation of the ATM traffic parameters can be based on typical, mean, or maximum frame size. The options presented take into account the ATM overhead encountered when an Ethernet frame is converted to ATM cells via AAL5 adaptation. It is also 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 than the computed PCR should not be less than the bandwidth or the sustained rate.

**Figure 64**  
**Ethernet to ATM traffic mapping options**

**1. Service Category: CBR**

$PCR_{0+1} = (CIR + EIR) \times \text{overheadFactor}(n) / (53 \times 8) \text{ cells/s}$   
 Engineering guidelines: ETH EF specify CIR, AF specify CIR/CBS/  
 EIR, DF specify EIR. Not enforced.  
 The resulting (CIR + EIR) should not be greater than AR.

**2. Service Category: rt-VBR**

$PCR_{0+1} = (CIR + EIR) \times \text{overheadFactor}(n) / (53 \times 8) \text{ cells/s}$   
 The resulting (CIR + EIR) should not be greater than AR.

$SCR_0 = CIR \times \text{overheadFactor}(n) / (53 \times 8) \text{ cells/s}$

$MBS_0 = [CBS / (1 - CIR/AR) + 1] \times \text{overheadFactor}(n) / (53 \times 8) \text{ cells}$

**3. Service Category: nrt-VBR (VBR.3)**

$PCR_{0+1} = (CIR + EIR) \times \text{overheadFactor}(n) / (53 \times 8) \text{ cells/s}$   
 The resulting (CIR + EIR) should not be greater than AR.

$SCR_0 = CIR \times \text{overheadFactor}(n) / (53 \times 8) \text{ cells/s}$

$MBS_0 = [CBS / (1 - CIR/AR) + 1] \times \text{overheadFactor}(n) / (53 \times 8) \text{ cells}$

**4. Service Category: UBR**

$PCR_{0+1} = (CIR + EIR) \times \text{overheadFactor}(n) / (53 \times 8) \text{ cells/s}$

Where:

$\text{overheadFactor}(n) = \text{ceiling}[(n + n + h_E + h_{rfc2684} + h_{trailer} - h_{FCS}) / 48] \times 53 / (n + h_E)$   
 ceiling(y) gives the number y rounded to the next largest integer  
 n represents the average frame size

The Ethernet service classes mapping is the Ethernet to ATM mapping method used. This method can be used for the following reasons: service availability, cost, bandwidth sharing.

Mapping between the ATM quality of service (QoS) class and the Ethernet per hop behavior (PHB) is chosen as follows:

- expedited forwarding (EF) --> traffic class = premium --> connection class = 3 (defaults to CBR)
- assured forwarding (AF31)--> traffic class = gold --> connection class = 2 (defaults to rt-VBR)
- AF21 --> traffic class = silver --> connection class = 1 (defaults to nrt-VBR)
- default forwarding (DF) --> traffic class = standard --> connection class = 0 (defaults to UBR)

The ATM service traffic parameters can be defined for each service category as shown in table “ATM service categories and parameters” (page 182).

**Table 4**  
**ATM service categories and parameters**

Traffic Parameters	ATM layer service category			
	CBR	rt-VBR	nrt-VBR	UBR
PCR and CDVT	specified			
SCR, MBS, CDVT	not applicable	specified		not applicable

There are alternatives to the mapping of Ethernet PHB to ATM service categories and ATM emission priority queues aimed at achieving end-to-end traffic performance requirements for the different types of services. The recommended mapping arrangement depends on the specific service mix carried by the network as well as the network designers strategy to support the different services' service category requirements.

Table “Ethernet PHB to ATM service category mapping” (page 183) presents a possible arrangement (Mapping A) for the mapping of frame-based services given certain Ethernet PHB to ATM service categories and therefore to different emission priority queues. This table represents the following:

- the CBR service category is assigned to cell relay (ATM bearer service) connections carrying circuit emulation service, requiring stringent cell delay variation performance targets
- traffic streams of multi-media services such as packetized voice with speech activity detection (SAD) are assigned the Ethernet PHB of expedited forwarding (EF) and are mapped to the CBR service category
- delay sensitive interactive data services, in particular with small frame sizes, are assigned the Ethernet PHB of AF3 and are mapped to the VBR-rt service category
- delay tolerant interactive data applications, in particular with relatively larger frame size, are assigned the Ethernet PHB of AF2 and are mapped to the VBR-nrt service category
- file transfer applications are assigned the Ethernet PHB of DF and are mapped to the UBR service category

**Table 5**  
**Ethernet PHB to ATM service category mapping**

Traffic type (examples)	Ethernet PHB (ePhb)	ATM	
		Service category	CLP
multimedia (for example, packetized voice)	EF	CBR	0
interactive (delay sensitive)	AF31	VBR-rt	0
transaction (delay tolerant, guaranteed bandwidth)	AF21	VBR-nrt	0
best effort	DF	UBR	0

Table “ATM service category to Ethernet emission priority mapping” (page 184) presents the ATM discard priority assigned to the ATM cell stream corresponding to CLP=0. Traffic streams for different ATM service categories with CLP=1 are all mapped to the lowest discard priority (DP3).

**Table 6**  
**ATM service category to Ethernet emission priority mapping**

ATM service category	Ethernet		
	Service class defaults	Emission priority	Discard priority
CBR	3	2	DP1
VBR-rt	2	3	DP1
VBR-nrt	1	5	DP2
UBR	0	7	DP3

Ethernet uses the following parameters:

- CIR: committed information rate
- EIR: excess information rate
- CBS: committed burst size
- EBS: excess burst size

ATM uses the following parameters:

- PCR: peak cell rate in cells/second
- CDVT: cell delay variation tolerance
- 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)

See figure “Ethernet to ATM traffic mapping options” (page 181) for the equations that 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:

**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 NN10600-551 *Nortel Networks Multiservice Switch 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.

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. A result of this inexact conversion is an overhead factor. For more information, see “Overhead factor” (page 185).

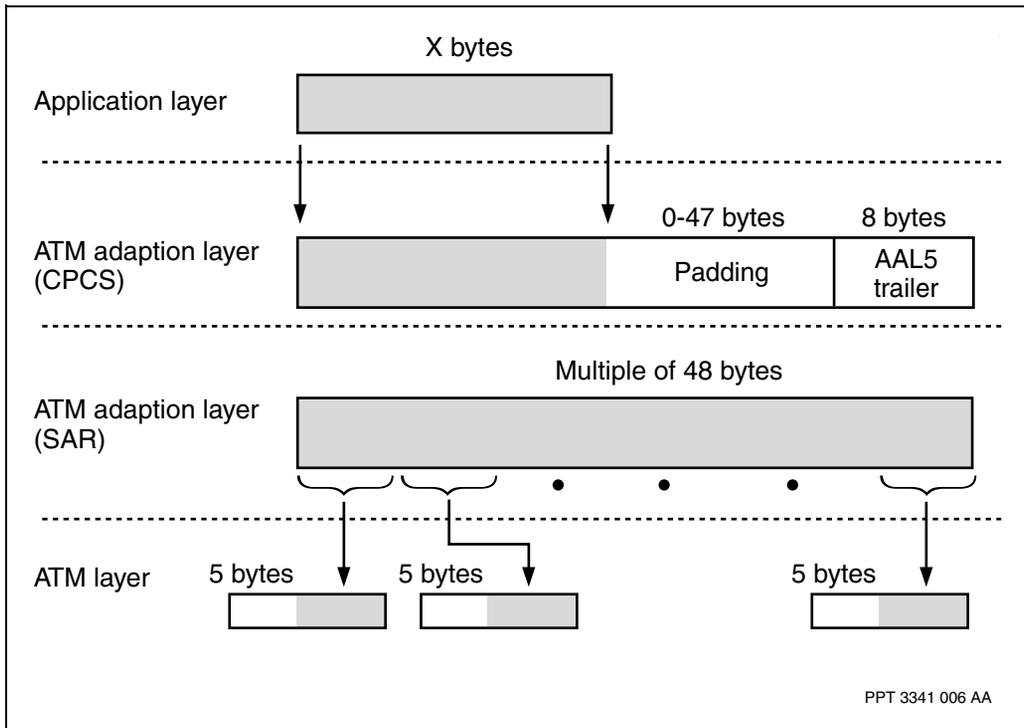
## Overhead factor

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 186) for more information.

**Figure 65**  
**Overhead encountered for frame-based services using AAL5**



### Overhead calculation

Algorithms that determine the overhead incurred by the Ethernet to ATM service interworking function are presented here. The types of overhead considered include the Ethernet overhead and the overhead introduced by the ATM adaptation (AAL5) and ATM layers as shown in table “Ethernet-ATM service interworking overhead summary” (page 188).

To transport a data unit of length  $n$ , IEEE 802.3 (Ethernet) adds a header of length  $h_E$ .

Counting pre-ample, tagging, and FCS,  $h'_E = 30$  bytes

Counting RFC2684 LLC encapsulation for bridged protocols,  $h_{\text{rfc2684}} = 10$  bytes (8+2 "Padding")

The IWF encapsulates the MAC frame starting at the MAC destination address and uses this information as the payload of the AAL5 CPCS-PDU. As part of the MAC overhead,  $h'_E$  has to be counted towards counting the overall overhead.

$h'_E = 22$  bytes if the MAC FCS is preserved ( $h_{\text{FCS}}$  is 4 bytes)

$h'_E - h_{\text{FCS}} = 18$  bytes if the MAC FCS is not preserved.

AAL5 adds two types of overhead:

- AAL5 trailer,  $h_{\text{trailer}} = 8$  bytes
- AAL5 SAR overhead,  $h_{\text{SAR}} = 0-47$  bytes

**Note:** Required to have the AAL5 CPCS-PDU length be an integer with multiples of 48 bytes.

An additional overhead due to encapsulating of higher layer protocols associated with LLC encapsulation: Counting RFC2684 bridged mode Vc encapsulation,  $h_{\text{rfc2684}} = 10$  bytes (8 + 2 "Padding").

Number of cells needed to transport n bytes of information:

$$N_{\text{cells}} = \text{Ceiling} ((n + h_{\text{rfc2684}} + h'_E - h_{\text{FCS}} + h_{\text{trailer}}) / 48)$$

**Note 1:** Cell size, excluding overhead, is equal to 48 bytes.

**Note 2:** Ceiling (x) is equal to the smallest integer that is greater or equal to x.

**Note 3:** Assuming the average frame size ( $n + h'_E$ ), including  $h_{\text{MAC}}$  (12 bytes),  $h_{\text{MACLength/Type}}$  (2 bytes),  $h_{\text{VLAN}}$  (4 bytes) if included and the  $h_{\text{FCS}}$  (4 bytes).

A correction factor is needed when rates are mapped between Ethernet and ATM. Assuming a data unit of length n, the correction factor is  $\text{overheadFactor} = N_{\text{cells}} * (n + h'_E)$ .

In the Ethernet to ATM direction, multiply Ethernet rate values by the overheadFactor. For example,  $SCR = \text{overheadFactor} * CIR$  (note that SCR is in cells/sec, while CIR is in bytes/sec). This analysis does not include the additional overhead due to encapsulating of higher layer protocols, for example IP. No overhead is associated with the VC multiplexing encapsulation.

The ATM overhead introduced by the ATM adaptation layer accounts for the 8 byte AAL5 trailer and the AAL5 padding bytes which are dependent upon the frame size. As well, the ATM overhead also accounts for the 5 byte ATM cell header.

A summary of equations used to account for the overhead is provided below:

$$\text{overheadFactor}(n) = \text{ceiling}(n) * 53 / (n + h'_E)$$

where: ceiling (n) gives the number n rounded to the next larger integer

$$\text{ceiling}(n) = ((n + h'_E + h_{\text{rfc2684}} + h_{\text{trailer}} - h_{\text{FCS}}) / 48) \text{ cells}$$

An overhead summary for selected data units based on the equations presented above is shown in table "Ethernet-ATM service interworking overhead summary" (page 188)

**Table 7**  
**Ethernet-ATM service interworking overhead summary**

Data unit length "n" (bytes)	User Data "n" (bytes)	Number of cells (cells)	Total ATM bytes to transfer DU	Total Ethernet bytes to transfer DU	Overhead factor (n) (cells/byte)
64	42	2	106	64	1.66
128	106	3	159	128	1.24
256	234	6	318	256	1.24
512	490	11	583	512	1.14
1024	1500	32	1696	1522	1.11

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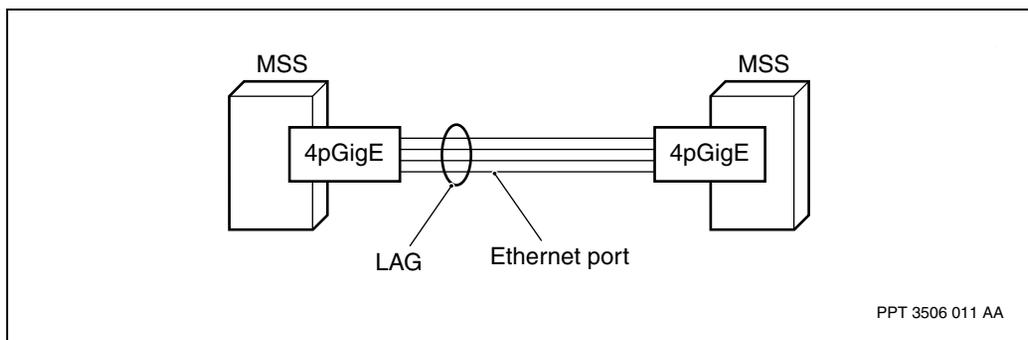
## Chapter 14

# Link Aggregation (LAG) on the 4-port Gigabit Ethernet FP

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Link aggregation (LAG) is a protocol that facilitates the grouping of several Ethernet ports, thus allowing a media access control (MAC) client to treat a set of ports as a single port. Link aggregation is an optional sublayer between a MAC client (application) and the MAC (physical interface or media). LAG is specified by IEEE Std 802.3-2002 Section 3 (Chapter 43). See figure “Link aggregation protocol” (page 189) for more information.

**Figure 66**  
**Link aggregation protocol**



Benefits of LAG include the following:

- Provides a mechanism to aggregate bandwidth across multiple Gigabit Ethernet (GigE) links without increasing LAN topology complexity.

- Offers dynamic bandwidth allocation by adding or removing links from LAG
- Facilitates link protection with quicker recovery from local link failure as compared with Layer 3 methodologies.
- Allows distribution of traffic across multiple links through load spreading.
- Assumes a low risk of duplication or mis-ordering of frames.
- Supports existing IEEE 802.3 MAC Clients.

Traffic load balancing is accomplished by distributing conversations or flows (for example IP flows) across the physical links comprising LAG. All packets within each individual conversation are always transmitted on the same physical link, eliminating the need for buffering and re-ordering at the receiving end.

## LAG architecture functions

The Lag and Link components are responsible for configuration, control and operation of LAG on the Nortel Networks Multiservice Switch 15000. The LAG group is configured by following provisioning procedures.

- For control - it incorporates Link Aggregation Control Protocol (LACP), that can be used for configuration and agreement on aggregation capabilities between systems.
- For operation - these components are responsible for distributing and collecting frames.
- On transmit - the Link components will pass LACP frame transmission requests for control of the LAG group.
- On receive - the Link components will distinguish LACP frames from user traffic. User traffic will be passed onto LanMedia, which is the application.

The functions described for the Lag and Link components are equivalent to the Aggregation Control, Aggregation and Control Processor functions described in IEEE Std 802.3-2002 Section 3 (Chapter 43)

LAG uses two protocols: Link Aggregation Control Protocol (LACP) to exchange LAG group and aggregated port information, and Marker Protocol to facilitate moving traffic (flow of conversations) to other links in the LAG without the need to buffer or resequence frames in a traffic flow.

For information about configuring Ethernet LAG, see “Ethernet LAG configuration” (page 33).





# Nortel Networks Multiservice Switch 7400/15000/20000 Operations: Ethernet Service

Release 6.1

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