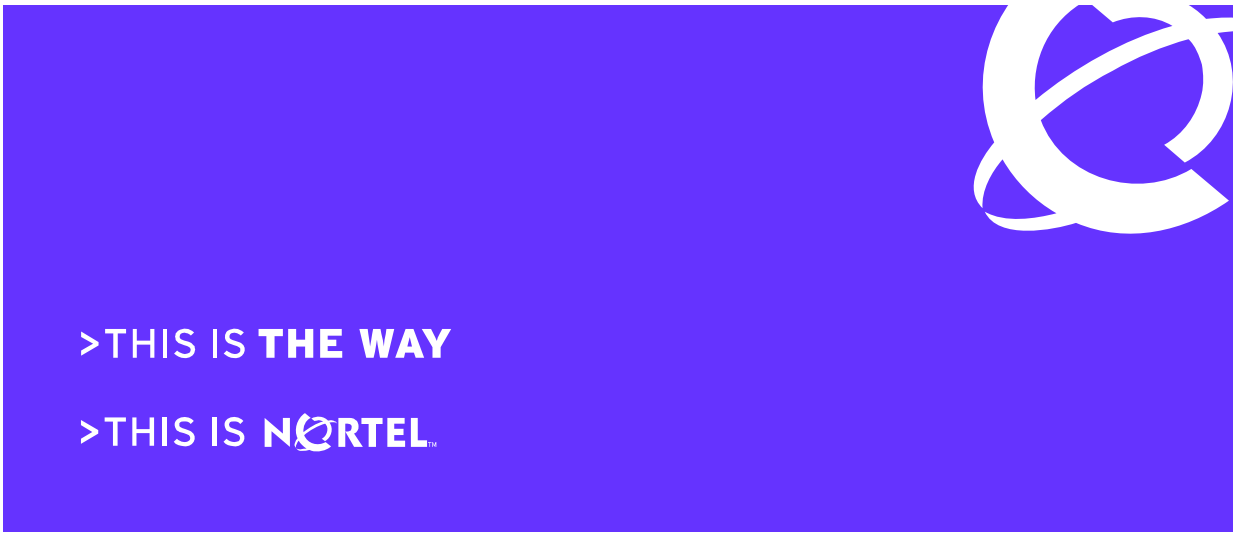

Nortel Multiservice Switch 7400/15000/20000

Operations: Frame Relay to ATM Interworking

NN10600-920

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Contents

Nortel Multiservice Switch 7400/15000/20000
Operations: Frame Relay to ATM Interworking
NN10600-920 7.2S1 Standard
PCR7.2 and up March 2006

What's new

The following feature was added to this document:

- Standard VPT for non-ATM SPVC (page 8)

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

Standard VPT for non-ATM SPVC

The following sections were updated:

- Configuring a FR-ATM SIWF SPVC (page 50)
- Verifying FR-ATM interworking connectivity (page 85)

Frame Relay to ATM interworking configuration

Configure Nortel Multiservice Switch frame relay to ATM (FR-ATM) interworking to allow frame relay traffic over ATM networking and transport infrastructure.

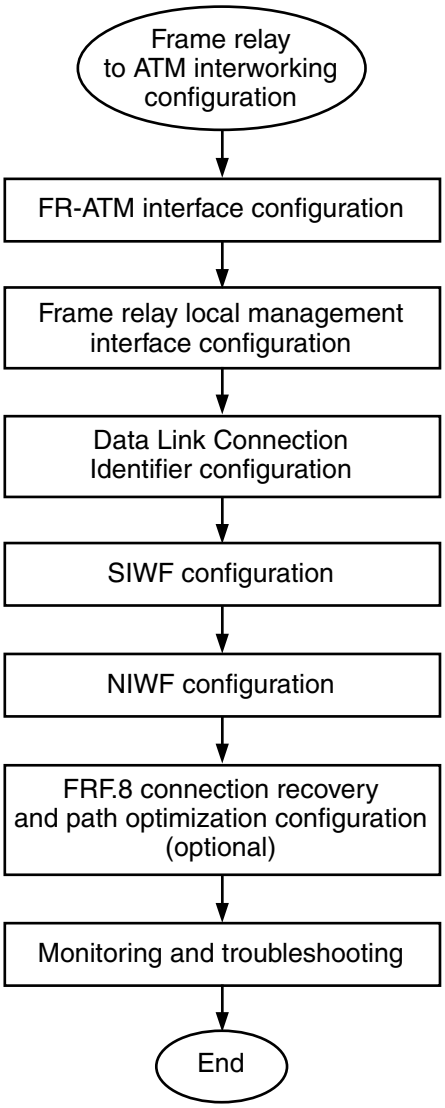
Prerequisites to Frame Relay to ATM interworking configuration

- Download the frame relay and ATM networking software. Use the procedures in NN10600-270 *Nortel Multiservice Switch 7400/15000/20000 Software Installation* to install frame relay and ATM networking software. The frame relay software is named frameRelay, and the ATM networking software is named atmNetworking.
- The task flows and procedures in this NTP describe configuring and monitoring FR-ATM software and services only. Basic configuration at the node level (in this case, creating an instance of a logical processor type, and adding the *frameRelayAtm* service to the *featureList* component) must be performed first. Use the task flows and procedures in NN10600-550 *Nortel Multiservice Switch 7400/15000/20000 Common Configuration Procedures* if you require supporting information or need to provision or reconfigure any node, or node elements, to support FR-ATM features.

Frame Relay to ATM interworking configuration tasks

This task flow shows you the sequence of the tasks you perform to configure Frame Relay to ATM interworking. To link to any task, go to Frame Relay to ATM interworking task navigation (page 10).

Frame Relay to ATM interworking configuration tasks



MSS 3352 001 AA

Frame Relay to ATM interworking task navigation

- FR-ATM interface configuration (page 12)
- Frame relay local management interface configuration (page 31)
- Data Link Connection Identifier configuration (page 34)
- SIWF configuration (page 42)
- NIWF configuration (page 55)
- FRF.8 connection recovery and path optimization configuration (page 73)

- Monitoring and troubleshooting (page 80)

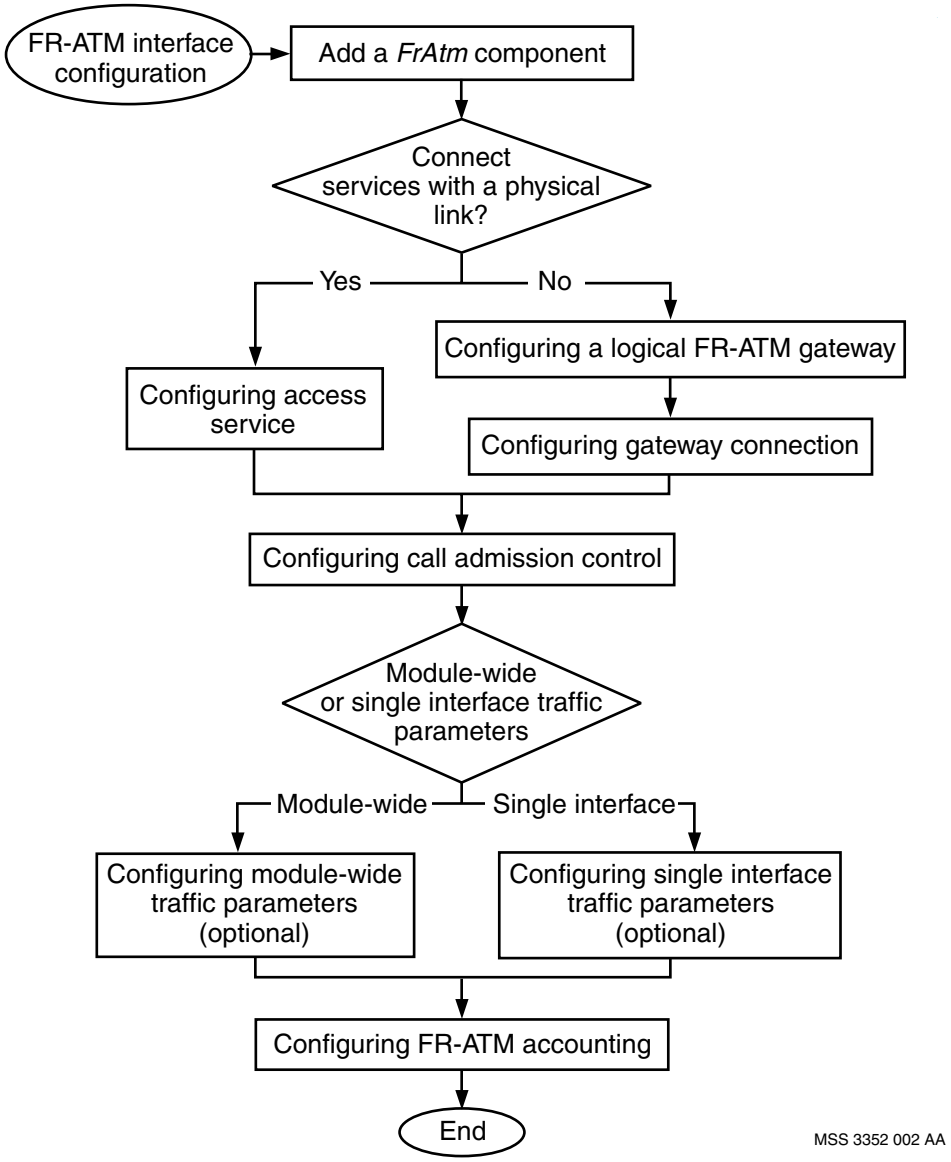
FR-ATM interface configuration

Configure a FR-ATM interface by creating an instance of the *FrAtm* component and associating it with an access interface. The FR-ATM interface is essential for FR-ATM interworking functionality.

FR-ATM interface configuration procedures

This task flow shows you the sequence of procedures you perform to configure FR-ATM. To link to any procedure, go to FR-ATM Interface configuration procedure navigation (page 13).

FR-ATM interface configuration procedures



FR-ATM Interface configuration procedure navigation

- Adding a FrAtm component (page 15)
- Configuring access service (page 16)
- Configuring a logical gateway (page 18)
- Configuring the gateway connection (page 21)
- Configuring call admission control (page 23)
- Configuring module-wide conversion parameters (page 25)

- Configuring single interface traffic parameters (page 27)
- Configuring FR-ATM accounting (page 29)

Adding a FrAtm component

Adding a *FrAtm* component defines a unique instance of the Frame Relay to ATM interworking interface. It manages the set of Frame Relay DLCI connections that are interworked with ATM connections.

Procedure steps

Step	Action
1	Create an instance of a FR-ATM interface. **`add FrAtm/<n>`** When you add the *FrAtm* component, Nortel Multiservice Switch system automatically adds the *Framer*, *Lmi*, and *Ca* subcomponents.
	--End--

Variable definitions

Variable	Value
<n>	is the instance value of the *FrAtm* component. The instance value you assign must be unique.

Configuring access service

Configure access service to associate an application component with a specific hardware interface link. You can also specify an address for the FR-ATM interface, under the optional *Address* component.

Procedure steps

Step	Action
1	Associate the *Framer* component to a physical port. **`set FrAtm/<n> Framer interfaceName Lp/<lp> <port_type>/ <port_no>`**
2	Optionally, specify the number of egress emission priority queues for the interface. If you are using the FR-ATM service in a gateway configuration, you must set the number of emission priority queues to 2. **`set FrAtm/<n> numberOfEmissionQs <number>`**
3	Optionally, specify the address of the FR-ATM interface. For FR-ATM SIWF SPVC connection support, you must configure the address of the FR-ATM interface **`add FrAtm/<n> Addr`**
4	Optionally, specify the address of the FR-ATM interface. For FR-ATM SIWF SPVC connection support, you must configure the address of the FR-ATM interface. **`set FrAtm/<n> Addr <address>`**

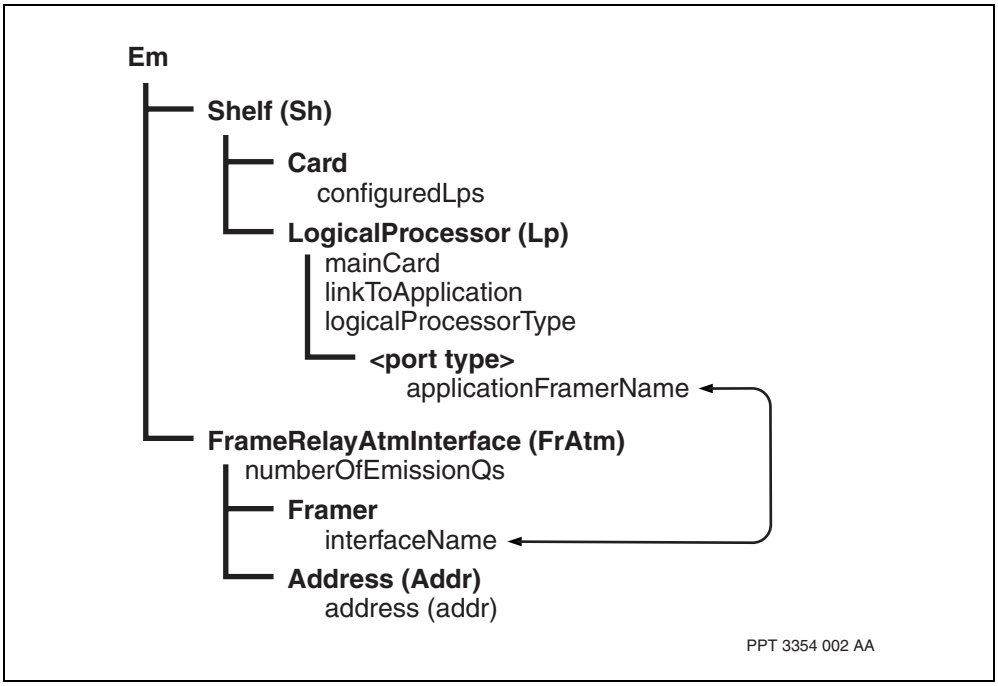
--End--

Variable definitions

Variable	Value
<address>	is the address of the FR-ATM interface in native E.164, X.121, or ATM address in NSAP format.
<lp>	is the instance value of the LP associated with the FR-ATM interface.
<n>	is the instance value of the *FrAtm* component.
<number>	is the number of emission queues.
<port_no>	is the port number associated with the FR-ATM interface.
<port_type>	is the card associated with the FR-ATM interface.

Procedure job aid

Access service component hierarchy



Configuring a logical gateway

Configure a logical gateway to connect services without associating either service to a physical port. Logical links reduce the number of physical ports in use and free-up those ports for other services.

Procedure steps

Step	Action
1	Set the *procedure* attribute under the *FrAtm Lmi* component. **`set FrAtm/<n> Lmi procedure autoconfigure`**
2	Set the *side* attribute under the *FrAtm Lmi* component. In a gateway configuration, you must set the *side* attribute to both. **`set FrAtm/ <n> Lmi side both`**
3	Delete the *Framer* component under the FR-ATM interface. **`del FrAtm/<n> Framer`**
4	Add a logical framer. **`add FrAtm/<n> VirtualFramer`**
5	Associate the FR-ATM interface with a logical processor. **`set FrAtm/<n> VirtualFramer Lp/<lp_no>`**
6	Associate the virtual framer to the *otherVirtualFramer* at the far end of the connection. If the virtual framer is configured on the 4-port DS3Ch or 1-port STM-1Ch FPs, the pair of virtual framers must be on the same LP. **`set FrAtm/<n> VirtualFramer otherVirtualFramer <far_end_connection> VirtualFramer`**
7	Configure a FR NNI instance. See NN10600-901 *Nortel Multiservice Switch 7400/15000/20000 Frame Relay Configuration Management* for information about creating a frame relay instance.
8	Set the *procedure* attribute under the *FrNni Lmi* component. **`set FrNni/<a> Lmi procedure autoconfigure`**
9	Delete the *Framer* component under the FR NNI. **`del FrNni/<a> Framer`**
10	Add a logical framer. **`add FrNni/<a> VirtualFramer`**
11	Associate the FR NNI with a logical processor. **`set FrNni/<a> VirtualFramer Lp/<lp_no>`**
12	Link the FR NNI and FR-ATM *VirtualFramer* components together.

```
set FrNni/<a> VFramer Ovf FrAtm/<n> VFramer
set FrAtm/<n> VFramer Ovf FrNni/<a> VFramer
```

13 In the same way as step 12, link the FR-ATM and the FR NNI *VirtualFramer* components together.

```
set FrNni/<a> VFramer Ovf FrAtm/<n> VFramer
set FrAtm/<n> VFramer Ovf FrNni/<a> VFramer
```

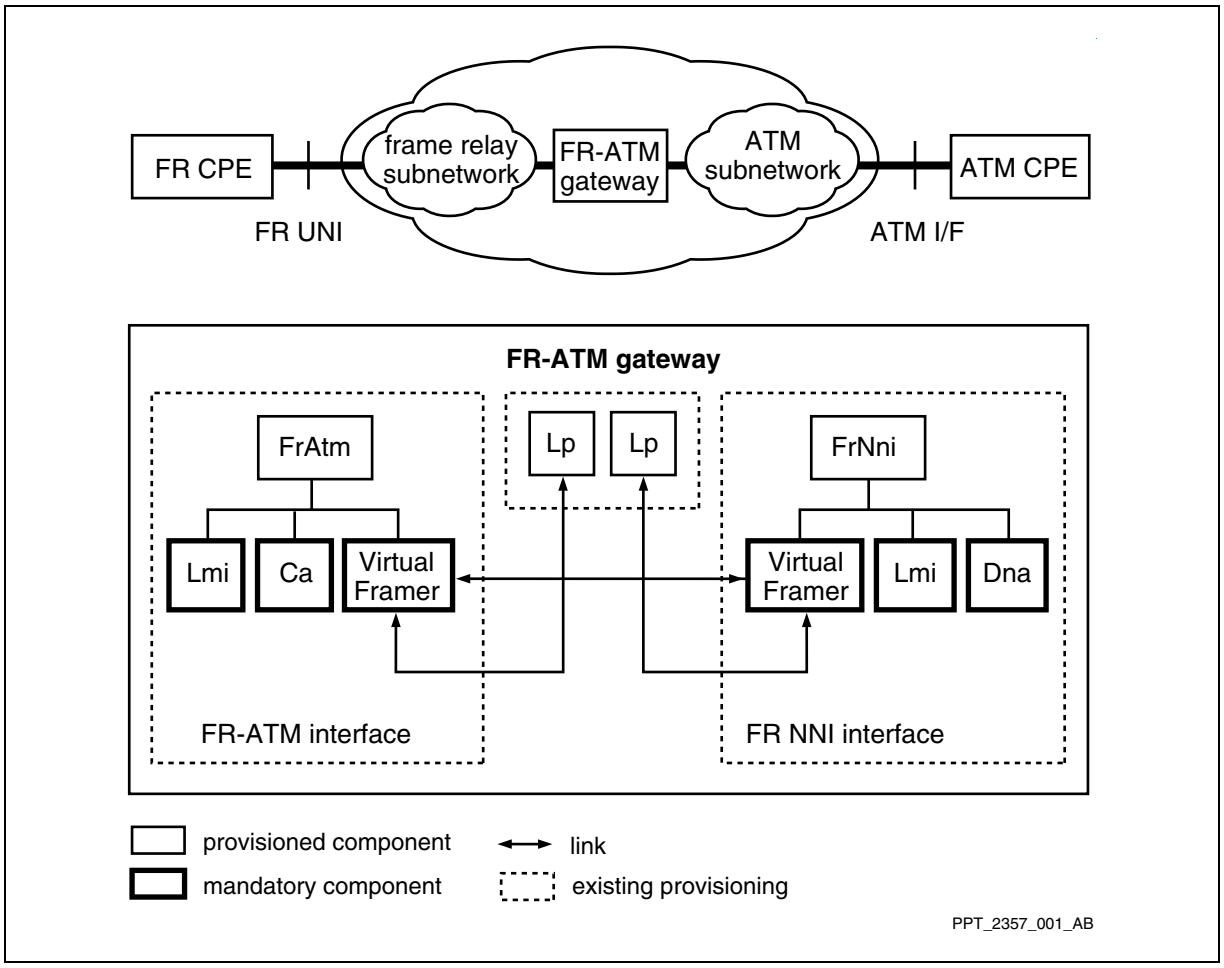
--End--

Variable definitions

Variable	Value
<a>	is the instance number of the FR NNI.
<lp_no>	is the instance number of the associated logical processor.
<far_end_connection>	is the type of connection and the instance that the virtual framer is connecting to at the far end. For example, the far end could be a FR UNI, FR NNI, or FR-ATM connection.
<n>	is the instance number of the FR-ATM interface.

Procedure job aid

Logical gateway topology and component structure



Configuring the gateway connection

Configure the gateway connection to associate the FR-ATM interface with a Frame Relay User-to-Network Interface (FR UNI) or Network-to-Network Interface (FR NNI). This procedure shows the configuration for a FR NNI.

Prerequisites

- For detailed information about how to configure a DLCI under a FR UNI, see NN10600-901 *Nortel Multiservice Switch 7400/15000/20000 Frame Relay Configuration Management*.

Procedure steps

Step	Action
1	Configure a DLCI on the access FR UNI. The remote DLCI of this DLCI is under the FR-ATM gateway's FR NNI. Add the DLCI to the access FR UNI. **`add FrUni/<b> Dlci/<dlci_no>`**
2	Set the remote DLCI. **`set FrUni/<b> Dlci/<dlci_no> Dc remoteDlci <rem_dlci>`**
3	Set the data network access. **`set FrUni/<b> Dlci/<dlci_no> Dc remoteDna <rem_dna>`**
4	Configure a DLCI on the FR-ATM gateway's FR NNI. The remote DLCI is the DLCI configured under the FR UNI in step 1. Add the DLCI on the FR-ATM gateway's FR NNI. **`add FrNni/<a> Dlci/<dlci_no>`**
5	Set the remote DLCI. **`set FrNni/<a> Dlci/<dlci_no> Dc remoteDlci <rem_dlci>`**
6	Set the remote data network access. **`set FrNni/<a> Dlci/<dlci_no> Dc remoteDna <rem_dna>`**

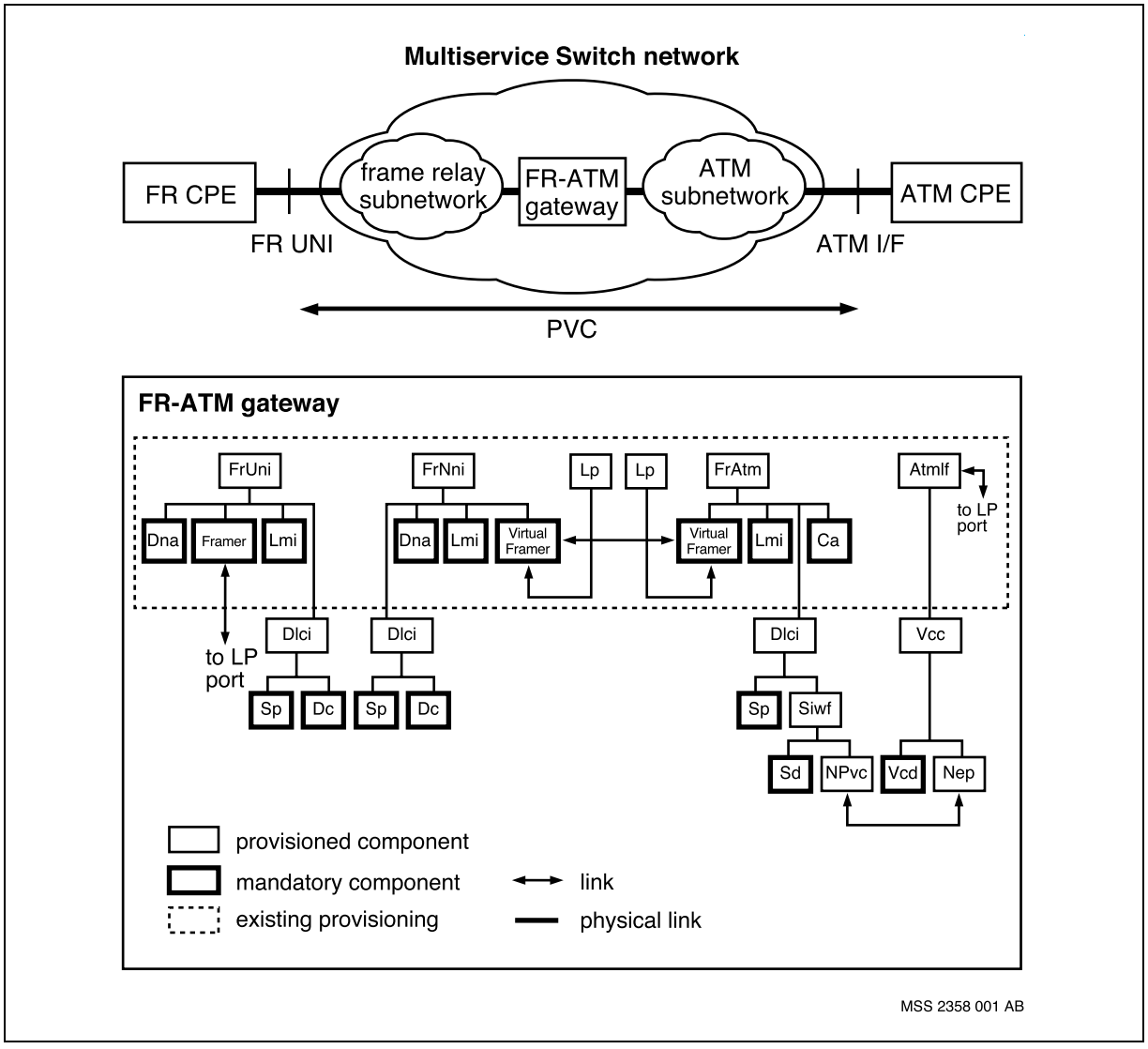
--End--

Variable definitions

Variable	Value
<a>	is the instance number of the FR NNI.
<b>	is the instance number of the FR UNI.
<dlci_no>	is the instance number of the DLCI associated with the FR UNI.
<rem_dlci>	is the DLCI associated with the FR NNI at the FR-ATM gateway.
<rem_dna>	is the data network address (DNA) of the remote FR NNI.

Procedure job aid

Gateway connection topology and component structure



Configuring call admission control

Configure call admission control in order to set common subscription options for connections on each FR-ATM interface. You can also partition port capacity into bandwidth pools under the *FrAtm* component for call admission purposes.

Procedure steps

Step	Action
1	Turn call admission control (CAC) on for the FR-ATM interface. **`set FrAtm/<n> Ca cac <on_off>`**
2	Specify the port capacity assigned to each bandwidth pool for the interface. The default is 100% for pool 0, and 0% for pools 1 to 15. To partition port capacity among multiple bandwidth pools, specify the bandwidth pool then the percentage value (separated by a space), for each pool. The command below is an example using two bandwidth pools. **`set FrAtm/<n> Ca bwPool <pool> <per> <pool> <per>`**
3	Optionally, set the link rate for this interface. If you are using a gateway configuration with the *VirtualFramer* component, you must set this attribute. **`set FrAtm/<n> Ca ovLinkRate <rate>`**

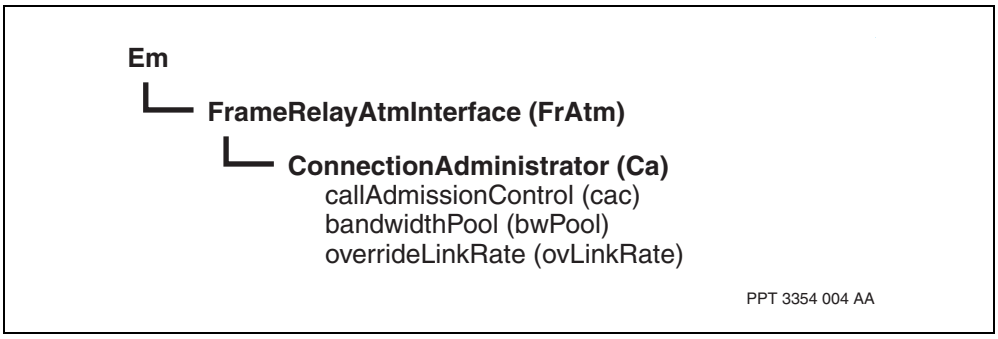
--End--

Variable definitions

Variable	Value
<n>	is the instance number of the FR-ATM interface.
<on_off>	is on or off and indicates whether call admission control is enabled or disabled.
<pool>	is the bandwidth pool. It can be any value from 0 to 15.
<per>	is the percentage of bandwidth assigned to the pool.
<rate>	is the link rate for the interface. it can be a value between 0 and 520 000 000.

Procedure job aid

Call admission control component hierarchy



Configuring module-wide conversion parameters

Configure module-wide conversion parameters to define module-wide transfer priority mappings for converting frame traffic to ATM traffic.

When you add the FR-ATM service to the feature list of an LPT, Nortel Multiservice Switch system automatically creates the *AtmNetworking* (*AtmNet*) component under the *Mod Frs* component. It also creates 16 instances (0 to 15) of the *TransferPriorityMapping* (*Tpm*) component for each supported transfer priority.

Procedure steps

Step	Action
1	Specify the egress emission priority to be used for traffic assigned to a specific transfer priority. **`set Mod Frs AtmNet Tpm/<tp> ep <em_pr>`**
2	Specify the ATM service category to be used for traffic assigned to a specific transfer priority. **`set Mod Frs AtmNet Tpm/<tp> sc <cat>`**
3	Specify the traffic conversion policy to be used for traffic assigned to a specific transfer priority. **`set Mod Frs AtmNet Tpm/<tp> tpcp <policy>`**
4	Specify the average frame size value to be used for the FR-ATM conversion policy. **`set Mod Frs AtmNet Tpm/<tp> afs <size>`**
5	Specify the bandwidth pool to be used for traffic assigned to a specific transfer priority. **`set Mod Frs AtmNet Tpm/<tp> asgBwPool <pool>`**

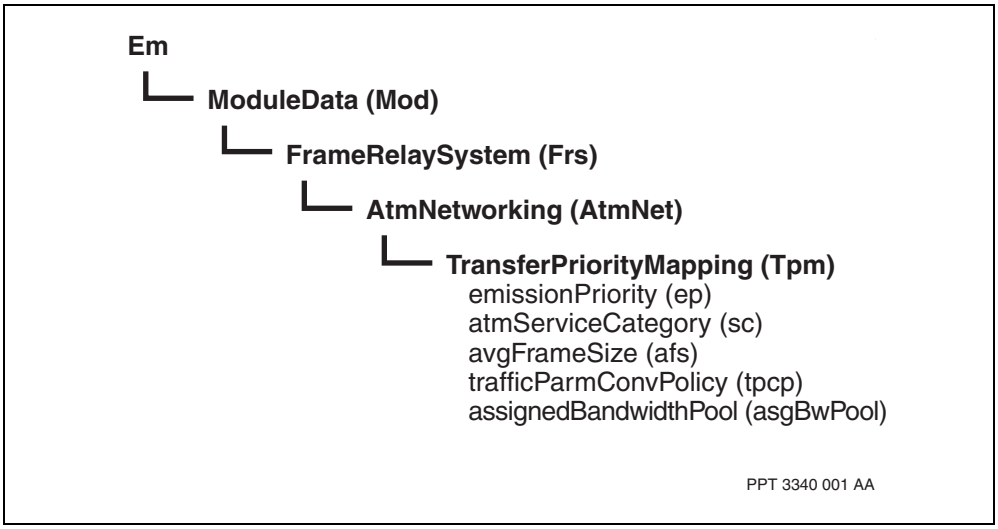
--End--

Variable definitions

Variable	Value
<cat>	is the ATM service category.
<em_pr>	is the egress emission priority.
<policy>	is the FR-ATM traffic conversion policy.
<pool>	is the bandwidth pool used to support this transfer priority.
<size>	is the average frame size in bytes used for the conversion policy.
<tp>	is the transfer priority instance.

Procedure job aid

Module-wide conversion parameters component hierarchy



Configuring single interface traffic parameters

Configure single interface traffic parameters for an individual FR-ATM interface if you do not want to use the module-wide parameters.

The *FrAtm Ca Tpm* component is an optional component created with every FR-ATM interface. When you configure the *FrAtm Ca Tpm* component, you override the module-wide transfer priority mappings for the FR-ATM interface. For information about configuring module-wide values, see Configuring module-wide conversion parameters (page 25).

Procedure steps

Step	Action
1	Create an instance of the *TransferPriorityMapping* (*Tpm*) component under the *FrAtm Ca* component. The *Tpm* instance corresponds to a transfer priority. **`add FrAtm/<n> Ca Tpm/<tp>`**
2	Assign a bandwidth pool to be used for traffic with this transfer priority. **`set FrAtm/<n> Ca Tpm/<tp> asgBwPool <pool>`**
3	Specify the traffic parameter conversion policy to be used for traffic with this transfer priority. **`set FrAtm/<n> Ca Tpm/<tp> tpcp <policy>`**
4	Specify the average frame size to be used in the conversion policy for traffic with this transfer priority. **`set FrAtm/<n> Ca Tpm/<tp> aFs <size>`**

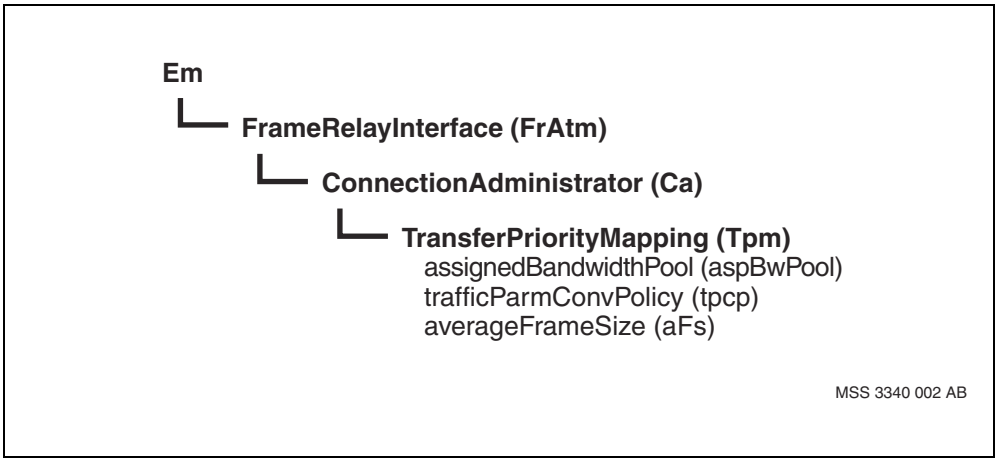
--End--

Variable definitions

Variable	Value
<n>	is the instance number of the FR-ATM interface.
<policy>	is the traffic conversion policy used for the transfer priority.
<pool>	is the bandwidth pool used to support the transfer priority.
<size>	is the average frame size in bytes.
<tp>	is the transfer priority instance.

Procedure job aid

Single interface traffic parameters component hierarchy



Configuring FR-ATM accounting

Configure FR-ATM accounting data collection on a FR-ATM interface, as well as for specific DLCIs.

Prerequisites

- Configure basic node accounting by following the procedures in NN10600-560 *Nortel Multiservice Switch 7400/15000/20000 Accounting*.

Procedure steps

Step	Action

CAUTION
Possible loss of service
Enabling accounting on an existing DLCI disrupts DLCI service.

5 Specify the data collection purposes for the FR-ATM interface.

```
set FrAtm/<n> Ca aco <cat>
```

6 Optionally, specify the accounting class for network operations usage.

```
set FrAtm/<n> Ca acl <class>
```

7 Optionally, specify the service exchange value for network operations usage.

```
set FrAtm Ca sre <exchange>
```

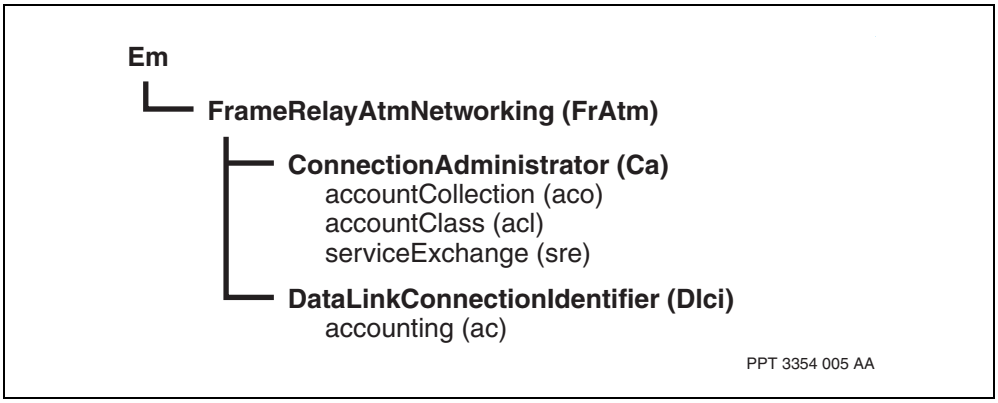
--End--

Variable definitions

Variable	Value
<cat>	is the purpose for which FR-ATM accounting collects records. You can specify one or more categories.
<class>	is an arbitrary 1-byte number. FR-ATM accounting stores this value in the Service Type field of the DLCI accounting record.
<exchange>	is an arbitrary 1-byte number. FR-ATM accounting stores this value in the Data Service Exchange field of the DLCI accounting record.
<n>	is the instance number of the FR-ATM interface.
<on_off>	is on or off and indicates whether accounting is enabled or disabled for the DLCI.

Procedure job aid

FR-ATM accounting component hierarchy



Frame relay local management interface configuration

Configure the frame relay local management interface (LMI) to define the parameters used to implement the LMI protocol. When you create an instance of the FR-ATM interface, the system automatically creates a *LocalManagementInterface (Lmi)* subcomponent. Configuring the *Lmi* component allows you to configure the permanent virtual circuit (PVC) status management.

Procedure steps

Step	Action
1	Specify the type of LMI procedures to be used for PVC status management on the FR-ATM interface. If you do not want to run LMI procedures on the FR-ATM interface, specify the type as none. **set FrAtm/<n> Lmi proc <type>**
2	Specify the number of error events that must occur before a PVC segment is considered inactive. **set FrAtm/<n> Lmi n392 <error_count>**
3	Specify the number of events within which no more than the specified number of error events (as configured in step 2) may occur. **set FrAtm/<n> Lmi n393 <count>**
4	Specify whether the FR-ATM interface generates asynchronous PVC status reports. **set FrAtm/<n> Lmi asr <on_off>**
5	Specify the frequency of status enquiry messages initiated by the FR-ATM interface for link integrity verification. **set FrAtm/<n> Lmi t391 <timer>**
6	Specify the number of polling cycles that must complete before the FR-ATM interface requests a full status report from the other network.

```
set FrAtm/<n> Lmi n391 <cycles>
```

7 Specify the time interval within which the FR-ATM interface expects a status enquiry message from the other network.

```
set FrAtm/<n> Lmi t392 <chk_interval>
```

8 Specify whether A-bit signaling affects data transfer on a PVC.

```
set FrAtm/<n> Lmi inab <yes_no>
```

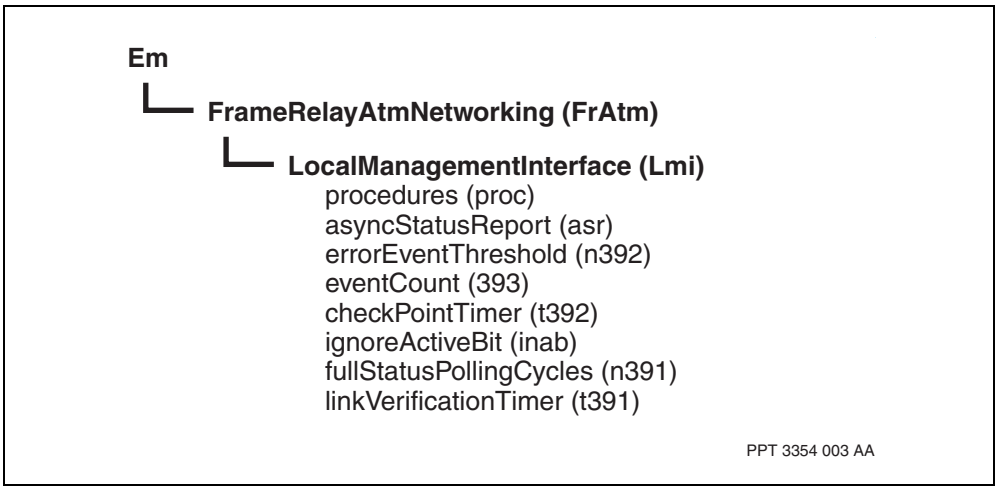
--End--

Variable definitions

Variable	Value
<chk_interval>	is the length of time in seconds.
<count>	is the number of monitored events.
<cycles>	is the number of polling cycles.
<error_count>	is the number of error events.
<n>	is the instance number of the FR-ATM interface.
<on_off>	is on or off and indicates whether asynchronous status reporting is enabled.
<timer>	is the length of time in seconds.
<type>	is the LMI procedures used (either none, vendorForum, ansi, itu, or autoConfigure). On a 4-port DS3 channelized frame relay FP, if the timeslot of a channel associated with a framer interface is provisioned with the value of none, the type of LMI procedure on the Fr-Atm interface also needs to be provisioned as none. Provisioning the timeslot value of none prevents the DLCI component from being provisionable.
<yes_no>	Is yes or no and indicates whether A-bit signaling is ignored.

Procedure job aid

Frame relay local management interface component hierarchy



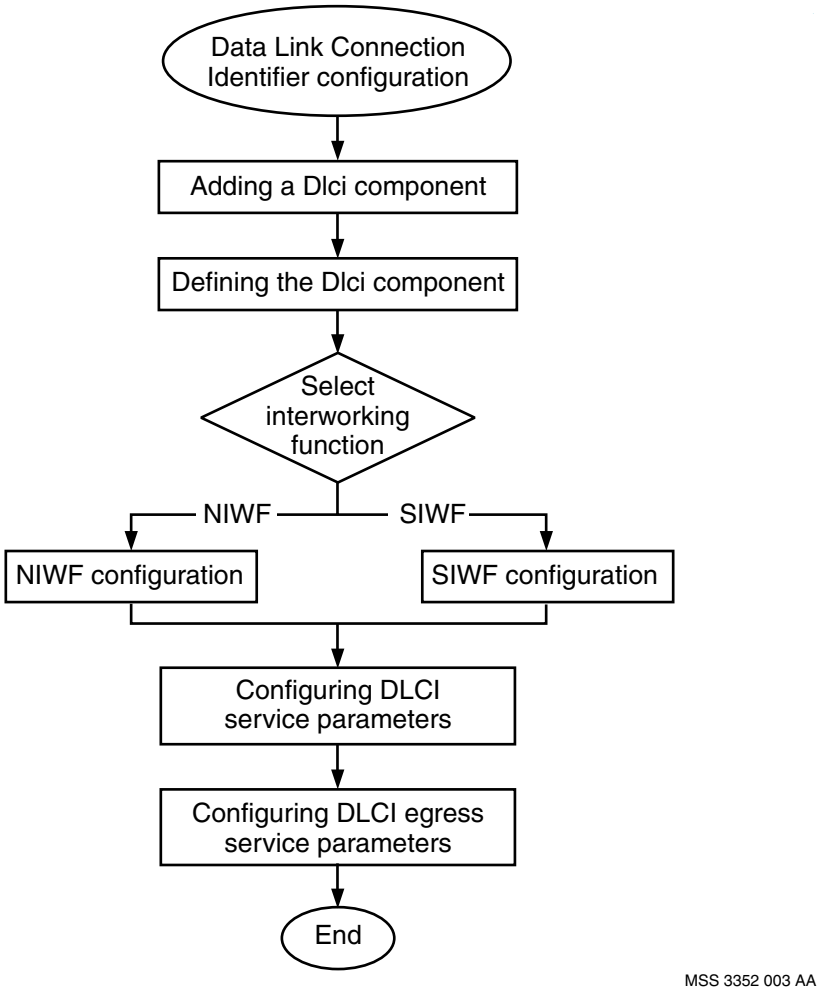
Data Link Connection Identifier configuration

Configure the Data Link Connection Identifier (DLCI) in order to set the parameters associated with the data link connection.

Data Link Connection Identifier configuration procedures

This task flow shows you the sequence of procedures you perform to configure the Data Link Connection Identifier. To link to any procedure, go to Data Link Connection Identifier procedure navigation (page 35).

Data Link Connection Identifier configuration procedures



Data Link Connection Identifier procedure navigation

- Adding a Dlci component (page 36)
- Defining the Dlci component (page 37)
- Configuring DLCI service parameters (page 38)
- Configuring DLCI egress service parameters (page 40)

Adding a Dlci component

Adding a *DataLinkConnectionIdentifier* (*Dlci*) component represents a data link connection. The *Dlci* component is responsible for the Frame Relay user-plane protocol for the specified data link connection.

Procedure steps

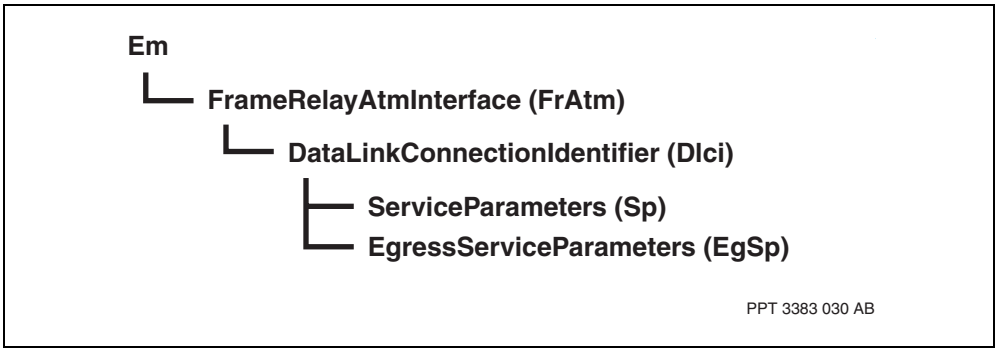
Step	Action
1	Add a FR-ATM DLCI with a unique instance value. **`add FrAtm/<n> Dlci/<dlci_no>`** When you add the FrAtm *Dlci* component, the Nortel Multiservice Switch system automatically adds the *ServiceParameter (Sp)* component.
	--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<n>	is the instance number of the FR-ATM interface.

Procedure job aid

Dlci component hierarchy



Defining the Dlci component

Defining the *Dlci* component provides either service interworking function capability or network interworking function capability between the Frame Relay data link connection and the ATM connection.

Procedure steps

Step	Action
1	Define the DLCI as a SIWF or NIWF connection. For a SIWF connection, add the *Siwf* component under the DLCI. **`add FrAtm/<n> Dlci/<dlci_no> Siwf`**
2	Define the DLCI as a SIWF or NIWF connection. For a NIWF connection, add the *Niwf* component under the DLCI. **`add FrAtm/<n> Dlci/<dlci_no> Niwf`**

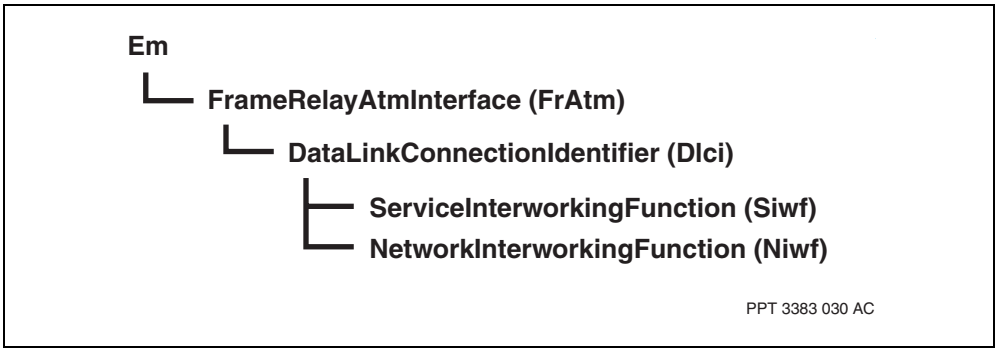
--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<n>	is the instance number of the FR-ATM interface.

Procedure job aid

Dlci component hierarchy



Configuring DLCI service parameters

Configuring service parameters for a FR-ATM DLCI sets parameters such as rate enforcement and traffic characteristics. By default, rate enforcement is on when you create a FR-ATM DLCI, and accounting is off. Traffic parameters for the FR-ATM DLCI also have default values.

Procedure steps

Step	Action
1	Turn rate enforcement either on or off. **`set FrAtm/<n> Dlci/<dlci_no> Sp re <on_off>`**
2	Set the committed information rate for the FR-ATM DLCI. **`set FrAtm/<n> Dlci/<dlci_no> Sp cir <sp_cir>`**
3	Set the committed burst size for the FR-ATM DLCI. **`set FrAtm/<n> Dlci/<dlci_no> Sp bc <sp_bc>`**
4	Set the excess burst size for the FR-ATM DLCI. **`set FrAtm/<n> Dlci/<dlci_no> Sp be <sp_be>`**
5	Set the maximum frame size for the FR-ATM DLCI. **`set FrAtm/<n> Dlci/<dlci_no> Sp n203 <size>`**
6	If the committed burst size (Bc) and committed information rate (CIR) are set to 0, define the measurement interval for the burst and rate sizes. **`set FrAtm/<n> Dlci/<dlci_no> Sp t <interval>`**

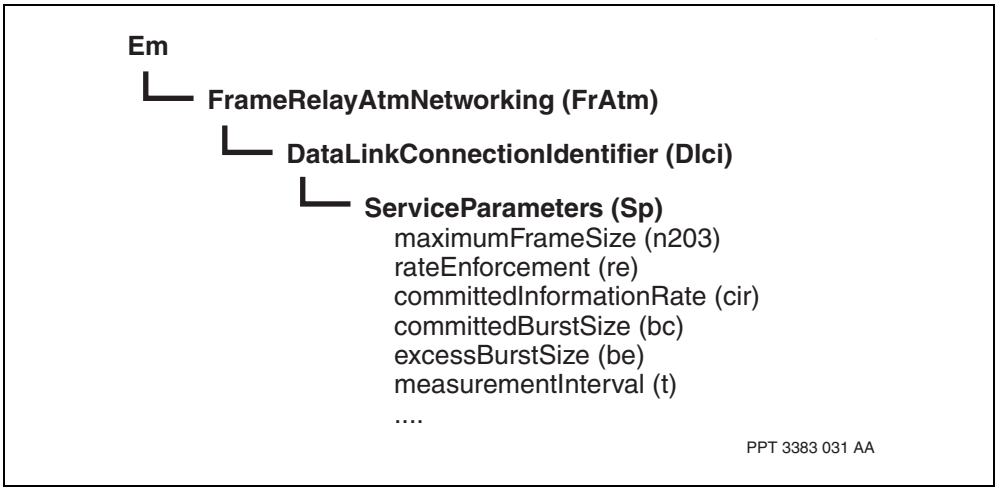
--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<interval>	is the time interval in seconds.
<n>	is the instance number of the FR-ATM interface.
<on_off>	is on or off and indicates whether rate enforcement is on or off.
<size>	is the maximum frame size in bytes.
<sp_bc>	is the committed burst size in bits.
<sp_be>	is the excess burst size in bits.
<sp_cir>	is the committed information rate in bits/s.

Procedure job aid

Dlci service parameters component hierarchy



Configuring DLCI egress service parameters

Configuring DLCI egress service parameters is done through the *EgressServiceParameter (EgSp)* component, which provides the backward bandwidth parameters at the remote ATM end and overrides the bandwidth parameters at the local end.

Procedure steps

Step	Action
1	Add the *EgSp* component under the FrAtm Dlci component. **`add FrAtm/<n> Dlci/<dlci_no> EgSp`**
2	Set the egress committed information rate for the FR-ATM DLCI. **`set FrAtm/<n> Dlci/<dlci_no> EgSp cir <eg_cir>`**
3	Set the egress committed burst size for the FR-ATM DLCI. **`set FrAtm/<n> Dlci/<dlci_no> EgSp bc <eg_bc>`**
4	Set the egress excess burst size for the FR-ATM DLCI. **`set FrAtm/<n> Dlci/<dlci_no> EgSp be <eg_be>`**
5	Set the egress measurement interval for the FR-ATM DLCI. **`set FrAtm/<n> Dlci/<dlci_no> EgSp t <eg_interval>`**

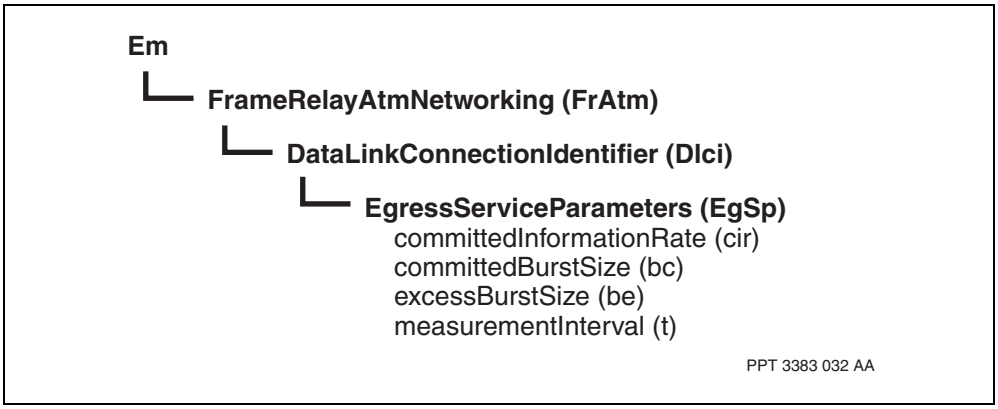
--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<eg_bc>	is the committed burst size in bits.
<eg_be>	is the excess burst size in bits.
<eg_cir>	is the committed information rate in bits/s.
<eg_interval>	is the time interval in seconds.
<n>	is the instance number of the FR-ATM interface.

Procedure job aid

DLCI egress service parameters component hierarchy



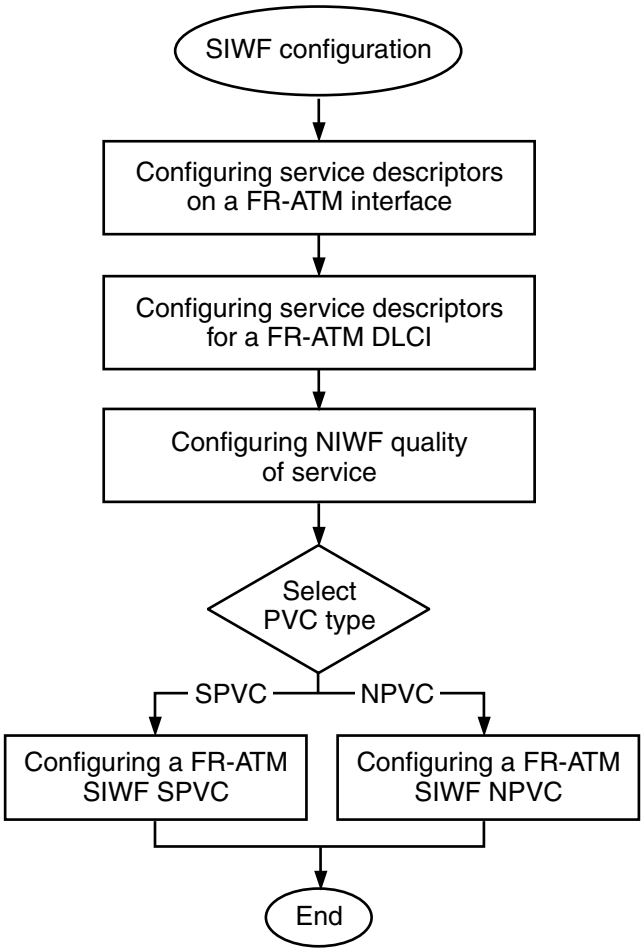
SIWF configuration

Configuring SIWF allows you to establish the FR-ATM service interworking function according to the standard.

SIWF configuration procedures

This task flow shows you the sequence of procedures you perform to configure SIWF. To link to any procedure, go to SIWF configuration procedure navigation (page 43).

SIWF configuration procedures



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SIWF configuration procedure navigation

- Configuring service descriptors on a FR-ATM interface (page 44)
- Configuring service descriptors for a FR-ATM DLCI (page 46)
- Configuring FR-ATM quality of service (page 48)
- Configuring a FR-ATM SIWF SPVC (page 50)
- Configuring a FR-ATM SIWF NPVC (page 52)

Configuring service descriptors on a FR-ATM interface

Configure service descriptors on a FR-ATM interface for all SIWF traffic through the FrAtm Ca component.

Procedure steps

Step	Action
1	Set the interoperability mode for SIWF upper layer protocol encapsulation. **`set FrAtm/<n> Ca sdMode <mode>`**
2	Set the discard mapping policy for SIWF traffic in the frame relay to ATM direction. **`set FrAtm/<n> Ca sdetclp <de_option>`**
3	Set the discard mapping policy for SIWF traffic in the ATM to frame relay direction. **`set FrAtm/<n> Ca sclpToDe <clp_option>`**
4	Set the forward congestion notification mapping policy for the frame relay to ATM direction. **`set FrAtm/<n> Ca sfecntefci <fecn_option>`**
5	Set the emission priority for frames sent to the FR-ATM interface from the SIWF. **`set FrAtm/<n> Ca sEpTolf <em_pr>`**
6	Set the transfer priority for frames received from and sent to the SIWF. **`set FrAtm/<n> Ca stp <tp>`**

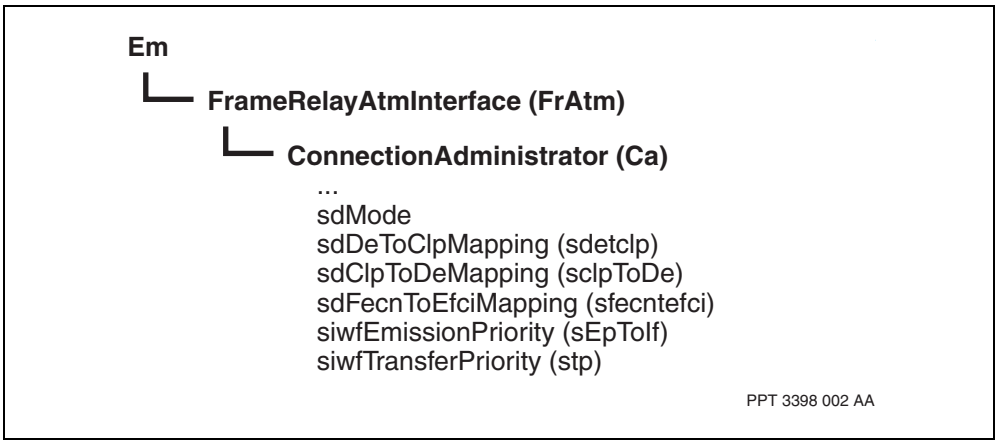
--End--

Variable definitions

Variable	Value
<clp_option>	is the CLP to DE discard mapping option.
<de_option>	is the DE to CLP discard mapping option.
<em_pr>	is the frame relay emission priority.
<fecn_option>	is the FECN to EFCI bit mapping option.
<mode>	is the interoperability mode for upper layer protocol encapsulation.
<n>	is the instance number of the FR-ATM interface.
<tp>	is the frame relay transfer priority.

Procedure job aid

Service descriptors on a FR-ATM interface component hierarchy



Configuring service descriptors for a FR-ATM DLCI

Configuring service descriptors for a FR-ATM DLCI overrides the FR-ATM interface service descriptor values for SIWF traffic on an individual DLCI basis. You can set service descriptor values for a particular DLCI by adding the *ServiceDescriptor (Sd)* component under the *FrAtm Dlci Siwf* component.

Procedure steps

Step	Action
1	Add the *ServiceDescriptor* component under the FrAtm Dlci Siwf component. **`add FrAtm/<n> Dlci/<dlci_no> Siwf Sd`**
2	Set the interoperability mode for SIWF upper layer protocol encapsulation. **`set FrAtm/<n> Dlci/<dlci_no> Siwf Sd mode <mode>`**
3	Set the discard mapping policy for SIWF traffic in the frame relay to ATM direction. **`set FrAtm/<n> Dlci/<dlci_no> Siwf Sd detclp <de_ption>`**
4	Set the discard mapping policy for SIWF traffic in the ATM to frame relay direction. **`set FrAtm/<n> Dlci/<dlci_no> Siwf Sd clpToDe <clp_option>`**
5	Set the forward congestion notification mapping policy for the frame relay to ATM direction. **`set FrAtm/<n> Dlci/<dlci_no> Siwf Sd fecntefci <fecn_option>`**

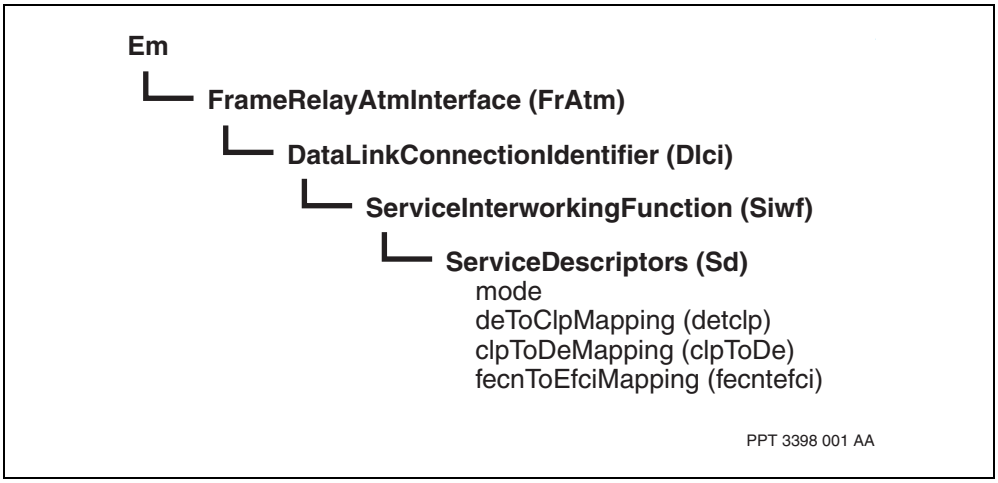
--End--

Variable definitions

Variable	Value
<clp_option>	is the CLP to DE discard mapping option.
<de_option>	is the DE to CLP discard mapping option.
<dlci_no>	is the instance number of the FR-ATM DLCI.
<mode>	is the interoperability mode for upper layer protocol encapsulation.
<n>	is the instance number of the FR-ATM interface.
<fecn_option>	is the FECN to EFCI bit mapping option.

Procedure job aid

Service descriptors for a FR-ATM DLCI component hierarchy



Configuring FR-ATM quality of service

Configuring FR-ATM quality of service involves configuring the *QualityOfService* (*QoS*) component under the *Dlci* component, which provides the quality of service overrides for its parent *Siwf* component.

Procedure steps

Step	Action
1	Add the *QoS* component under the FrAtm Dlci Siwf component. **`add FrAtm/<n> Dlci/<dlci_no> Siwf QoS`**
2	Set the emission priority for frames sent to the FR-ATM interface from the SIWF on this DLCI. **`set FrAtm/<n> Dlci/<dlci_no> Siwf QoS epTolf <em_pr>`** The FrAtm Framer component allows a maximum of four emission queues. The *FrAtm VirtualFramer* component allows only two emission queues.
3	Set the transfer priority for frames received from and sent to the SIWF on this DLCI. **`set FrAtm/<n> Dlci/<dlci_no> Siwf QoS tp <tp>`**

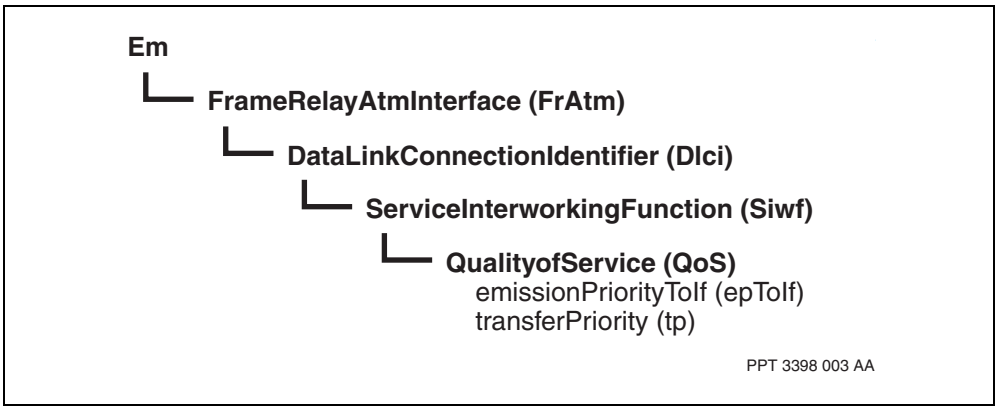
--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<em_pr>	is the frame relay emission priority.
<n>	is the instance number of the FR-ATM interface.
<tp>	is the frame relay transfer priority.

Procedure job aid

FR-ATM quality of service component hierarchy



Configuring a FR-ATM SIWF SPVC

Configuring a FR-ATM SIWF SPVC requires you to define the DLCI associated with the *FrAtm* component and establish the link to the ATM soft PVC.

Procedure steps

Step	Action
1	Add an *Spvc* component under the *FrAtm Dlci Siwf* component. **`add FrAtm/<n> Dlci/<dlci_no> Siwf Spvc`**
2	If one is not already available, configure a DLCI under the remote FR-ATM interface. To set the address for this FR-ATM interface, follow the steps described in Configuring the gateway connection (page 21). **`add FrAtm/<r> Dlci/<r_dlci_no>`**
3	Add a *Siwf* component. To set the address for this FR-ATM interface, follow the steps described in Configuring the gateway connection (page 21). **`add FrAtm/<r> Dlci/<r_dlci_no> Siwf`**
4	For configuring a FR-ATM to FR-ATM connection, set the frame relay address for the remote end of the SPVC connection. **`set FrAtm/<n> Dlci/<dlci_no> Siwf Spvc raddr <FR_addr>`** For configuring the master end of a FR-ATM to ATM connection, set the ATM address of the remote end of the SPVC connection **`set FrAtm/<n> Dlci/<dlci_no> Siwf Spvc raddr <ATM_addr>`** For configuring the master end of an ATM to FR-ATM connection, add an Spvc component under the Vcc component. For details on how to configure a soft permanent virtual circuit (SPVC), see NN10600-710 *Nortel Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
5	For a FR-ATM to FR-ATM connection, set the connection identifier for the remote end of the SPVC connection. **`set FrAtm/<n> Dlci/<dlci_no> Siwf Spvc rci 0.<rdlci>`** For a FR-ATM to ATM interface, set the connection identifier for the remote end of the SPVC connection. **`set FrAtm/<n> Dlci/<dlci_no> Siwf Spvc rci <vpi.vci>`**
6	Optionally, set the correlationTag attribute under the Spvc component for FR-ATM accounting. **`set FrAtm/<n> Dlci/<dlci_no> Siwf Spvc correlationTag <string>`**
7	Optionally, delete a previously provisioned correlation tag value.

```
set FrAtm/<n> Dlci/<dlci_no> Siwf Spvc correlationTag “”
```

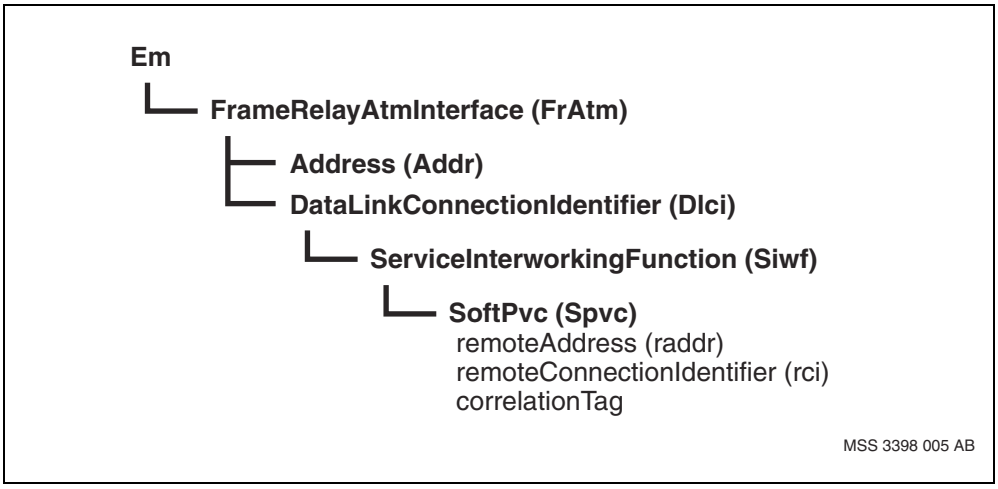
--End--

Variable definitions

Variable	Value
<ATM_addr>	is remote ATM address in NSAP format.
<dlci_no>	is the instance number of the FR-ATM DLCI.
<FR_addr>	is the address of the remote FR-ATM interface in native X.121, E.164, or ATM address in NSAP format.
<n>	is the instance number of the FR-ATM interface.
<r>	is the instance number of the remote FR-ATM interface.
<rdlci>	is the remote DLCI and is a value between 16 and 1007.
<r_dlci_no>	is the instance number of the remote DLCI.
<string>	is a unique ASCII string for the FR-ATM DLCI.
<vpi.vci>	is the remote ATM connection. The VPI is the virtual path ID (0-255) and the VCI is the virtual channel ID (0-65535).
<“”>	is a pair of double quotation marks used to indicate an empty string.

Procedure job aid

FR-ATM SIWF SPVC component hierarchy



Configuring a FR-ATM SIWF NPVC

Configuring a FR-ATM SIWF NPVC involves defining the frame relay nailed-up PVC associated with the *FrAtm* component and establish the link to the ATM PVC.

Prerequisites

- Configure the required ATM interfaces and connections on the Nortel Multiservice Switch node hosting the FR-ATM interworking function. For more information about provisioning an ATM interface (AtmIf), see NN10600-710 *Nortel Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

Procedure steps

Step	Action
1	Add a nailed-up PVC (*Npvc*) component under the *FrAtm Dlci Siwf* component. **`add FrAtm/<n> Dlci/<dlci_no> Siwf Npvc`**
2	Configure a VCC under an ATM interface. if one is not already available. **`add AtmIf/<i> [Vpt/<Vpi>] Vcc/<x>`**
3	Configure a VCC under an ATM interface. if one is not already available. This VCC is directly associated with the FR-ATM interworking function and resides on the same node. The connection is a nailed-up end point (NEP). **`add AtmIf/<i> [Vpt/<Vpi>] Vcc/<x> Nep`**
4	Set the atmConnection attribute under the Npvc component to link the FR-ATM DLCI to the ATM VCC. **`set FrAtm/<n> Dlci/<dlci_no> Siwf Npvc atmConn AtmIf/<i> [Vpt/<Vpi>] Vcc/<x> Nep`**
5	Optionally, set the correlationTag attribute under the Npvc component for FR-ATM accounting. **`set FrAtm/<n> Dlci/<dlci_no> Siwf Npvc correlationTag <string>`**
6	You can also delete a previously provisioned correlation tag value. **`set FrAtm/<n> Dlci/<dlci_no> Siwf Npvc correlationTag “”`**

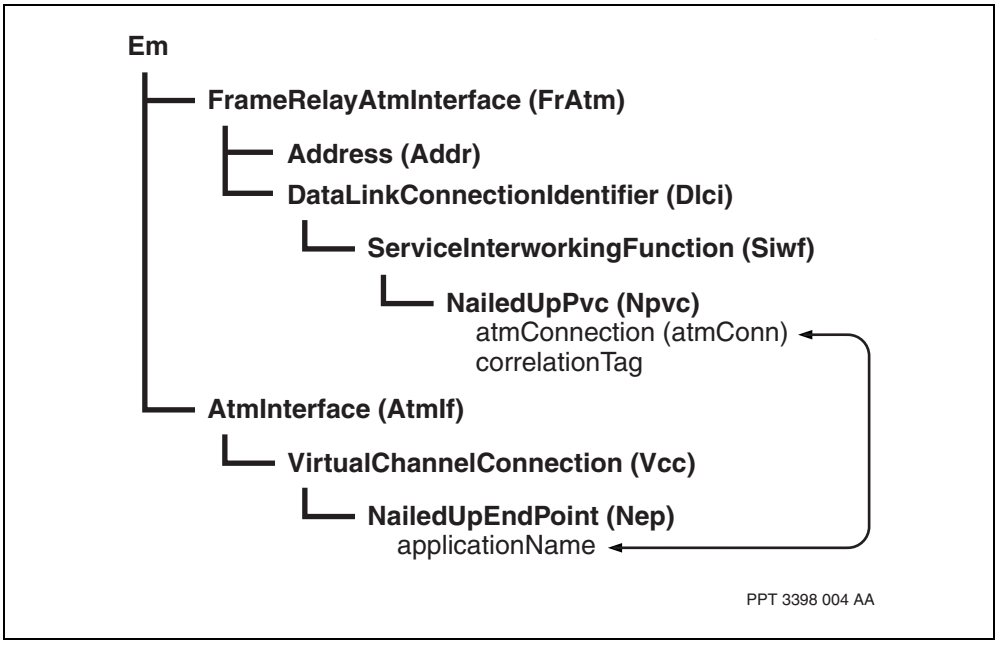
--End--

Variable definitions

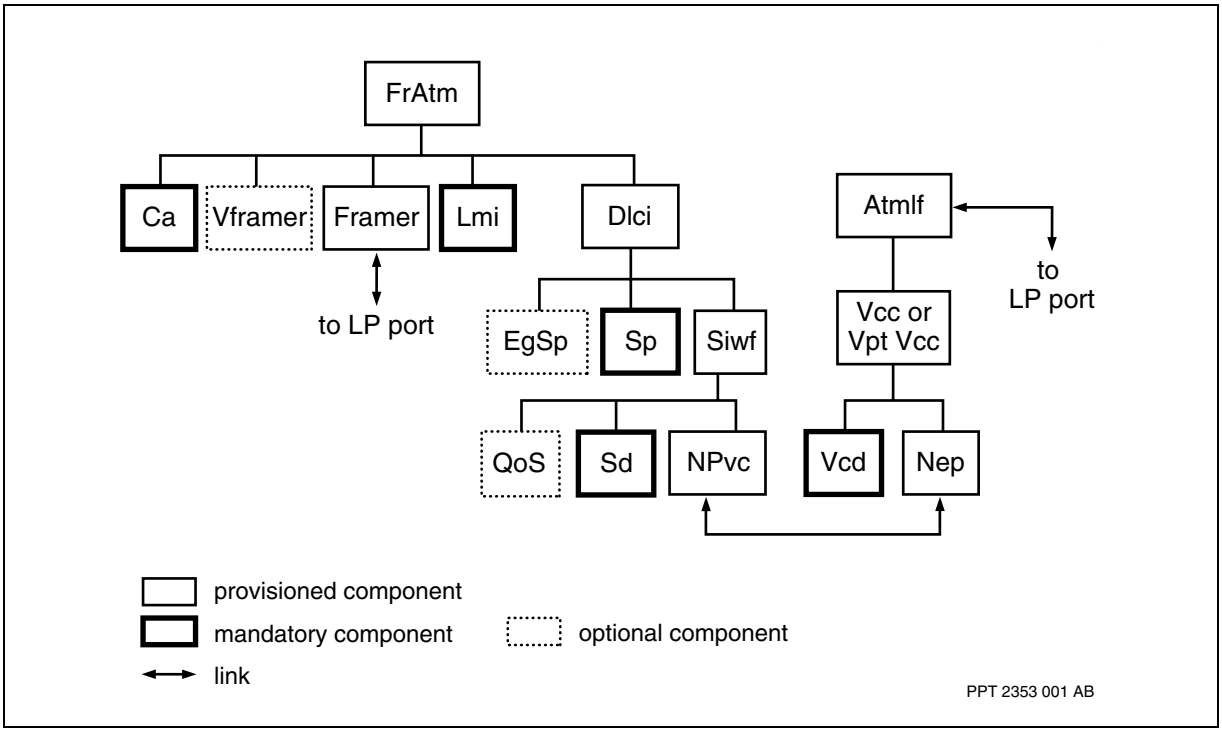
Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<i>	is the instance number of the ATM interface.
<n>	is the instance number of the FR-ATM interface.
<string>	is a unique ASCII string for the FR-ATM DLCI.
<Vpi>	is the instance value of the *Vpt* component.
[Vpt/<Vpi>]	is the *VirtualPathTerminator* component. Use this variable if the virtual connection is associated with a *Vpt* component.
<x>	is the instance of the *Vcc* component. If the virtual channel is associated with an *AtmIf* component, <x> represents the VPI.VCI value. If the virtual channel is associated with a *Vpt* component, <x> represents the VCI value.
<“”>	is a pair of double quotation marks used to indicate an empty string.

Procedure job aid

FR-ATM SIWF NPVC component hierarchy



FR-ATM SIWF NPVC component structure



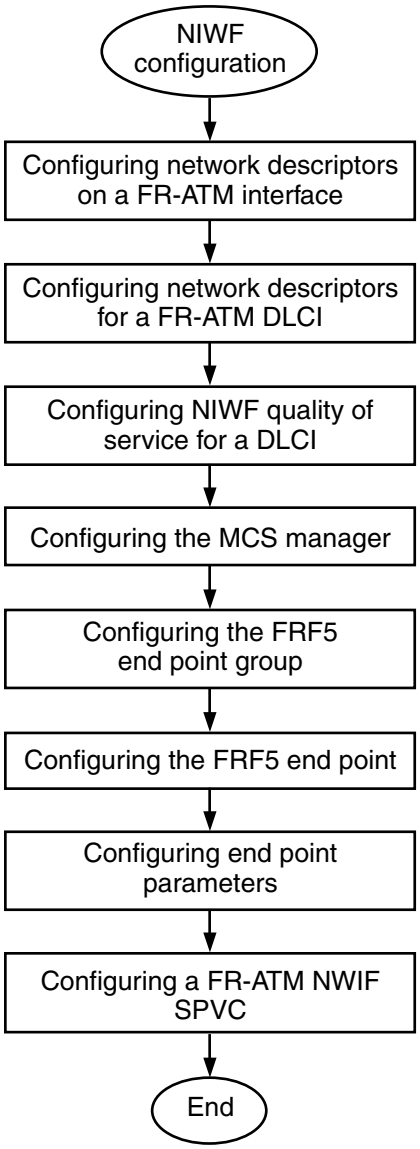
NIWF configuration

Configuring NIWF allows you to establish network interworking function according to the FRF.5 standard.

NIWF configuration procedures

This task flow shows you the sequence of procedures you perform to configure NIWF. To link to any procedure, go to NIWF configuration procedure navigation (page 56).

NIWF configuration procedures



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NIWF configuration procedure navigation

- Configuring network descriptors on a FR-ATM interface (page 58)
- Configuring network descriptors for a FR-ATM DLCI (page 60)
- Configuring NIWF quality of service for a DLCI (page 62)
- Configuring the MCS manager (page 64)
- Configuring the FRF.5 end point group (page 65)
- Configuring the FRF.5 end point (page 67)

- Configuring end point parameters (page 69)
- Configuring a FR-ATM NIWF SPVC (page 71)

Configuring network descriptors on a FR-ATM interface

Configure network descriptors on a FR-ATM interface for all NIWF traffic through the FrAtm Ca component.

Procedure steps

Step	Action
1	Specify the discard mapping policy for NIWF traffic in the frame relay to ATM direction. **`set FrAtm/<n> Ca ndetclp <option>`**
2	Specify the discard mapping policy for NIWF traffic in the ATM to frame relay direction. **`set FrAtm/<n> Ca nclptde <option>`**
3	Specify the emission priority for frames sent to the FR-ATM interface from the NIWF. **`set FrAtm/<n> Ca nEpToIf <em_pr>`**
4	Specify the transfer priority for frames received from and sent to the NIWF. **`set FrAtm/<n> Ca ntp <tp>`**

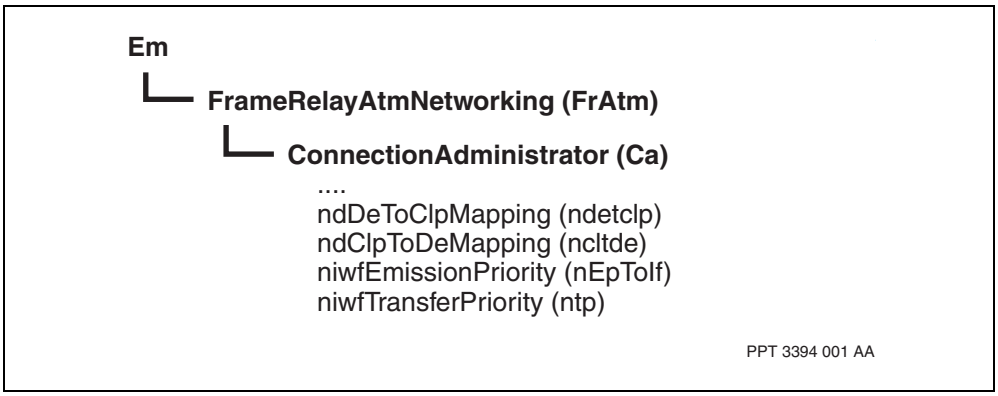
--End--

Variable definitions

Variable	Value
<em_pr>	is the frame relay emission priority.
<n>	is the instance number of the FR-ATM interface.
<option>	is the CLP to DE bit mapping option.
<tp>	is the frame relay transfer priority.

Procedure job aid

Network descriptors on a FR-ATM interface component hierarchy



Configuring network descriptors for a FR-ATM DLCI

Configure network descriptors for a FR-ATM DLCI if you want to override the FR-ATM interface network descriptor values for NIWF traffic on an individual DLCI basis.

Procedure steps

Step	Action
1	Add the *NetworkDescriptor* component under the FrAtm Dlci Niwf component. **`add FrAtm/<n> Dlci/<dlci_no> Niwf Nd`**
2	Specify the discard mapping policy for NIWF traffic in the frame relay to ATM direction. **`set FrAtm/<n> Dlci/<dlci_no> Niwf Nd detclp <option>`**
3	Specify the discard mapping policy for NIWF traffic in the ATM to frame relay direction. **`set FrAtm/<n> Dlci/<dlci_no> Niwf Nd clptde <option>`**

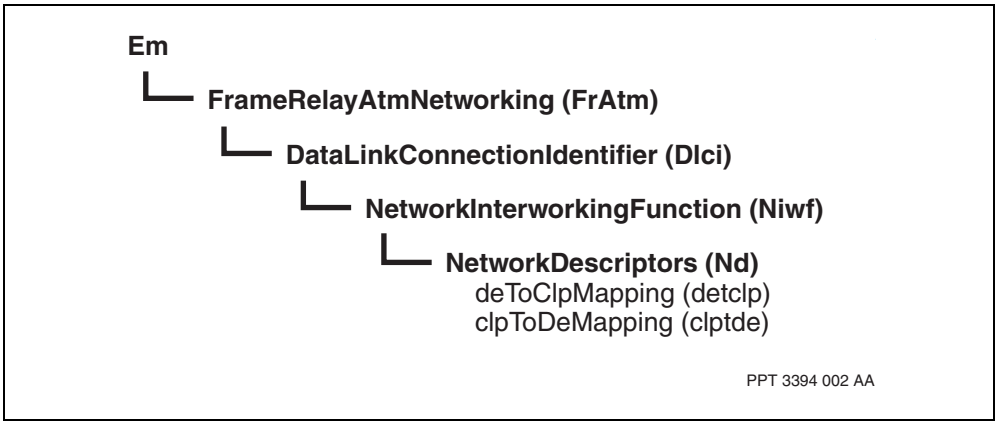
--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<n>	is the instance number of the FR-ATM interface.
<option>	is the CLP to DE bit mapping option (for the *clpToDeMapping* attribute) or the DE to CLP bit mapping option (for the *deToClpMapping* attribute).

Procedure job aid

Network descriptors for a FR-ATM DLCI component hierarchy



Configuring NIWF quality of service for a DLCI

Configure NIWF quality of service for a DLCI by configuring the *QualityOfService* (*QoS*) component, which provides the quality of service overrides for its parent *Niwf* component.

Procedure steps

Step	Action
1	Add the *QoS* component under the FrAtm Dlci Niwf component. **`add FrAtm/<n> Dlci/<dlci_no> Niwf QoS`**
2	Specify the emission priority for frames sent to the FR-ATM interface from the NIWF on this DLCI. **`set FrAtm/<n> Dlci/<dlci_no> Niwf QoS epToIf <em_pr>`**
3	Specify the transfer priority for frames received from and sent to the NIWF on this DLCI. **`set FrAtm/<n> Dlci/<dlci_no> Niwf QoS tp <tp>`**

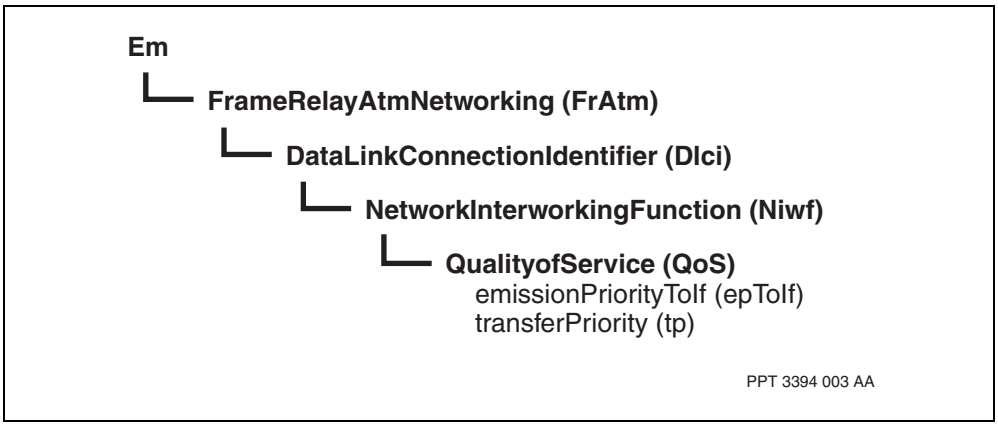
--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<em_pr>	is the frame relay emission priority. The *FrAtm Framer* component allows a maximum of four emission queues. The *FrAtm VirtualFramer* component allows only two emission queues.
<n>	is the instance number of the FR-ATM interface.
<tp>	is the frame relay transfer priority.

Procedure job aid

NIWF quality of service for a DLCI component hierarchy



Configuring the MCS manager

Configure the Managed Cut-through Switching (MCS) manager on any logical processor (LP). To ensure redundancy, you can configure two candidate MCS managers by creating one or more software LPTs, and linking them to more than one LP.

The attributes associated with the *McsMgr* component have default values.You can change the values of some of these attributes using the set command. For more information on configuring the MCS manager, see NN10600-440 *Nortel Multiservice Switch 7400 Operations: Frame Relay Managed Cut Through Switching*.

Procedure steps

Step	Action
1	Create one or more software LPTs for the frf5EndPoint feature and a networking interface. **`set sw lpt/<lpt_name> fl! frf5EndPoint atmApi`**
2	Link the LPT to an LP. **`set lp/<n> lpt sw lpt/<lpt_name>`**
3	Add an *McsMgr* component. **`add McsMgr`**

--End--

Variable definitions

Variable	Value
<lpt_name>	is any mnemonic (for example, frameRelayAtm). The value of this attribute selected in step 2 must be the same as that in step 1.
<n>	is the instance number of the LP.

Configuring the FRF.5 end point group

Configure the FRF.5 end point group to configure the extremity of an ATM pipe that multiplexes a number of frame relay connections. The end point group is the logical grouping of end points that share the same destination.

Procedure steps

Step	Action
1	Add an *Frf5EpG* component. **`add McsMgr Frf5EpG/<n>`** This step adds the mandatory *Address* subcomponent of the *Frf5EpG* component. The *Address* subcomponent specifies the destination NSAP address of all end points within an FRF.5 end point group. The destination address can be an ATM interface, or a remote frame relay managed cut-through switching (MCS) manager
2	Specify the address of the ATM end system to which all end points will establish their ATM connections. **`set McsMgr Frf5EpG/<n> Address remoteAddress <addr>`**
3	Specify the list of frame relay address prefixes the end points support within the FRF.5 end point group. **`set McsMgr Frf5EpG/<n> Address addressPrefix <address>`**

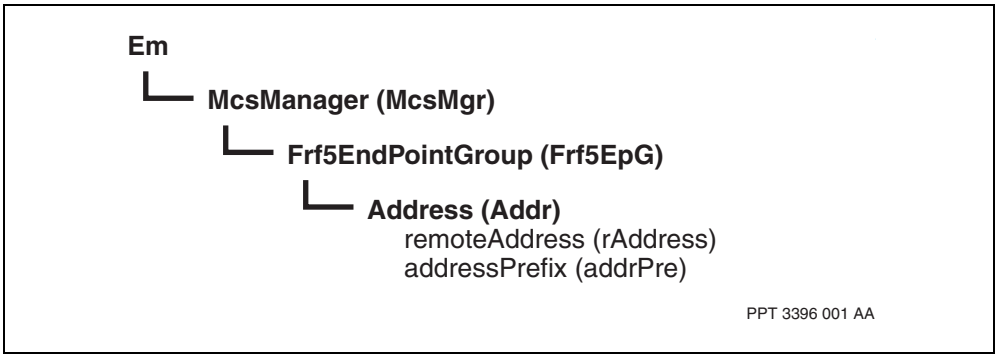
--End--

Variable definitions

Variable	Value
<addr>	is the address of the ATM end system, either MCS or AtmIf, in NSAP format.
<address>	is a list of frame relay addresses in native E.164 or X.121 format. E.164 format is 15 digits prefixed with an “E.”, and X.121 format is 14 digits prefixed with an “X.”. The address value must be preceded by an *e.* or an *x.* depending on the standard chosen.
<n>	is the *Frf5EpG* component instance number.

Procedure job aid

FRF.5 end point group component hierarchy



Configuring the FRF.5 end point

Configure the FRF.5 end point in order to configure the extremity of a single ATM VCC.

Procedure steps

Step	Action
1	Add the *EndPoint (Ep)* component. **`add McsMgr Frf5EpG/<n> Ep/<m>`** This step adds the mandatory *Epd* subcomponent of the *Ep* component.
2	Add the *EndPoint Lmi* subcomponent. **`add McsMgr Frf5EpG/<n> Ep/<m> Lmi`**
3	Specify the *remoteConnectionIdentifier* attribute. **`set McsMgr Frf5EpG/<n> Ep/<m> Epd rci <n.m>`**

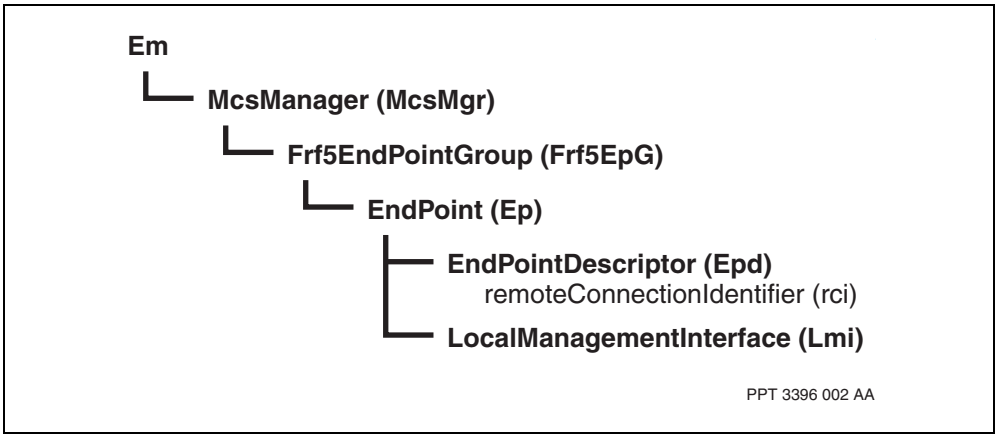
--End--

Variable definitions

Variable	Value
<m>	is the *Ep* instance number.
<n>	is the *Frf5EpG* component instance number.
<n.m>	is the VPI.VCI of a remote ATM interface (MCS to AtmIf) or the *EndPoint* instance.*Frf5EndPointGroup* instance of a remote MCS manager (MCS to MCS).

Procedure job aid

FRF.5 end point component hierarchy



Configuring end point parameters

Configuring end point parameters is required because although the end point represents the extremity of an ATM VCC, frame relay terms define all its traffic management parameters.

Prerequisites

- Define the ATM traffic parameters by configuring the transfer priority mappings. For information on this procedure, refer to Configuring module-wide conversion parameters (page 25).

Procedure steps

Step	Action
1	Specify the connection transfer priority. **`set McsMgr Frf5EpG/<n> Ep/<m> Epd connTp <tp>`**
2	Specify the value for the connection CIR. **`set McsMgr Frf5EpG/<n> Ep/<m> Epd cir <cir_value>`**
3	Specify the value for the connection Bc. **`set McsMgr Frf5EpG/<n> Ep/<m> Epd bc <bc_value>`**

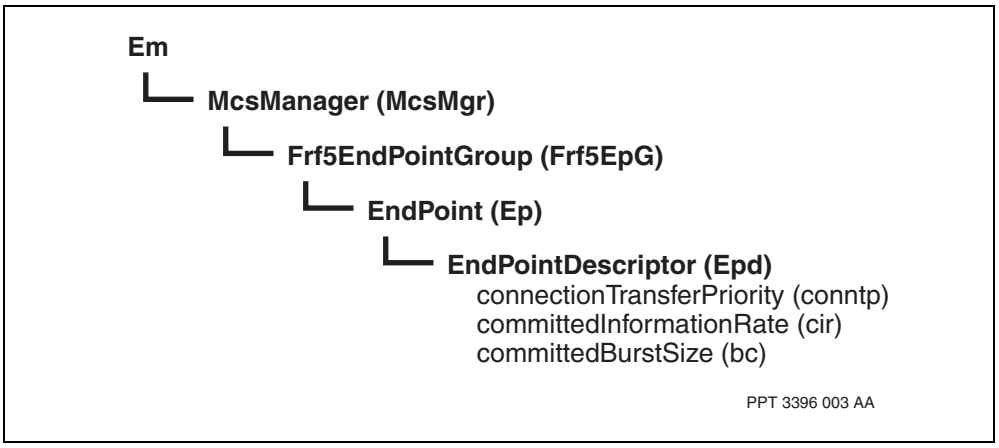
--End--

Variable definitions

Variable	Value
<bc_value>	is the committed burst size in bits, within the range of 0 to 50 000 000. The default is 0 bits.
<cir_value>	is the CIR in bit/s, within the range of 0 to 50 000 000. The default is 64 000 bit/s.
<m>	is the *Ep* instance number.
<n>	is the *Frf5EpG* component instance number.
<tp>	is a transfer priority corresponding to a *Mod Frs AtmNet Tpm* component.

Procedure job aid

End point parameters component hierarchy



Configuring a FR-ATM NIWF SPVC

Configure a FR-ATM NIWF SPVC to establish a subconnection between a frame relay NIWF and an FRF.5 end point leading into an ATM VCC.

Prerequisites

- Configure the FR-ATM NIWF. For information on defining a Dlci component as a NIWF connection, refer to Defining the Dlci component (page 37).
- Do not configure any ATM networking signalling components (for example, PNNI, UNI, IISP) under the *AtmInterface (Atmif) VirtualPathTerminator (Vpt)* component if the FR-ATM NIWF SPVCs can route over a VPT. FR-ATM NIWF SPVCs over VPTs are not supported.

Procedure steps

Step	Action
1	Specify the address prefix of the FRF.5 end point that will multiplex the frame relay DLCI. **`set FrAtm/<n> Dlci/<dlci_no> Niwf Spvc raddr <address>`**
2	Specify the DLCI number the FRF.5 end point will use. **`set FrAtm/<n> Dlci/<dlci_no> Niwf Spvc remoteDlci <remotedlci_no>`**
3	Set the correlationTag attribute under the Spvc component for FR-ATM accounting. To enable FR-ATM accounting for a FR-ATM DLCI, see Configuring DLCI service parameters (page 38). **`set FrAtm/<n> Dlci/<dlci_no> Niwf Spvc correlationTag <string>`**
4	Optionally, you can delete a previously provisioned correlation tag value by setting the correlationTag attribute to "" (the pair of double quotation marks indicates an empty string). **`set FrAtm/<n> Dlci/<dlci_no> Niwf Spvc correlationTag ""`**

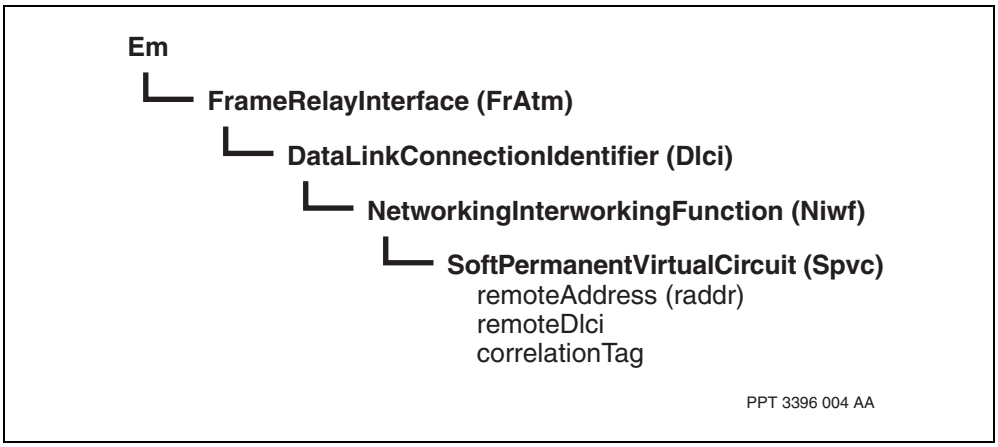
--End--

Variable definitions

Variable	Value
<address>	is a frame relay address in native E.164 or X.121 format. E.164 format is 15 digits prefixed with an “E.”, and X.121 format is 14 digits prefixed with an “X.”.
<dlci_no>	is the instance number of the FR-ATM DLCI.
<n>	is the *FrAtm* component instance number.
<remotedlci_no>	is the instance number of the remote connection identifier.
<string>	is a unique ASCII string for the FR-ATM DLCI.

Procedure job aid

FR-ATM NIWF SPVC component hierarchy



FRF.8 connection recovery and path optimization configuration

Optionally, configure FRF.8 connection recovery and path optimization. FRF.8. Rerouting provides connection recovery and path optimization capabilities within a PNNI network for frame relay to ATM (FR-ATM) service interworking (FRF.8) on SPVC connections. Rerouting enhances the capabilities of PNNI networks to provide high availability during network failures and path optimizations without needing intervention by the originator of the connection. For more conceptual information on rerouting including connection recovery, path optimization, and time of day optimization see, NN10600-702 *Nortel Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*.

For information useful when performing these procedures on rerouting for FRF.8, see the section FRF.8 connection recovery and path optimization (page 164)

Prerequisites to FRF.8 connection recovery and path optimization

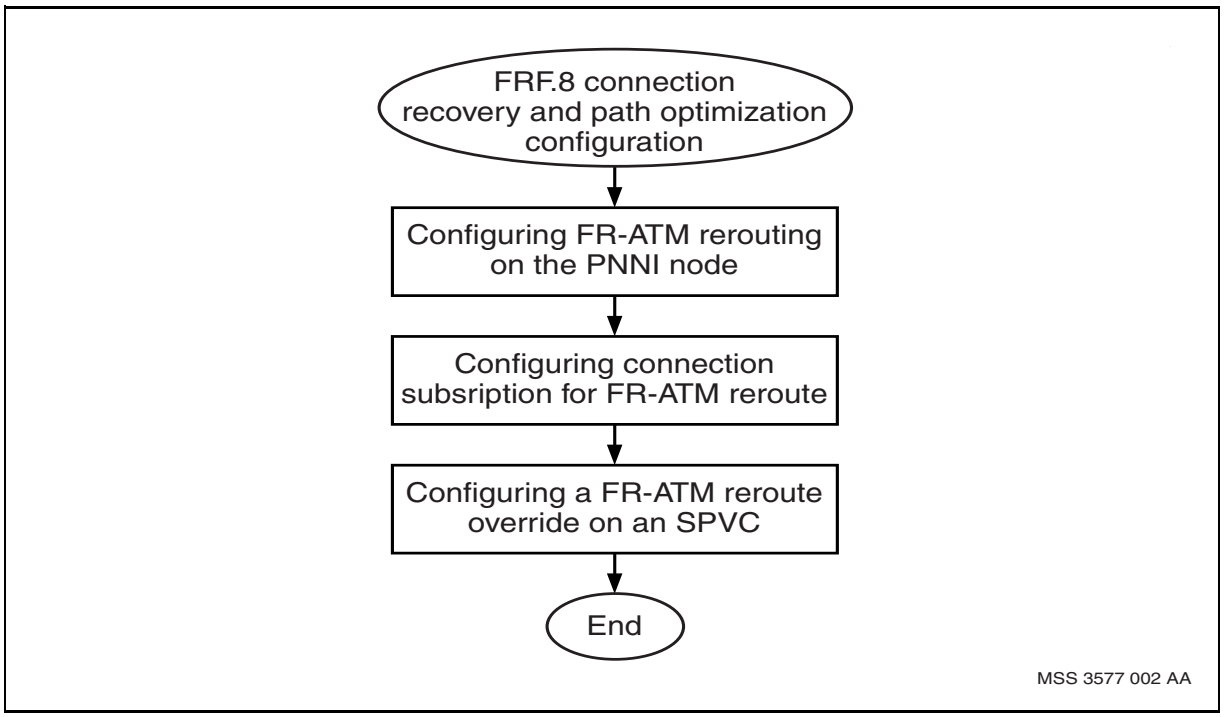
- Rerouting procedures enable connections that traverse the PNNI network to be eligible for PNNI rerouting capabilities. For a connection to be eligible for rerouting, both ingress and egress PNNI nodes used by the connection need to support rerouting. The source and destination node must also have a *Rerouting* component provisioned.
- Valid configurations for rerouting for FRF.8 are:
  - FR-ATM to ATM
  - FR-ATM to FR-ATM
- configure the PNNI nodes for rerouting:
  - install the feature on each FR-ATM function processor that will originate or terminate an rerouting connection
  - configure the *Reroute* component on each FR-ATM function processor that will originate a reroute connection
- configure the FR-ATM interface for connection recovery or path optimization (or both)

- as an option, configure the *RerouteOv* component for individual SPVCs. This component has the capability to override Rerouting options.

FRF.8 connection recovery and path optimization configuration procedures

This task flow shows you the sequence of procedures you perform to configure FRF.8 connection recovery and path optimization. To link to any procedure, go to FRF.8 connection recovery and path optimization procedure navigation (page 74).

FRF.8 connection recovery and path optimization configuration procedures



FRF.8 connection recovery and path optimization procedure navigation

- Configuring FR-ATM rerouting on the PNNI node (page 75)
- Configuring connection subscription for FR-ATM Reroute (page 76)
- Configuring a FR-ATM reroute override on an SPVC (page 78)

Configuring FR-ATM rerouting on the PNNI node

Configure FR-ATM rerouting on the PNNI node.

As of PCR 5.1, frameRelayAtmEbr has migrated to frameRelayAtmReroute.

Prerequisites

- The feature must be present in the sw lpt and on the source destination FPs.

Procedure steps

Step	Action
1	Create a suitable software LPT with the rerouting feature. **`set featureList FrameRelayAtmReroute`**
	--End--

Configuring connection subscription for FR-ATM Reroute

Use this procedure to configure connection subscription for *FrAtm Reroute*. The *Reroute* component for the destination FR-ATM is only used to configure RCL versus standard optimization in the *SwitchOverMechanism* attribute.

Prerequisites

- Connections that exist before configuring connection subscription for rerouting retain the options determined at call establishment. New call set up requests initiated after configuring connection subscription for rerouting will use the new connection subscription options.
- The *Reroute* component always needs to be configured from the source FR-ATM and needs to be present on the rendezvous node
- If the rerouting protocol is *localOnly* or *localGlobal*, only *local* attributes are shown. If the protocol is *ebrOnly*, only global attributes are shown.
- If you have configured the rerouting override capability on a per-connection basis for SPVCs, see the procedure Configuring a FR-ATM reroute override on an SPVC (page 78).

Procedure steps

Step	Action
1	Add the *Reroute* component to the FrATM interface. **`add Reroute`** The only case in which Reroute is configured on a PNNI interface is when a network-initiated connection (SPVC) is configured on that interface.

Attention: The default values for the attributes and the Ov component are added after the Reroute component is added.

2	Set the default rerouting protocol use by the FrATM interface. **`set FrAtm/<n> Reroute Ov protocol <protocol>`**
3	Set the connection recovery subscription option. **`set FrAtm/<n> Reroute Ov globalConnectionRecoverySubscr <globalcon>`**
4	Set the path optimization subscription option. **`set FrAtm/<n> Reroute Ov globalPathOptimizationSubscr <globalpath>`**
5	Set the switchover subscription option. **`set FrAtm/<n> Reroute Ov switchoverMechanism <switchoverMechanism>`**

--End--

Variable definitions

Variable	Value
<globalcon>	specifies the subscription of connections to rerouting connection recovery. The value can be set to either yes, no, or sameAs. The default value is sameAsARtgPnniReroute (sameAs).
<globalpath>	specifies the subscription of connections to rerouting path optimization. The value can be set to either yes, no, or sameAs. The default value is sameAsARtgPnniReroute (sameAs).
<moduleOptimization>	specifies connections that are considered by a module optimization pass. It can either consider only the connections recovered since the last optimization pass or all connections that subscribe to optimization. The value can be set to none, recoveredOnly, allSubscribed, or sameAsARtgPnni. The default value is sameAsARtgPnni.
<n>	is instance number of the FR-ATM interface.
<protocol>	specifies the default rerouting protocol used by the FrATM interface. The possible values are: loclGlobal, localOnly, globalOnly, localEbr, ebrOnly, and sameAsARtgPnniReroute.
<switchoverMechanism>	specifies the mechanism used to switchover to the rerouted connection segment. The value can be set to standard, rcl, or sameAsARtgPnniReroute (sameAs). The default value is sameAs.

Configuring a FR-ATM reroute override on an SPVC

Use this procedure to configure a reroute override for an SPVC connection.

Prerequisites

- It is recommended that you perform this procedure only during maintenance windows.

Procedure steps

Step	Action
1	Add the *RerouteOv* component to the Spvc. **`add FrAtm/<n> Dlci/<m> Siwf Spvc RerouteOv`**
2	Set the connection recovery for the SPVC. **`set FrAtm/<n> Dlci/<m> Siwf Spvc RerouteOv globalRecoverySubscribed <globalRecoverySubscribed>`**
3	Set the path optimization subscription option. **`set FrAtm/<n> Dlci/<m> Siwf Spvc RerouteOv globalOptimizationSubscribed <globalOptimization>`**

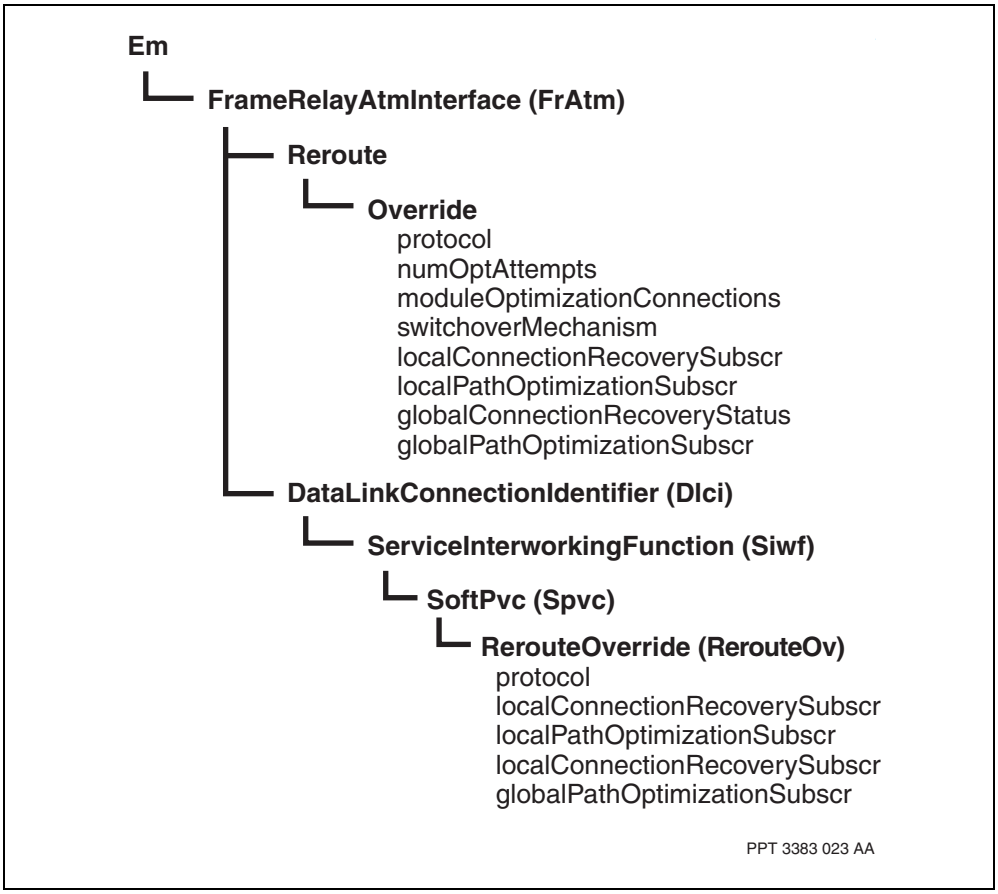
--End--

Variable definitions

Variable	Value
<globalOptimization>	Indicates the actual subscription value for global path optimization. The value does not change during the lifetime of the connection. The value can be set to either yes, no, or sameAs.
<globalRecoverySubscribed>	Indicates the actual subscription value for global connection recovery. The value does not change during the lifetime of the connection. The value can be set to either yes, no, or sameAs.
<m>	The instance value of the *Dlci* component.
<n>	The instance number of the FrATM interface.

Procedure job aid

Component tree for configuring rerouting and path optimization



Monitoring and troubleshooting

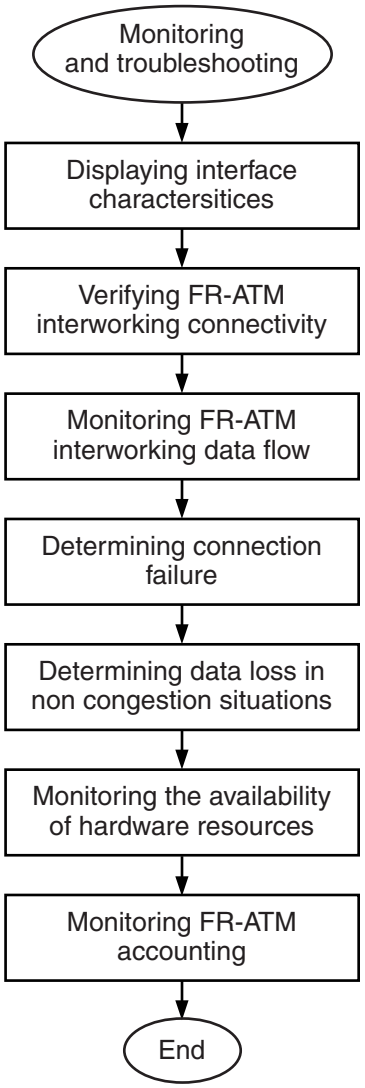
Use the guidelines in this section to monitor a FR-ATM interworking connection, and solve problems that occur after the FR-ATM interworking function is operational.

For supporting information about alarms and troubleshooting, refer to the section Alarms and troubleshooting (page 134)

Monitoring and troubleshooting procedures

This task flow shows you the sequence of procedures you perform to monitor a FR-ATM interworking connection. To link to any procedure, go to Monitoring and troubleshooting procedures (page 80).

Monitoring and troubleshooting procedures



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Monitoring and troubleshooting procedure navigation

- Displaying interface characteristics (page 83)
- Verifying FR-ATM interworking connectivity (page 85)
- Monitoring FR-ATM interworking data flow (page 88)
- Determining connection failure (page 90)
- Determining FR-ATM connection congestion (page 93)
- Determining data loss in non-congestion situations (page 96)
- Monitoring the availability of hardware resources (page 99)

- Monitoring FR-ATM accounting (page 101)

Displaying interface characteristics

Display the characteristics of the FR-ATM interface.

Procedure steps

Step	Action
1	Determine the interface's OSI state. **`display FrAtm/<n> OsiState`**
2	Determine the interface's administration state. **`display FrAtm/<n> adminStat`**
3	Determine the interface's operational state. **`display FrAtm/<n> operationalState`**
4	Determine the type of interface traffic. **`display FrAtm/<n> Statistics`** This command displays the values of the *lastUnknownDlci, unknownDlciFramesFromIf,* and the *invalidHeaderFramesFromIf* attributes. If the value of the *lastUnknownDlci* attribute is anything but zero and the value of the *unknownDlciFramesFromIf* attribute increases, you are sending traffic on a non-existent DLCI. If the value of the *invalidHeaderFramesFromIf* attribute increases, the frame has a bad header.
5	Determine the traffic statistics. **`display FrAtm/<n> framer Statistics`** The *framer* command displays the values of the *aborts, crcErrors, lrcErrors, nonOctetErrors, overruns, underruns, largeFrmErrors,* and *frmModeErrors* attributes. If the value of these attributes do not increase, no problems exist. If the value of these attributes increase, there are problems with the traffic. The *framer* command also displays the values of the *frmFromIf* and *frmToIf* attributes. If the value of the *frmFromIf* attribute increases, traffic comes from the interface. If the value of the *frmToIf* attribute increases, traffic goes to the interface.
6	Determine the traffic statistics. **`display FrAtm/<n> vframer Statistics`** The *VFramer* command displays the values of the *frmToOtherVFramer*, *frmFromOtherVFramer*, *octetFromOtherVFramer*, and *discFrmFromOtherVFramer* attributes. If the value of the *frmToOtherVFramer* attribute increases, more traffic is flowing from the interface. If the values of the *frmFromOtherVFramer* or *octetFromOtherVFramer* attributes increase, traffic is flowing to the interface. If the value of the *discFrmFromOtherVFramer* increases, an

increasing number of frames from the *otherVirtualFramer* attribute are being discarded, indicating that the function processor is falling behind in the handling of traffic.

7 Display characteristics of a FR-ATM SIWF connection.

```
display FrAtm/<n> Dlci/<dlci_no> Siwf vccState
```

If the value of the *vccState* attribute is anything but *enabledUp*, there is a problem with the connection. Check the *vccClearCause* attribute for possible network-related problems

You can only view the *Siwf* component at the called end after the call is up.

8 Display network description information for a FR-ATM NIWF connection.

```
display FrAtm/<n> Dlci/<dlci_no> Niwf
```

9 Determine the *Frf5EpG Ep* component to which a FrAtm Dlci instance is bound by observing the *AtmDlci* attribute

```
display FrAtm/<n> Dlci/<dlci_no> Niwf AtmDlci
```

10 Verify the connection from the end point by entering the command.

```
display McsMgr Frf5EpG/1 Ep/1 Dlci/200
accessConnectionComponent
```

11 Determine the ATM hop to which the FRF.5 end point is linked by observing the *AtmCon* attribute of the *Frf5EpG Ep* component

```
display McsMgr Frf5EpG/<y> Ep/<z> AtmCon nextHop
```

12 verify the connection from the VCC to the end point

```
display AtmIf/120 Vcc/0.200 Ep
```

--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<n>	is the instance number of the FR-ATM interface.
<y>	is the instance number of the *Frf5EpG* component.
<z>	is the instance number of the *Ep* component.

Verifying FR-ATM interworking connectivity

Verify FR-ATM interworking connectivity by firstly, verifying the SIWF connectivity and then verifying the NIWF connectivity.

Procedure steps

Step	Action
1	To verify the FR-ATM SIWF connectivity, begin by verifying the frame relay-side connectivity. The interpretation of the A-bit status information is identical for the FR-ATM interface and FR UNI. For more information, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*. **`display FrAtm/<n> Dlci/<dlci_no> aBitStatus`**
2	Verify ATM network-side connectivity for NPVC (step 2, step 3 and step 4). Identify the first connection point (the ATM nailed-up end point). Display the connected *Atmif Nep* component. **`display FrAtm/<n> Dlci/<dlci_no> Siwf Npv`**
3	Get information on the next ATM hop by displaying the VCC's *nextHop* attribute. Display instance numbers for the *AtmIf*, *Vpt*, and *Vcc* components set as the next hop in the ATM bearer service (ABS). Repeat this step for every hop in the list until you reach the remote end point. **`display AtmIf/<i> [Vpt/<Vpi>] Vcc/<x> Nrp nextHop`**
4	When you have a list of all VCCs in the ATM connection, use the trace command to test any segment from any VCC. Any missing *Vcc* component in the response to the trace command may have a fault. See NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management* for information on trace loopbacks and determining the status of missing VCCs. **`trace AtmIf/<i> [Vpt/<Vpi>] Vcc/<x>`**
5	Verify ATM network-side connectivity for SPVC (step 5 and step 6). Identify the connection point. Display the connected *AtmIf Vcc Ep* component. **`display FrAtm/<n> Dlci/<dlci_no> Siwf AtmConnection`**
6	Get information on the next ATM hop by displaying the VCC at the remote end of the physical connection. Repeat this step to display the information for each relay point until the connection terminates with an end point. **`display Atmif/<i> [Vpt/<Vpi>] Vcc/<x> Rp`**
7	To verify the FR-ATM NIWF connectivity, begin by determining the FrAtm Spvc connectivity by observing the aBitStatus group under the Dici component.

The connection has local status (link side) and network side status. The attributes aBitStatusFromIf and aBitReasonFromIf verify the link side of the connection. The aBitStatusToIf and the aBitReasonToIf attributes verify the network side of the connection. The connection is ready to process data when both sides of the connection are active.

```
display FrAtm/<n> Dlci/<dlci_no> aBitStatus
```

8 Determine DLCI connectivity by observing the aBitStatus group attributes under the *Dlci* component.

The connection has local status (link side) and network side status. The attributes aBitStatusFromIf and aBitReasonFromIf verify the link side of the connection. The aBitStatusToIf and the aBitReasonToIf attributes verify the network side of the connection. The connection is ready to process data when both sides of the connection are active.

```
display McsMgr Frf5EpG/<y> Ep/<z> Dlci/200 op
```

9 Determine the status of the FRF.5 MCS switched path LMI, observe the protocolStatus attribute under the *Lmi* component.

The *protocolStatus* attribute can have a value of either normalCondition or errorCondition. When the Lmi component is up, it is in normalCondition, otherwise it is in errorCondition. Display the Lmi status.

```
display McsMgr Frf5EpG/<y> Ep/<z> Lmi protocolStatus
```

10 Optionally, display a full listing of the *Lmi* status.

```
display McsMgr Frf5EpG/<y> Ep/<z> Lmi
```

11 Determine the status of the FRF.5 ATM VCC by displaying the Status attribute under the *Vcc* component.

```
display AtmIf/<i> [Vpt/<Vpi>] Vcc/<x> Status
```

--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<i>	is the ATM interface instance.
<n>	is the instance number of the FR-ATM interface.
[Vpt/<Vpi>]	is the *VirtualPathTerminator* component. Use this parameter if the virtual connection is associated with a *Vpt* component.

(1 of 2)

Variable	Value
<x>	is the instance of the *Vcc* component. If the virtual channel is associated with an *AtmIf* component, <x> represents the VPI.VCI value. If the virtual channel is associated with a Vpt, <x> represents VCI value.
<y>	is the instance number of the *Frf5EpG* component.
<z>	is the instance number of the *Ep* component.

(2 of 2)

Monitoring FR-ATM interworking data flow

Monitor the traffic flow for FR-ATM interworking to verify data flow across the Nortel Multiservice Switch network. View statistics for both FR-ATM interface and the ATM interface.

As the data travels along a path, it:

- transmits from the FR DTE to the FR-ATM interface.
- passes up from the *Framer* component to the FR-ATM DLCI.
- in the case of an NIWF connection, it enters the ATM network through the ATM interface (set up by FRF.5 switched path networking API).
- with an SIWF connection, it leaves the FRF and traverses the bus, exiting the node through an ATMIf Vcc, and enters the ATM subnetwork through ATM interface
- crosses the ATM subnetwork.
- terminates at an ATM interface which passes the data to the ATM DTE.

In this procedure, look for changes in attribute values. For each step that assesses the value of an attribute as increasing or decreasing, repeat the command line several times. Each time, record the values the command displays for the list of attributes.

Procedure steps

Step	Action
1	Optionally, verify that the FR-ATM *Framer* is receiving the data from the frame relay DTE. **`display FrAtm/<n> Framer`** For the *Framer* command, if the value of the *frmFromIf* attribute is increasing, the FR-ATM IWF is receiving data.
2	Optionally, verify that the FR-ATM *VFramer* is receiving the data from the frame relay DTE. **`display FrAtm/<n> VFramer`** For the *VFramer* command, if the value of the *frmToOtherVFramer* attribute increases, more traffic is flowing from the interface.
3	Verify that the DLCI associated with the FR-ATM interface is receiving data. **`display FrAtm/<n> Dlci/<dlci_no> Stats`** If the value of the *frmFromIf* attribute is increasing, and the value for the *bytesFromIf* attribute is increasing by the byte size, then the FR-ATM DLCI is receiving data.

4 For an SIWF connection, identify the connection point for an NPVC or SPVC. Refer to Verifying FR-ATM interworking connectivity (page 85) for the specific commands to use.

5 Verify that each ATM interface is receiving data.

```
display AtmIf/<i> Statistics
```

If the value of the *receivedCells* attribute is increasing, then the ATM interface is receiving data from the remote end.

Repeat this step for each ATM interface in the ATM segment of the PVC.

6 Verify that each ATM connection hop is receiving data.

```
display Atmif/<i> [Vpt/<Vpi>] Vcc/<x> Statistics
```

If the value of the *receivedCells* attribute is increasing by the cell size, then the connection is receiving data from the remote end.

Repeat this step for each ATM connection hop in the ATM segment of the PVC.

--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<i>	is the ATM interface instance.
<n>	is the instance number of the FR-ATM interface.
<vpi>	is the instance value of the *Vpt* component.
[Vpt/<Vpi>]	is the *VirtualPathTerminator* component. Use this parameter if the virtual connection is associated with a *Vpt* component.
<x>	is the instance of the *Vcc* component. If the virtual channel is associated with an *AtmIf* component, <x> represents the VPI.VCI value. If the virtual channel is associated with a *Vpt*, <x> represents VCI value.

Determining connection failure

If you have detected abnormalities in FR-ATM service interworking data flow, you must isolate the connection failure. When you detect data loss, check the connection status.

Prerequisites

- Make sure that all components are unlocked.
- Enable connection admission control (CAC) to perform step 8 and monitor the bandwidth pools to determine the what is causing DLCIs to fail.

Procedure steps

Step	Action
1	Determine if a fault in the frame relay local link is causing a connection failure. **`display FrAtm/<n> Dlci/<dlci_no> Abit`** If the value of the *aBitStatusFromIf* attribute is *inactive*, look towards the FR-ATM side of the network for connection problems. If the value of the *aBitStatusToIf attribute* is *inactive*, look towards the ATM network for connection problems. If the value of the *aBitStatusFromIf* attribute is *inactive*, and the value of the *aBitReasonFromIf* attribute is *localLinkDown*, connection failure is occurring at the FR-ATM DLCI.
2	Determine if a fault on the ATM side of the NPVC connection is causing a connection failure (step 2, step 3 and step 4). Determine the component identity of the corresponding ATM connection. **`display FrAtm/<n> Dlci/<dlci_no> Siwf Npvc atmConnection`**
3	Get information on the next ATM hop by displaying the VCC's *nextHop* attribute at the remote end of the physical connection. Repeat this step for every hop in the list until you have identified all hops in the ATM segment of the NPVC. This command displays instance numbers for the *AtmIf*, *Vpt*, and *Vcc* components that you provisioned as the next hop in the ABS. **`display Atmif/<i> [Vpt/<Vpi>] Vcc/<x> Nrp nextHop`**
4	Check the VCC status for each connection hop. **`display Atmif/<i> [Vpt/<Vpi>] Vcc/<x> Status`** Repeat this step for each hop in the ATM segment of the PVC to check the VCC status at all ATM intermediate points. If the *aisState* and *rdiState* attributes have a value of *bad*, the connection failure is occurring at this ATM interface or VCC.

5 Determine if a fault on the ATM side of the SPVC connection is causing a connection failure (step 5 and step 6). Determine the component identity of the corresponding ATM connection.

```
display FrAtm/<n> Dlci/<dlci_no> Siwf atmConnection
```

6 Get information on the next ATM hop. Display the VCC's *nextHop* attribute. This command displays instance numbers for the *AtmIf*, *Vpt*, and *Vcc* components that you provisioned as the next hop in the ABS.

```
display Atmif/<i> [Vpt/<Vpi>] Vcc/<x> Rp nextHop
```

Repeat this step to display the information for each relay point until the connection terminates with an end point.

7 Determine if a fault related to the frame relay local management interface (LMI) is causing a connection failure. Check the A-bit status for the DLCI associated with the FR-ATM interface.

```
display FrAtm/<n> Dlci/<dlci_no> Abit
```

If the value for the *aBitStatusFromIf* attribute is *inactive* and the value for the *aBitReasonFromIf* attribute is *localLmiError,* the connection failure is related to the frame relay LMI associated with the FR-ATM interface.

8 Monitor the bandwidth pools determine what is causing the DLCIs to fail (step 8, step 9, step 10, step 11, and step 12). Check for troubled PVCs on the FR-ATM interface.

```
display FrAtm/<n> Ca troubledDlcis
```

9 Check the reason for the troubled Dlci on the FR-ATM interface.

```
display FrAtm/<n> Dlci/<dlci_no> troubledReason
```

If a system response of *notAdmitted* displays the CAC algorithm has failed to admit this connection. Check whether there is sufficient bandwidth allocation.

10 Make sure that the requested EBR for a connection is less than or equal to the bandwidth in the *poolAvailableBandwidth* attribute. First, determine the troubled connection's assigned bandwidth pool.

```
display FrAtm/<n> Dlci/<dlci_no> Siwf
assignedBandwidthPool
```

11 Check the available bandwidth in each of the bandwidth pools.

```
display FrAtm/<n> CA poolAvailableBandwidth
```

12 Determine the requested bandwidth for a specific PVC in the bandwidth pool.

```
display FrAtm/<n> Dlci/<dlci_no> Siwf equivalentBitRate
```

13 Determine if a failure on the FRF.5 switched path caused the connection failure. This can only be performed on an NIWF connection.

```
display McsMgr Frf5EpG/<y> Ep/<h> Dlci/<dlci_no> oper
```

```
display McsMgr Frf5EpG/<y> Ep/<h> Lmi
```

14 Determine if a *FrAtm Lmi* component that is down caused the congestion failure. This can only be performed on an NIWF connection.

`display FrAtm/<n> Dlci/<dlci_no> Abit`

See if the *aBitStatusFromIf* attribute is inactive and the *aBitReasonFromIf* attribute is set to localLmiError.

--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<i>	is the ATM interface instance.
<n>	is the instance number of the FR-ATM interface.
<vpi>	is the instance value of the *Vpt* component.
[Vpt/<Vpi>]	is the *VirtualPathTerminator* component. Use this parameter if the virtual connection is associated with a *Vpt* component.
<x>	is the instance of the *Vcc* component. If the virtual channel is associated with an *AtmIf* component, <x> represents the VPI.VCI value. If the virtual channel is associated with a *Vpt*, <x> represents VCI value.
<y>	is the instance number of the *Frf5EpG* component.
<z>	is the instance number of the *Ep* component.

Determining FR-ATM connection congestion

Isolate the point of congestion when observing data loss on a FR-ATM connection. Use the statistics on FR-ATM and ATM for detection. If a local FR-ATM connection is congested, determine the cause of the congestion.

Once the connection is *up*, the frame relay managed cut-through switching (MCS) manager no longer processes data and is a point of congestion.

Procedure steps

Step	Action
1	Determine if congestion is occurring at the local FR-ATM interface (step 1 and step 2). Check resource utilization for the function processor (FP) that hosts the FR-ATM. **`display Lp/<lp> Util`** Check if the value of the *cpuUtil* attribute (CPU utilization) is approaching 100%. High CPU utilization is one possible indication of FP congestion and data loss. FP CPU congestion causes frame relay queue congestion and data loss.
2	Check the DLCI associated with the FR-ATM interface for congestion indication and discards to determine the direction in which congestion is occurring. Repeat this step several times, noting the values displayed. **`display FrAtm/<n> Dlci/<dlci_no> Stats`** If the values of the *becnFrmToIf, discCongestedFromIf,* and *discCongestedFromIfBytes* attributes are increasing, congestion is in the direction of the network. If the values of the *fecnFrmToIf, discCongestedToIf,* and *discCongestedToIfBytes* attributes are increasing, congestion is in the direction of the FR-ATM connection.
3	Determine if the ATM network is congested in the direction of the FR-ATM SIWF (step 3, step 4, step 5 and step 6). Check the DLCI associated with the FR-ATM interface for congestion indication and discards. Repeat this step several times, noting the values displayed. **`display FrAtm/<n> Dlci/<dlci_no> Stats`** If the values of the *fecnFrmToIf* and *efciFromNetwork* attributes are increasing, ATM network congestion is occurring in the direction of the FR-ATM SIWF.
4	For an SIWF connection only, get information on the next ATM hop by displaying the VCC's *nextHop* attribute. For NPVC, display the instance numbers for the AtmIf, Vpt, and Vcc components that you provisioned as the next hop in the ABS. **`display AtmIf/<i> [Vpt/<Vpi>] Vcc/<x> Nrp nextHop`**

5 For SPVC, display the instance numbers for the AtmIf, and Vcc components that you provisioned as the next hop in the ABS.

Repeat step 4 and step 5 for hop in the list until you have identified all hops in the ATM segment of the PVC.

```
display AtmIf/<i> Vcc/<x> Rp nextHop
```

6 Check data loss at the VCC for every hop in the ATM segment of the PVC.

```
display AtmIf/<i> [Vpt/<Vpi>] Vcc/<x> Statistics
```

Observe the values of the *txCellDiscard* and *rxCellDiscard* attributes. The *txCellDiscard* indicates data loss in the direction of the ATM link. The *rxCellDiscard* attribute indicates data loss in the direction of the ATM FP. The *rxCellDiscard* attribute also contains the data loss due to AAL5 reassembly errors

Repeat step 3 to step 6, to check data loss at every connection hop.

7 Determine if the ATM network is congested in the direction of the ATM interface (step 7, step 8, step 9, step 10,and step 11). Check the data by the ATM interface associated with the FR-ATM SIWF.

```
display AtmIf/<i> [Vpt/<Vpi>] Vcc/<x> Statistics
```

Take note of the value of the *transmittedCell* attribute.

8 For an SIWF connection and nailed-up VCCs only, get information on the next ATM hop by displaying the VCC's *nextHop* attribute. Display instance numbers for the AtmIf, Vpt, and Vcc components provisioned as the next hop in the AB

```
display AtmIf/<i> [Vpt/<Vpi>] Vcc/<x> Nrp nextHop
```

9 For an SIWF connection and soft VCCs only, get information on the next ATM hop by displaying the VCC's *nextHop* attribute. Display instance numbers for the AtmIf, and Vcc components provisioned as the next hop in the ABS.

```
display AtmIf/<i> Vcc/<x> Rp nextHop
```

10 Check the data that the VCC on the user side (remote end of the ATM segment of the PVC) received.

```
display AtmIf/<i> [Vpt/<Vpi>] Vcc/<x> Statistics
```

Note the value of the *rxCell* attribute. If the value of txCell that you obtained at step 7 equals the value of the *rxCell* attribute from this step, there is no data loss. Repeat step 7, if necessary, to obtain refreshed information on the *txCell* attribute. If rxCell is less than txCell, data loss is occurring.

Repeat this step for every hop in the list until you have identified all hops in the ATM segment of the PVC.

11 Check for data loss for the ATM interface associated with the FR-ATM SIWF.

```
display AtmIf/<i> [Vpt/<Vpi>] Vcc/<x> Statistics
```

Repeat this command several times, noting the values you get.

If the value of the *txDiscard* attribute is increasing, data loss is occurring in the direction of the link. If the value of the *rxDiscard* attribute is increasing, data loss is occurring in the direction of the ATM node. The *rxDiscard* attribute also counts the data loss due to AAL5 reassembly errors.

Repeat this step to check data loss at every ATM connection hop.

--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<i>	is the ATM interface instance.
<n>	is the instance number of the FR-ATM interface.
<vpi>	is the instance value of the *Vpt* component.
[Vpt/<Vpi>]	is the *VirtualPathTerminator* component. Use this parameter if the virtual connection is associated with a *Vpt* component.
<x>	is the instance of the *Vcc* component. If the virtual channel is associated with an *AtmIf* component, <x> represents the VPI.VCI value. If the virtual channel is associated with a *Vpt*, <x> represents VCI value.

Determining data loss in non-congestion situations

Data loss can occur at the following points even when there is little or no congestion on either the frame relay segment or the ATM segment of the PVC:

- *Framer* component
- FR-ATM interface
- FR-ATM DLCI
- FR-ATM SIWF in the direction of the ATM subnetwork
- VCC
- ATM interface
- FR-ATM SIWF in the direction of the FR-ATM (from the ATM subnetwork)

Procedure steps

Step	Action
1	Optionally, check the *Framer* component associated with the FR-ATM interface. **`display FrAtm/<n> Framer`** If the values for the *rxDiscard* attribute are increasing and if there is no congestion, then AAL5 reassembly is causing the data loss. If the values for the *aborts, crcErrors, overruns*, or *underruns* attributes are increasing, a bad cable or a bad hardware configuration is causing the data loss. If the values for the *largeFrmErrors* or *nonOctetErrors* attributes are increasing, then corrupted data which is too long or not in octet format, is causing the data loss.
2	Optionally, check the *VFramer* component associated with the FR-ATM interface. **`display FrAtm/<n> VFramer`** If the values for the *rxDiscard* attribute are increasing and if there is no congestion, then AAL5 reassembly is causing the data loss. If the values for the *aborts, crcErrors, overruns*, or *underruns* attributes are increasing, a bad cable or a bad hardware configuration is causing the data loss. If the values for the *largeFrmErrors* or *nonOctetErrors* attributes are increasing, then corrupted data which is too long or not in octet format, is causing the data loss.
3	Check the FR-ATM interface. **`display FrAtm/<n> Stats`**

If the values for the *invalidHeaderFramesFromIf* attribute are increasing, then invalid frame headers are causing the data loss.

If the values for the *unknownDlciFramesFromIf* attribute are increasing, then an invalid DLCI in frame header is causing the data loss.

4 Check the DLCI associated with the FR-ATM interface.

```
display FrAtm/<n> Dlci/<dlci_no> Stats
```

If the values for the *discFrameAbit* and *discByteAbit* attributes are increasing, then an inactive A-bit is causing the data loss.

If the values for the *discExcessFromIf* and *discExcessFromIfBytes* attributes are increasing, then rate enforcement is causing the data loss.

If the values for the *errorLongFrmFromIf* and *errorLongBytesFromIf* attributes are increasing, then frame lengths greater than the *maximumFrameSize* attribute specifies are causing the data loss.

If the values for the *errorShortBytesFromIf* attribute are increasing, then a frame length that has a 0-byte payload is causing the data loss.

5 Check the FR-ATM SIWF in the direction toward ATM subnetwork.

```
display FrAtm/<n> Dlci/<dlci_no> Siwf
```

If the values for the *unknown1490Frames* attribute are increasing, then frame headers that are not supported according to the RFC 1490/2427 encapsulation method are causing the data loss.

If the values for the *invalid1490Frames* attribute are increasing, then frame headers that are not recognizable according to the RFC 1490/2427 encapsulation method are causing the data loss.

6 Check the ATM interface VCC.

```
display AtmIf/<i> [Vpt/<Vpi>] Vcc/<x> Statistics
```

7 Check the ATM interface associated with the FR-ATM SIWF.

```
display AtmIf/<i> Statistics
```

If the values for the *droppedRxCell* attribute are increasing, then either a cell header error correction (HEC) error or an invalid vpi.vci is causing the data loss.

8 Check the FR-ATM SIWF in the direction of the FR-ATM interface (from the ATM subnetwork).

```
display FrAtm/<n> Dlci/<dlci_no> Siwf
```

If the values for the *unknown1483Frames* attribute are increasing, frame headers that are not supported according to the RFC 1483 encapsulation method are causing the data loss.

If the values for the *invalid1483Frames* attribute are increasing, then frame headers that are not recognizable according to the RFC 1483 encapsulation method are causing the data loss.

The contents of the last unknown or unrecognized RFC 1483 header is available in the *lastUnknown1483ProtocolHeader* attribute.

--End--

Variable definitions

Variable	Value
<dlci_no>	is the instance number of the FR-ATM DLCI.
<i>	is the ATM interface instance.
<n>	is the instance number of the FR-ATM interface.
<vpi>	is the instance value of the *Vpt* component.
[Vpt/<Vpi>]	is the *VirtualPathTerminator* component. Use this parameter if the virtual connection is associated with a *Vpt* component.
<x>	is the instance of the *Vcc* component. If the virtual channel is associated with an *AtmIf* component, <x> represents the VPI.VCI value. If the virtual channel is associated with a *Vpt*, <x> represents VCI value.

Monitoring the availability of hardware resources

Monitoring the availability of hardware resources is important because a DLCI that cannot acquire the necessary hardware resources will remain locked until sufficient resources become available, regardless of any attempt to unlock the DLCI. Hardware resources become unavailable for one of the following two reasons:

- More than the maximum number of supported DLCIs are provisioned on the Lp.
- All sub-connection resources are used on the Lp.

Procedure steps

Step	Action
1	Display the number of FrUni/FrNni DLCIs that are currently under the Lp: **`d lp/<v> eng frs currentCalls`**
2	Display the number of sub-connections on the Lp: **`d lp/<v> eng fcrc`** IP-optimized DLCI requires two sub-connections.
3	Delete one or more DLCI to free up hardware resources. Deleting any type of DLCI frees up resources. **`del FrAtm/<w> Dlci/<x>`**
4	Delete one or more DLCI to free up hardware resources. Deleting any type of DLCI frees up resources. **`del FrUni/<t> Dlci/<x>`**
5	Delete one or more DLCI to free up hardware resources. Deleting any type of DLCI frees up resources. **`del FrNni/<u> Dlci/<x>`**
6	Unlock one or more DLCI after hardware resources become available. **`unlock FrAtm/<w> Dlci/<z>`**

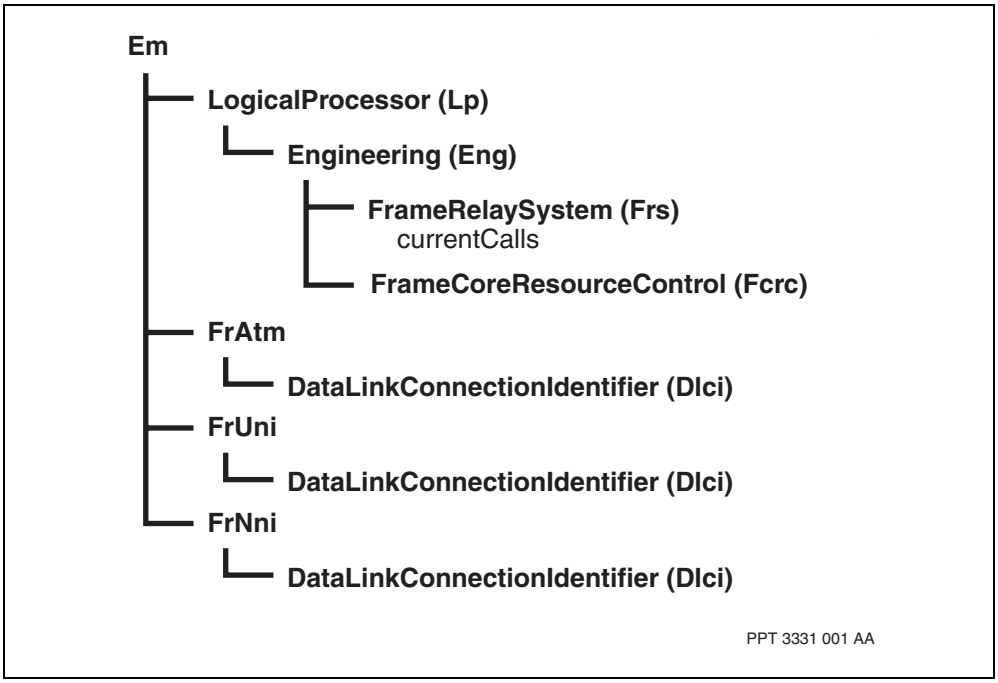
--End--

Variable definitions

Variable	Value
<t>	is the instance number of the FrUni.
<u>	is the instance number of the FrNni.
<v>	is the instance number of the Lp.
<w>	is the instance number of the FrAtm.
<x>	is the instance number of the DLCI to be deleted.
<z>	The instance number of the DLCI to be unlocked.

Procedure job aid

Monitoring availability of hardware resources component hierarchy



Monitoring FR-ATM accounting

Monitor FR-ATM accounting in two ways:

- monitoring the call data of a DLCI
- monitoring the interval data of a DLCI

Procedure steps

Step	Action
1	Display the values of the CallData attributes of the DLCI. **`display FrAtm/<n> Dlci/<dlci_no> callData`**
2	Display the values of the *Interval Data* attributes of the DLCI. To understand the significance of these values, refer to the table IntervalData attributes (page 101). **`display FrAtm/<n> Dlci/<dlci_no> IntervalData`**

--End--

Variable definitions

Variable	Definition
<n>	is the instance number of the FR-ATM interface.
<dlci_no>	is the instance number of the FR-ATM DLCI.

Monitoring FR-ATM accounting supporting information

IntervalData attributes

Attribute name	Attribute description
startTime	This is start time for the current accounting interval in yyyy-mm-dd or hh:mm:ss format.
totalIngressBytes	This is the current total number of local ingress bytes since the beginning of the accounting interval.
totalEgressBytes	This is the current total number of local egress bytes since the beginning of the accounting interval.
eirIngressBytes	This is the current total number of local EIR ingress bytes since the beginning of the accounting interval.

(1 of 2)

IntervalData attributes (continued)

Attribute name	Attribute description
eirEgressBytes	This is the current total number of local EIR egress bytes since the beginning of the accounting interval.
discardedBytes	This is the current total number of local discarded bytes since the beginning of the accounting interval.
totalIngressFrames	This is the current total number of local ingress frames since the beginning of the accounting interval.
eirIngressFrames	This is the current total number of local EIR ingress frames since the beginning of the accounting interval.
eirEgressFrames	This is the current total number of local EIR egress frames since the beginning of the accounting interval.
discardedFrames	This is the current total number of local discarded frames since the beginning of the accounting interval.
elapsedDifference	This is the elapsed time since the beginning of the accounting interval.

(2 of 2)

FR-ATM accounting

FR-ATM accounting allows a service provider to bill end users based on the amount of network resources they use. Also, statistics and service level agreements (SLAs) can use accounting records.

FR-ATM accounting provides usage-based accounting for best-effort delivery services. In these services, network congestion or rate policing can lose or discard end-user frames. Therefore, end users require account billing according to the amount of data that the network actually transfers.

Each FP has its own, independent accounting subsystem that can generate records for the FR-ATM connections on that FP. You can turn FR-ATM accounting on at one end interface (single-ended accounting) or at both ends interfaces (double-ended accounting).

The accounting meter collects accounting data. You can enable accounting data collection for FR-ATM DLCIs at the interface level. There is one accounting meter for each connection (DLCI) that has accounting turned on. The FR-ATM accounting service sends the accounting data to the accounting system, specifically to the accounting meter.

There is one FR-ATM accounting controller for each FP. Each FR-ATM connection (with accounting enabled) registers with the FR-ATM accounting controller. On each time of day accounting (TODA) changeover event, the accounting meters collect the accounting data. The data collection system (DCS) then spools the accounting records to the Nortel Multiservice Switch disk.

Accounting records transfer from the disk to the Management Data Provider (MDP) on Nortel Multiservice Data Manager. The MDP system converts the accounting records to the standard bulk data format (BDF) or published format and stores them on the MDP. For more information about MDP, refer to the 241-6001-309 *Nortel Multiservice Data Manager Management Data Provider*.

In BDF, the customer's billing server can handle the files and transfer them to either a billing host or a network engineering host. The customer uses their own software packages to post-process the (standard) BDF files containing accounting data.

FR-ATM accounting is service-oriented. It collects a set of service-specific data and uses this data for billing purposes for a specific service. The usage billing data is different for each service and changes as the service matures and gains knowledge about network operations.

For more information about Multiservice Switch accounting, see NN10600-560 *Nortel Multiservice Switch 7400/15000/20000 Accounting*.

Navigation

Benefits of FR-ATM accounting

There are many benefits to using FR-ATM accounting.

The benefits of this feature are as follows:

- FR-ATM accounting enables a usage-based billing policy which is more flexible and more accurate than flat-rate accounting. Double-ended accounting reflects the amount of data actually transported from end to end. Single-ended accounting eliminates the overhead of correlating the off-switch accounting records. However, single-ended accounting does not always accurately reflect the traffic that actually transfers from end-to-end through the network.
- FR-ATM accounting adds market value for Multiservice Switch FR-ATM, since it enables the service provider to get revenues from billing for the service they provide.
- FR-ATM accounting enables the network operator to provide proof of meeting QoS requirements and service level agreements (SLAs) to end users.
- Network engineering and planning personnel can use the information in the Multiservice Switch FR-ATM accounting record.

- FR-ATM accounting provides accounting records similar to frame relay accounting. Therefore, the data traffic units are suitable for a frame-based access service such as FR-ATM.
- By provisioning a correlation tag identifier with a value (the default is null), the identifier is assigned to a FR-ATM PVC endpoint or the source end of an SPVC. The identifier is then reported in the accounting record as the *callConnId* and *circuitId* attributes. The use of a circuit identifier facilitates off-switch correlation of data for the interfaces involved in the same permanent connection.

FR-ATM accounting concepts

For more information about FR-ATM accounting concepts, see the following sections:

- FR-ATM accounting and FRF.8 (page 105)
- FR-ATM accounting and FRF.5 (page 106)
- FR-ATM gateway (page 107)
- Time of day accounting (TODA) detection for FR-ATM accounting (page 108)
- FR-ATM record correlation (page 108)
- FR-ATM single-ended and double-ended accounting (page 109)
- CircuitId attribute and the accounting record (page 110)

FR-ATM accounting and FRF.8

The figure, FR-ATM accounting and FRF.8 (page 106) shows how FRF.8 maps each DLCI to one VCC. The end-to-end connection is either of the following:

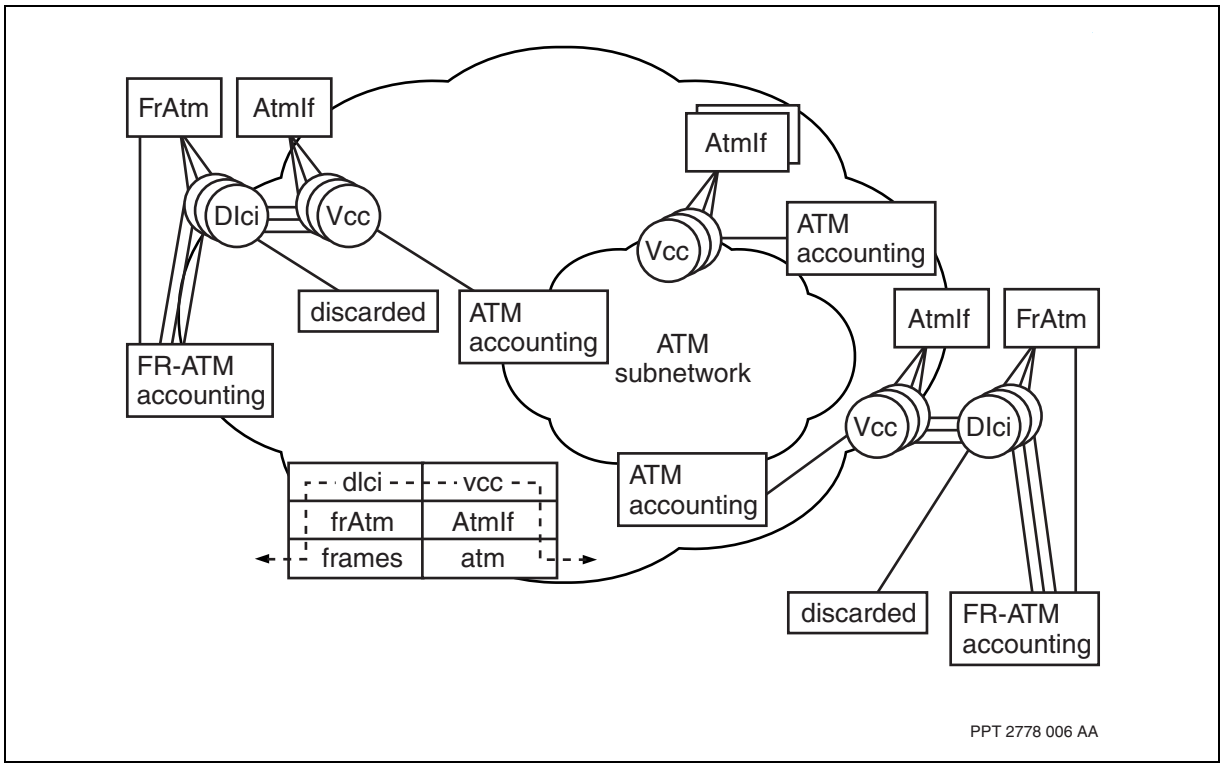
- a FR-ATM interface at both ends of the connection (FrAtm/Dlci and AtmIf/Vcc connects to AtmIf/Vcc and FrAtm/Dlci)
- a FR-ATM interface at one end of the connection and an ATM interface at the other end of the connection

FR-ATM accounting collects accounting data and generates records for each single connection (DLCI). FR-ATM accounting collects traffic counts at the access card. ATM accounting can collect accounting data at the ATM IF VCC. This configuration can be useful if one of the connection ends is FR-ATM DLCI and the other end is ATM IF VCC. If the ATM interface provides transport support for the FR-ATM service, the ATM accounting collects the data at the transport card where the ATM IF VCC is located.

FR-ATM accounting generates records similar to the frame relay over DPRS accounting records, and this makes it very useful for delivering frame-based access services. ATM accounting generates ATM accounting records. A

record comparison is difficult because the traffic counts are in different units. However, you can compare the ATM IF VCC-generated records that support the FR-ATM service with the ATM IF VCC-generated records at the other end of the connection.

FR-ATM accounting and FRF.8



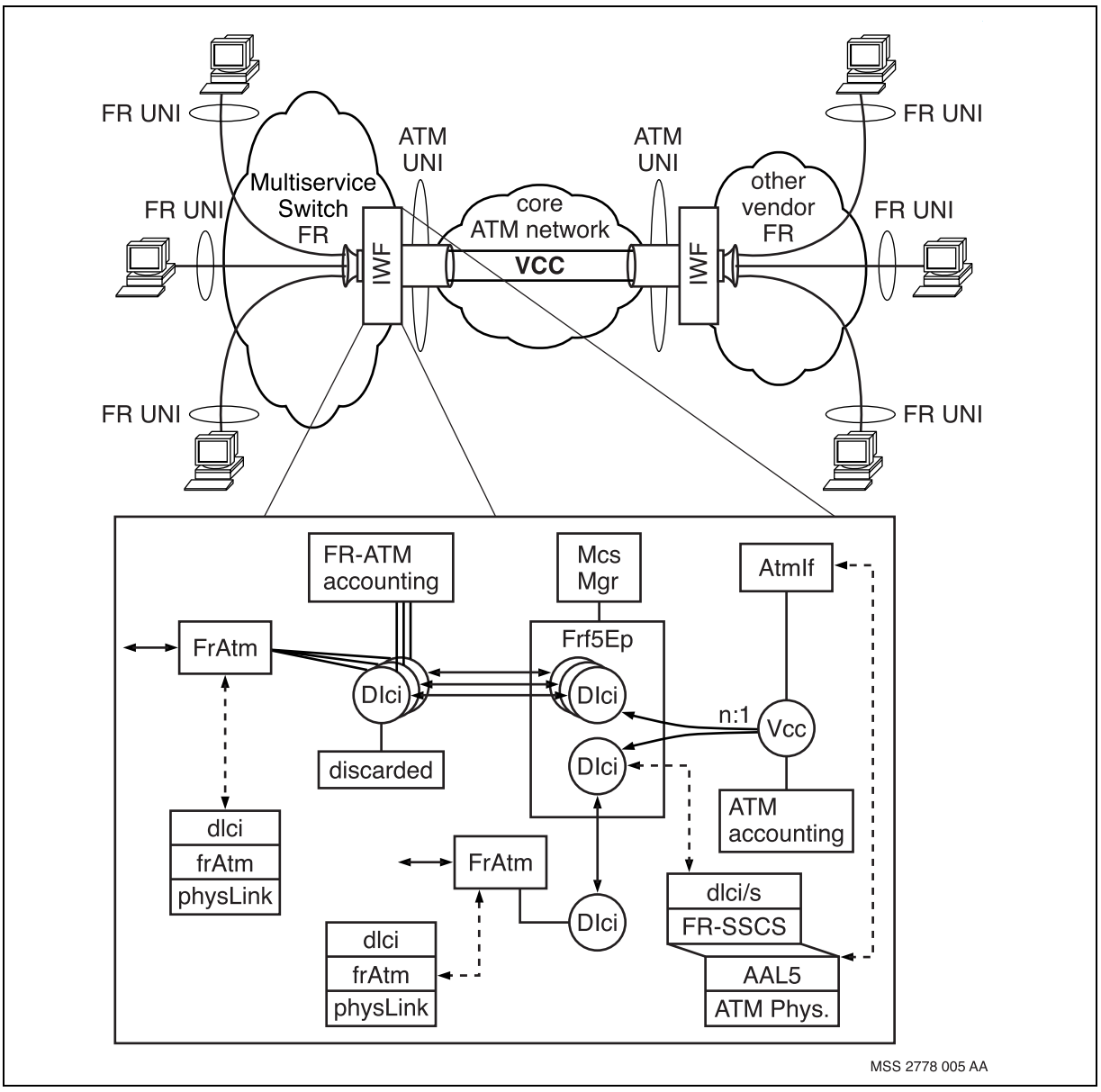
FR-ATM accounting and FRF.5

FR-ATM accounting supports accounting data collection for each single connection (DLCI). FRF.5 accounting collects traffic data only at the access card for each FR-ATM DLCI. The figure, FR-ATM accounting and FRF.5 (page 107) shows how several FR-ATM DLCIs map at the FRF.5 end point to a single ATM IF VCC. This is known as n:1 mapping.

FR-ATM accounting collects accounting data for each FR-ATM DLCI. The available ATM IF VCC accounting can collect and generate ATM accounting records. However, these ATM accounting records show the traffic counts for all the FR-ATM DLCIs, because they share the same ATM IF VCC.

If you use double-ended accounting, then you can compare the records from both ends to monitor the underlaying ATM network. You can compare the FR-ATM accounting records from both ends of a connection to evaluate the traffic through each DLCI that shares the same ATM IF VCC.

FR-ATM accounting and FRF.5



FR-ATM gateway

In a gateway configuration, there is one frame relay over DPRS DLCI connected to one FR-ATM DLCI (FRF.5). Both frame relay over DPRS accounting and FR-ATM accounting are available.

For accounting, you have three choices:

- Do not use accounting; disable both frame relay and FR-ATM accounting services.
- Enable either frame relay accounting or FR-ATM accounting.

- Enable both frame relay and FR-ATM accounting. This is not recommended because the same traffic goes through a FR DLCI and its connected FR-ATM DLCI. Therefore, one of the accounting records is redundant.

Time of day accounting (TODA) detection for FR-ATM accounting

The DCS provides and maintains TODA. The DCS provides two alternative methods for detecting the TODA changeover. They are

- a global variable which changes on each TODA changeover
- broadcasting on TODA changeover

Nortel Multiservice Switch frame relay over DPRS accounting polls the global variable on each frame (ingress and egress bus). FR-ATM accounting uses a message for the TODA changeover detection. Once FR-ATM accounting receives the message, it reads and stores the data traffic counters for each connection one after another.

The records show the accounting interval time with some offset from the TODA changeover. FR-ATM accounting provides precise data traffic counts over slightly shifted accounting intervals. This does not impact the performance. The accounting intervals are shown in the records. For details, see Generating reports (page 117).

TODA changeover

The DCS on Multiservice Switch nodes provides TODA. You can provision TODA with the *collectionTimes* attribute under the *Collector/accounting* (*Col/acc*) component. FR-ATM accounting provides a maximum of 24 TODA changeovers in a 24-hour period. The shortest interval between two TODA changeovers is one hour. Each TODA changeover produces one accounting record for each connection for each interface.

12-hour accounting timer termination

FR-ATM accounting has a 12-hour timer. If you do not provision TODA, the expiration of the 12-hour accounting timer triggers an accounting record.

FR-ATM record correlation

FR-ATM accounting does not provide on-switch correlation of the accounting records collected at different points of the connection. Instead a call correlation tag (an identifier, unique per call) is used to correlate accounting records issued by the ends of the same connection at different nodes in the network. For more information, see the following procedures:

- Configuring a FR-ATM SIWF SPVC (page 50)
- Configuring a FR-ATM SIWF NPVC (page 52)
- Configuring a FR-ATM NIWF SPVC (page 71)

For NPVCs, if you require circuit ID functionality, you must provision the correlation tag. In contrast, for FRF.5 SPVCs, you have a choice; the correlation tag can either be provisioned or automatically generated. For automatically generated correlation tags, the identifier is always unique, whereas, this may or may not be the case if the correlation tags are provisioned.

For SPVCs, each calling DLCI generates a unique correlation tag and it propagates to the called end. For FRF.5, each pair of DLCIs connected through some calling/called end points (EP) have the same unique correlation tag at both ends. It is calculated at the connection set up time at both ends. FR-ATM accounting uses the value of the called DLCI going through the VCC to calculate the unique correlation tag, because it is unique for the shared VCC.

The following describes the relationship between the call correlation tag and the generated accounting records:

- Single-ended accounting (only one end generates accounting records, with no feedback from the other end) is possible, but does not always provide enough information. If a network is undergoing data loss, there is no guarantee that the whole ingress traffic (number of cells) was successfully delivered to the other end of the connection.
- With the FR-ATM accounting feature, accounting data collection can be enabled at both the ingress and egress points of a connection (double-ended accounting). The records are generated independently at the two ends. In this case, the records generated at the two ends need to be correlated (off switch) using the call correlation tag.
- For SPVCs, the call correlation tag is automatically generated by the originating node and distributed to all connection points along the path of the call.
- Because there is no signalling infrastructure to generate a call correlation tag for NPVCs, it must be provisioned. The network operator must provision the two end points of the NPVC connection with the same unique correlation tag.

FR-ATM single-ended and double-ended accounting

In FR-ATM single-ended accounting, only one end of the connection generates one accounting record for each TODA. Because FR-ATM accounting does not support egress protocol, the single-ended accounting record does not have any data from the other end of the connection. The records only have the local accounting data. Therefore, FR-ATM accounting cannot confirm that the whole traffic (the cells carried by the ATM network, therefore the frame/byte traffic at the FR-ATM interface) was successfully delivered to the other end of the connection.

In FR-ATM double-ended accounting, both ends generate accounting records, but the records only have the accounting data local to each generating end. With this feature, you can enable the accounting data collection separately at both ends of the connection. FR-ATM accounting generates two records independently for each TODA at the two ends of the connection. You compare and correlate the accounting records.

CircuitId attribute and the accounting record

When FR-ATM accounting is enabled and the correlation tag identifier is provisioned on a connection by a user, the identifier is added to the accounting record for a FR-ATM PVC or SPVC as the *callConnId* and *circuitId* attributes. The *circuitId* attribute only appears in the accounting record if a value is provisioned for the correlation tag. However, the circuit ID feature is not essential to FR-ATM accounting. A correlation tag can be provisioned against a FR-ATM DLCI without enabling accounting and accounting can be enabled without having to provision a correlation tag.

A user cannot use a correlation tag that is provisioned against a connection to control or access the endpoint of that connection. A correlation tag value can be changed on an active permanent connection without bringing down the connection. The new correlation tag value takes effect immediately but is only visible if a display of the specific DLCI is performed. Changing a correlation tag value does not result in the immediate generation of an accounting record. Instead, the value is included in the next accounting record that is generated.

The *circuitId* attribute is part of the accounting record generated at the endpoint or source end where accounting is enabled. The circuit ID is local to the FR-ATM DLCI where it is provisioned by the user. The value for the *circuitId* attribute is the same value that was provisioned as the value for the correlation tag.

Provisioning bothEnds accounting with accounting enabled results in the generation of an accounting record at both the master and slave ends of the connection. Provisioning singleEnd accounting with accounting enabled results in the generation of an accounting record only at the master end of the connection. In both cases, the accounting record contains local accounting information only.

The circuit ID is part of the bulk data format (BDF) information of an accounting record sent to the data collection system (DCS) only when the correlation tag is provisioned. The use of a circuit identifier facilitates off-switch correlation of data for the interfaces involved in the same connection.

There is no system enforcement of the correlation tag value. The user can provision different values for the correlation tag at the FR-ATM DLCI for a connection. Nortel Multiservice Switch systems do not require that the value of the string be unique. It is the user's responsibility to provision a unique

correlation, if correlation of accounting records for that connection is required. Once provisioned, the correlation tag value is static and can only be changed by further provisioning.

Attention: Since the DLCIs for switched endpoints are created dynamically, the circuit identifiers for switched connections are not provisionable.

To provision a correlation tag for an SPVC, refer to the procedure Configuring a FR-ATM NIWF SPVC (page 71). To provision a correlation tag for an NPVC, refer to the procedure Configuring a FR-ATM NIWF SPVC (page 71).

Configuring FR-ATM accounting

For detailed provisioning procedures of FR-ATM accounting, see NN10600-920 *Nortel Multiservice Switch 7400/15000/20000 Operations: Frame Relay to ATM Interworking*. The following aspects of provisioning are, however, very important for the proper operation of FR-ATM accounting:

- Interface configuration (page 111)
- Correlation tag configuration (page 111)
- DLCI configuration for FR-ATM accounting (page 113)
- Configuration behavior (page 113)

Interface configuration

The *AccountingOptions* group of attributes under the *FrAtm Ca* component contains attributes for FR-ATM accounting configuration:

- The *accountCollection* attribute turns accounting on or off at the FR-ATM interface. When you turn accounting on, FR-ATM accounting only counts connections set up from then on. Therefore, if you need accounting for a FR-ATM interface, turn accounting on using this attribute early during provisioning. See What happens when accounting is turned off and on again (page 124) for more details.
- FR-ATM accounting records the currently provisioned value of attributes *accountingClass* and *serviceExchange* in the accounting record. These attributes do not affect the internal operation of FR-ATM accounting.

Correlation tag configuration

There are three separate correlation tags:

- FrAtm Dlci Siwf Npvc correlation tag (page 112)
- FrAtm Dlci Siwf Spvc correlationTag (page 112)
- FRF.5 FrAtm Dlci Niwf Spvc correlationTag (page 112)

FrAtm Dlci Siwf Npvc correlation tag

By default, the value of the *FrAtm Dlci Siwf Npvc correlationTag* is an empty string. You can view the operational value of the *correlationTag* in the *FrAtm Dlci correlationTag* attribute.

There is no initial system-generated value for the *correlationTag* attribute in the NPVC case. The value of the *correlationTag* does not propagate to the other side of the permanent connection. Therefore, to correlate accounting records, it is best to provision a *correlationTag* attribute at the other end of the NPVC.

You can provision the *correlationTag* as an even hex digit string of a maximum of 56 digits. To set to an empty string for the *correlationTag*, use two double-quotations as a value, that is, ““.

FrAtm Dlci Siwf Spvc correlationTag

By default, the value of the provisioned *FrAtm Dlci Siwf Spvc correlationTag* is an empty string. You can view the operational value of the *correlationTag* in the *FrAtm Dlci correlationTag* attribute.

In the SPVC case, FR-ATM accounting provides a system-generated value for the operational *correlationTag* attribute when the provisioned value is an empty string. The *correlationTag* propagates to the other side of the connection at call setup. If you change the value of the *correlationTag* attribute while accounting is enabled after the call is already established, the provisioned *correlationTag* value does not propagate until the next call setup. A lock and then an unlock command of the *Dlci* component causes a call setup to occur.

Use the following guidelines to ensure record correlation. If you want a system-generated *correlationTag*, do not provision the *correlationTag* attribute, and propagate the *correlationTag* value by clearing the call. If you want to provision a *correlationTag*, you must set the value, and propagate the *correlationTag* attribute value by clearing the call. Normally, you provision unique values for each connection, but provisioning the *correlationTag* attribute allows you to use correlation strategies such as correlating many connections together.

You can provision the *correlationTag* as an even hex digit string of a maximum of 56 digits. To set to an empty string for the correlationTag, use two double-quotations as a value, that is, ““.

FRF.5 FrAtm Dlci Niwf Spvc correlationTag

By default, the value of the provisioned *FrAtm Dlci Siwf Spvc correlationTag* attribute is an empty string. You can view the operational value of the *correlationTag* in the *FrAtm Dlci correlationTag* attribute.

In the FRF.5 SPVC case, FR-ATM accounting generates a system-generated value for the *correlationTag* attribute when the provisioned value is an empty string.

Use the following guidelines to ensure record correlation. If you want a system-generated *correlationTag*, do not provision a *correlationTag* attribute at each end of the connection. If you want to provision a *correlationTag*, you must set the same value at each end of the connection. Usually, you provision unique values for each connection, but configuration of the *correlationTag* attribute provides you with the flexibility to use correlation strategies such as correlating many connections together or correlating a connection into two sides.

If you remove a FRF.5 *FrAtm Dlci* and provision another *Dlci* in its place at a remote DLCI end point, the new DLCI receives the same system-generated *correlationTag* attribute upon the DLCI's call setup.

You can provision the *correlationTag* as an even hex digit string of a maximum of 56 digits. To set to an empty string for the *correlationTag*, use two double-quotations as a value, that is, ““.

DLCI configuration for FR-ATM accounting

To enable FR-ATM accounting at the DLCI, you only have to provision the *accounting* attribute to “on” under the *FrAtm Dlci Sp* component. Turning the accounting attribute on is a critical change; an activate prov terminates the DLCI service.

Configuration behavior

Changes to the accounting provisionable attributes in *FrAtm Ca* component are non-critical; they do not terminate the service, existing connections remain the same, and accounting continues, (if enabled). Also, they only take effect upon the next call setup. Moreover, if you turn the *accounting* attribute off for the *Dlci Sp* component, FR-ATM accounting disables and releases the accounting resources. The DLCI service does not terminate.

The only critical provisioning change is if there are provisioned reasons in the *FrAtm Ca accountCollection* attribute and the *Fratm Dlci Sp accounting* attribute is turned “on”. When this occurs, a check prov indicates that the DLCI service will terminate, an activate prov terminates the DLCI service, and finally the DLCI service restarts with accounting enabled.

Changes to the *correlationTag* attribute in *FrAtm Dlci Siwf Npvc, Fratm Dlci Siwf Spvc*, and *Fratm Dlci Niwf Spvc* components are also non-critical and take effect immediately, if accounting is enabled.

Data collection

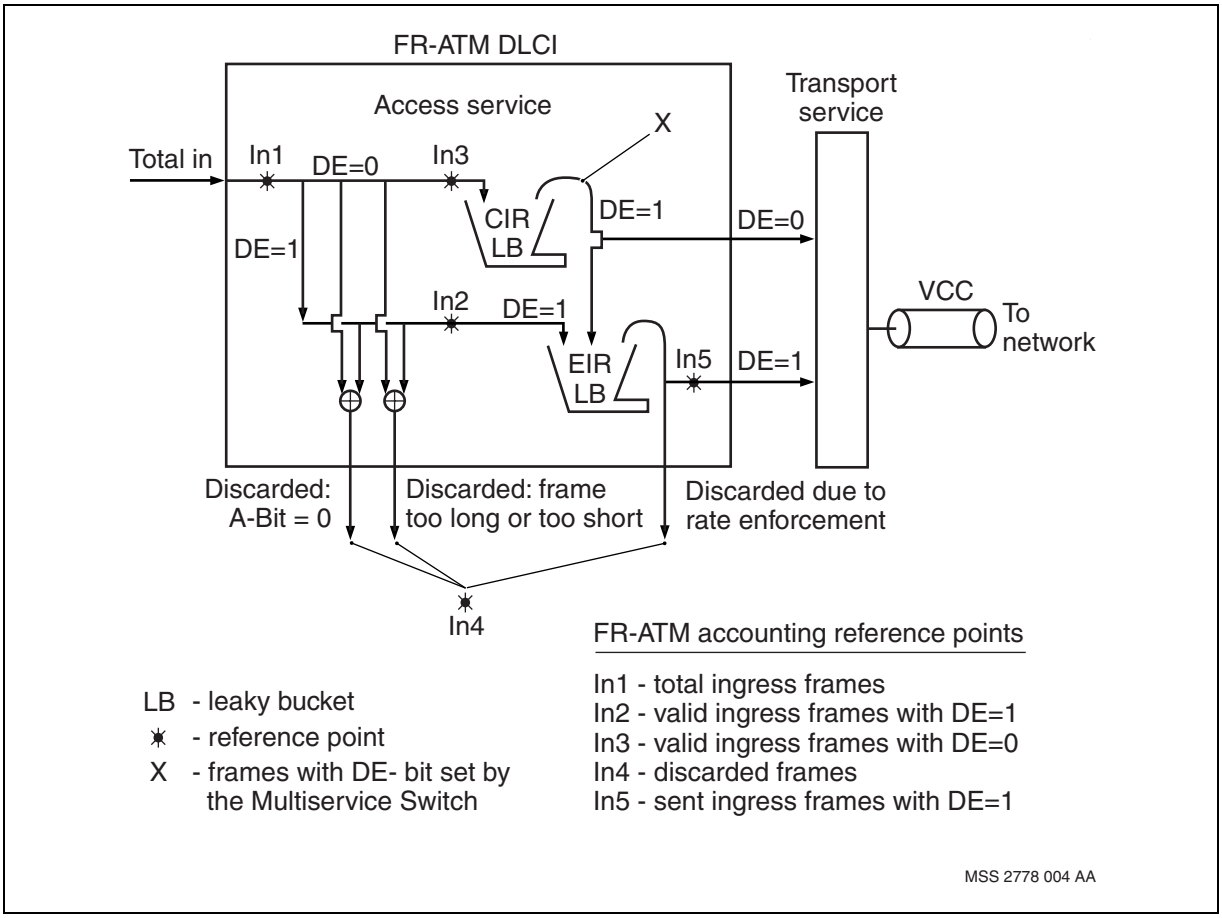
FR-ATM accounting collects accounting data for each connection (FR-ATM DLCI). To collect accounting data and generate accounting records at both ends, you must turn on accounting at both ends of the connection.

You can turn on FR-ATM accounting and accounting data collection for each DLCI. This flexibility allows you to enable accounting for a select set of connections. Therefore, FR-ATM accounting uses only the necessary system resources. You can also control accounting collection for each interface through the *accountCollection* attribute. For details on the *accountCollection* attribute, see Interface configuration (page 111).

FR-ATM accounting supports permanent virtual connections (NPVCs), switched permanent virtual connections (SPVCs), and FRF.5 SPVC DLCIs.

FR-ATM accounting associates with the access service, and therefore the reference points where it collects the data. The figure, FRF.8 and FRF.5 DLCI ingress accounting data collection (page 115) shows the reference points for ingress data collection. The figure, FRF.8 and FRF.5 DLCI egress accounting data collection (page 116) shows the reference points for egress data collection.

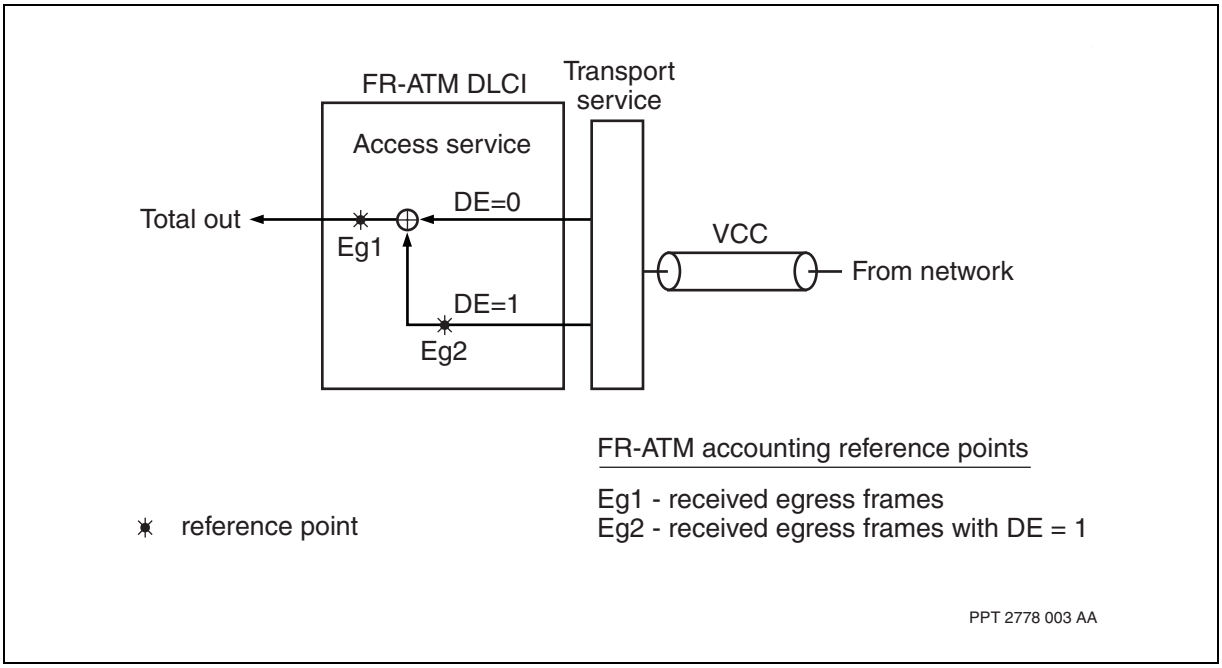
FRF.8 and FRF.5 DLCI ingress accounting data collection



FR-ATM accounting collects the following:

- Total ingress frames and bytes at reference point In3
- Frames and bytes discarded due to rate enforcement at reference point In4
- EIR frames and bytes at reference point In5

FRF.8 and FRF.5 DLCI egress accounting data collection

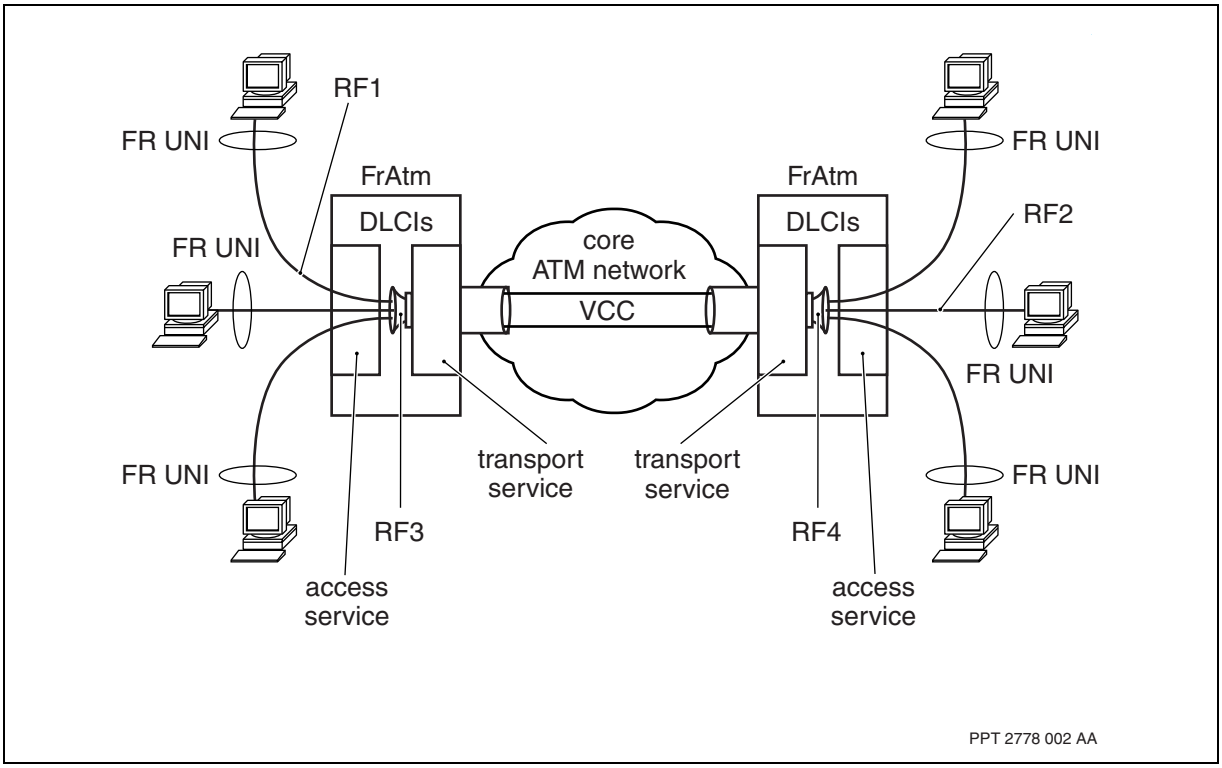


FR-ATM accounting collects the egress frames and bytes at reference point Eg1 and EIR egress frames and bytes at Eg2.

For FRF.5, FR-ATM accounting can collect accounting data at reference points RF1 and RF2 in the figure, FRF.5 DLCIs and end point (page 117). Reference points RF1 and RF2 are the two ends of a single connection (DLCI) that share the ATM VCC with other connections. Reference points RF3 and RF4 are the end points of the VCC and represent the traffic that goes through all the connections. However, FR-ATM accounting collects data for each connection (DLCI) and therefore does not collect any data at RF3 and RF4.

At reference points RF1 and RF2, FR-ATM accounting collects data the same as it collects for FRF.8 (see the figures, FRF.8 and FRF.5 DLCI ingress accounting data collection (page 115) and FRF.8 and FRF.5 DLCI egress accounting data collection (page 116)).

FRF.5 DLCIs and end point



Generating reports

The following events trigger FR-ATM accounting record generation:

- A time of day accounting (TODA) changeover occurs
- The 12-hour accounting timer expires
- A call clears

TODA and the termination of the 12-hour accounting timer trigger non-final accounting records. Call clear triggers final accounting records. For some calls, there can only be one accounting record. FR-ATM accounting generates this single accounting record for a call clear before any TODA changeover or 12-hour accounting timer expiration occurs.

A field in the accounting record distinguishes between the different accounting record types. FR-ATM accounting generates the following accounting record types:

- First record
- Intermediate record
- Final record
- One record (first and last)

The table, FR-ATM accounting record (page 118) shows the common fields in the FR-ATM accounting record for FRF.5 and FRF.8. The table, FR-ATM accounting record connection parameters (page 122) shows the groups of connection parameters based on the calling or called specifier.

FR-ATM accounting record (page 118) shows the accounting data available for FRF.8 NPVCs, FRF.8 SPVCs and FRF.5 SPVCs. Some of the fields are the same for both the calling and the called end. They do not have a specifier (calling or called) in the calling and called end records. Some of the fields have a specifier, either a calling or called specifier.

Some of the fields in the frame relay over DPRS records are not available or do not make sense for FR-ATM records. For example, X.25 values shown as clear cause or diagnostic code. FR-ATM accounting uses some of the ATM record fields instead, for example, the ATM clear cause value.

Record fields marked with an (fr) are also in the frame relay over DPRS records and have the same meaning. In a few cases, the field name may differ but the meaning of the field remains the same.

In the table, FR-ATM accounting record (page 118) for record fields marked with an (*), see FR-ATM accounting record connection parameters (page 122).

FR-ATM accounting record

Field name	Field description
Record identifier (fr)	The record identifier indicates the contents of the accounting record. It is a constant value that identifies the record as a FR-ATM accounting record with collected data for each DLCI and presents the data in frames and bytes. The value is 30.
Record type (fr)	The record type is a 2-bit field that indicates the sequence of records for a call: • 01 - first record for the call (new call) • 00 - intermediate (call is in progress) • 10 - last record for the call (call terminates) • 11 - new call terminates during the same interval (first and last record)

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FR-ATM accounting record (continued)

Field name	Field description
Call connection ID (fr)	The call connection ID correlates accounting records for the same call issued a different points (interfaces) in the network. It is 28 bytes long. The call connection ID comes from the *correlationTag* attribute (either system-generated or provisioned). For SPVCs, the Multiservice Switch node generates the call connection ID as follows: • The first 20 bytes are the NSAP address of the interface of the call origin. • The next four bytes are the VPI and VCI at originating connection point. • The next four bytes are a counter that the interface increments to ensure that this ID is unique, even when the interfaces reuses the same VPI and VCI during the same billing interval. For NPVCs, you provision the *correlationTag* attribute value and this sets the call connection ID.
Who generated (fr)	The who generated field is set to 0 if the calling end generates the record. This field is set to 1 if the called end generates the record.
Calling/called node identifier (fr)	This field is the node unique number in the *ModuleData* component.
Calling/called customer identifier (fr)	This field identifies the customer in CNM or VPN environment.
ATM call termination cause value	This field indicates the call termination cause value for a final record (where the record type field is last or first and last), as defined by the ATM Forum AtmIf UNI 3.1 specification. It is set to 0 for a non-final record.
Calling CIR (fr)	This field is the provisioned CIR in bits/s (if calling end). It is the provisioned egress CIR in bits/s (if called end). If you do not provision egress CIR, this field is just CIR.
Calling EIR (fr)	This field is the provisioned EIR in bits/s (if calling end). It is the provisioned egress EIR in bits/s (if called end). If you do not provision egress EIR, this field is just EIR.
Called CIR (fr)	This field is the provisioned egress CIR in bits/s (if calling end). It is the provisioned CIR in bits/s (if called end). If you do not provision egress CIR, this field is just CIR.
Called EIR (fr)	This field is the provisioned egress EIR in bits/s (if calling end). It is the provisioned EIR in bits/s (if called end). If you do not provision egress EIR, this field is just EIR.
Calling/called service type (fr)	This field indicates the service that the port supports for the call. You provision this value as the *accountClass* attribute.
Calling/called collection reason (fr)	This field indicates one or more reasons for accounting collection. You can provision any combination of billing, test, study, audit, and force.
Calling/called DSE	This field defines the data service exchange that you provision.

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FR-ATM accounting record (continued)

Field name	Field description
Calling/called transfer priority (fr)	This field specifies the transfer priority. You provision the value between 0 and 15.
Call type	This field specifies the call type. A value of 0 is NPVC and a value of 3 is SPVC.
Interworking type	This field specifies the connection type: • 0 is FRF.8 service interworking • 1 is FRF.5 network interworking
Flags	This field indicates values for the call characteristics. The Flags field is 17 bits long; bit 5 represents *calledGenerated* and bit 6 represents *calledCleared*.
Calling end point address (*)	This field is the NSAP address of the calling end point.
Called end point address (*)	This field is the NSAP address of the called end point.
Called address (*)	This field is the NSAP address associated with the called DLCI.
Calling DLCI (fr) (*)	This field is the calling DLCI.
Called DLCI (fr) (*)	This field is the called DLCI.
Calling VPI (*)	This field is the VPI of the VCC associated with the calling DLCI.
Called VPI (*)	This field is the VPI of the VCC associated with the called DLCI.
Calling VCI (*)	This field is the VCI of the VCC associated with the calling DLCI.
Called VCI (*)	This field is the VCI of the VCC associated with the called DLCI.
Start time (fr)	This field shows the time the call was set up or the time FR-ATM accounting issues the previous accounting record.
End time (fr)	This field shows the time FR-ATM accounting issues the current accounting record.
Elapsed time (fr)	This field shows the elapsed time (in 1/10 seconds) between the previous and current accounting record.
Calling/called egress bytes (fr)	This field shows the total number of received bytes.
Calling/called ingress bytes (fr)	This field shows the total number of bytes sent.
Calling/called egress frames (fr)	This field shows the total number of received frames.
Calling/called ingress frames (fr)	This field shows the total number of frames sent.

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FR-ATM accounting record (continued)

Field name	Field description
Calling/called EIR ingress bytes (fr)	This field shows the total number of received EIR bytes.
Calling/called EIR egress frames (fr)	This field shows the total number of received EIR frames.
Calling/called EIR ingress frames (fr)	This field shows the total number of EIR frames sent.
Calling/called discarded bytes (fr)	This field shows the number of discarded bytes due to rate enforcement.
Calling/called discarded frames (fr)	This field shows the number of discarded frames due to rate enforcement.
(4 of 4)	

Since FR-ATM is based on both the frame relay access and the ATM network, the connection parameters are more complicated than those for either frame relay or ATM. Also, the reference point of view, calling or called end, comes from the specifics of the interworking between the frame relay access and the ATM transport. These specifics are:

- FRF.8, NPVC - consider both ends of the connection as calling ends.
- FRF.8, SPVC - consider one of the ends as the calling end and consider the other end as the called end.
- FRF.5, DLCI - consider both ends as calling; the VPI and VCI are the ends of the end point (EP). In FRF.5, the accounting end for the DLCI is determined by the end point to which the DLCI connects.

The table, FR-ATM accounting record connection parameters (page 122) shows the groups of connection parameters based on the calling or called specifier. The connection parameters are optional (opt), not available (no), or available (yes). The records do not include the not available connection parameters. The optional connection parameters are available if you provision them.

The address fields show the NSAP address. For FRF.5, there is a calling end point and a called end point. Both ends of the connection that share the VCC connection are considered as calling ends. For FRF.5 accounting records, the VPI and VCI fields show the NSAP address of the called and calling end point.

In the table, FR-ATM accounting record connection parameters (page 122), for FRF.5 (DLCI) the record field is calling, the EP address is optional and is the calling end.

FR-ATM accounting record connection parameters

	Record field is calling					Record field is called				
	EP address	**Addr**	**DLCI**	**VPI**	**VCI**	**EP address**	**Addr**	**DLCI**	**VPI**	**VCI**
FRF.8 NPVC	-	optional	yes	yes	yes	-	no	no	no	no
FRF.8 SPVC (calling end)	-	yes	yes	yes	yes	-	yes	no	yes	yes
FRF.8 SPVC (called end)	-	optional	no	opt	opt	-	yes	yes	yes	yes
FRF.5 (DLCI)	optional	optional	yes	yes	yes	yes	yes	yes	yes	yes

Call clear

Call clear only generates an accounting record if either of the following conditions are true:

- FR-ATM accounting generates at least one accounting record since the call set-up
- some data transfer since the call set-up

If neither of these conditions are true, call clear does not generate an accounting record.

Flat-rate billing

Flat-rate billing policies are developed by the service provider based on specific parameters and values provisioned by the end user and not on the amount of data delivered. This flexibility allows the service provider to develop a variety of flat-rate tariff bands based on the following elements:

- CIR, EIR values
- class-of-service parameters
- rate enforcement and rate adaptation parameters

Attention: Each time the parameters and values for the FR-ATM service are changed, a new accounting record is generated. However, changing the value of a correlation tag on an active FR-ATM permanent connection does not result in the generation of a new accounting record.

Troubleshooting FR-ATM accounting

Several situations exist that affect the generation of accounting records. See also Generating reports (page 117) for specifics on accounting records. The following sections include information on:

- What happens during node time changes (page 123)
- What happens during CP switchover (page 124)
- What happens when accounting is turned off and on again (page 124)
- What happens in congestion situations (page 124)

What happens during node time changes

In TODA mode, if the node time is adjusted such that it is advanced past a TODA table entry, then the accounting record corresponding to that table entry is still generated, after the time has been adjusted. For example, if there is a TODA changeover at 10:00 but at 9:55 the node time is adjusted forward by 10 minutes, then after the adjustment, at 10:05, an accounting record for the 10:00 changeover is generated. However, the time stamp on that record shows 10:05, the actual time, rather than 10:00, the time the TODA changeover was skipped.

If the forward time adjustment skips more than one TODA changeover, multiple records are not generated. Only one record, corresponding to the last changeover, is generated.

If the node time is adjusted such that it is moved back by at least 10 seconds past a TODA table entry, the accounting record corresponding to that table entry is generated immediately if there has been no TODA record generated in the last 59 minutes. The record is not generated again at 10:00. The DCS agent ensures that TODA records do not occur closer than 59 minutes apart.

In timer mode, when TODA is disabled, intermediate accounting records are generated every 12 hours for a connection that stays up for a long time. The interval between two intermediate accounting records (12 hours) stays the same even if the node time is adjusted. For example, if an accounting record is generated at 9:00 a.m. the next one is due at 9:00 p.m. But if in the meantime the time is moved forward by two hours, the next record will be generated at 11:00 p.m. which is when 12 hours actually elapsed.

As a general rule, the start-time and end-time fields in the accounting record always represent the node (network) time at the start and end of the recording interval and, as such, they are affected by time changes (manual or automatic time adjustments). However, for switched connections, the elapsed time always corresponds to the exact length of the accounting interval, since it is calculated from a different clock source, one that is not affected by the node

time adjustments. For permanent connections, the elapsed time corresponds to the time during which the connection was enabled (during the accounting interval).

What happens during CP switchover

The CP switchover is handled by the spooling system. However, any records that exist only in the memory of the failed CP are lost. Only records that recorded on disk are preserved during a CP switchover.

As for accounting itself, even when a TODA changeover notification is lost because of a CP switchover, there is no fatal impact. The cell counts for each connection continue to record the traffic. The counts are reported in the next or in the final accounting record, which is issued anyway. In this case, the record contains the cumulated cell counts over two accounting intervals.

What happens when accounting is turned off and on again

The following applies, at the interface (*FrAtm Dlci Sp* component) level:

- When you turn FR-ATM accounting off for a DLCI, FR-ATM accounting disables immediately, but the service does not terminate. Accounting record generation stops immediately, which means that for existing connections no final accounting records generate.
- When you turn accounting back on again, FR-ATM accounting enables after the call re-establishes.

Therefore, accounting should not be turned on and off, unless absolutely necessary.

What happens in congestion situations

When link congestion occurs, SPVC requests may be dropped by the node. FR-ATM accounting does not issue accounting records for unsuccessful call attempts.

In case there is not enough memory to generate an accounting record, the FR-ATM accounting system does not generate the record, nor does it prevent the call from going through. Clearing or not clearing the call is decided by the SVC handler (the ATM Networking software), depending on the resources available to handle the call.

The exact moment when accounting record generation is suspended for lack of memory is marked by the “minor qualityOfService thresholdCrossed” alarm (id 70140000 in NN10600-500 *Nortel Multiservice Switch 6400/7400/15000/20000 Alarms Reference*). After the node issues this alarm, no accounting records are generated for existing connections. This situation lasts until the Nortel Multiservice Switch node clears the memory alarm.

When memory shortage causes an intermediate accounting record to be skipped, the situation is recovered by the next accounting record issued for that connection (assuming the memory usage goes back to normal). Since the frame counts are accumulated in hardware the next record correctly reflects the traffic during the next accounting interval.

FR-ATM interworking overview

Nortel Multiservice Switch frame relay to ATM (FR-ATM) interworking service maps frame relay permanent virtual circuits (PVCs) to and from ATM PVCs to provide connectivity between frame relay customer-provided equipment (CPE) and ATM CPE.

When deployed as an end-to-end interworking solution, the FR-ATM service:

- enables FR-ATM interoperability over any standards-compliant ATM system
- provides full traffic management capabilities, including multiple quality of service (QoS) classes
- supports an integrated network management system

Navigation

FR-ATM service characteristics

The FR-ATM service includes a core frame relay UNI/NNI service and an interworking function. The core frame relay UNI/NNI service provides the access side of a frame relay UNI or NNI. The interworking function provides an interface for connection to an ATM subnet

To configure a FR-ATM connection, you bind the interworking function of a FR-ATM DLCI to an ATM VCC. You then configure a normal ATM PVC across the ATM subnet.

Frames arrive at the FR-ATM interface on a frame relay PVC. The interworking functions of the FR-ATM interface transmit the frames through the backplane to the appropriate ATM interface card. The ATM interface segments the frames according to AAL5 and sends the traffic out as ATM cells. From there, the cells move across the ATM subnetwork and exit the network at the remote ATM interface.

In the opposite direction, ATM cells arrive at the ATM interface where AAL5 reassembly occurs. The assembled frame moves across the backplane to the FR-ATM interworking function. The FR-ATM interface then transmits the frame as normal frame relay traffic on a frame relay PVC.

The basic elements of the FR-ATM service define interworking for these aspects of the FR-ATM connection:

- user plane mappings for upper-layer protocol encapsulation, congestion notification and discard priority
- traffic descriptor type and QoS class mappings
- traffic management
- permanent virtual circuit (PVC) status management

FR-ATM core UNI/NNI service

The FR-ATM core UNI/NNI service manages the set of frame relay DLCI connections handled by the FR-ATM interface. The FR-ATM core UNI/NNI service:

- manages the physical or logical layer and supports the use of a framer or virtual framer
- supports Q.922 link layer protocol
- selects and executes the layer management procedures over the link layer interface

You can configure a native E.164, X.121 address, or ATM address in NSAP format on each FR-ATM interface.

Physical and link layer management

The FR-ATM core UNI/NNI service allows you to bind the service instance to the physical or logical layer through either a *Framer* or a *virtualFramer* component. This layer provides statistics and reports the OSI state of the link.

Frame relay uses data link layer addressing to multiplex and demultiplex many logical connections within the same access channel. For each connection in the user data transfer plane (U-plane), the bearer service:

- provides bidirectional transfer of frames

- preserves the frame order as given at the UNI on delivery to the ATM network or end point
- detects transmission, format, and operational errors
- transports frames transparently. Only the administrative fields are modified including the address and the frame check sequence FCS
- performs protocol validation and provides error statistics

This layer runs transparently over the full range of physical or logical framing layers.

PVC status management

The FR-ATM core UNI/NNI service supports control procedures for PVCs as described in the following standards:

- Chapter 6 of “Local Management Interface (LMI) - Common Extensions”, *Frame Relay Specification with Extensions*
- Annex D of ANSI T1.617
- Annex A of ITU-T Q.933

You can run these procedures as user side, network side, or in both sides mode. This flexibility allows the FR-ATM core UNI/NNI service to operate as a user side UNI, a network side UNI, or as an NNI.

DLCI management

The FR-ATM core UNI/NNI service manages frame relay DLCIs. You can configure these DLCIs to provide either service interworking (SIWF) or network interworking (NIWF).

You can configure each DLCI with a unique traffic contract. The configuration of frame relay traffic parameters controls the traffic contract according to the service level agreement (SLA). The FR-ATM interworking function maps the frame relay SLA into ATM traffic management capabilities.

Each DLCI provides a common set of frame statistics used to monitor the connection’s performance from a frame relay point of view. These statistics include discard counts for bytes and frames, and counts for frames delivered successfully in each direction.

FR-ATM accounting

FR-ATM accounting provides usage-based accounting for best-effort delivery services. FR-ATM accounting collects traffic data for each FR-ATM connection at the access card. You can use ATM accounting to collect accounting data at the ATM interface VCC.

You can enable FR-ATM accounting and accounting data collection for each DLCI, and control accounting collection for each FR-ATM interface. You can also configure FR-ATM accounting as single- or double-ended.

For a detailed description of FR-ATM accounting, see NN10600-560 *Nortel Multiservice Switch 7400/15000/20000 Accounting*.

Service operation and management

The FR-ATM core UNI/NNI service provides the interface to the Nortel Multiservice Switch node infrastructure for operations and management.

You can configure and monitor the FR-ATM service through the same integrated network management system that supports existing DPN and Multiservice Switch frame relay and ATM services.

The FR-ATM FR UNI/NNI core service supports the following:

- configuration and surveillance through CAS
- configuration and surveillance through the SNMP Enterprise MIB
- surveillance through a standard frame relay SNMP IfTable entry

FR-ATM interworking function

The FR-ATM interworking function supports the application of the FRF.8 standard for service interworking (SIWF), and the FRF.5 standard for network interworking (NIWF).

The SIWF maps frame relay DLCIs to ATM VCCs on a one-to-one basis. The NIWF encapsulates frame relay over ATM and multiplexes many frame relay DLCIs to one ATM VCC.

FR-ATM service interworking function (SIWF)

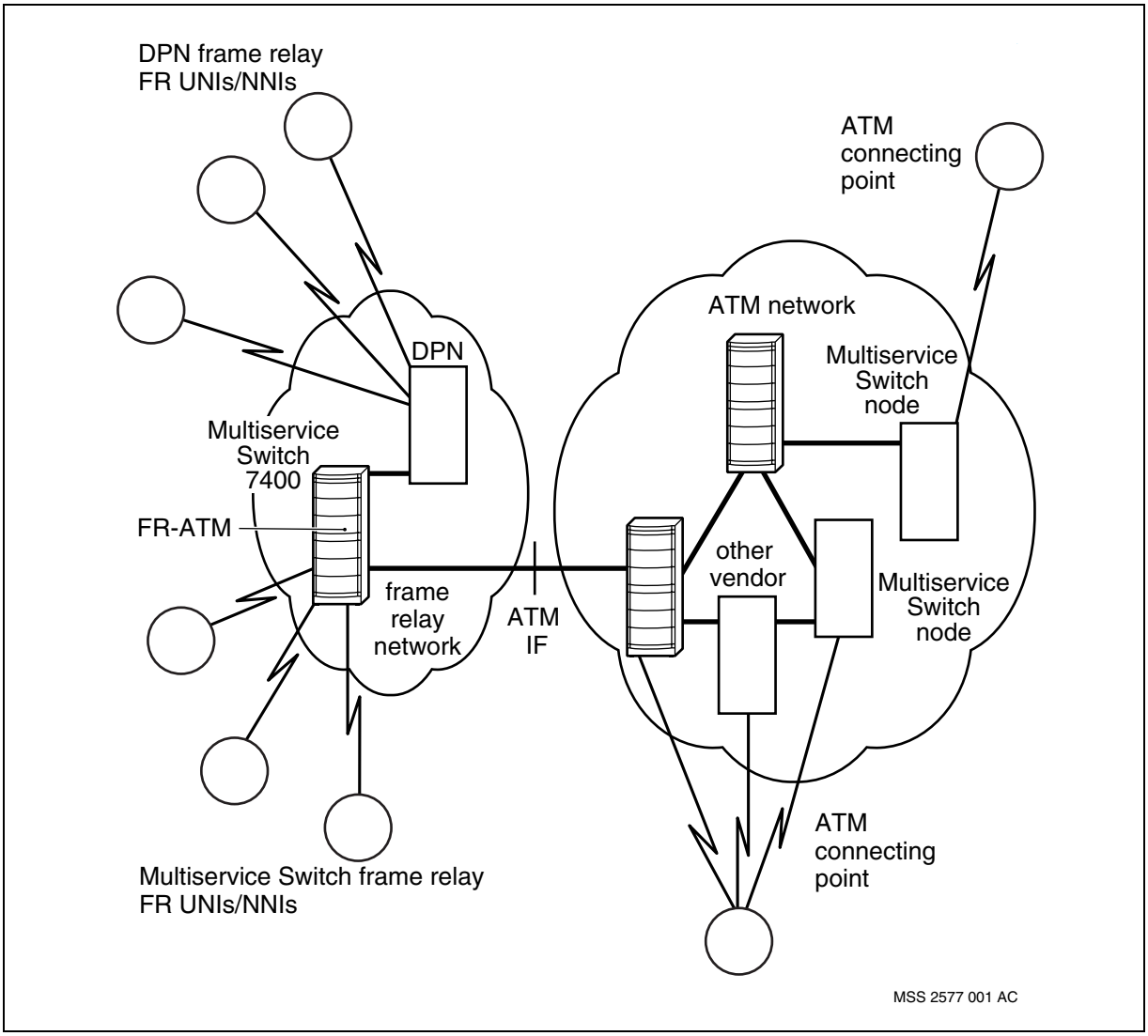
The FR-ATM service interworking function (SIWF) enables frame relay CPE to communicate with ATM-capable CPE. The figure FR-ATM service interworking (FRF.8) (page 130) shows an end-to-end service interworking connection.

The FR-ATM SIWF maps frame relay connections to ATM connections, and ATM connections to frame relay connections. It maintains standard interworking between frame relay and ATM equipment that is transparent to the end users.

The FRF.8 standard supports the SIWF at the edge of a Nortel Multiservice Switch ATM network, connected to an external frame relay network or frame relay CPE.

For more information on the technical details surrounding SIWF, see SIWF technical description (page 167). For information on configuring SIWF, see SIWF configuration (page 42)

FR-ATM service interworking (FRF.8)



FR-ATM network interworking function (NIWF)

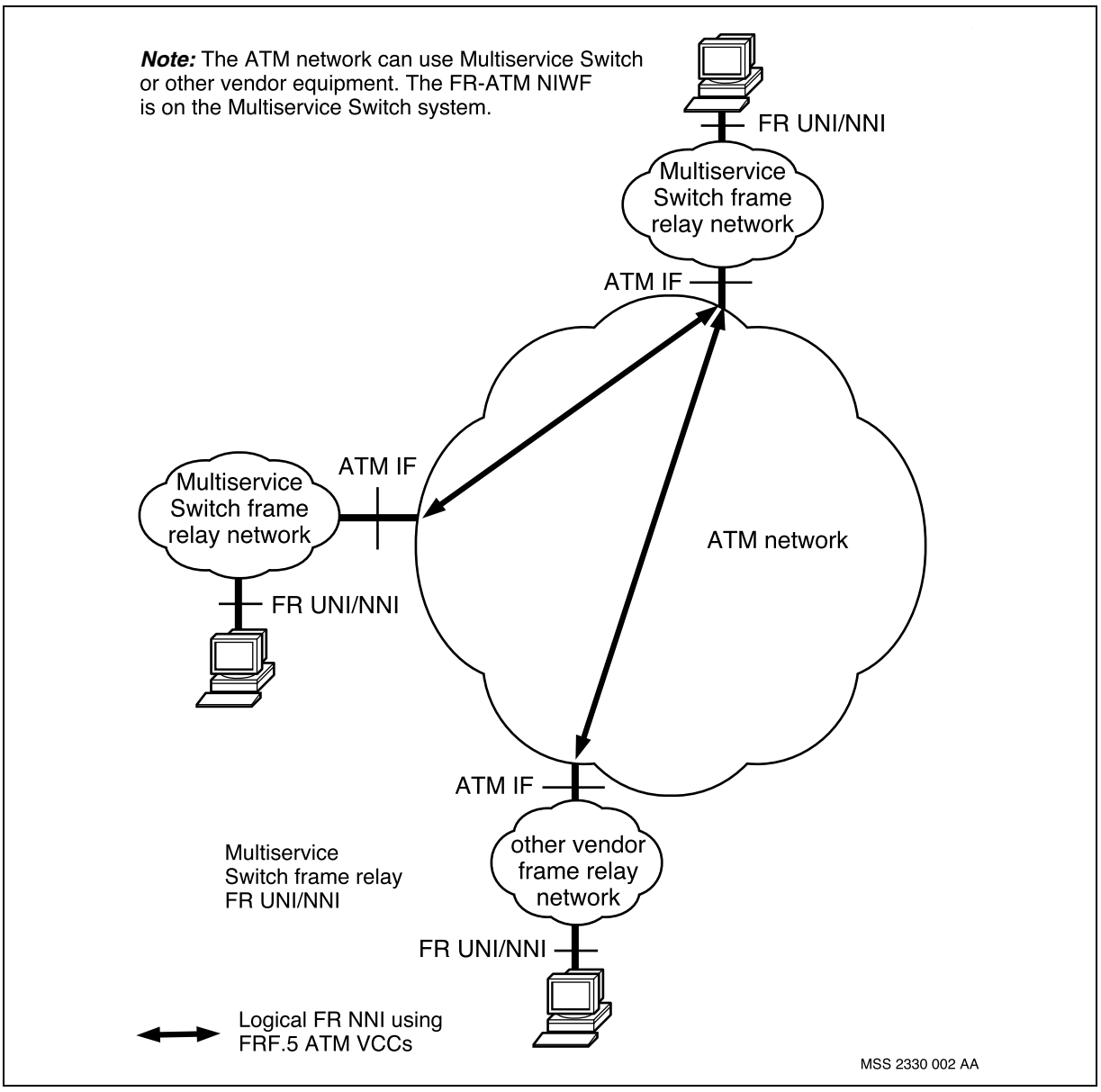
The FR-ATM network interworking function (NIWF) enables frame relay CPE connectivity over frame relay networks interconnected through a backbone ATM network. The figure FR-ATM network interworking (FRF.5) (page 132) shows an end-to-end network interworking connection.

For network interworking, the interworking function performs the encapsulation of frame relay over ATM. The NIWF maintains standard interworking between frame relay networks or nodes around an ATM core. Frame relay end users on interconnected frame relay networks or nodes are unaware of the use of ATM in the core.

The FRF.5 standard supports the NIWF in a cluster topology where frame relay networks interconnect over an ATM backbone.

For more information on the technical details surrounding NIWF, see NIWF technical description (page 182). For information on configuring SIWF, see NIWF configuration (page 55).

FR-ATM network interworking (FRF.5)



Spared frame relay services on Multiservice Switch 15000 and Multiservice Switch 20000 nodes

Nortel Multiservice Switch 15000 and Multiservice Switch 20000 applications and services are categorized as hot, warm or cold standby based on their sparing behavior. The following interfaces are warm standby features when provisioned on a spare LP:

- frame relay user-to-network interface (UNI)
- network-to-network interface (NNI)

- frame relay to ATM interface (FR-ATM)
- IP over frame relay (IP/FR)

Attention: The IP/FR interface is a warm standby feature during a hitless software migration only.

Warm standby features reduce service outages during an equipment switchover. During an equipment switchover, warm standby applications and features incur a longer outage of service that hot standby applications and features, but not as long as cold standby applications and features. As well, all connections must be re-established.

See NN10600-550 *Nortel Multiservice Switch 7400/15000/20000 Common Configuration Procedures* for a description of hitless services and hot, warm, and cold standby applications and features.

Hardware and feature compatibility

To convert frame relay traffic to ATM traffic, you must configure the FR-ATM service with an ATM interface on the same node. Both the FR-ATM core UNI/NNI and the FR-ATM interworking function coexist on a frame-based function processor (FP). The ATM physical layer is on a separate ATM FP.

The table Function processors that support the FR-ATM service (page 133) lists the interfaces you can configure to support the FR-ATM service. Not every function processor listed in this table is compatible with Nortel Multiservice Switch platforms. For the details on every frame relay FP in the table below, see the corresponding section of NN10600-551 *Nortel Multiservice Switch 7400/15000/20000 FP Configuration Reference*.

Function processors that support the FR-ATM service

Function processor	Link speeds (kbit/s)	maximum number of frame relay interfaces (single link mode)	maximum number of frame relay interfaces (fractional link mode, n*64 or n*56)
4-port DS1	56 - 1544	4	8
4-port DS1Ch	56 - 1544	4	96
8-port DS1	56 - 1544	8	8
32-port DS1 MSA	56 - 1544	32	500
1-port DS3	44736	1	Not applicable
1-port DS3Ch	44736	28	28

(1 of 2)

Function processors that support the FR-ATM service (continued)

Function processor	Link speeds (kbit/s)	maximum number of frame relay interfaces (single link mode)	maximum number of frame relay interfaces (fractional link mode, n*64 or n*56)
4-port DS3Ch ATM FR	44736	112 (DS1links)	1024
4-port DS3Ch ATM FR (when unchannelized)	44736	4 (DS3 links)	Not applicable
4-port E1	56 - 2048	4	8
4-port E1Ch	56 - 2048	4	124
1-port E3	34368	1	Not applicable
32-port E1 MSA	56 - 2048	32	500
1-port HSSI	1000 - 50000	1	Not applicable
1-port STM -1Ch FR	63 - 2040	63 (E1 links)	768
8-port V.11	9.6 - 7680	8	Not applicable
8-port V.35	9.6 - 3840	8	Not applicable
(2 of 2)			

A warm standby application or feature can operate together with a hot standby application or feature on the same FP without affecting the ability of the hot standby application or feature to provide hitless services. See NN10600-550 *Nortel Multiservice Switch 7400/15000/20000 Common Configuration Procedures* for a description of hitless services and hot, warm and cold standby applications and features.

Specific feature combinations are subject to existing exclusivity rules and are limited to product roll-out considerations. For more information, see *Nortel Multiservice Switch Release Notes*.

The FR-ATM gateway does not manage a physical or logical port when configured as an interworking server. It can run on any FP, even if no ports or channels are available.

Alarms and troubleshooting

Use the information in this section to assist you with troubleshooting FR-ATM interworking connection problems. For procedural informations, refer to the section, Monitoring and troubleshooting (page 80)

Alarms

Alarms indicate faults or failure conditions on the node. Alarms are displayed on a user interface such as a VT100 terminal or Nortel Multiservice Data Manager. For information on Multiservice Data Manager tools, see 241-6001-023 *Nortel Multiservice Data Manager Configuration Tools*.

Nortel Multiservice Switch components generate alarms asynchronously to signal one of the following:

- degradation of quality-of-service conditions (for example if a threshold is reached)
- processing errors (for example, protocol violations)
- failures/out-of-service conditions (for example, hardware or failures)
- administrative conditions (for example, issuing the lock command)
- security violations

Alarms contain a large amount of information, all of which can assist you in monitoring both the node and the network. The figure Example of alarm as it appears on the text interface (page 135) provides an example of an alarm. For complete information on alarms, see NN10600-500 *Nortel Multiservice Switch 6400/7400/15000/20000 Alarms Reference*.

Example of alarm as it appears on the text interface

```
    FrAtm/133; 1998-05-07 17:39:09.69
SET critical operator operationalCondition        00001000
    ADMIN: locked   OPER: disabled  USAGE: idle
    AVAIL: offline  PROC:           CNTRL:
    ALARM:          STBY: notSet    UNKNW: false
    Id:  0D000004   Rel:  Lp/13
    Com: The component is locked
    Int: 13/1/2/29750; osiState.cc;666;p5.0d.18
                                                  PPT 2420 001 AA
```

OSI state information for FR-ATM components

Nortel Multiservice Switch nodes use component state definitions according to the Open Systems Interconnection (OSI) standards. For a description of OSI state and status attributes, see NN10600-520 *Nortel Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting*.

The following tables summarize the OSI state attributes specific to the Multiservice Switch FR ATM service:

- OSI state information for the FR ATM IWF (page 136)
- OSI state information for the LMI (page 136)
- OSI state information for a DLCI (page 137)

OSI state information for the FR ATM IWF

State	Meaning
adminState: unlocked operationalState: disabled usageState: idle	The FR ATM IWF is waiting for the access facility to become available.
adminState: unlocked operationalState: enabled usageState: idle	The FR ATM IWF is ready to provide service, but no user DLCIs have been defined on the interface.
adminState: unlocked operationalState: enabled usageState: active	The FR ATM IWF is in service and supports at least one user DLCI.
adminState: locked operationalState: disabled usageState: idle	An operator lock command is in effect. There are no operational user DLCIs on the interface.
On a 4-port DS3 channelized frame relay FP, provisioning the timeslot of the associated frame interface to the value of none and not locking the FrAtm and channel result in the OSI state of unlocked, enabled, idle.	

OSI state information for the LMI

State	Meaning
adminState: unlocked operationalState: disabled usageState: idle	The *Lmi* component is waiting for the FR ATM IWF to become available. An access facility may have failed, or the *FrAtm* component may be locked.
adminState: unlocked operationalState: enabled usageState: busy	The *Lmi* component is in service.

OSI state information for a DLCI

State	Meaning
adminState: locked operationalState: disabled usageState: idle	An operator lock command is in effect. The DLCI cannot provide service.
adminState: unlocked operationalState: disabled usageState: idle	Any one of the following circumstances can cause the *Dlci* component to be out of operation: • an access facility failure • a lock command of the *FrAtm* component • a failure at the LMI (for PVCs) or LAPF (for SVCs) • a broken connection across the network The *Dlci* component is not operational until the following conditions are satisfied: • the interface becomes available • the LMI (for PVCs) or LAPF (for SVCs) becomes operational • the connection is established
adminState: unlocked operationalState: enabled usageState: busy	The DLCI is operational and in service.
adminState: locked operationalState: disabled usageState: idle availabilityStatus: failed	Underlying hardware resources are unavailable. See Troubleshooting hardware resources (page 139).

Troubleshooting

Troubleshooting for FR-ATM IWF involves procedures for both Nortel Multiservice Switch frame relay and Multiservice Switch ATM. FR-ATM IWF does not support the frame loopback tool in this release. This section contains the following:

Tools for troubleshooting the frame relay service

Troubleshooting tools for the frame relay user network interface (FR UNI) side of the FR-ATM IWF connection include operational statistics. FR-ATM services maintain interface and service level statistics that you can use to verify connection integrity.

Tools for troubleshooting the ATM service

See NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management* for a description of the troubleshooting tools for the ATM side of a connection. There are four types of tools:

- loopbacks

  The cell loopback capability allows ATM connection monitoring for each Nortel Multiservice Switch network segment. Loopbacks are turned on or off through three provisionable attributes (one attribute for each type of loopback) of *Vcd* subcomponents. When connectivity for a particular segment is lost, the network operator can issue a query using the trace command. The trace command is issued from a segment end point and determines which Multiservice Switch modules in that segment are reachable along the connection path.

- trace loopback

  These loopbacks are Multiservice Switch-specific loopbacks that trace the path of an ATM connection within a Multiservice Switch segment. The trace response displays a list of VCC-related components traversed by the segment.

  Use the trace command to trace the VCCs across the network from one end of the FRF.5 end point to the other end. This command traces connections inside Multiservice Switch ATM networks only. The first non-Multiservice Switch ATM equipment in the path of the connection terminates the trace.

  ```
  trace AtmIf/<i> [Vpt/<v>] Vcc/<x>
  ```

  For details, see the NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.

- test and loop components

  The test and loop application verifies the integrity of the hardware connections using user-defined traffic. You can use test and loop components in conjunction with external networks or equipment. These are provisionable components and require provisioning changes after testing is complete. See NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management* to perform the following:

  — provisioning test and loop services

  — performing connection test

— displaying connection test results

- operational statistics

  The ATM maintains traffic statistics at *AtmIf* and *Vcc* component level. These statistics verify connection integrity.

Summary of the troubleshooting process for FR-ATM IWF

Since a FR-ATM connection spans both a FR UNI or FR NNI and an ATM network, the troubleshooting process must isolate the problem to the specific network portion of the connection. The generic troubleshooting process is as follows:

1 Analyze alarms that components are generating. See NN10600-500 *Nortel Multiservice Switch 6400/7400/15000/20000 Alarms Reference*.

2 Display and analyze FR-ATM service level operational statistics.

3 Use test and loop capabilities where non-Nortel Multiservice Switch equipment is part of the connection.

4 Identify corrective actions by using the following resources:

5 For problems related to FR UNI/FR-ATM, FR NNI/FR-ATM, and frame-cell networks, see the troubleshooting chapter of the NN10600-900 *Nortel Multiservice Switch 7400/15000/20000 Frame Relay Technology Fundamentals*.

6 For ATM-related problems, see the troubleshooting chapter of the NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.

Troubleshooting hardware resources

When the hardware resources for a DLCI are unavailable, the system will lock the DLCI. Attempts to unlock the DLCI will result in an alarm.

Hardware resources can become unavailable due to one of the following two reasons:

- More than the maximum supported DLCIs are provisioned on the Lp.
- All sub-connection resources are used on the Lp.

To determine whether these states exist, see the “Monitoring the availability of hardware resources” procedure in NN10600-901 *Nortel Multiservice Switch 7400/15000/20000 Frame Relay Configuration Management*.

Troubleshooting using Multiservice Data Manager

Nortel network managers offer a comprehensive set of fault management tools for detecting and isolating problems. When using Multiservice Data Manager to troubleshoot, use the integrated alarms display for alarms collection and the integrated command console for access to FR-ATM IWF operational attributes.

For details on the scope and use of the Multiservice Data Manager interface and software tools, see 241-6001-023 *Nortel Multiservice Data Manager Configuration Tools*.

Handling problems

For guidelines on how to respond to problems that may occur in FR-ATM IWF, refer to the table Handling problems (page 140).

Problems that occur when your service is up and running may not be confined to FR-ATM IWF components only.

Handling problems

Problems that may occur	Probable causes	Corrective measures
Data cannot be received at the remote end.	There is a failure on the ATM side.	Identify all the intermediate connection ports starting from the ATM end point nearest the DLCI.
		Observe if the *aisState* and *rdiState* is bad.
	There is a failure beyond the FR-ATM and ATM link.	Identify all the intermediate connection ports starting from the ATM end point nearest the DLCI.
Data loss occurs.	FR-ATM is congested.	Check resource utilization for function processor congestion.
	ATM is congested.	Check the *FrAtm Dlci* component for congestion indication and discards. Repeat this step to check data loss at every connection hop.
		Check for data loss in the ATM portion of the network. For details, see NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.
	The system is incorrect service interworking mode.	Check provisioned value of service interworking mode.
	Frame length is not correct.	Check to ensure that invalid frame statistics are not increasing.

(1 of 4)

Handling problems (continued)

Problems that may occur	Probable causes	Corrective measures
	Rate enforcement causes data loss.	Check to ensure that long/short frame statistics are not increasing. Increase CIR/EIR if necessary.
FR-ATM IWF CAC failure occurs.	The bandwidth is insufficient.	Check the *FrAtm Ca* component for available bandwidth. Adjust the bandwidth as required.
PVC is not up.	ATM side port is locked.	Unlock the ATM port.
	ATM side link is down (cable removed).	Install cable.
The link does not come up.	There is an operator error.	Check the physical layer attributes and make sure essential components are not locked.
	There are bad cables.	Test cables using port and line tests and remove bad cables.
	There is incorrect provisioning data.	Make sure that both ends of the link have compatible provisioning data.
LMI is not operating correctly.	The LMI system parameters on both sides of the link are incompatible.	Change protocol to ensure that the LMI system parameters are compatible. As a temporary measure, turn off the network LMI through provisioning as well as the LMI on the router. This will allow the U-plane to operate without the C-plane.
	There are mismatching LMI protocols.	Check that both the user and network are running the same LMI standard. As a temporary measure, turn off the network LMI through provisioning as well as the LMI on the router. This allows the U-plane to operate without the C-plane.
	There are mismatching LMI procedures.	Ensure that one side is provisioned as user and the other side is provisioned as network. If the LMI is bidirectional, each side must be set to both.
	The number of status responses does not match the number of status enquiries (due to low resource availability).	Reengineer the function processor to utilize fewer resources (provision fewer DLCIs).
	The number of full status responses is less than the number of full status enquiries (due to low resource availability).	Reengineer the function processor to utilize fewer resources (provision fewer DLCIs).

Handling problems (continued)

Problems that may occur	Probable causes	Corrective measures
The permanent virtual circuit (PVC) does not come up.	The NPVC has incorrect service data.	Verify the *Npvc atmConnection* component has correct value. Check frame relay and ATM links.
The soft PVC (SPVC) does not come up.	A CAC failure occurs.	Check the *FrAtm Ca* component for available bandwidth. Adjust the bandwidth as required.
	An outage in the ATM network occurs.	Check the *lastVccClearCause* attribute value. For details on clear cause codes, see NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.
The PVC is up and running, and only frames with the DE = 0 are sent. Frames with DE = 1 are rejected.	Excess burst (Be) is set to 0.	Set Be to a non-zero value.
PVC is up but all frames are discarded.	The PVC status is inactive.	Check the PVC A-bit zero causes to and from the interface.
	LMI is inactive.	Check that the LMI procedure is set correctly.
Only partial data is getting through (frame discard is occurring).	One or more of the following parameters are not set to handle your network traffic requirements: • committed information rate (CIR) • committed burst (Bc) • Be	Check if each of the parameters are at the correct settings. For example, CIR must be high enough to accommodate your traffic.
There is an engineering alarm for the *FrAtm* component.	Too many DLCIs are provisioned.	Delete some DLCIs.

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Handling problems (continued)

Problems that may occur	Probable causes	Corrective measures
SPVC is going through the managed cut-through switching (MCS) manager and an end point does not come up.	End point is locked.	Unlock end point.
	Remote end point is locked.	Unlock end point.
		Check provisioning.
	Remote end point DLCI is disabled or does not exist.	See troubleshooting procedures in NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.
	VCC is disabled.	
End point LMI is disabled.	LMI protocol is mismatched between the local and remote LMIs.	Fix provisioning.
	VCC is disabled.	See troubleshooting procedures in NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.
Endpoint is not active.	Problem is related to the ATM interface.	Check clear cause for specific cause and resolution.
		See ATM Forum's ATM User-Network Interface Specification 3.1 Section 5 for a list of ATM clear causes.

(4 of 4)

Deployment models

There are two basic deployment configurations for the FR-ATM service. You can use the FR-ATM service as an access service that permits frame relay CPEs to connect directly to ATM networks. You can also use the FR-ATM service as a gateway that permits transport between Nortel Multiservice Switch frame relay and ATM networks.

Navigation

- FR-ATM UNI/NNI access service (page 144)
- FR-ATM gateway (page 145)

FR-ATM UNI/NNI access service

You can deploy the FR-ATM service as a frame relay UNI or NNI on the Nortel Multiservice Switch node supporting the interworking function directly. Frame-to-cell adaptation occurs at the edge of the ATM network and the CPE connects directly to the FR-ATM service.

The FR-ATM UNI/NNI access service includes a FR-ATM interworking function, and an ATM interface located on the same node.

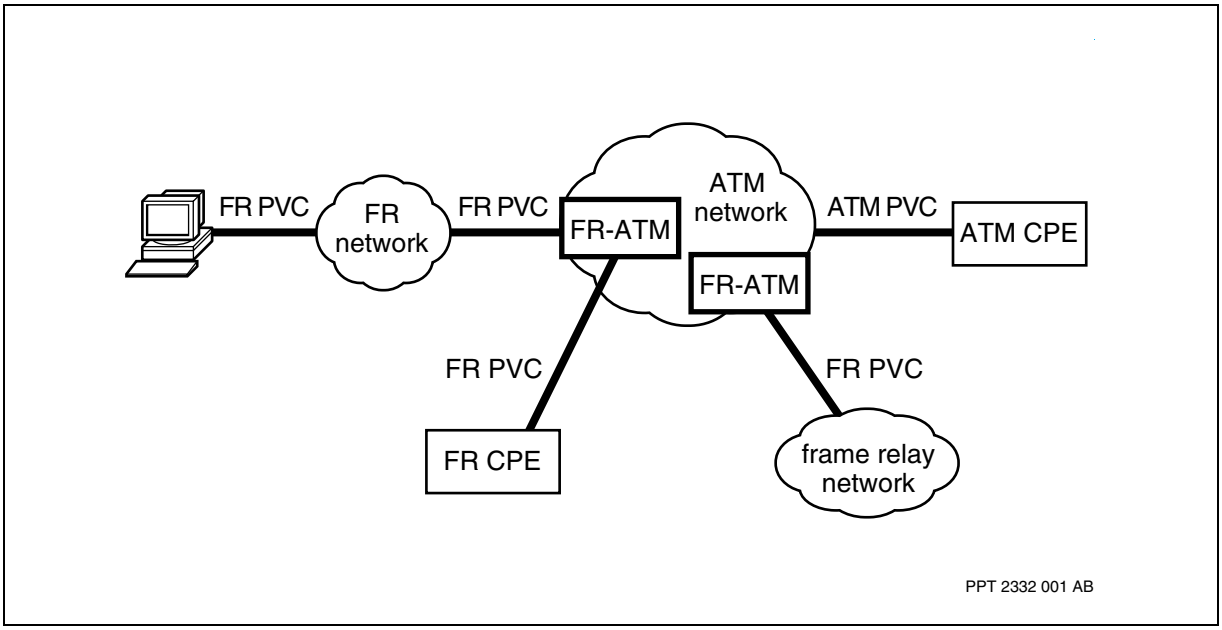
ATM-centric network configuration

In this deployment model, several frame relay end points access the ATM network through a FR-ATM UNI/NNI access service. See the figure ATM-centric network (page 145). In this configuration, the FR-ATM interworking function also incorporates the functions of the FR UNI.

The frame-to-cell conversion occurs at the edge of the ATM network. This is an application of a FR-ATM UNI/NNI access service, directly implementing the interworking function at the edge of the network.

For information about traffic shaping in an ATM-centric network configuration, see NN10600-706 *Nortel Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals*.

ATM-centric network



Resiliency in an ATM-centric network

If an intermediate node on an ATM connection fails, the FR-ATM SPVC immediately tries to re-establish itself using a different route. This process requires no user intervention.

You can configure alternate routes at every Nortel Multiservice Switch node along the ATM connection. When multiple ATM interfaces on the same node produce a match for a called address, call set-up occurs in sequence. Each interface accepts a call request in turn when the same best-match address occurs again.

FR-ATM gateway

You can augment the FR-ATM service to provide a gateway function between two subnetworks. This implementation allows frame relay services in the dynamic packet routing system (DPRS) subnetwork to interwork with ATM services in the ATM subnetwork. The FR-ATM gateway consists of a frame relay interface, a FR-ATM interface, and an ATM interface located on the same node.

You can deploy FR-ATM gateway in one of the following configurations:

- Interconnected frame relay and ATM subnetworks (page 146)
- Frame relay network leveraging another carrier's ATM network (page 147)

For more information about FR-ATM gateway, see the following sections:

- Resiliency in a mixed DPRS and ATM network (page 148)

- Resiliency in a frame relay to ATM network (page 149)
- DPN interworking with a Multiservice Switch network featuring a Multiservice Switch 7400 series node (page 149)

Interconnected frame relay and ATM subnetworks

In this deployment model, several DPRS subnetworks connect to a single ATM subnetwork using a standard FR-ATM gateway configuration. The subnetworks are part of a large Nortel Multiservice Switch mixed media network. The frame-to-cell conversion occurs inside the Multiservice Switch network, between the DPRS and ATM subnetworks.

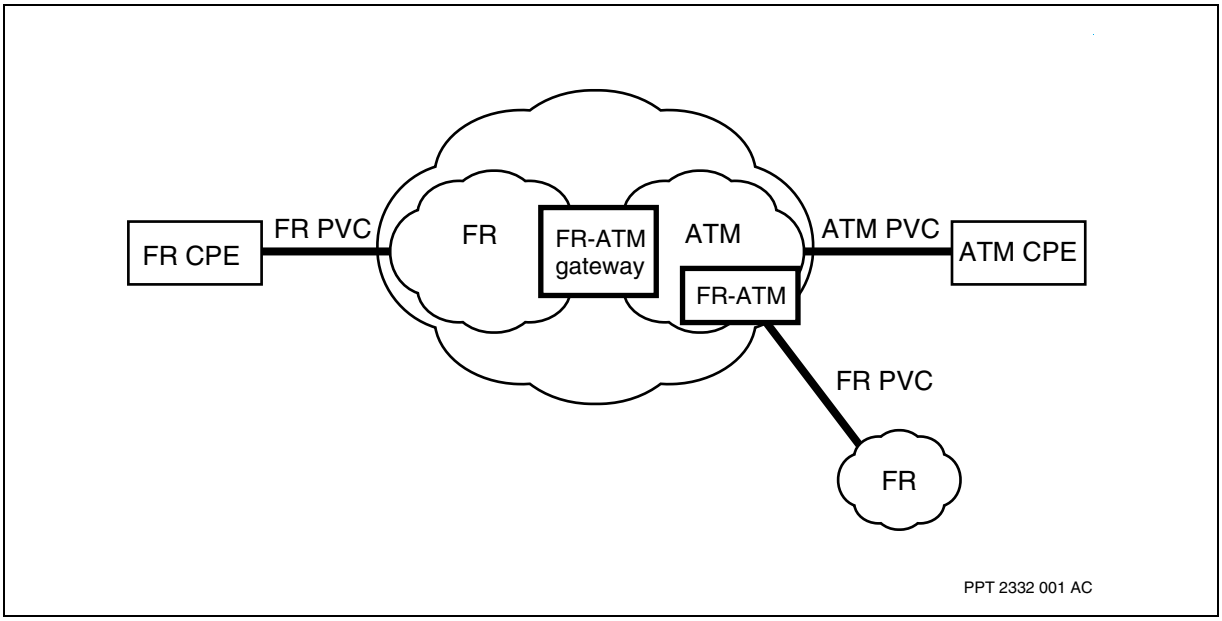
See the figure FR-ATM gateway between DPRS and ATM subnetworks (page 146). In this topology, a FR UNI connects to the DPRS subnetwork on the left. An ATM interface connects to the ATM subnetwork on the right. Any link between the two interfaces has two segments:

- a frame relay PVC between FR UNIs/FR NNIs in the DPRS subnetwork
- an ATM PVC between ATM interfaces in the ATM subnetwork

These segments interconnect through the FR-ATM gateway.

For information about traffic shaping for interconnected frame relay and ATM networks, see Traffic policing and shaping (page 160).

FR-ATM gateway between DPRS and ATM subnetworks



Frame relay network leveraging another carrier's ATM network

In this configuration, several frame relay connections route through a single ATM interface. The FR-ATM interworking function does the frame-to-cell conversion at the edge of the frame relay network.

See the figure FR-ATM gateway at the edge of a Multiservice Switch frame relay network (page 147). In this topology, a FR UNI connects to the DPRS subnetwork on the left. An ATM interface (within the Nortel Multiservice Switch network) connects to the external ATM network on the right. The ATM interface in the network can also connect directly to an ATM CPE.

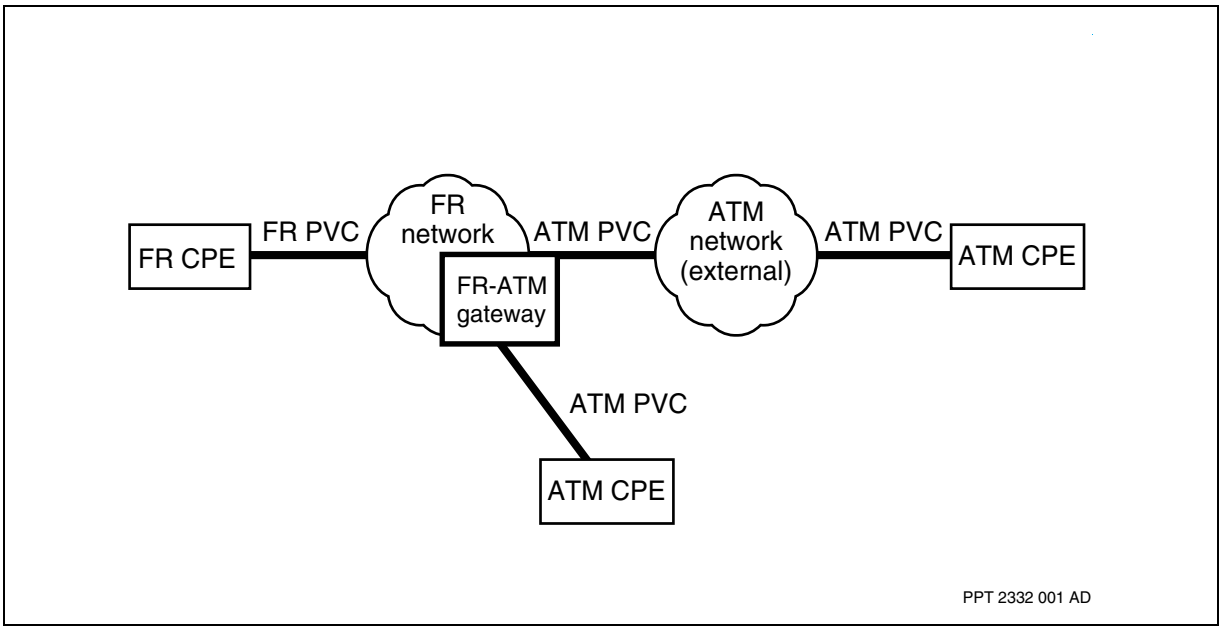
Any link between the FR UNI in the Multiservice Switch network and the interfaces in the external ATM network has two segments:

- the frame relay segment through the Multiservice Switch network
- the ATM segment from the Multiservice Switch ATM interface to the external network

These segments interconnect through the FR-ATM gateway.

For information about traffic shaping for a frame relay network leveraging another carrier's ATM network, see NN10600-706 *Nortel Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals*.

FR-ATM gateway at the edge of a Multiservice Switch frame relay network



Resiliency in a mixed DPRS and ATM network

A connection between a frame relay DPRS PVC and a destination ATM interface has the following three segments:

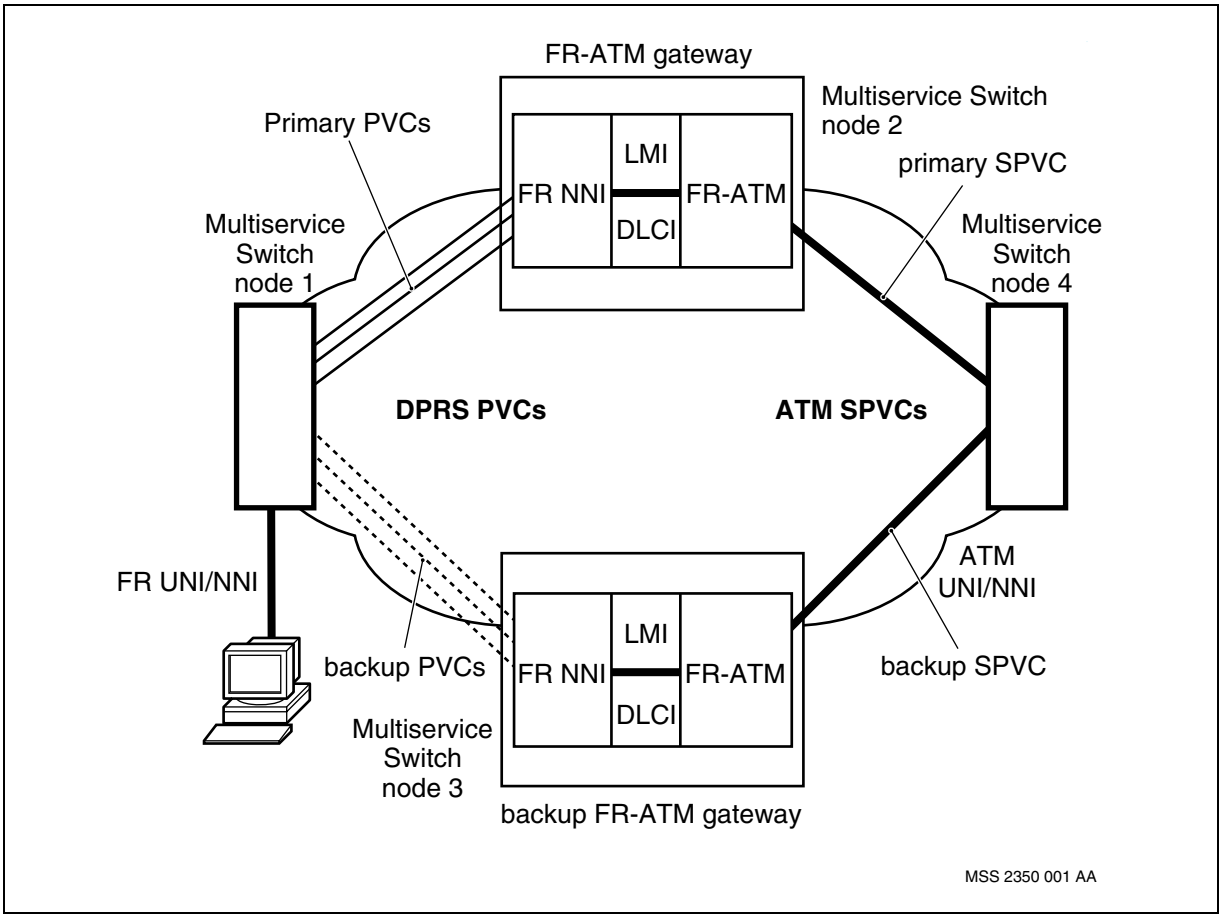
- DPRS PVC
- FR-ATM gateway
- ATM SPVC

Each segment has its own degree of resiliency. The figure FR-ATM gateway resiliency (page 149) illustrates a configuration using resiliency.

For SIWF, the FR-ATM interface informs the ATM interface of a network failure through OAM cells. After a network failure, an alternate DPRS route establishes itself automatically. This is a frame relay configurable feature. SIWF SPVCs also take advantage of SPVC resiliency.

For NIWF, the FR-ATM interface informs the ATM interface of a network failure through the LMI. The NIWF also has the added benefit of ATM SPVC resiliency. A failure inside the ATM network triggers the re-establishment of the pipe. The SPVC reconnects using an alternate path, and there is no major impact on the DLCI connections. For details, see the NN10600-702 *Nortel Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*.

FR-ATM gateway resiliency



Resiliency in a frame relay to ATM network

In the FR-ATM gateway configuration, you can back up the FR UNI or FR NNI at the access, subject to existing rules. For failures on Nortel Multiservice Switch DPRS trunks or UTP trunks, frame relay traffic automatically reroutes to an alternate path, without user intervention.

DPN interworking with a Multiservice Switch network featuring a Multiservice Switch 7400 series node

The FR-ATM gateway allows a DPN frame relay service to interwork with a Nortel Multiservice Switch ATM service that includes a Nortel Multiservice Switch 7400 series node. The FR-ATM gateway terminates the DPRS PVC from a DPN-100 or Multiservice Switch Access Switch (MAS) frame relay service. It can then pipe this connection across the ATM subnetwork to the appropriate ATM interface service. The engineering considerations for setting traffic parameters such as CIR, Bc, and Be for traffic management still apply in this configuration.

Bandwidth management

The FR-ATM interface supports bandwidth management for the following connections:

- FRF.8 nailed-up PVCs (NPVCs)
- FRF.8 soft PVCs (SPVCs)
- FRF.5 SPVCs

When the FR-ATM interface receives a request for a new connection, the FR-ATM connection administrator (*FrAtm Ca* component) decides if or not to admit the connection. You can restrict the amount of bandwidth allocated to a given type of traffic by partitioning the port capacity into bandwidth pools and mapping them to frame relay transfer priorities. See the figure Transfer priority to bandwidth pool mapping (page 152).

Navigation

Frame relay transfer priorities

The transfer priority is a preference configured for an application based on its delay-sensitivity requirement. Frames with a higher transfer priority are served by the network before frames with a lower transfer priority. Each frame relay transfer priority has different quality of service (QoS) requirements.

The capacity of a FR-ATM interface can be shared among 16 different frame relay transfer priorities. A combination of three priority network queues and four egress emission queues service the transfer priorities. The capacity allocated to each transfer priority accommodates nailed-up and switched connections. These consist of FRF.8 NPVCs, FRF.8 SPVCs, and FRF.5 access SPVCs.

For more information about frame relay transfer priorities, see NN10600-900 *Nortel Multiservice Switch 7400/15000/20000 Frame Relay Technology Fundamentals*.

Bandwidth pools

You can partition the port capacity into a maximum of 16 different bandwidth pools. You can assign each bandwidth pool a percentage of the link capacity through the *bandwidthPool* attribute of the *FrAtm Ca* component.

You can display information about available bandwidth for a connection under the *FrAtm Ca* component. The *poolProvisionedBandwidth* attribute is the percentage of the bandwidth that is user-configured. The *poolAdmittedBandwidth* attribute is the actual bandwidth used in the connection. The *poolAvailableBandwidth* attribute is the difference between the *poolProvisionedBandwidth* and the *poolAdmittedBandwidth* values; it is the bandwidth still available for the connection.

Mapping transfer priorities to bandwidth pools

You can map each transfer priority to a given bandwidth pool either globally or locally for each interface.

To map transfer priorities to specific bandwidth pools globally, set the module-wide parameters under the *Mod Frs AtmNet Tpm* component.

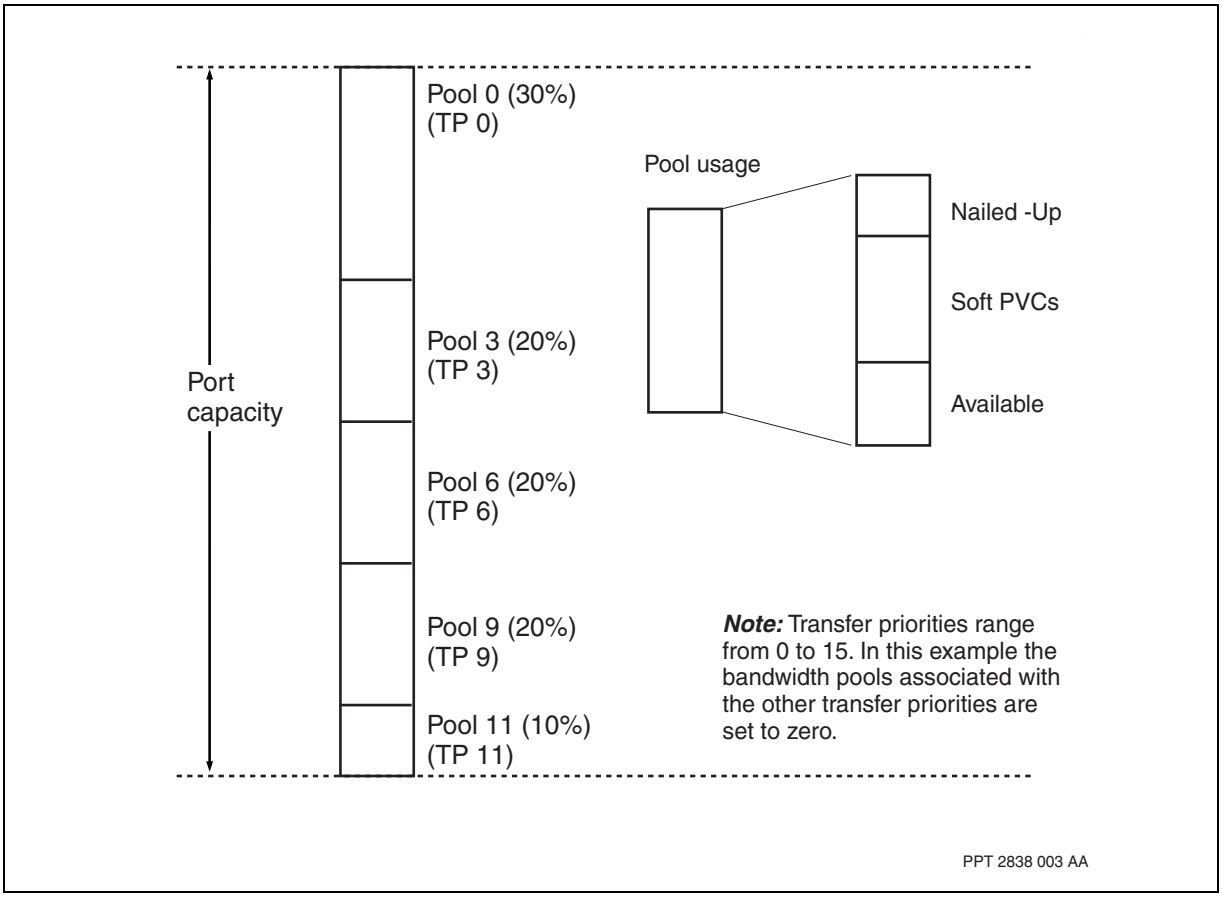
You can override the global mapping of transfer priorities to bandwidth pools on each FR-ATM interface. To configure the relationship for a FR-ATM interface, assign the transfer priority to a bandwidth pool under the *FrAtm Ca Tpm* component.

For more information, see the following sections:

- Over- and under-subscription (page 152)
- Full sharing (page 153)

The figure Transfer priority to bandwidth pool mapping (page 152) shows bandwidth pools and their associated transfer priorities.

Transfer priority to bandwidth pool mapping



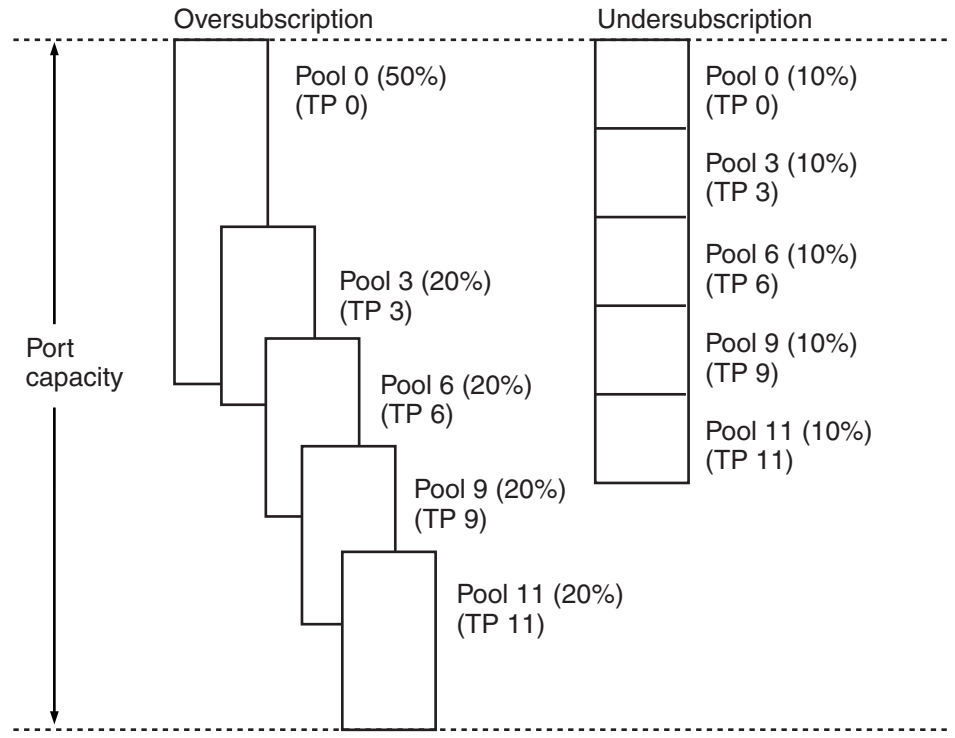
Over- and under-subscription

The percentages assigned to the 16 bandwidth pools do not have to add up to 100 percent. The percentage of link capacity for a bandwidth pool can vary between 0 and 10 000 percent. This flexibility allows for over- and under-subscription of the port as shown in the figure Over- and under-subscription (page 153). You can use this flexibility to increase or decrease port usage.

Over-subscription is a set of percentages totalling more than 100 percent: it assumes that only a fraction of the subscriber connections are active simultaneously. Over-subscription allows you to take advantage of the statistical gain introduced through variable user traffic flow.

Under-subscription is a set of percentages totalling less than 100 percent: it implicitly reserves bandwidth for connections with a specific transfer priority. Under-subscription allows you to set aside the bandwidth required by a specific traffic type, and prevent traffic with other transfer priorities from using it.

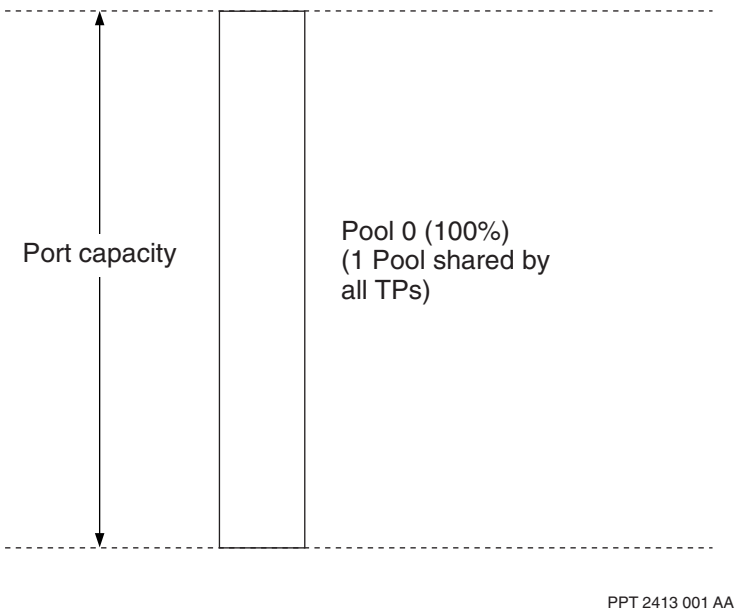
Over- and under-subscription



Full sharing

You can configure the port capacity for full sharing among bandwidth pools, by assigning 100 percent (or more) of the capacity to one common bandwidth pool. All connections reserve their required EBR from this pool, regardless of their transfer priority. See the figure Full sharing of bandwidth (page 154). In this configuration, the entire port capacity is available on a first-come, first-serve basis to any transfer priority.

Full sharing of bandwidth



Connection admission control

Connection admission control (CAC) is a mechanism used to determine whether an interface can accommodate a connection request. CAC provides quality of service (QoS) guarantees to the different transfer priorities (TPs). FR-ATM supports CAC on the egress link only.

Connection admission or rejection is based on the attributes of both the requested connection and the existing connections. CAC uses several factors to determine resource availability: these include the link rate, the frame relay traffic descriptors (CIR, Bc, Be, and Tc), and the current available link capacity.

The ATM CAC mechanism for ATM connections uses the transmit traffic descriptor parameters (PCR, SCR, and MBS). For more information about ATM connection admission control, see NN10600-705 *Nortel Multiservice Switch 7400/15000/20000 ATM Traffic Management Fundamentals*.

For more information about FR-ATM connection admission control, see the following sections:

- Equivalent bit rate (EBR) (page 155)
- Bandwidth requirements (page 156)
- Overriding the link rate (page 156)

Equivalent bit rate (EBR)

The FR-ATM CAC algorithm uses several parameters including CIR, Bc, Be, Tc, and EIR to determine the bandwidth required for a connection. The amount of bandwidth reserved is known as the equivalent bit rate (EBR).

If CAC is on, you can display the status of the required bandwidth for any FR-ATM connection through the *equivalentBitRate* attribute under the *FrAtm Dlci Siwf* and *FrAtm Dlci Niwf* components. The *poolAdmittedBandwidth* attribute under the *FrAtm Ca* component indicates the total admitted bandwidth from each bandwidth pool. It is the sum of the EBR values for all the active connections, both permanent and switched.

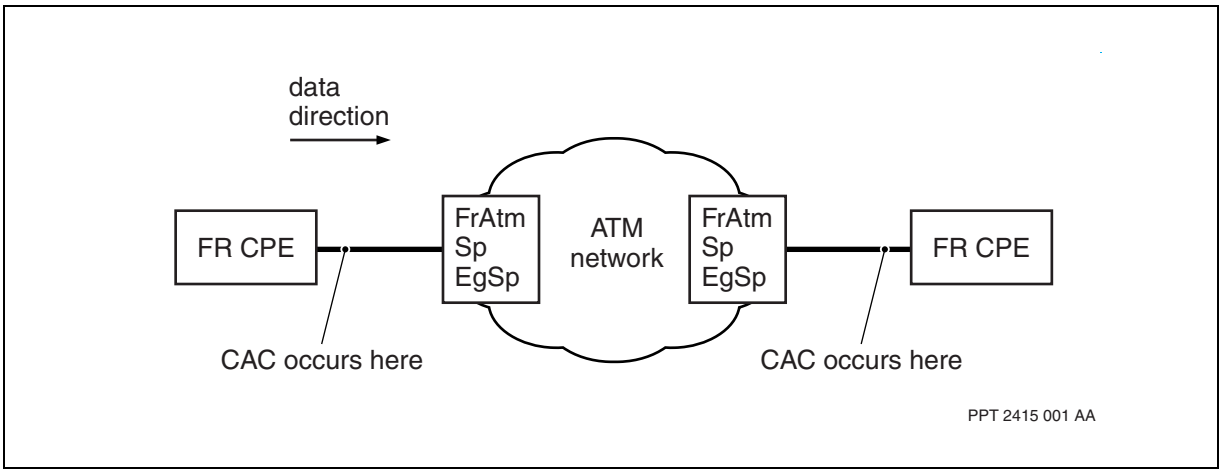
The table Access class of service types (page 155) shows the frame relay access classes of service and their respective EBRs.

Access class of service types

Class	Type of service	CIR	Bc	Be	Tc	EIR	EBR
A	Discard eligibility only	= 0	= 0	> 0	> 0	Be/Tc	0
B	CIR only	> 0	> 0	= 0	= Bc/CIR	0	CIR
C	CIR plus Discard eligibility	> 0	> 0	> 0	= Bc/CIR	Be/Tc	CIR

The figure FR-ATM to FR-ATM CAC operation (page 155) shows the components used in a FR-ATM to FR-ATM connection.

FR-ATM to FR-ATM CAC operation



Bandwidth requirements

The FR-ATM CAC occurs on the egress link only. FR-ATM allows you to specify the bandwidth requirements in the forward direction, by configuring the *FrAtm Dlci Sp* component and a bandwidth conversion policy. CAC uses these parameters to derive the EBR for the connection, based on the table Access class of service types (page 155).

FR-ATM allows you to specify different bandwidth requirements in the backward direction for a connection, under the optional *FrAtm Dlci EgressSp* (*EgSp*) component. Configuring the *EgSp* component overrides the *Sp* component configuring for CAC.

The recovery of frame relay traffic characteristics from ATM connection traffic parameters cannot be exact. It requires knowledge of the algorithm used to convert traffic from frame relay to ATM, the average frame size used, and the access rate on the source end of the frame relay connection.

To get end-to-end bandwidth accuracy and synchronization, you must specify the bandwidth requirements at the FR-ATM slave end of the connection. You do this by configuring the *ServiceParameters* (*Sp*) component under the *FrAtm Dlci Siwf* or *FrAtm Dlci Niwf* components.

On the master end of the connection, the ATM bandwidth parameters (PCR, SCR, and MBS) indicate ATM bandwidth requirements in the forward direction. On the slave end, these parameters display the ATM bandwidth requirements in the backward direction.

You can determine the master and slave ends of a connection by displaying the *type* attribute under the *FrAtm Dlci Siwf* or *FrAtm Dlci Niwf* components.

Overriding the link rate

The operational *linkRate* attribute under the *FrAtm Ca* component reflects the actual link rate of the connection. You can change the link rate by configuring the *overrideLinkRate* attribute under the *FrAtm Ca* component. By default, this attribute is set to 0.

If you are using the *FrAtm Framer* component, and the *overrideLinkRate* attribute is 0, the value of the *linkRate* attribute is the speed of the port of the FR-ATM connection. If you are using the *FrAtm VirtualFramer* component, and the *overrideLinkRate* attribute is 0, the value of the *linkRate* attribute is 429496729.

ATM connection establishment

You can create a FR-ATM connection by binding a FR-ATM DLCI to an ATM VCC, in addition to standard ATM PVC configuration across the ATM subnet. A combination of frame and ATM traffic management capabilities enforce the service level agreement (SLA) for each FR-ATM connection.

For information about rerouting for FRF.8 and configuring FRF.8 connection recovery and path optimization, see the section FRF.8 connection recovery and path optimization configuration (page 73).

Navigation

FR-ATM connection types

The FR-ATM service supports two types of connection establishment procedures:

Currently, the Nortel Multiservice Switch system implementation of FRF.8 supports both NPVC and SPVC connections, and FRF.5 end points support SPVC connections only.

Soft permanent virtual connections (SPVC)

For SPVCs, you need only configure the connection at the source end. Route selection and connection establishment is automatic, but you must configure network nodes for hop-by-hop routing. If a network failure occurs, the SPVC re-establishes itself automatically if you have configured multiple routes.

If you are configuring a FR-ATM to FR-ATM or ATM to FR-ATM FRF.8 connection, you must configure a *Siwf* component at the called end.

If you are configuring a SIWF SPVC, you must configure the *FrAtm Addr* component.

The FR-ATM service uses ATM networking protocols to set up SPVC connections. For information about ATM networking, see NN10600-702 *Nortel Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*.

The establishment of an FRF.5 ATM SPVC is subject to the same rules and limitations as one originating from an *AtmIf Vcc Src* component. In particular, if the SPVC is expected to route through a Nortel Multiservice Switch ATM interface on which usage parameter control (UPC) is enabled, the derived ATM traffic parameters must respect the appropriate hardware limitations dictated by the network's software and hardware configuration.

These limitations apply to frame relay connections using traffic policies three, four, and five only.

Nailed-up permanent virtual connections (NPVC)

For NPVCs, you must configure the connection hop-by-hop. You define the static route in advance and set it up manually. If a network facility or node along the selected route fails, the connection goes down and remains out of service for the duration of the outage. The NPVC re-establishes itself automatically after recovery from a network failure.

Nortel Multiservice Switch system currently supports NPVCs for service interworking only.

Traffic management

For SPVCs, the FR-ATM transfer priority (TP) maps to a set of options using global configuring data. Use the FR-ATM transfer priority to derive the SPVC configuration.

For NPVCs, you configure both sides of the connection individually. The FR-ATM DLCI includes configuration for the FR-ATM emission priority and bandwidth parameters. The VCC configuration includes the ATM service category and bandwidth parameters.

FR-ATM traffic management consists of the following elements:

- Frame Relay and ATM traffic parameters (page 159)
- ATM service categories (page 159)
- Emission priority (page 160)
- Discard priority (page 160)
- Traffic policing and shaping (page 160)

- Frame relay to ATM quality of service mappings (page 163)

Frame Relay and ATM traffic parameters

Frame relay and ATM use different traffic parameters to characterize the traffic of a given connection. See the table Frame relay and ATM traffic parameters (page 159).

Frame relay and ATM traffic parameters

Frame Relay traffic parameters	ATM traffic parameters
• CIR: committed information rate (bits/s) • EIR: excess information rate (bits/s) • Bc: committed burst (bits) • Be: excess burst (bits) • AR: access rate (bit/s) • maximum frame size (bytes)	• PCR: peak cell rate (cells/s) • SCR: sustained cell rate (cells/s) • MBS: maximum burst size (cells)

On the access side, FR-ATM uses frame relay traffic parameters. For information about frame relay quality of service, see NN10600-900 *Nortel Multiservice Switch 7400/15000/20000 Frame Relay Technology Fundamentals*.

On the network side, FR-ATM uses ATM traffic parameters. For information about ATM quality of service, see NN10600-705 *Nortel Multiservice Switch 7400/15000/20000 ATM Traffic Management Fundamentals*.

The mapping between these traffic parameters is subject to engineering considerations. It is also dependent on the balance between acceptable loss probabilities and network costs. For more information, see *Nortel Multiservice Switch Release Notes*.

The FR-ATM interworking function maps the frame relay and ATM traffic parameters for each FR-ATM connection. For more information, see Frame relay to ATM quality of service mappings (page 163).

ATM service categories

The ATM service category specifies the service provided by an ATM connection. Possible values are:

- constant bit rate (CBR)
- real-time variable bit rate (rt-VBR)

- non real-time variable bit rate (nrt-VBR)
- unspecified bit rate (UBR)

For more information about ATM service categories, see NN10600-705 *Nortel Multiservice Switch 7400/15000/20000 ATM Traffic Management Fundamentals*.

Emission priority

For frame relay, you can assign connection traffic to separate emission priority queues at the access. Connection traffic on a high emission priority queue takes precedence over traffic transmitted on lower emission priority queues.

The *Framer* component supports two or four egress emission priority queues for each frame relay interface. Two queues are available by default. You can use four queues to further differentiate traffic at the egress of the network. This is important in networks where traffic uses high speed trunks with lower speed access lines, creating a bottleneck at the access.

The *VirtualFramer* component supports only two queues for each frame relay interface.

For ATM, the emission priority is derived from the ATM service category. For more information about ATM emission priorities, see NN10600-707 *Nortel Multiservice Switch 7400/15000/20000 ATM Queuing and Scheduling Fundamentals*.

Discard priority

The discard priority specifies the importance of the frame in the node's backplane. For ATM, the ATM service category for a given connection determines the discard priority.

The data transfer between the FR-ATM access card and the ATM card uses the ATM discard priority. For more information about ATM discard priorities, see NN10600-707 *Nortel Multiservice Switch 7400/15000/20000 ATM Queuing and Scheduling Fundamentals*.

Traffic policing and shaping

Traffic policing protects the network from excessive traffic on particular connections. You can enable traffic policing on the frame relay access side by turning rate enforcement on for a given DLCI.

Traffic shaping offers some buffering to smooth out the inherent bursts that result from frame-to-cell conversion. You can enable traffic shaping on the ATM portion of the network by turning traffic shaping on for a given ATM interface. For more information, see NN10600-706 *Nortel Multiservice Switch 7400/15000/20000 ATM Traffic Shaping and Policing Fundamentals*.

Network administrators often configure traffic policing at the network's receiving interface and traffic shaping at the ATM transmit interface (if connected to an external ATM network).

For more information, see the following sections:

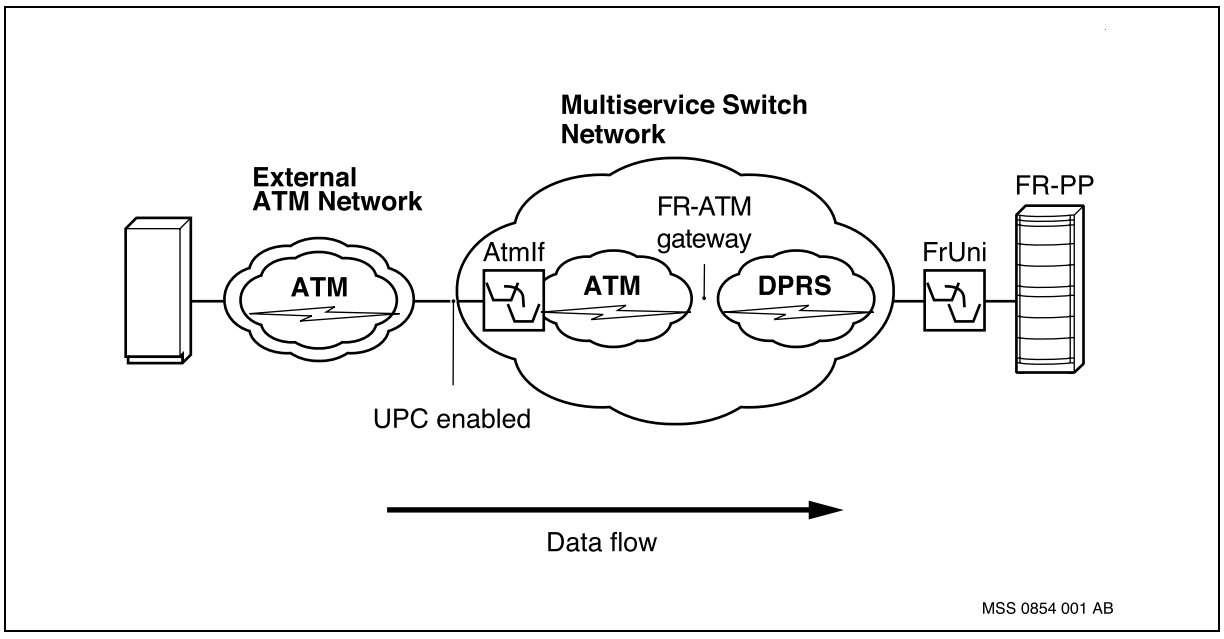
- Traffic policing and shaping in an ATM-centric network (page 161)
- Traffic policing and shaping in a mixed Multiservice Switch network (page 161)
- Traffic policing and shaping in a frame relay to ATM network (page 162)

Traffic policing and shaping in an ATM-centric network

In an ATM-centric network, the ATM usage parameter control (UPC) is enabled on the ATM interface that is adjacent to the FR-ATM interface. Like frame relay CIR, Bc, and Be parameters, UPC ensures that traffic conforms to the traffic contract for the subscriber. In effect, UPC takes over the frame relay traffic management controls. This means there is no additional configuring required on the frame relay side to the FR-ATM interface.

See the figure Rate enforcement from ATM to frame relay (page 161).

Rate enforcement from ATM to frame relay



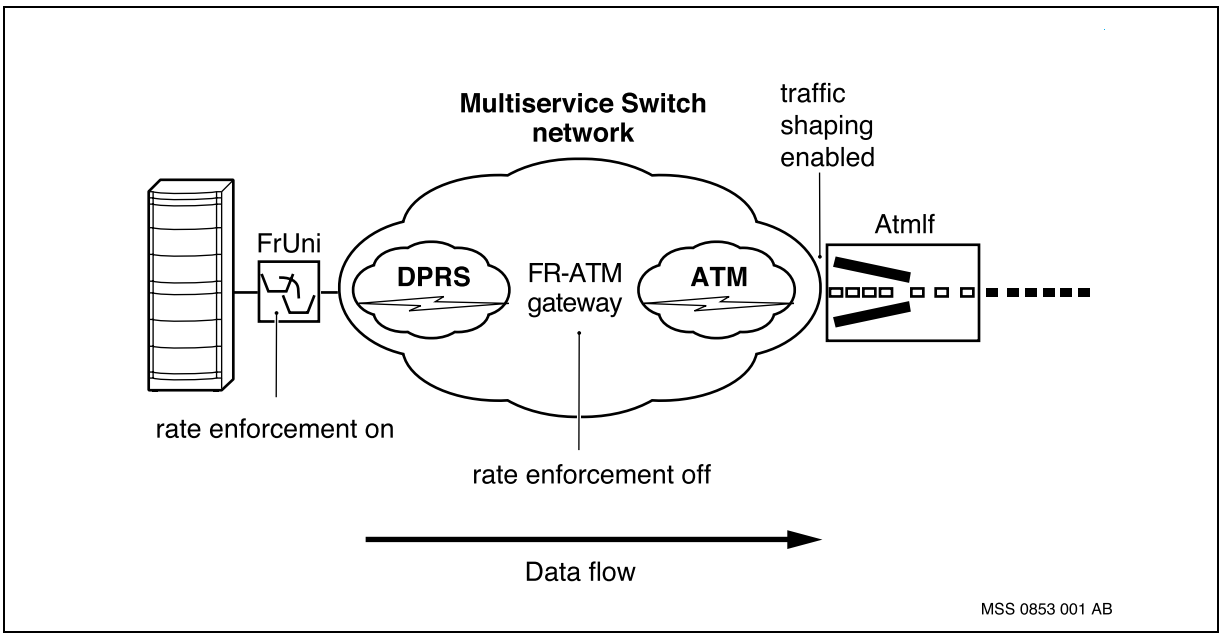
Traffic policing and shaping in a mixed Multiservice Switch network

In a mixed Nortel Multiservice Switch network, rate enforcement is on at the FR UNI located at the edge of the DPRS subnetwork. Because it is on the FR UNI adjacent to the frame relay CPE, traffic management mechanisms are

already in place and do not need to be duplicated at the FR-ATM gateway interface. Traffic shaping is configured and enabled for the transmit ATM interface (within the ATM subnetwork) connected to the FR-ATM interface. This ensures that proper traffic management is in place before cells cross the network. Traffic management for each subnetwork is self-contained. However, there are engineering considerations related to the capacity of the link associated with the ATM interface.

See the figure Rate enforcement and traffic shaping in a mixed DPRS and ATM network (page 162).

Rate enforcement and traffic shaping in a mixed DPRS and ATM network



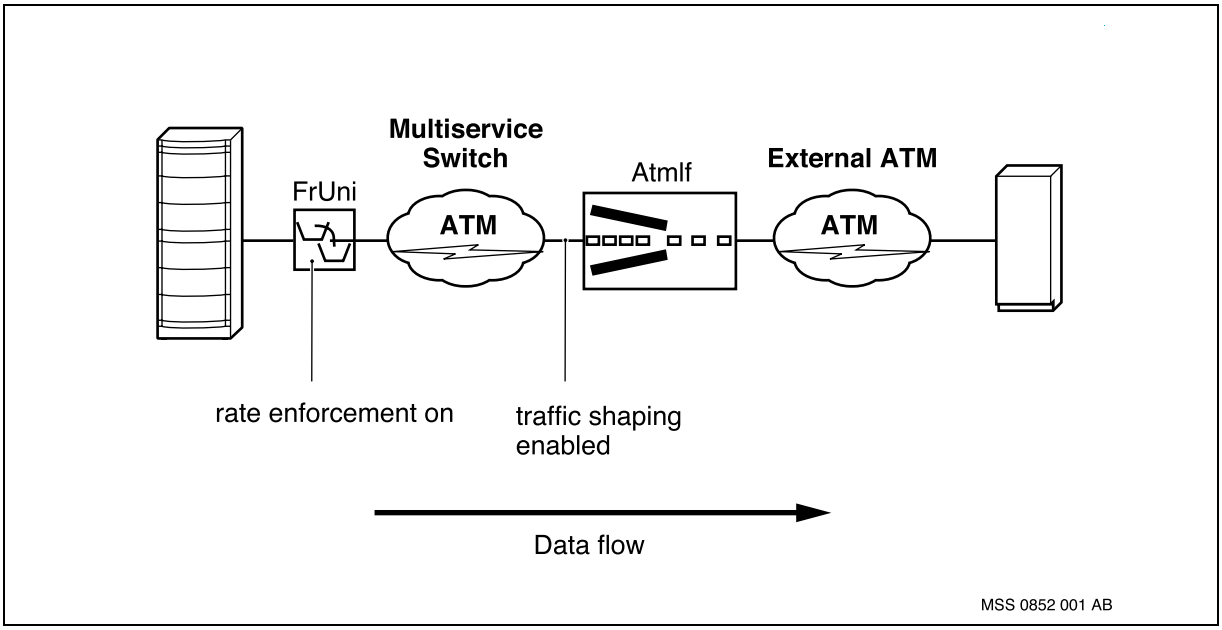
Traffic policing and shaping in a frame relay to ATM network

In a frame relay to external ATM network configuration, rate enforcement is on for the FR UNI functions that the FR-ATM service controls. Rate enforcement on the FR-ATM interface ensures proper traffic management before frames convert to cells and cross to the ATM interface. Traffic shaping is configured and enabled for the transmit ATM interface (within the ATM subnetwork) connected to the FR-ATM interface. This ensures proper traffic management is in place before cells cross the network.

In this way, the frame relay interface maintains rate enforcement on that part of the connection that belongs to the frame relay PVC in accordance with frame relay requirements. Similarly, the ATM interface maintains traffic shaping on that part of the connection that belongs to the ATM PVC, in accordance with ATM networking requirements.

See the figure Rate enforcement and traffic shaping from frame relay to ATM (page 163).

Rate enforcement and traffic shaping from frame relay to ATM



Frame relay to ATM quality of service mappings

You can configure quality of service mapping between frame relay and ATM services globally under the *Mod Frs AtmNet Tpm* component. For each FR-ATM transfer priority, you can specify the following:

- FR-ATM emission priority
- ATM service category
- average frame size
- traffic conversion policy
- assigned bandwidth pool

You can override the module-wide quality of service parameters for a particular connection by configuring attributes under the *FrAtm Dlci Siwf Qos* and *FrAtm Dlci Niwf Qos* components respectively.

The table Sample Frame Relay to ATM service mappings (page 164) presents a possible combination of frame-based services, ATM service categories, and frame relay transfer priorities (TPs). This combination maps to different emission priority queues in Nortel Multiservice Switch systems.

Sample Frame Relay to ATM service mappings

Traffic type	Frame Relay TP	ATM service category	Frame Relay emission priority
file transfer	TP0	UBR	0
interactive data (delay-tolerant)	TP6	nrtVbr	1
interactive data (delay-sensitive)	TP9	rtVbr	2
multimedia (packetized voice)	TP11	rtVbr	3

Conversion of traffic parameters

Frame relay and ATM traffic parameters are dissimilar and require conversion by the FR-ATM interworking function. The conversion between frame relay and ATM traffic parameters cannot be exact, because each set describes different connection behaviors. However, you can use frame relay parameters to derive equivalent ATM traffic parameters.

The conversion of traffic parameters is slightly different for the service and network interworking functions. For more information, see the following sections:

- FRF.8 conversion of traffic parameters (page 173)
- FRF.5 conversion of traffic parameters (page 190)

FRF.8 connection recovery and path optimization

Use the information in this section to learn more about FRF.8 connection recovery and path optimization. For information about configuring FRF.8 connection recovery and path optimization, see the section FRF.8 connection recovery and path optimization configuration (page 73)

Rerouting behavior for FRF.8

The following behaviors are applicable to FRF.8 SPVC connections with Nortel Multiservice Switch FrAtm rerouting capabilities:

- During connection recovery or path optimization, frames may be lost. If the LMI or link is down at the same time and the A-bit Inactive message fails to deliver to the remote end, then the message is resent after 60 seconds.
- Without rerouting capabilities, when an FRF.8 SPVC connection fails, the SPVC call is retried automatically. The DLCI state is then changed to DOWN and the event is reported to LMI accordingly. With rerouting provisioned, the application is not informed of the connection recovery and the user is not aware of the connection outage if the SPVC connection is recovered successfully.

Rerouting limitations for FRF.8

Two rerouting FRF.8 limitations are:

- route recovery limitation
- path optimization pacing

In the event of a network failure with a large number of FRF.8 connections, only a limited number of FRF.8 connections will be recovered per node (see Nortel Engineering Guidelines for more information). The remaining connections will time out on a route find failure, clear to the destination, and will go through standard SPVC retry or other call re-establishment mechanisms.

Path optimization is performed one connection at a time, for example to minimize impacts to new call setup attempts. To optimize a large connection space will take time.

FRF.8 connection recovery and path optimization services

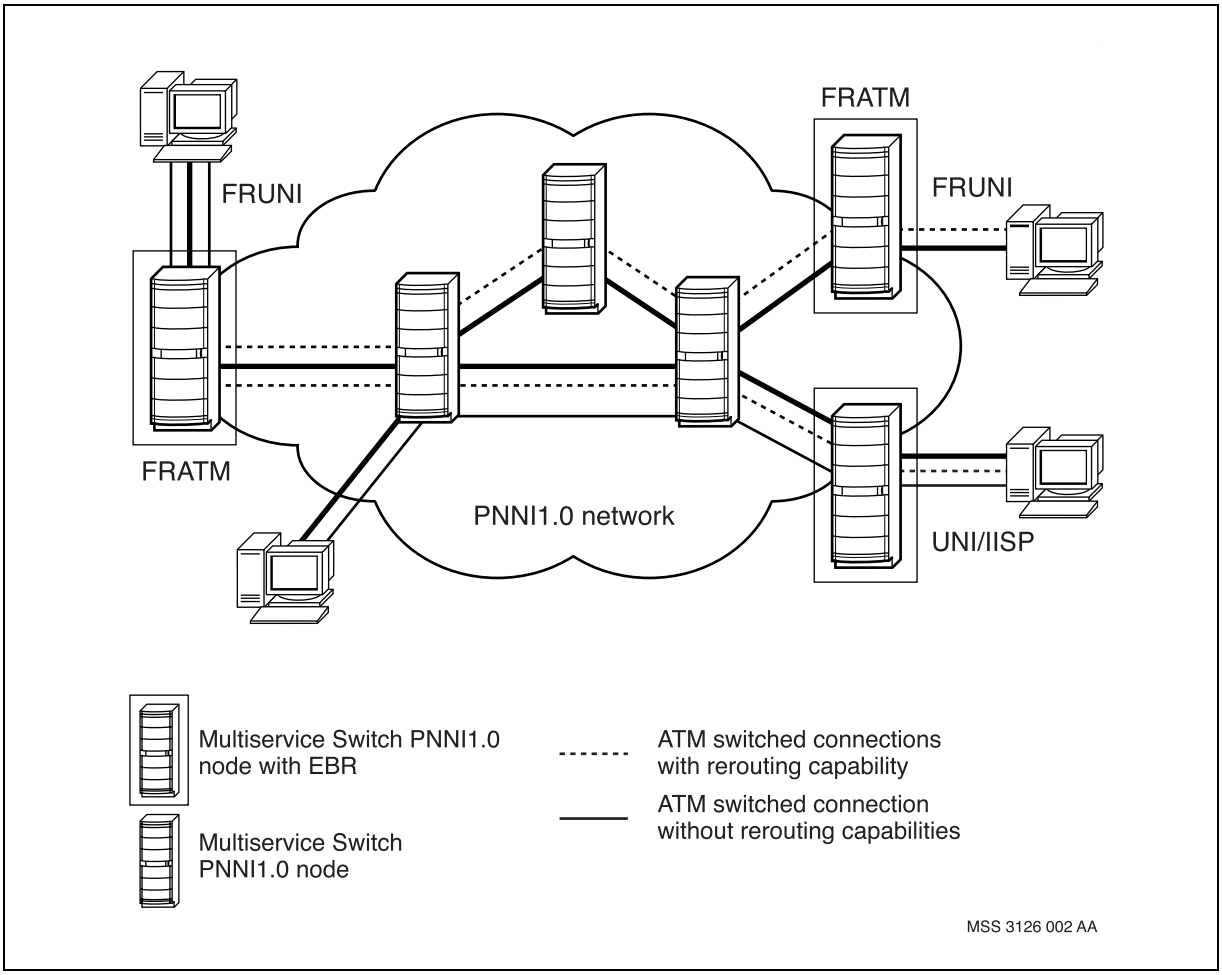
To configure connection recovery on a FRATM signaling interface, you can set the *globalConnectionRecovery* attribute to turn on connection recovery for configured connections. To configure path optimization, you can set the *globalPathOptimization* attribute to turn on path optimization for configured connections. The default for both attributes is turned on for both connection types.

When you configure rerouting for a FR-ATM interface, a dynamic *RouteInfo* component appears under the *FrAtm Dlci Siwf* component for each affected connection if the connection successfully negotiates rerouting parameters. For an SPVC, you can optionally configure an *RerouteOv* component. The *RerouteOv* component enables you to override the rerouting capabilities defined for the interface on the basis of individual connections.

Existing connections retain the old subscription options and new connections are assigned the new options. However, changes to the *RerouteOv* component are not critical. Therefore, the SPVC will not restage. However, to pick up the new subscription capabilities, the DLCI must be restage.

The figure FrAtm connections using PNNI rerouting (page 166) displays some typical examples of FrAtm connections using the PNNI rerouting capabilities across the ATM network. The PNNI rerouting capabilities are supported in both FRATM to FRATM connections where both ends of the connection are frame relay users and FRATM to ATM connections where one end is a frame relay user and the other end is an ATM user. Rerouting on FRF.8 connections can be provisioned with the source of the SPVC on the FRATM side.

FrAtm connections using PNNI rerouting



SIWF technical description

The FR-ATM service interworking function (SIWF) enables frame relay customer premise equipment (CPE) to communicate with ATM-capable CPE. It supports both nailed-up PVCs (NPVCs) and soft PVCs (SPVCs), and maps frame relay DLCIs to ATM VCCs on a one-to-one basis.

In accordance with the FRF.8 standard, the FR-ATM SIWF maps Q.922 data frames to and from ATM AAL5 frames using the FRF.8 null SSCS Q.933 Annex A specification.

Navigation

- SIWF data flow (page 167)
- SIWF user plane mappings (page 168)
- Establishing FR-ATM SIWF connections (page 171)
- FRF.8 conversion of traffic parameters (page 173)
- PVC status management for SIWF (page 179)

SIWF data flow

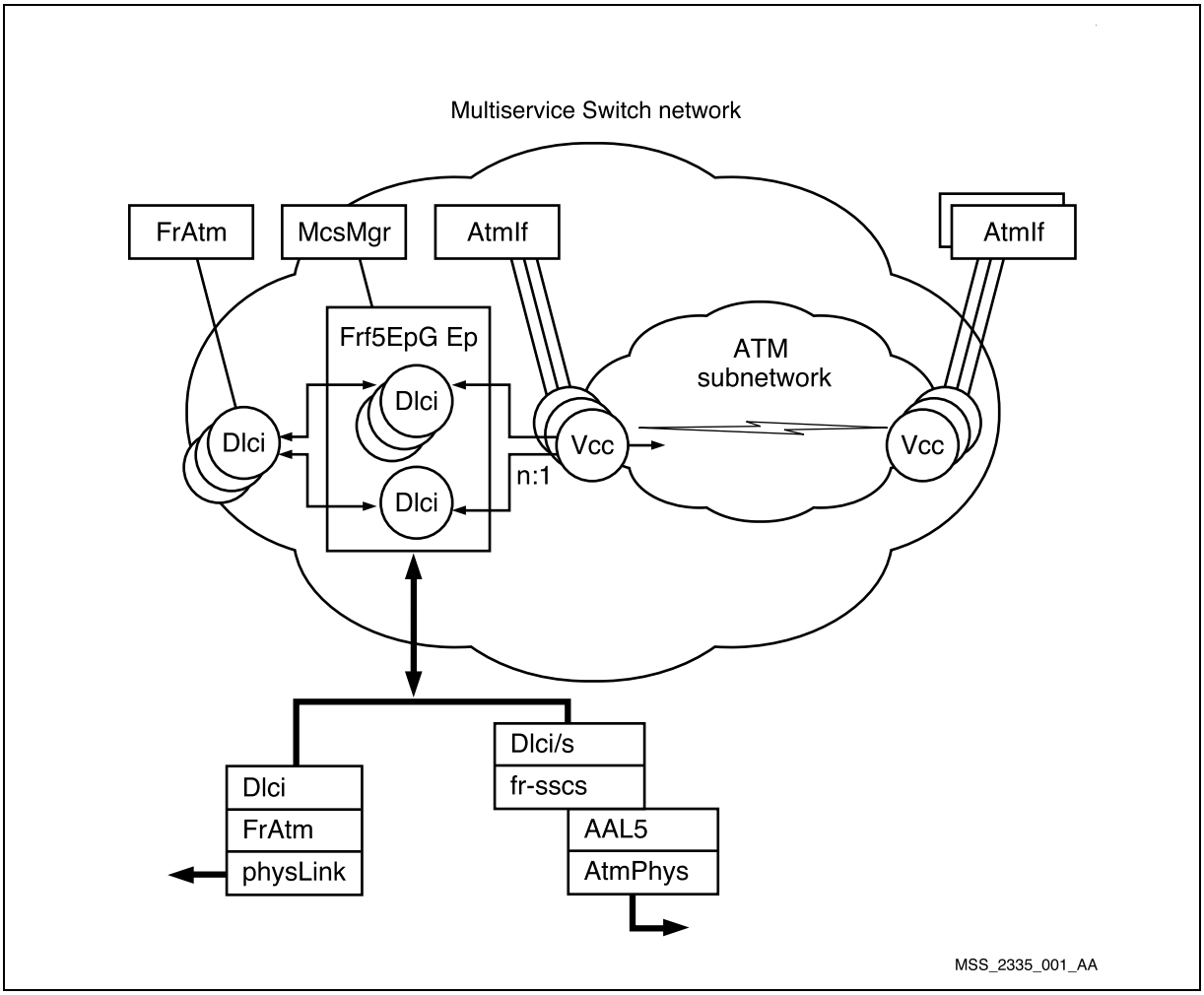
In the frame relay to ATM direction, frames coming in on a frame relay DLCI arrive at the FR-ATM interface for interworking functions. The FR-ATM SIWF examines the frames and performs user plane mappings and encapsulation for delivery over ATM. The FR-ATM SIWF then forwards the frames through the node's backplane to the appropriate ATM interface. The ATM interface performs AAL5 encapsulation and segments the frames into cells before they leave the node. From there, the cells traverse the ATM subnetwork and exit the network at the remote ATM interface.

In the ATM to frame relay direction, cells coming in from the ATM subnetwork on an ATM VCC arrive at the ATM interface for cell-to frame conversion. The ATM interface reassembles the AAL5 frame and passes it to the FR-ATM SIWF for interworking functions. The FR-ATM SIWF performs user plane mappings and adds a frame relay header for transmission on the frame relay link. The frame exits the node as regular frame relay traffic.

For frame relay to frame relay SPVCs that originate and terminate on the same node, only the Q.922 header requires modification. There is no AAL5 encapsulation.

The figure FR-ATM service interworking (page 168) shows an end-to-end service interworking connection.

FR-ATM service interworking



SIWF user plane mappings

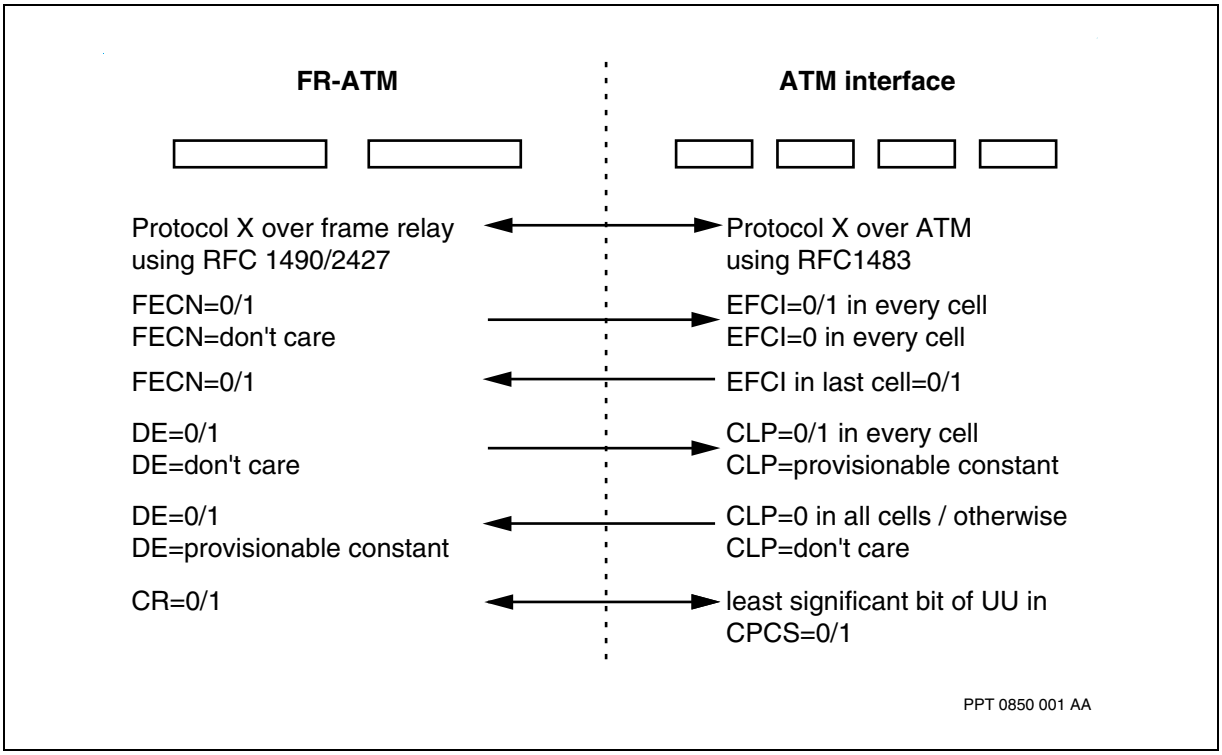
For each frame passing through the FR-ATM service interworking function, the FR-ATM SIWF performs the following mapping functions:

- Upper layer protocol encapsulation (page 169)
- Congestion notification mapping (page 170)
- Discard mapping (page 170)
- Command/response (C/R) mapping (page 171)

- Address mapping (page 171)

The figure SIWF user plane mappings (page 169) summarizes FR-ATM SIWF support for user plane mappings.

SIWF user plane mappings



Upper layer protocol encapsulation

Based on RFC 1490 and ANSI T1.617 Annex G, FRF.3 defines the procedures to encapsulate multiple protocol traffic within frame relay frames. RFC 1483 defines the procedures to encapsulate multiple protocol traffic within ATM AAL5 packets. The two encapsulation methods are not compatible.The FR-ATM SIWF supports interworking for upper layer protocol encapsulation between frame relay and ATM-capable equipment.

In addition to RFC 1490, RFC 2427 is also supported.

The FRF.8 standard defines two modes for upper layer encapsulation interworking:

- Transparent mode (page 170)
- Translation mode (page 170)

Transparent mode

In transparent mode, the FR-ATM SIWF forwards data to the ATM interface without altering the upper layer protocol encapsulation. If the FR-ATM SIWF is operating in transparent mode, the encapsulation methods between terminal equipment must be compatible.

Translation mode

In translation mode, the FR-ATM SIWF performs mapping between RFC 1490/2427 and RFC 1483 encapsulated headers.

SIWF translation mode supports multiple upper layer user protocols over the same PVC, and allows the interworking of routed protocols. It also maps single protocol packet encapsulation (single connection-oriented protocol with no RFC 1490/2427 header) between the frame relay and ATM encapsulation methods. The FR-ATM SIWF does not support RFC 1490/2427 fragmentation and reassembly.

FR-ATM SIWF supports encapsulation mapping for all upper layer protocols specified in the FRF.8 standard.

If the FR-ATM SIWF is unable to decode the incoming payload header, it discards the frame and records the action. See Monitoring and troubleshooting (page 80) for information about SIWF operational attributes.

Congestion notification mapping

In the frame relay to ATM direction, the forward explicit congestion notification (FECN) bit on each frame maps directly to the EFCI bit of every cell of that frame. You can configure a bypass of mapping for congestion notification so that the EFCI bit is initially set to 0 for every cell. Subsequent nodes in the ATM connection can set the EFCI bit to signal congestion as required.

In the ATM to frame relay direction, the EFCI bit of the last cell of a frame maps directly to the FECN bit of that frame.

In accordance with the FRF.8 standard, FR-ATM does not map the BECN bit between frame relay and ATM. The BECN bit reflects local congestion at the FR-ATM interface.

Discard mapping

In the frame relay to ATM direction, the discard eligible (DE) bit of a frame maps directly to the CLP bit of every cell of that frame. You can configure a bypass of mapping for discard eligibility so that the CLP bit of every cell is set to either 0 or 1

In the ATM to frame relay direction, the CLP bit of incoming ATM cells maps to the DE bit of the resulting frame. If the CLP bit in all cells of a frame is 0, the resulting frame exiting the FR-ATM has the DE bit set to 0. If at least one cell

of a frame has the CLP bit set to 1, the resulting frame has the DE bit set to 1. You can configure a bypass of discard mapping so that the DE bit on all frames is set to either 0 or 1.

Command/response (C/R) mapping

In the frame relay to ATM direction, the command/response (C/R) bit of the FR-ATM frame maps directly to the least significant bit of the user-to-user (UU) data. The UU data is in the common part convergence sub-layer (CPCS) of the AAL5 encapsulation.

In the ATM to frame relay direction, the least significant bit of the UU data in the CPCS maps directly to the C/R bit of the FR-ATM frame.

Address mapping

For SIWF SPVC connections, the FR-ATM service must support native X.121 and native E.164 addressing on the frame relay side, and NSAP addressing on the ATM side. The FR-ATM SIWF maps native E.164 addressing into an NSAP format.

ATM networks use addresses that follow the OSI NSAP format. The first two digits of the NSAP address contain an Authority and Format Identifier (AFI) value that indicates the type of address encapsulated inside the NSAP address. Valid values are 39 for DCC, 45 for E.164, and 47 for ICD. If an ATM node receives a call request with an AFI value other than 39, 45, or 47, it rejects the call.

Attention: ATM Forum standards do not define an AFI value for an X.121 ATM address. The X.121 address format works inside the Nortel Multiservice Switch network and uses an AFI value of 37.

For more information about ATM NSAP addresses, see NN10600-702 *Nortel Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*.

Establishing FR-ATM SIWF connections

The FR-ATM SIWF supports NPVCs and SPVCs.

For more information, see the following sections:

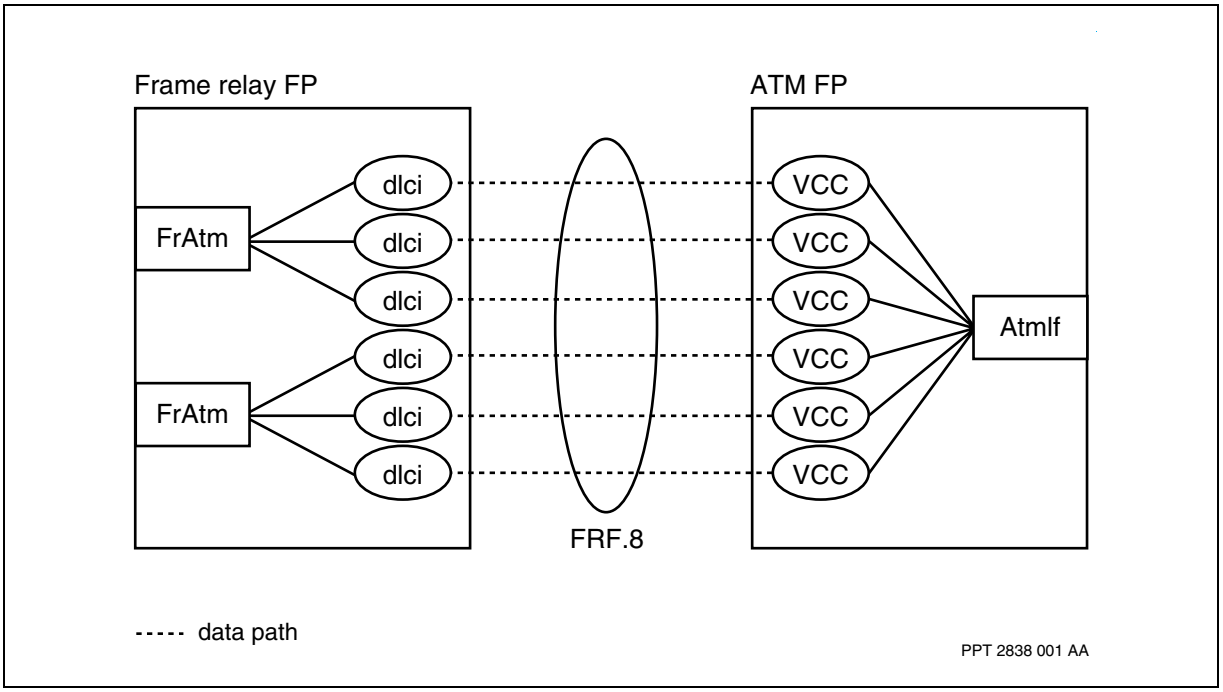
- Establishing a SIWF NPVC (page 172)
- Establishing a SIWF SPVC (page 172)

Establishing a SIWF NPVC

To establish a FR-ATM nailed-up permanent virtual connection (NPVC) across the ATM subnetwork, you must bind a FR-ATM DLCI to an ATM VCC. In addition, you need to configure the ATM PVC across the ATM subnetwork.

To convert frame relay traffic for transport onto an ATM subnetwork, you bind a FR-ATM DLCI SIWF to an ATM VCC associated with an ATM interface on the same node. You can bind only one FR-ATM DLCI SIWF to a given ATM VCC. See the figure Intra-shelf DLCI to VCC binding (page 172).

Intra-shelf DLCI to VCC binding



Establishing a SIWF SPVC

To establish a FR-ATM soft permanent virtual connection (SPVC) across the ATM subnetwork, you only have to configure the FR-ATM DLCI end of the SIWF connection. The ATM signalling automatically sets up an SPVC connection that terminates at the ATM interface VCC specified by the FR-ATM DLCI source end.

Attention: You must configure a *Siwf* component on the called end for FR-ATM to FR-ATM and ATM to FR-ATM connections.

The mandatory *FrAtm Dlci Sp* component supports symmetrical bandwidth requirements for the transmit and receive directions. You can set asymmetrical bandwidth requirements for the transmit and receive directions by configuring the optional *FrAtm Dlci EgSp* component.

FRF.8 conversion of traffic parameters

Frame relay and ATM traffic parameters are dissimilar and require conversion by the FR-ATM interworking function. The conversion between frame relay and ATM traffic parameters cannot be exact, because each set describes different connection behaviors. However, you can use frame relay parameters to derive equivalent ATM traffic parameters.

For a given frame relay connection with variable size frames, the calculation of the ATM traffic parameters can be based on a typical frame size, an average frame size, or a maximum frame size. When the traffic parameters are used for UPC traffic policing, you must select the worst case values.

For more information, see the following sections:

- Frame relay and ATM overhead (page 174)
- Traffic conversion policies (page 175)

The table Traffic parameter mapping options (page 173) summarizes the conversion policy options.

These options are in alignment with those defined in the following specifications:

- ATM Forum B-ICI (*Broadband Inter-Carrier Interface v2.0, Appendix A*)
- UNI (*User Network Interface, Informative Appendix II*) 3.0/3.1

Traffic parameter mapping options

Conversion policy	Frame relay traffic parameter	ATM traffic descriptor	ATM service category	ATM traffic descriptor type
3	AR —> CIR, EIR —> Bc, Be, CIR, EIR, AR —>	PCR_{0+1} SCR_{0+1} MBS_{0+1}	rtVbr, nrtVbr	6
4	AR —> CIR —> Bc, CIR, AR —>	PCR_{0+1} SCR_0 MBS_0	rtVbr, nrtVbr	7
5	CIR, EIR —> CIR —> Bc, CIR, AR —>	PCR_{0+1} SCR_0 MBS_0	rtVbr, nrtVbr	7/8
6	CIR —>	PCR_{0+1}	UBR, CBR, rtVbr, nrtVbr	3
The —> symbol means the frame relay traffic parameter determines the ATM traffic descriptor.				

The mapping between these traffic parameters is subject to engineering considerations. It is also dependent on the balance between acceptable loss probabilities and network costs. For more information, see *Nortel Multiservice Switch Release Notes*.

Frame relay and ATM overhead

Because of the different overhead between frame relay and ATM, conversion from one set of traffic characterization parameters to the other requires an overhead factor.

Frame relay to ATM conversion policies include two types of overhead factors for converting traffic parameters:

- overheadFactorA(n)
- overheadFactorB(n)

OverheadFactorA(n) represents overhead from the access level in cells per byte of a frame relay frame of *n* bytes

OverheadFactorA = [n/(n+5)] x OverheadFactorB

OverheadFactorB(n) represents the ATM overhead in cells per byte of a frame relay frame of *n* bytes:

OverheadFactorB = ceiling[(n+8)/48]/n

where *ceiling*(*m*) represents the ceiling function, which rounds the number *m* up to the nearest integer.

In FR-ATM conversion policies, there are two types of overhead:

- Frame relay overhead (page 174)
- ATM overhead (page 175)

Frame relay overhead

The frame relay overhead of five bytes per frame applies only when the frame relay access rate maps into an ATM traffic descriptor parameter. This reduces the available user data carrying capacity on the frame relay access link.

The frame relay overhead does not apply when you use other frame relay parameters such as CIR, EIR, Bc, or Be to determine values for the ATM traffic descriptor parameters. The FR-ATM SIWF removes the frame relay overhead from the frame before forwarding it to the ATM interface.

ATM overhead

The encapsulation of an application layer frame into ATM cells involves the following types of overhead:

- network layer or routing overhead which represents an application-dependent routing header to the frame
- ATM Adaptation (AAL5) layer CPCS overhead which represents 0 to 47 bytes of padding and an 8-byte trailer to the frame. The amount of padding makes the total length of the CPCS layer frame size a multiple of 48 bytes.
- ATM layer overhead which represents a 5-byte ATM header that includes the VPI and VCI fields

The amount of overhead added during encapsulation of an adaptation layer frame into ATM cells is determined as follows:

$$\textit{Total ATM overhead} = \text{ceiling}\,[(n+8)/48] \times 53 - n$$

where:
n represents the frame size in bytes
ceiling[*m*] represents the ceiling function, which gives the number *m* rounded up to the nearest integer

The table FR-ATM SIWF overhead summary (page 175) provides an overhead summary for frames of variable sizes based on these equations.

FR-ATM SIWF overhead summary

Frame size (bytes)	OverheadFactor A (cells/byte)	OverheadFactor B (cells/byte)	Total ATM overhead (bytes)
128	0.0225	0.0234	31
256	0.0229	0.0234	62
512	0.0213	0.0215	71
1024	0.0214	0.0215	142
2048	0.0210	0.0210	231
4096	0.0210	0.0210	462

Traffic conversion policies

A summary of the traffic parameter mapping options is provided in the figure FRF.8 frame relay to ATM traffic parameter conversion policies (page 177). Policy 3 is the most conservative traffic conversion policy relative to bandwidth conservation, and policy 6 is the most aggressive.

Each conversion policy takes into account the ATM overhead encountered when a frame relay frame is converted to ATM cells through AAL5 adaptation. When traffic shaping occurs at the ATM connection, UPC traffic policing also occurs. The selected traffic shaping rate for the ATM connection determines the maximum rate cells travel over the ATM link.

For more information about the individual FR-ATM traffic conversion policies, see the following sections:

- Conversion policy 3 (page 177)
- Conversion policy 4 (page 178)
- Conversion policy 5 (page 178)
- Conversion policy 6 (page 178)
- Sample traffic conversion values (page 179)

For all conversion options, the PCR determines the selected traffic shaping rate. The traffic shaping rate that the Nortel Multiservice Switch system selects automatically can be lower than the desired PCR. You can configure the connection shaping rate manually to ensure that it is equal to or larger than the desired PCR.

FRF.8 frame relay to ATM traffic parameter conversion policies

Policy 3

$$PCR_{0+1} = \frac{AR}{8} \times OvA_{(n)}$$

$$SCR_{0+1} = \frac{CIR + EIR}{8} \times OvB_{(n)}$$

$$MBS_{0+1} = \left[\left(\left(\frac{Bc + Be}{8} \right) \left(\frac{1}{1 - \frac{CIR+EIR}{AR}} \right) \right) + 1 \right] * [OvB_{(n)}]$$

Policy 4

$$PCR_{0+1} = \frac{AR}{8} \times OvA_{(n)}$$

$$SCR_{0} = \frac{CIR}{8} \times OvB_{(n)}$$

$$MBS_{0} = \left[\left(\left(\frac{Bc}{8} \right) \left(\frac{1}{1 - \frac{CIR}{AR}} \right) \right) + 1 \right] * [OvB_{(n)}]$$

Policy 5

$$PCR_{0+1} = \frac{CIR + EIR}{8} \times OvB_{(n)}$$

$$SCR_{0} = \frac{CIR}{8} \times OvB_{(n)}$$

$$MBS_{0} = \left[\left(\left(\frac{Bc}{8} \right) \left(\frac{1}{1 - \frac{CIR}{AR}} \right) \right) + 1 \right] * [OvB_{(n)}]$$

Policy 6

$$PCR_{0+1} = \frac{\left[\frac{CIR}{8} \right]}{53}$$

where:

n	is the frame size (bytes)
PCR	is the Peak Cell Rate (cells/s)
SCR	is the Sustained Cell Rate (cells/s)
MBS	is the maximum burst size (cells)
AR	is the frame relay access rate (bits/s)
CIR	is the committed information rate (bits/s)
EIR	is the excess information rate (bits/s)
Bc	is the committed burst size (bits)
Be	is the excess burst size (bits)
$OvA_{(n)}$	is overhead from access level (cells/byte)

$$OvA_{(n)} = \text{accessOverhead} \times OvB_{(n)} = \frac{n}{n+5} \times OvB_{(n)}$$

$OvB_{(n)}$ is the ATM overhead (cells/byte)

$$OvB_{(n)} = \frac{\text{ceiling}\left(\frac{(n+8)}{48} \right)}{n}$$

where **ceiling** is rounded to the next largest integer

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Conversion policy 3

For conversion policy 3, the selected ATM traffic descriptor is type 6. In addition:

- The frame relay AR determines the PCR_{0+1}.
- The CIR and EIR determine the SCR_{0+1}.
- The Bc, Be, CIR, EIR, and AR determine the MBS_{0+1}.
- The instantaneous rate of the frame relay stream can burst above CIR and up to the AR.

Policy 3 requires the following conditions on the frame relay traffic parameters:

- (Bc + Be) > 0
- AR > (CIR + EIR) > 0

Conversion policy 4

For conversion policy 4, the selected ATM traffic descriptor is type 7 or 8. Type 7 discards non-conforming cells. With type 8, the UPC traffic policer tags non-conforming cells. In addition:

- The AR determines the PCR_{0+1}.
- The CIR determines the SCR_0.
- The Bc, CIR, and AR determine the MBS_0.
- There is no direct characterization of EIR. The difference between the AR and CIR determines the allowed EIR.

Policy 4 requires the following conditions on the frame relay traffic parameters:

- CIR > 0
- Bc > 0
- AR > CIR > 0

Conversion policy 5

For conversion policy 5, the selected ATM traffic descriptor is type 7 or 8. Type 7 discards non-conforming cells. With type 8, the UPC traffic policer tags non-conforming cells. In addition:

- The CIR and EIR determine the PCR_{0+1}.
- The CIR determines the SCR_0.
- The Bc, CIR, and AR determine the MBS_0.
- The CIR and EIR, determine the maximum PCR.

Policy 5 requires the following conditions on the frame relay traffic parameters:

- Bc > 0
- AR > CIR > 0

Conversion policy 6

For conversion policy 6, the selected ATM traffic descriptor is type 3, and the CIR determines the PCR_{0+1}. In addition, policy 6 requires that the frame relay CIR be greater than 0.

Sample traffic conversion values

Consider a frame relay connection over a DS1 access link that then travels over an ATM connection which is an E3 ATM link. The frame relay traffic parameters are as follows:

- CIR = 128000 kb/s
- EIR = 256000 b/s
- Bc = 8192 bits
- Be = 12288 bits
- AR = 1500000 b/s
- average frame size (n) = 128 bytes

The table Computed ATM traffic descriptor parameters (page 179) shows the corresponding ATM traffic parameters for each of the mapping options.

Computed ATM traffic descriptor parameters

Policy	PCR (cells/s)	SCR (cells/s)	MBS (cells)
3	PCR_{0+1} = 4229	SCR_{0+1} = 1125	MBS_{0+1} = 81
4	PCR_{0+1} = 4229	SCR_0 = 375	MBS_0 = 26
5	PCR_{0+1} = 1125	SCR_0 = 375	MBS_0 = 26
6	PCR_{0+1} = 302	N/A	N/A
All options are applicable when there is both traffic shaping and UPC traffic policing.			

PVC status management for SIWF

The FR-ATM service supports complete interworking between the frame relay and ATM PVC status management systems.

The LMI protocol provides bidirectional PVC status exchange information for frame relay DLCIs. The main attributes of the LMI procedures implementation for the FR-ATM service include:

- bidirectional polling between the user equipment and the network for information on PVC status
- verification of physical link integrity between the user equipment and the network
- A-bit signaling for notification of PVC availability

The FR-ATM interface supports the complete set of frame relay PVC management procedures, as defined in the following standards:

- Original Vendor Forum specification

- ITU-T Q.933 Annex A
- ANSI T1.617 Annex D

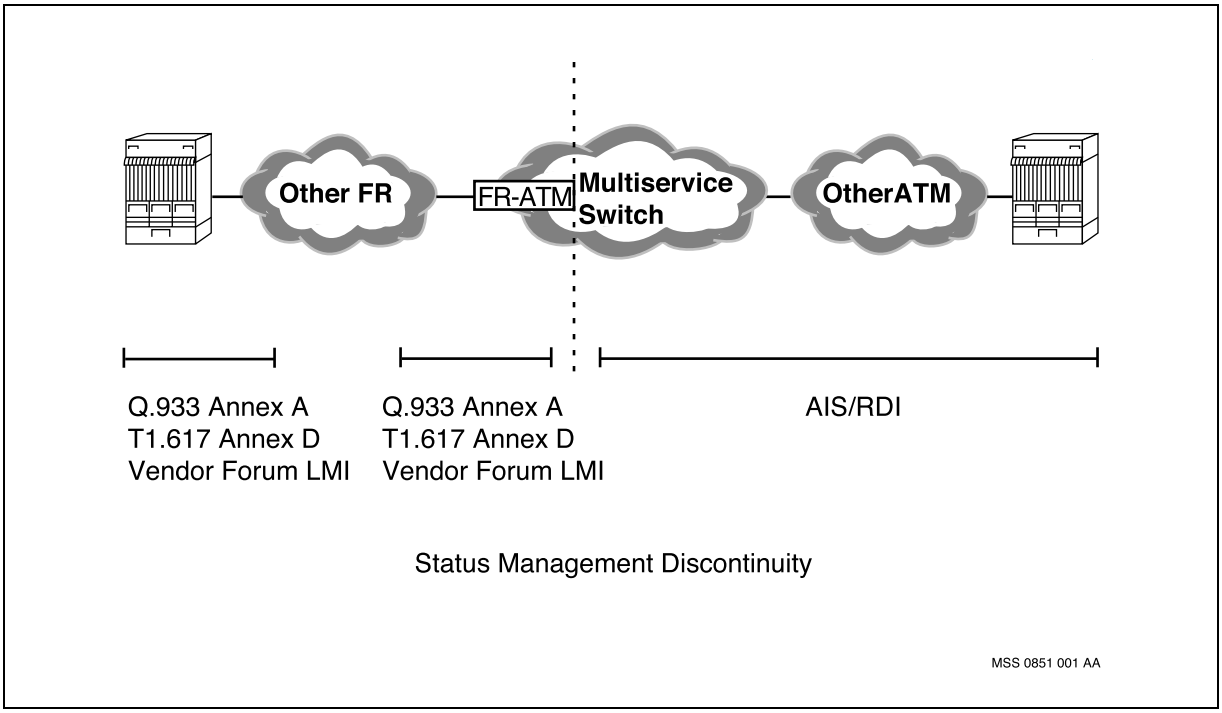
You can run LMI procedures as user side, network side, or both on the FR-ATM interface. For more information about LMI procedures, see NN10600-901 *Nortel Multiservice Switch 7400/15000/20000 Frame Relay Configuration Management*.

The ATM OAM functions (alarm indication signal and remote defect indication signaling) provide ATM PVC management. For more information about ATM OAM functions, see NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.

The FR-ATM LMI propagates PVC status changes from the local end to the remote end. A status change on the frame relay portion of the FR-ATM connection triggers ATM OAM AIS/RDI cell insertion across the ATM network to inform the remote end of the PVC change. Therefore, a PVC status change at the local end is propagated to the remote end of the connection. The PVC status at the ATM side and the PVC status at the frame relay side of the FR-ATM service are interdependent. See the figure SIWF PVC status management (page 181).

ATM OAM cells cannot transmit the state of the local link across the ATM network. The *AbitStatusToIf* attribute under the *FrAtm Dlci* component indicates whether the ATM PVC is active or inactive. However, it does not distinguish between a PVC that is down and the state of the remote link.

SIWF PVC status management



NIWF technical description

The FR-ATM network interworking function (NIWF) enables connectivity between frame relay networks over a backbone ATM network. It encapsulates and aggregates frame relay traffic inside an ATM VCC. The FR-ATM NIWF supports soft PVC (SPVC) connections and multiplexes many DLCIs to one ATM VCC.

In accordance with the FRF.5 standard, the FR-ATM NIWF maps Q.922 data frames to and from ATM AAL5 frames using FRF.5 FR-SSCS Q.933 Annex A specification.

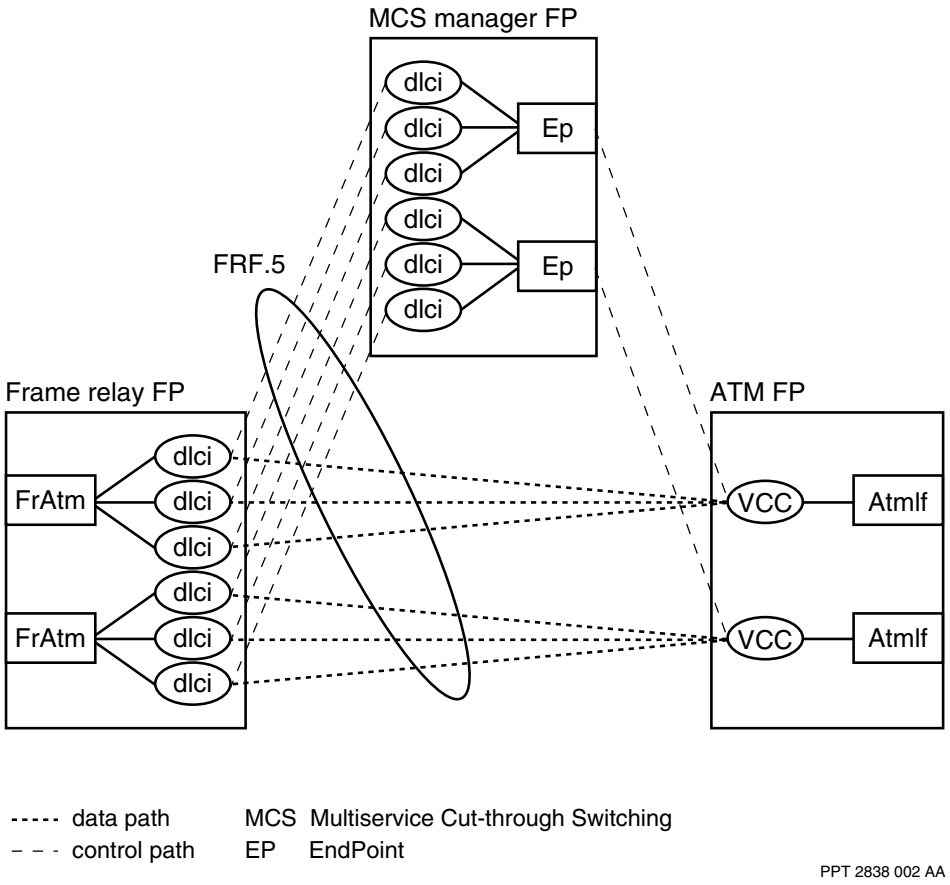
Navigation

Basic elements of the FR-ATM NIWF

The *FrAtm Dlci Niwf* component is the part of the NIWF that is configured at the frame relay access. This component manages the part of the NIWF residing on the access card. You can bind it to an FRF.5 ATM VCC by adding an *Spvc* component.

The FR-ATM NIWF uses FRF.5 end points to merge many FR-ATM DLCIs into a single ATM VCC. An FRF.5 end point (or Frf5EpG Ep component) controls the FRF.5 ATM VCC and manages the multiplexed DLCIs. All connections within the pipe share the same QoS. See the figure FRF.5 DLCI to VCC binding (page 183).

FRF.5 DLCI to VCC binding



The *FrAtm Dlci Niwf* component interacts with an *Frf5EpG Ep* component to request joining the FRF.5 ATM VCC. FRF.5 end points that connect to the same ATM destination are managed by the frame relay managed cut-through switching (MCS) manager in FRF.5 end point groups.

For more information, see the following sections:

- FRF.5 end point (page 184)
- FRF.5 end point group (page 184)
- Managed cut-through switching manager (page 184)

FRF.5 end point

FR-ATM connections merge onto an FRF.5 ATM VCC (or pipe) through an FRF.5 end point. The FRF.5 end point establishes the ATM SPVC connection and manages the FR-ATM DLCIs that are multiplexed through the FRF.5 VCC. It also administers PVC management for FR-ATM DLCIs inside the FRF.5 VCC.

FRF.5 end point group

The FRF.5 end point group is a collection of FRF.5 end points that share a common destination. Each end point group provides a static address map identifying a path to a given frame relay address prefix or prefixes. The end point group can have a maximum of 16 end points, but each end point within the same group must have a different transfer priority.

Managed cut-through switching manager

The managed cut-through switching (MCS) manager maintains a collection of one or more switched path end points. It creates, manages, and dismantles FRF.5 end points (pipes) under configuration control. You can configure one or more FRF.5 end point groups *(Frf5EpG*) and end points (Frf5EpG *Ep)* under the *McsMgr* component.

The MCS manager handles requests from access *FrAtm Dlci* components to join an FRF.5 end point. It also maintains a mapping table of destination address prefixes and FRF.5 end point instances. For more information, see Address mapping (page 184).

Address mapping

When a FrAtm Dlci Niwf component requests an SPVC connection, the MCS manager uses a configurable address mapping table to identify the FRF.5 end point that can serve the request. The MCS manager compares the requested destination address with the address prefix entries. From the corresponding address prefix, it determines the appropriate address instance and the FRF.5 end point bound to it.

NIWF data flow

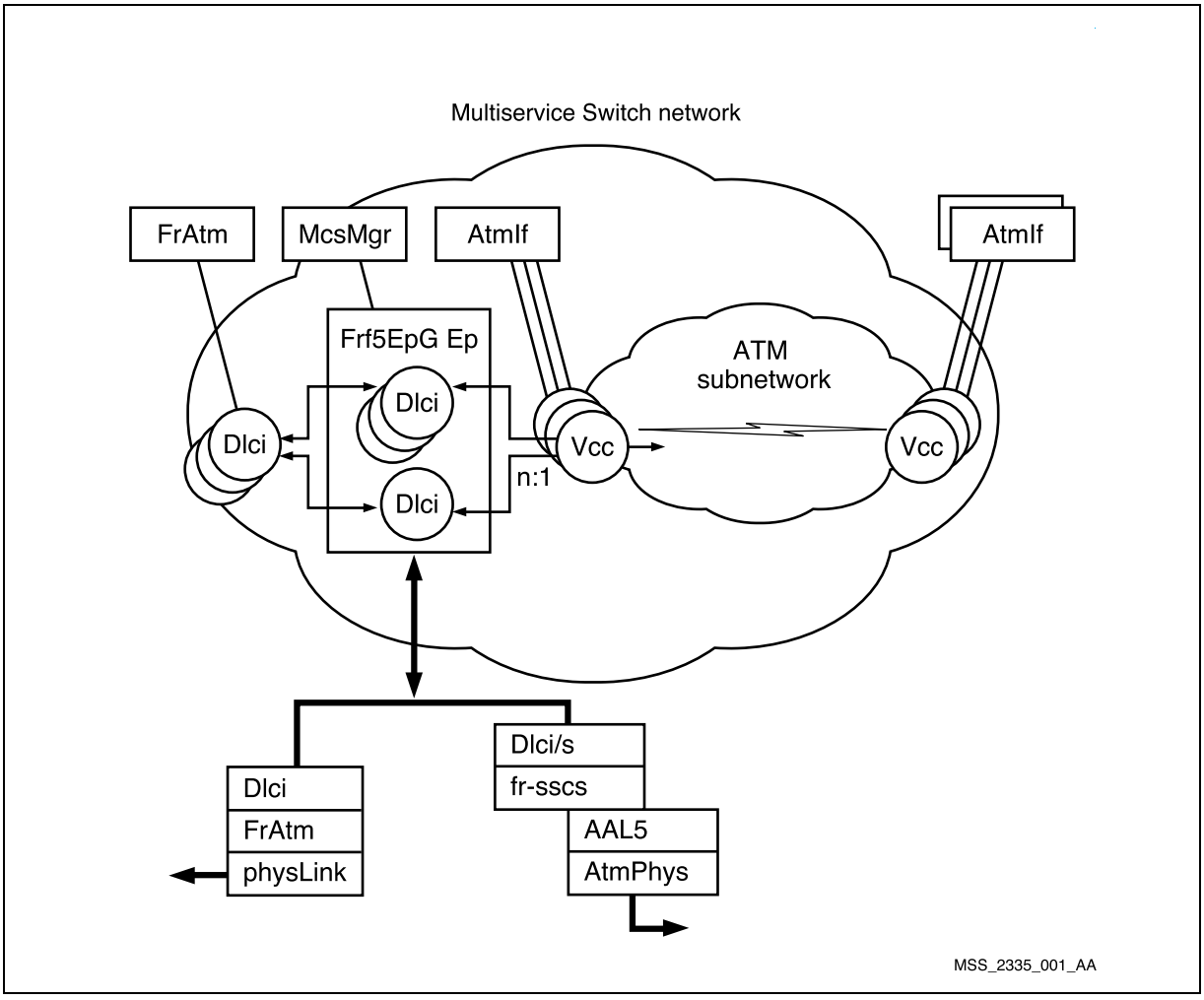
In the frame relay to ATM direction, frames coming in on a frame relay DLCI arrive at the FR-ATM interface for interworking functions. When the *FrAtm Dlci* component receives the frames from the HDLC link it strips them of the CRC and the flags. Frame relay protocol validation, rate enforcement, and statistic counting are done before the frames continue to the backplane. The AtmIf card processes the frames to implement the FR-SSCS. The frames pass down to the AAL-5 to generate the resulting cells onto the ATM link.

The AAL-5 then performs AAL-5 recombination on the cells followed by the ingress FR-SSCS. An important task of the FR-SSCS in this direction is to decode the encapsulated Q.922 header. This action demultiplexes the frame

and selects the appropriate *FrAtm Dlci Niwf* component destination for the frame. When the *FrAtm Dlci Niwf* component receives the frames from the backplane, appends the required frame relay flags and transmits the frames onto the frame relay link.

The figure FR-ATM network interworking (page 185) shows an end-to-end network interworking connection. One or more FR-ATM NIWFs are linked to anFRF.5 end point which controls an ATM SPVC. The ATM SPVC links a series of hops across the ATM portion of the network. At the remote end of the ATM connection, there is a symmetric configuration of another FRF.5 end point that links to one or more FR-ATM NIWFs.

FR-ATM network interworking



The ITU-T Recommendation I.555, section 7 defines two network interworking scenarios:

- Network interworking with frame relay CPE (page 186)

- Network interworking with FR-SSCS-capable ATM CPE (page 187)

Network interworking with frame relay CPE

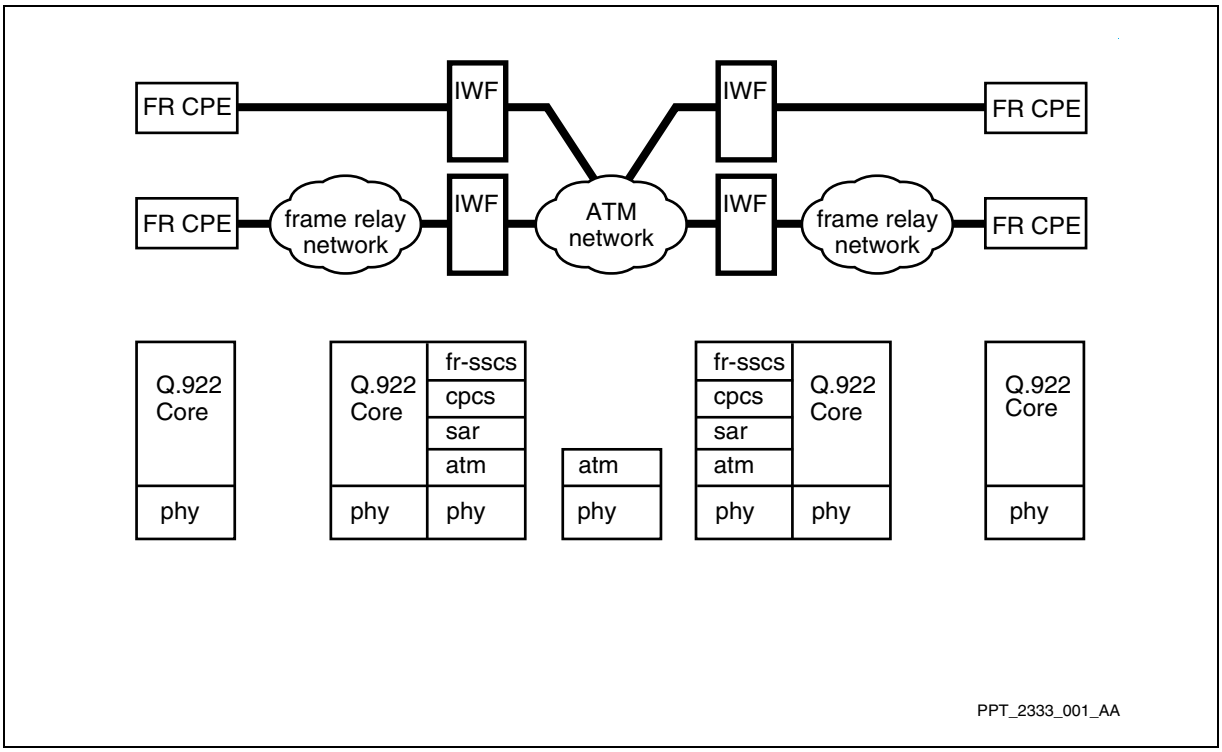
The figure Network interworking with frame relay CPE (page 186) illustrates the first scenario.

This scenario multiplexes frame relay traffic for one or more connections through an ATM network over a single ATM VCC. Each NIWF adds a Q.922 core header to the data at the frame relay service specific convergence sublayer (FR-SSCS) for frames in the frame relay to ATM direction. This distinguishes multiple frame relay connections inside the ATM pipe. The Common Part Convergence Sublayer (CPCS) performs AAL5 encapsulation of the frames before they segment into cells.

In the ATM to frame relay direction, the cells recombine using AAL5, the FR-SSCS encapsulation strips off, and a frame relay header joins to the frame for transmission into the FR network.

Frame relay PVC status management messages operate on DLCI 0 between NIWFs across the ATM network.

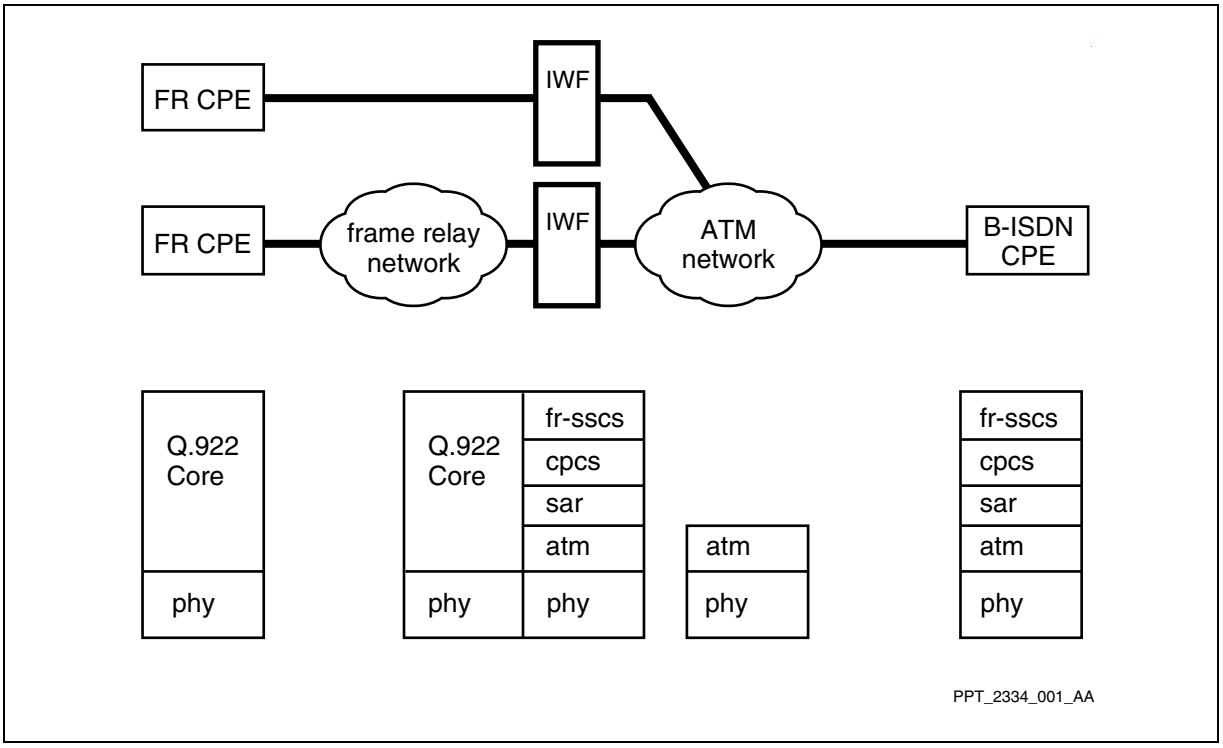
Network interworking with frame relay CPE



Network interworking with FR-SSCS-capable ATM CPE

The figure Network interworking with ATM-capable CPE (page 187) illustrates the second scenario. This scenario describes the interworking between a frame relay CPE and an ATM-capable CPE possessing specific frame relay knowledge. The ATM-capable CPE has a protocol stack that includes the FR-SSCS, and can interpret and process frame relay traffic. In this case, the FR-ATM NIWF performs FRF.5 encapsulation of frame relay traffic, but a second interworking function is not required at the egress of the ATM network to interpret the encapsulated traffic.

Network interworking with ATM-capable CPE



NIWF user plane mappings

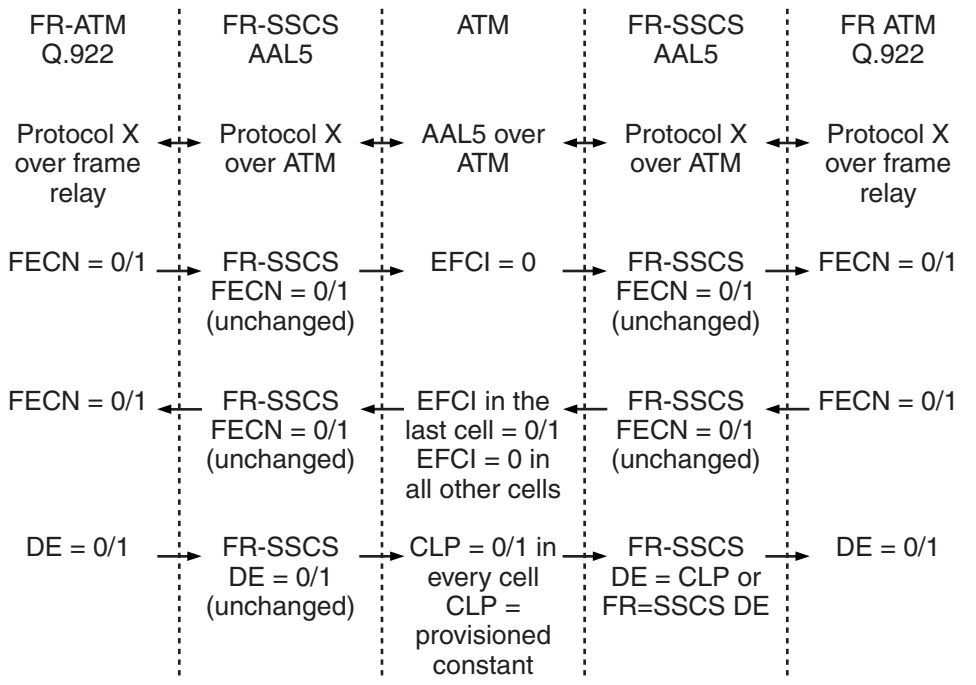
For each frame passing through the FR-ATM network interworking function, the FR-ATM NIWF performs the following mapping functions:

- NIWF congestion notification mapping (page 188)
- NIWF discard mapping (page 188)

Upper layer protocol traffic passes transparently between frame-capable ends of the FRF.5 connections.

The figure U-plane mappings (NIWF) (page 188) summarizes all characteristics of U-plane mapping for NIWF.

U-plane mappings (NIWF)



NIWF congestion notification mapping

In the frame relay to ATM direction, the FRF.5 standard specifies that the FECN bit in the Q.922 core header maps unchanged to the FR-SSCS FECN bit, and that the ATM EFCI is always set to zero (no congestion). You do not need to configure this mapping.

In the ATM to frame relay direction, the FECN bit in the Q.922 core header is set to one if the EFCI field in the last ATM cell of the segmented frame received is set to one (congestion experienced), or if the FECN field of the received FR-SSCS PDU is set to one. You do not need to configure this mapping.

You do not need to configure backward congestion mapping. Mapping complies with the FRF.5 standard.

NIWF discard mapping

In the frame relay to ATM direction, the discard eligibility (DE) bit on the Q.922 core header maps unchanged to the FR-SSCS DE bit, and to the CLP bit of every cell of the frame. You can configure a bypass of mapping for discard eligibility so that the CLP bit of every cell is set to either 0 or 1.

In the ATM to frame relay direction, the CLP bit of incoming cells maps to the DE bit of the Q.922 core header. If at least one cell of a frame has the CLP bit set to 1, or if the DE bit of the FR-SSCS header is set to 1, the DE bit of the Q.922 core header is also set to 1. You can configure a bypass of discard mapping so that the DE bit of the FR-SSCS header maps unchanged to the DE bit on the Q.922 core header.

Establishing FR-ATM NIWF connections

The FR-ATM NIWF supports SPVCs only.

To establish a NIWF soft permanent virtual connection (SPVC) across the ATM subnetwork, you must add an Spvc component to the FrAtm Dlci Niwf component and specify the destination address. The MCS Manager uses the destination address to determine which FRF.5 end point can service the request.

An FRF.5 end point can have a type of either master or slave. A master FRF.5 end point initiates SPVC connections, and a slave FRF.5 end point receives SPVC connection requests.

For a master FRF.5 end point, you must specify a remote connection identifier: this can be either the VPI.VCI of a remote ATM interface or another FRF.5 end point instance.

If the ATM network does not support end-to-end SPVCs, you must terminate at the last node that does support SPVCs and nail up the rest of the path.

FR-ATM DLCI subconnection establishment

In the frame relay to ATM direction, the *FrAtm Dlci Niwf* component sends a DLCI setup message to the *McsMgr* component. The *McsMgr* component determines the FRF.5 end point instance that can serve the request and forwards the subconnection request. If the *McsMgr* component cannot identify an end point, it rejects the call. The *Frf5EpG Ep* component checks if the remote DLCI already exists in the pipe. If it does not exist, it adds a new subconnection to the established ATM VCC. If the DLCI does exist in the FRF.5 ATM VCC, the *Frf5EpG Ep* component rejects the subconnection request and sends an error message to the *FrAtm Dlci Niwf* component.

In the ATM to frame relay direction, the *AtmIf* component receives an ATM UNI call setup request from the external network. If the calling address in matches the address of the MCS manager, the *AtmIf* component forwards the call to the *McsMgr* component. The *McsMgr* component determines the FRF.5 end point instance that can serve the request and forwards the call setup message. If the *McsMgr* component cannot identify an end point, it rejects the call. The end point accepts or rejects the call depending on its state and type (slave or master).

Traffic parameters for the FRF.5 pipe

Since FRF.5 allows many DLCIs to be carried over one ATM VCC, the frame relay traffic parameters must be mapped into a composite value for the FRF.5 pipe. You configure composite traffic parameters for each FRF.5 end point.

The table Composite FRF.5 traffic parameters (page 190) shows the minimum and maximum values for the composite frame relay traffic parameters.

Composite FRF.5 traffic parameters

Traffic parameter	Minimum value	Maximum value
AR	highest configured AR value on all multiplexed access links	sum of all AR values on all multiplexed access links
CIR	highest configured CIR value on all multiplexed DLCIs	sum of all CIR values on all multiplexed DLCIs
EIR	highest configured EIR value on all multiplexed DLCIs	sum of all EIR values on all multiplexed DLCIs
Bc	highest configured Bc value on all multiplexed DLCIs	sum of all Bc values on all multiplexed DLCIs
Be	highest configured Be value on all multiplexed DLCIs	sum of all Be values on all multiplexed DLCIs
Average frame size	lowest configured value for average frame size on all multiplexed DLCIs	highest configured value for average frame size on all multiplexed DLCIs
Maximum frame size	highest configured value for maximum frame size on all multiplexed DLCIs	highest configured value for maximum frame size on all multiplexed DLCIs

Values closer to the minimum are more aggressive and assume a great degree of statistical gain. This is because the multiplexed traffic is smoother (less bursty) than its individual components, and different DLCIs peak at different times. Values closer to the maximum are more conservative.

FRF.5 conversion of traffic parameters

Frame relay and ATM traffic parameters are dissimilar and require conversion by the FR-ATM interworking function. The conversion between frame relay and ATM traffic parameters cannot be exact, because each set describes different connection behaviors. However, you can use frame relay parameters to derive equivalent ATM traffic parameters.

In addition to specifying composite frame relay parameters for the FRF.5 pipe, you must choose one of four frame relay to ATM conversion options (option 3, 4, 5, or 6). The choice of the different frame relay parameters must map into

an allowable set of ATM parameters. For the first three options in particular, the following equations should always be satisfied by the FRF.5 frame relay parameters:

$$\frac{Bc}{CIR} = \frac{Be}{EIR} = \frac{Bc + Be}{CIR + EIR} < 1.34s$$

For a given frame relay connection with variable size frames, the calculation of the ATM traffic parameters can be based on a typical frame size, an average frame size, or a maximum frame size. When the traffic parameters are used for UPC traffic policing, you must select the worst case values.

For more information, see the following sections:

- Frame relay and ATM overhead (page 192)
- Traffic conversion policies (page 194)

The table Traffic parameter mapping options (page 191) summarizes the conversion policy options.

These options are in alignment with those defined in the following specifications:

- ATM Forum B-ICI (*Broadband Inter-Carrier Interface v2.0, Appendix A*)
- UNI (*User Network Interface, Informative Appendix II*) 3.0/3.1

Traffic parameter mapping options

Conversion policy	Frame relay traffic parameter	ATM traffic descriptor	ATM service category	ATM traffic descriptor type
3	AR —> CIR, EIR —> Bc, Be, CIR, EIR, AR —>	PCR_{0+1} SCR_{0+1} MBS_{0+1}	rtVbr, nrtVbr	6
4	AR —> CIR —> Bc, CIR, AR —>	PCR_{0+1} SCR_0 MBS_0	rtVbr, nrtVbr	7
5	CIR, EIR —> CIR —> Bc, CIR, AR —>	PCR_{0+1} SCR_0 MBS_0	rtVbr, nrtVbr	7/8

(1 of 2)

Traffic parameter mapping options (continued)

Conversion policy	Frame relay traffic parameter	ATM traffic descriptor	ATM service category	ATM traffic descriptor type
6	CIR —>	PCR_{0+1}	UBR, CBR, rtVbr, nrtVbr	3
The —> symbol means the frame relay traffic parameter determines the ATM traffic descriptor.				
(2 of 2)				

The mapping between these traffic parameters is subject to engineering considerations. It is also dependent on the balance between acceptable loss probabilities and network costs. For more information, see *Nortel Multiservice Switch Release Notes*.

Frame relay and ATM overhead

Because of the different overhead between frame relay and ATM, conversion from one set of traffic characterization parameters to the other requires an overhead factor.

Frame relay to ATM conversion policies include two types of overhead factors for converting traffic parameters:

- overheadFactorA(n)
- overheadFactorB(n)

OverheadFactorA(n) represents overhead from the access level in cells per byte of a frame relay frame of *n* bytes

OverheadFactorA = [n/(n+5)] x OverheadFactorB

OverheadFactorB(n) represents the ATM overhead in cells per byte of a frame relay frame of *n* bytes

OverheadFactorB = ceiling[(n+10)/48]/n

where *ceiling*(*m*) represents the ceiling function, which rounds the number *m* up to the nearest integer

In FR-ATM conversion policies, there are two types of overhead:

- Frame relay overhead (page 192)
- ATM overhead (page 193)

Frame relay overhead

The frame relay overhead of five bytes per frame applies only when the frame relay access rate maps into an ATM traffic descriptor parameter. This reduces the available user data carrying capacity on the frame relay access link.

The frame relay overhead does not apply when you use other frame relay parameters such as CIR, EIR, Bc, or Be to determine values for the ATM traffic descriptor parameters. The FR-ATM NIWF removes the frame relay overhead from the frame before forwarding it to the ATM interface.

ATM overhead

The encapsulation of an application layer frame into ATM cells involves the following types of overhead:

- network layer or routing overhead which represents an application-dependent routing header to the frame
- ATM Adaptation (AAL5) layer CPCS overhead which represents 0 to 47 bytes of padding and an 8-byte trailer to the frame. The amount of padding makes the total length of the CPCS layer frame size a multiple of 48 bytes.
- ATM layer overhead which represents a 5-byte ATM header that includes the VPI and VCI fields

The amount of overhead added during encapsulation of an adaptation layer frame into ATM cells is determined as follows:.

$$\textit{Total ATM overhead} = \text{ceiling}\,[(n+8)/48] \times 53 - n$$

where:
n represents the frame size in bytes
ceiling[*m*] represents the ceiling function, which gives the number *m* rounded up to the nearest integer

The table FR-ATM NIWF overhead summary (page 193) provides an overhead summary for frames of variable sizes based on these equations.

FR-ATM NIWF overhead summary

Frame size (bytes)	OverheadFactor A (cells/byte)	OverheadFactor B (cells/byte)	Total ATM overhead (bytes)
128	0.0225	0.0234	31
256	0.0229	0.0234	62
512	0.0213	0.0215	71
1024	0.0214	0.0215	142
2048	0.0210	0.0210	231
4096	0.0210	0.0210	462

Traffic conversion policies

A summary of the traffic parameter mapping options is provided in the figure FRF.5 frame relay to ATM traffic parameter conversion policies (page 195). Policy 3 is the most conservative traffic conversion policy relative to bandwidth conservation, and policy 6 is the most aggressive.

Each conversion policy takes into account the ATM overhead encountered when a frame relay frame is converted to ATM cells through AAL5 adaptation. When traffic shaping occurs at the ATM connection, UPC traffic policing also occurs. The selected traffic shaping rate for the ATM connection determines the maximum rate cells travel over the ATM link.

For more information about the individual FR-ATM traffic conversion policies, see the following sections:

- Conversion policy 3 (page 195)
- Conversion policy 4 (page 196)
- Conversion policy 5 (page 196)
- Conversion policy 6 (page 196)
- Sample traffic conversion values (page 197)

For all conversion options, the PCR determines the selected traffic shaping rate. The traffic shaping rate that the Nortel Multiservice Switch system selects automatically can be lower than the desired PCR. You can configure the connection shaping rate manually to ensure that it is equal to or larger than the desired PCR.

FRF.5 frame relay to ATM traffic parameter conversion policies

Policy 3

$$PCR_{0+1} = \frac{AR}{8} \times OvA_{(n)}$$

$$SCR_{0+1} = \frac{CIR + EIR}{8} \times OvB_{(n)}$$

$$MBS_{0+1} = \left[\left(\left(\frac{Bc + Be}{8}\right)\left(\frac{1}{1 - \frac{CIR+EIR}{AR}}\right)\right) + 1\right] * [OvB_{(n)}]$$

Policy 4

$$PCR_{0+1} = \frac{AR}{8} \times OvA_{(n)}$$

$$SCR_{0} = \frac{CIR}{8} \times OvB_{(n)}$$

$$MBS_{0} = \left[\left(\left(\frac{Bc}{8}\right)\left(\frac{1}{1 - \frac{CIR}{AR}}\right)\right) + 1\right] * [OvB_{(n)}]$$

Policy 5

$$PCR_{0+1} = \frac{CIR + EIR}{8} \times OvB_{(n)}$$

$$SCR_{0} = \frac{CIR}{8} \times OvB_{(n)}$$

$$MBS_{0} = \left[\left(\left(\frac{Bc}{8}\right)\left(\frac{1}{1 - \frac{CIR}{AR}}\right)\right) + 1\right] * [OvB_{(n)}]$$

Policy 6

$$PCR_{0+1} = \frac{\left[\frac{CIR}{8}\right]}{53}$$

where:

n	is the frame size (bytes)
PCR	is the Peak Cell Rate (cells/s)
SCR	is the Sustained Cell Rate (cells/s)
MBS	is the maximum burst size (cells)
AR	is the frame relay access rate (bits/s)
CIR	is the committed information rate (bits/s)
EIR	is the excess information rate (bits/s)
Bc	is the committed burst size (bits)
Be	is the excess burst size (bits)
$OvA_{(n)}$	is overhead from access level (cells/byte)

$$OvA_{(n)} = \text{accessOverhead} \times OvB_{(n)} = \frac{n}{n + 5} \times OvB_{(n)}$$

$OvB_{(n)}$ is the ATM overhead (cells/byte)

$$OvB_{(n)} = \frac{\text{ceiling}\left(\frac{(n + 8)}{48}\right)}{n}$$

where **ceiling** is rounded to the next largest integer

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Conversion policy 3

For conversion policy 3, the selected ATM traffic descriptor is type 6. In addition:

- The frame relay AR determines the PCR_{0+1}.
- The CIR and EIR determine the SCR_{0+1}.
- The Bc, Be, CIR, EIR, and AR determine the MBS_{0+1}.
- The instantaneous rate of the frame relay stream can burst above CIR and up to the AR.

Policy 3 requires the following conditions on the frame relay traffic parameters:

- (Bc + Be) > 0
- AR > (CIR + EIR) > 0

Conversion policy 4

For conversion policy 4, the selected ATM traffic descriptor is type 7 or 8. Type 7 discards non-conforming cells. With type 8, the UPC traffic policer tags non-conforming cells. In addition:

- The AR determines the PCR_{0+1}.
- The CIR determines the SCR_0.
- The Bc, CIR, and AR determine the MBS_0.
- There is no direct characterization of EIR. The difference between the AR and CIR determines the allowed EIR.

Policy 4 requires the following conditions on the frame relay traffic parameters:

- CIR > 0
- Bc > 0
- AR > CIR > 0

Conversion policy 5

For conversion policy 5, the selected ATM traffic descriptor is type 7 or 8. Type 7 discards non-conforming cells. With type 8, the UPC traffic policer tags non-conforming cells. In addition:

- The CIR and EIR determine the PCR_{0+1}.
- The CIR determines the SCR_0.
- The Bc, CIR, and AR determine the MBS_0.
- The CIR and EIR, determine the maximum PCR.

Policy 5 requires the following conditions on the frame relay traffic parameters:

- Bc > 0
- AR > CIR > 0

Conversion policy 6

For conversion policy 6, the selected ATM traffic descriptor is type 3, and the CIR determines the PCR_{0+1}. In addition, policy 6 requires that the frame relay CIR be greater than 0.

Sample traffic conversion values

Consider a frame relay connection over a DS1 access link that then travels over an ATM connection which is an E3 ATM link. The frame relay traffic parameters are as follows:

- CIR = 128000 b/s
- EIR = 256000 b/s
- Bc = 8192 bits
- Be = 12288 bits
- AR = 1500000 b/s
- average frame size (n) = 128 bytes

The table Computed ATM traffic descriptor parameters (page 197) shows the corresponding ATM traffic parameters for each of the mapping options.

Computed ATM traffic descriptor parameters

Policy	PCR (cells/s)	SCR (cells/s)	MBS (cells)
3	PCR_{0+1} = 4229	SCR_{0+1} = 1125	MBS_{0+1} = 81
4	PCR_{0+1} = 4229	SCR_0 = 375	MBS_0 = 26
5	PCR_{0+1} = 1125	SCR_0 = 375	MBS_0 = 26
6	PCR_{0+1} = 302	N/A	N/A
All options are applicable when there is both traffic shaping and UPC traffic policing.			

PVC status management for NIWF

The FR-ATM service supports complete interworking between the frame relay and ATM PVC status management system. In the FRF.5 standard, PVC management refers to the procedures for managing the multiplexed FR-ATM DLCIs that traverse the ATM network.

The main attributes of the LMI procedures implementation for the FR-ATM service include:

- bidirectional polling between the user equipment and the network for information on PVC status
- verification of physical link integrity between the user equipment and the network
- A-bit signaling for notification of PVC availability

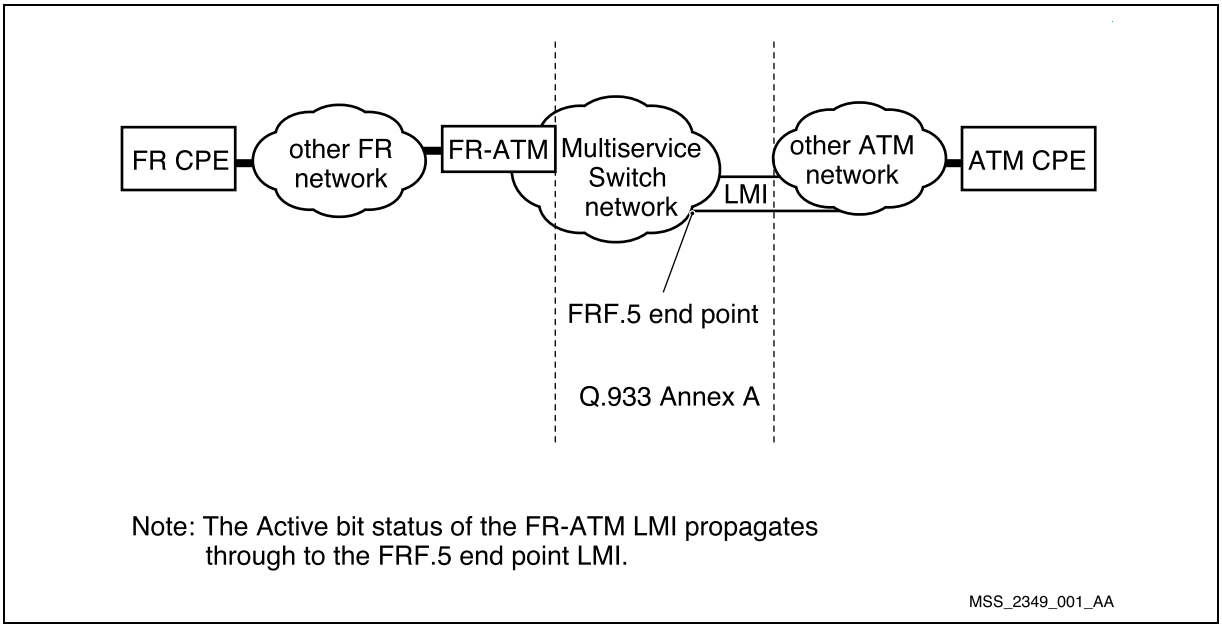
The FR-ATM interface supports the complete set of frame relay PVC management procedures, as defined in the following standards:

- Original Vendor Forum specification
- ITU-T Q.933 Annex A
- ANSI T1.617 Annex D

You can run LMI procedures as user side, network side, or both on the FR-ATM interface. For more information about LMI procedures, see NN10600-901 *Nortel Multiservice Switch 7400/15000/20000 Frame Relay Configuration Management*.

In accordance with ITU-T Recommendation Q.933 Annex A, the FRF.5 end point runs LMI procedures on DLCI 0. The status of a FR-ATM DLCI transmits to its corresponding FRF.5 end point. The FRF.5 end point propagates the FRF.5 DLCI status information to the remote FRF.5 end point using the LMI procedure inside the FRF.5 ATM VCC. See figure NIWF PVC status management (page 198).

NIWF PVC status management



Deployment and migration procedures

Use this section to learn about how to deploy the FR-ATM service in each of three deployment models and about how to migrate between models. The FR-ATM service supports three deployment models as described in Deployment models (page 144).

The three deployment models are:

- Frame relay leveraging another carrier's ATM network
- Interconnected frame relay and ATM subnetworks
- ATM-centric deployment

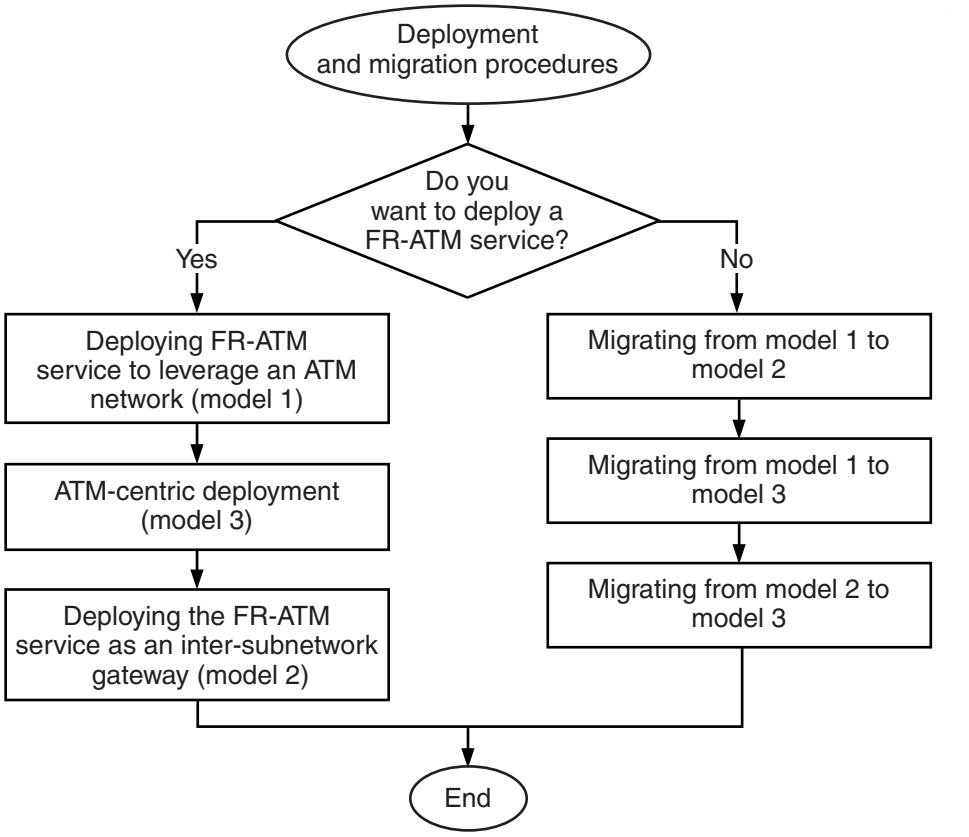
You can place one or more deployment models within a single customer network. You can also expect the FR-ATM service configurations to evolve from one model to another.

You can use overlapping migration strategies, and the choice between them is not clear cut. The deciding factor in choosing one model over another rests in the key attributes associated with each model. Since each deployment model has unique key attributes, base the choice of migration strategy on the priority and importance of these attributes in the customer network.

Deployment and migration procedures

This task flow shows you the sequence of procedures you perform to deploy or migrate FR-ATM services. To link to any procedure, go to Deployment and migration procedure navigation (page 200).

Deployment and migration procedures



Deployment and migration procedure navigation

- Deploying FR-ATM service to leverage an ATM network (page 201)
- Deploying the FR-ATM service as an inter-subnetwork gateway (page 203)
- ATM-centric deployment (page 206)
- Migrating from model 1 to model 2 (page 208)
- Migrating from model 1 to model 3 (page 210)
- Migrating from model 2 to model 3 (page 212)

Deploying FR-ATM service to leverage an ATM network

In the frame relay leveraging another carrier's ATM network deployment model 1, the FR-ATM service is deployed in a pure frame relay network that uses dynamic packet routing system (DPRS) networking in the backbone. The purpose of this deployment strategy is to selectively upgrade some FR UNI access ports to high-speed ATM interfaces while leaving the DPRS backbone undisturbed.

This deployment model leverages the installed base of pure frame relay networking to allow FR-ATM cross-connections. At the same time, it exploits the maturity of the DPRS networking capability from end-to-edge.

The figure Frame relay leveraging another carrier's ATM network (model 1) (page 202) illustrates the deployment of the FR-ATM service in this model.

The *FrUni* component instances that formerly managed the upgraded interfaces convert to *FrAtm* components in a gateway configuration. This supports FR-ATM interworking adjacent to the upgraded ATM links. You can implement this deployment model as the first step in a migration from a pure frame relay network to a FR-ATM interworking network.

Procedure steps

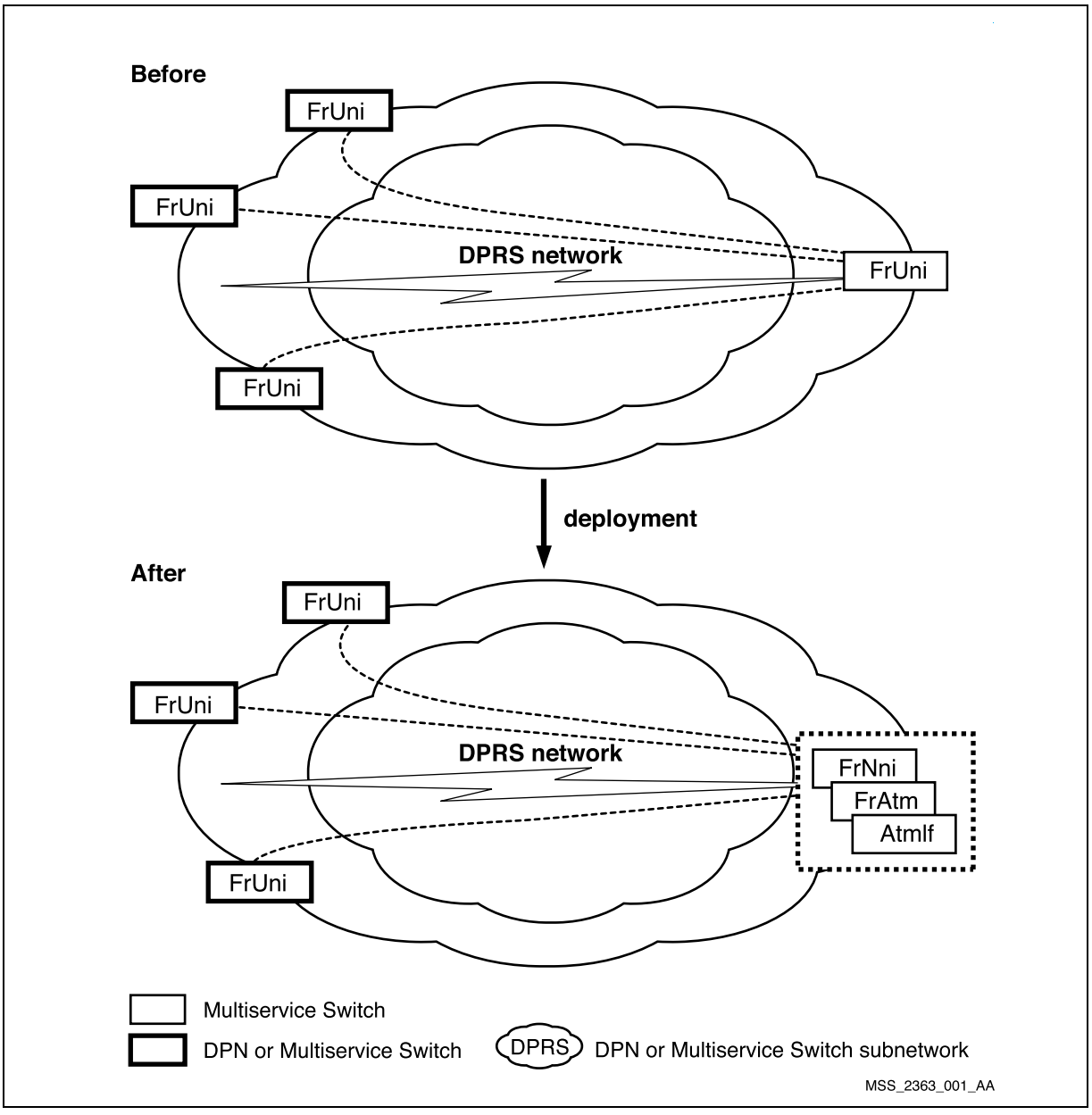
Step	Action
1	Select the nodes where the ATM interface service will replace the FR UNI service.
2	Add an ATM interface card on the selected nodes and provision the LPT feature list to run on the card. See NN10600-270 *Nortel Multiservice Switch 7400/15000/20000 Software Installation*. Use the procedure for configuring a new processor card and for adding application features to an LPT.
3	Provision *Atmif* component instances and set the *oamSegmentBoundary* attribute to *yes* to manage the new ATM user ports. See NN10600-700 *Nortel Multiservice Switch 7400/15000/20000 ATM Technology Fundamentals*. Use the procedure for configuring an ATM interface.
4	Select the corresponding *FrUni* component instances that you are replacing.
5	On each of the selected cards, install the *FrameRelayUni* and *FrameRelayAtm* components. See NN10600-270 *Nortel Multiservice Switch 7400/15000/20000 Software Installation*. Use the procedure for adding application features to an LPT. For each selected port, copy the provisioning of the existing *Fruni* components to corresponding instances of the *FrAtm* component.
6	Bind the *FrUni* and *FrAtm* components in a gateway configuration. See Configuring a logical gateway (page 18).

7 Provision FR-ATM connections through the gateway and terminate them on the ATM UNI, according to the procedures for this connection configuration. See Configuring the gateway connection (page 21).

--End--

Procedure job aid

Frame relay leveraging another carrier's ATM network (model 1)



Deploying the FR-ATM service as an inter-subnetwork gateway

In the interconnected frame relay and ATM subnetworks deployment model 2, the FR-ATM service is deployed in a mixed backbone environment.

Instances of the *FrUni* component manage the existing FR UNIs in this configuration. Cross-connection between the DPRS backbone and the ATM backbone portions of the network is not possible without this deployment of the FR-ATM service.

The key characteristics of this deployment model from a Nortel Multiservice Switch perspective are:

- The service provider has continued use of the installed base in the frame relay portion of the network while the network undergoes a DPRS to ATM backbone conversion.
- The service provider can research and explore the use of relatively new ATM technology within the ATM portion of the network.
- The service provider can cross-connect between the of frame relay and ATM end points through the FR-ATM gateway.
- The model permits a cell-only relay path through the ATM portion of the network.
- The model permits early trial of a thin-layer adaptation of FR-ATM in selected nodes in the ATM portion of the network. This is important for new offerings of frame relay features based on evolving ATM networking and traffic management capabilities.

The figure Interconnected frame relay and ATM subnetworks (model 2) (page 205) illustrates this FR-ATM service deployment model.

To connect the FR UNI points to the ATM interface across two network portions, deploy FR-ATM gateway configurations at selected nodes in the middle of the Nortel Multiservice Switch network between the DPRS and ATM subnetworks.

Procedure steps

Step	Action
1	Identify the nodes where you can deploy a gateway. See the FR-ATM gateway deployment criteria in the Procedure job aid (page 204).
2	On each of the selected function processors (FPs), install the *FrameRelayUni* and *FrameRelayAtm* components. See NN10600-270 *Nortel Multiservice Switch 7400/15000/20000 Software Installation*. Use the procedures for adding application features to the LPTs.

3 Add an instance of a *FrUni* component and a *FrAtm* component and bind them in a gateway configuration. See Configuring a logical gateway (page 18).

4 Provision FR-ATM connections through this gateway according to the procedures for this connection configuration. See Configuring the gateway connection (page 21).

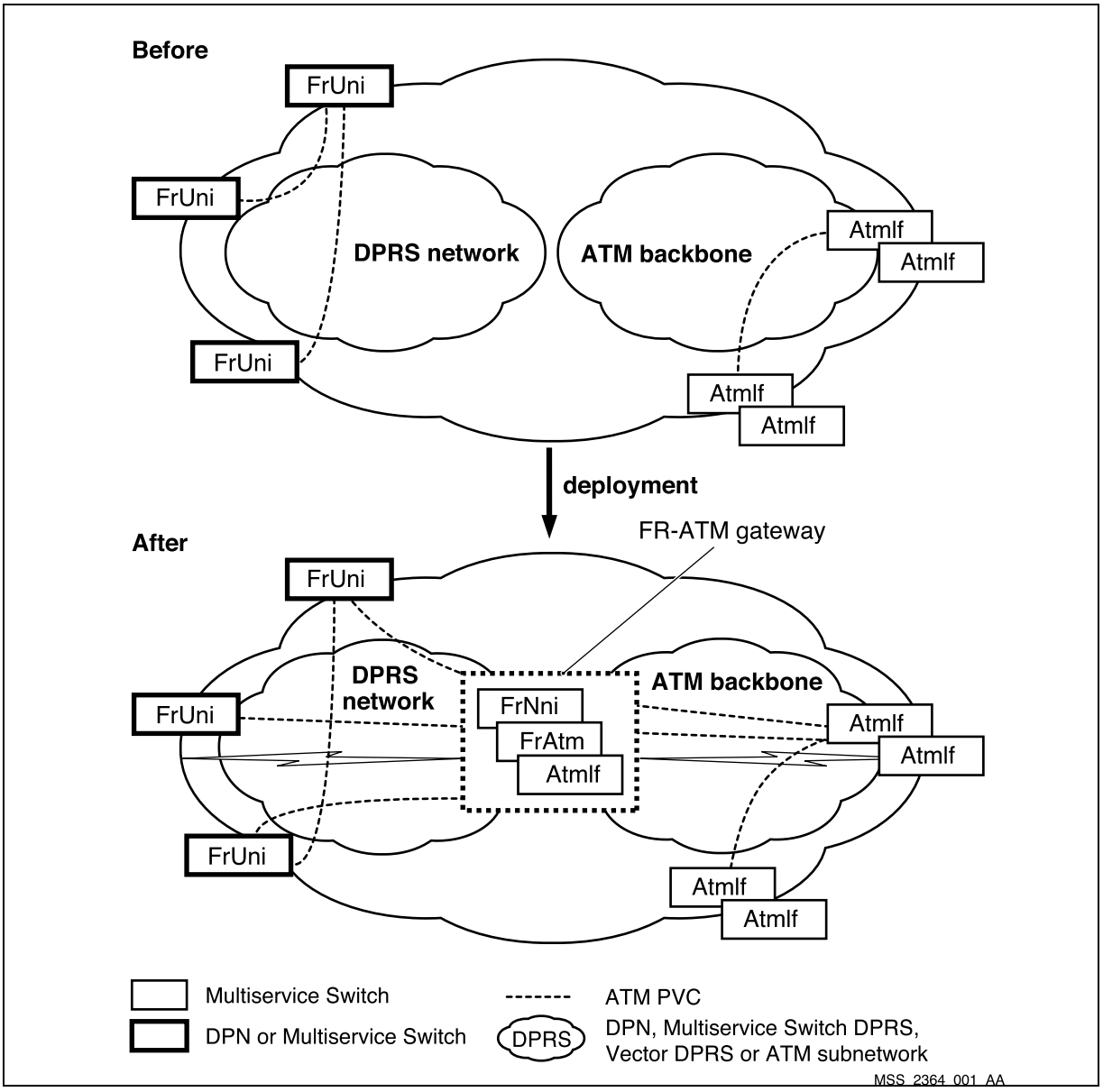
--End--

Procedure job aid

Use the following FR-ATM gateway deployment criteria for an interconnected FR and ATM subnetwork deployment to decide where to put the gateway and how many gateways to provision based on these criteria:

- location of the node relative to the ATM and DPRS subnetworks (that is, the need for either a DPRS trunk or an ATM logical trunk, and an ATM link terminating on the selected node)
- available slots on the candidate nodes or available frame FPs already doing FR UNI processing
- available frame processing power on the candidate FPs
- available connection fan out on the candidate FPs
- engineering and distribution of gateway connection fan out across multiple gateway instances on different FPs on the node or on separate nodes
  - — to balance the throughput load
  - — to optimize the end-to-end hop count (delay)
- resiliency requirements

Interconnected frame relay and ATM subnetworks (model 2)



ATM-centric deployment

In the ATM-centric deployment model 3, the FR-ATM service is deployed directly into a pure ATM network as a new service.

The key characteristics of this deployment model from a Nortel Multiservice Switch perspective are as follows:

- The model enables the universal employment of thin-layer adaptation of FR-ATM. This is important for new offerings of frame relay based on evolving ATM networking and traffic management capabilities.
- The model enables a cell-only relay path through the ATM network.

The figure ATM-centric deployment model (model 3) (page 207) illustrates deployment of the FR-ATM service in this model.

FrAtm component instances, each managing a FR UNI, are defined on new ports located on Multiservice Switch nodes at the periphery of an existing Multiservice Switch ATM network.

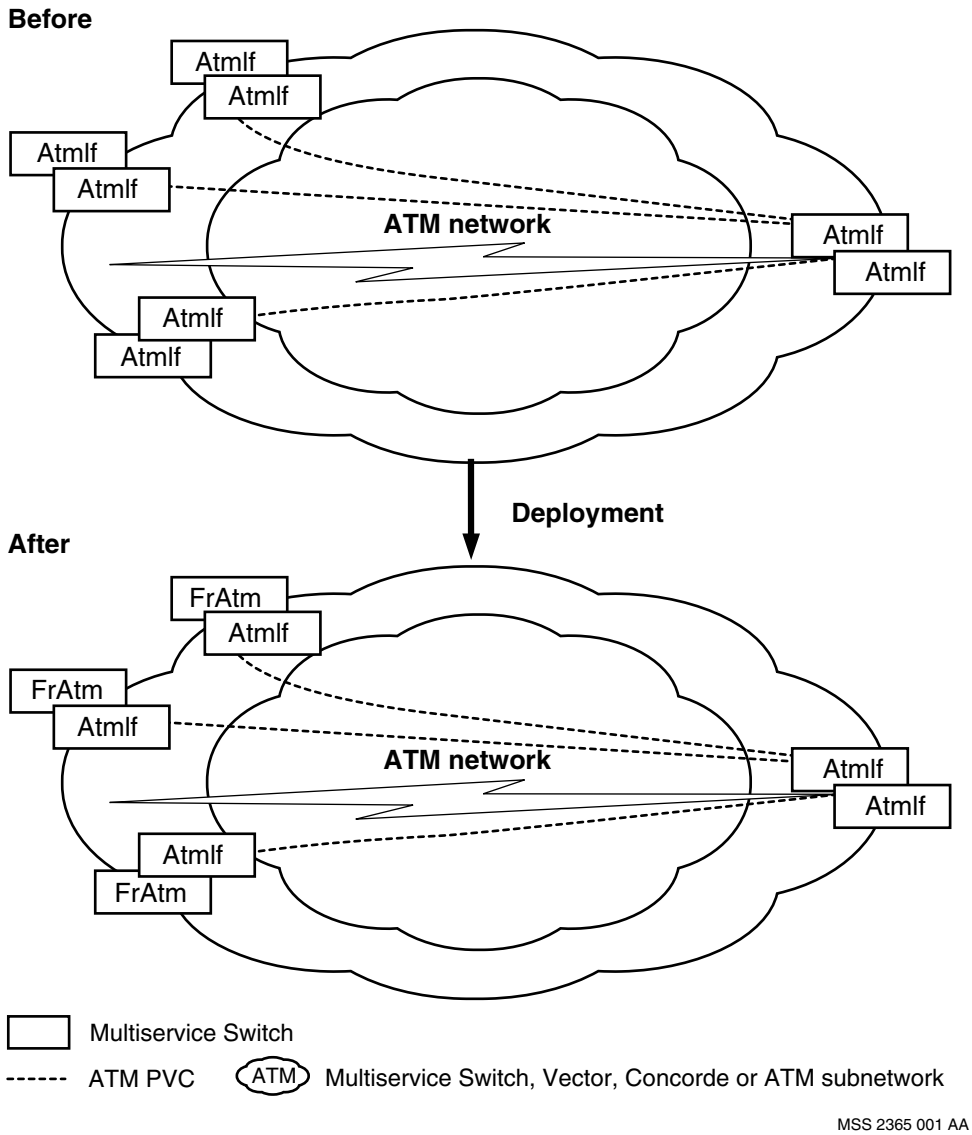
Procedure steps

Step	Action
1	Select the nodes where you want FR UNI service.
2	On each of the selected nodes, add a function processor and install it to load the desired *frameRelayAtm* component. See NN10600-270 *Nortel Multiservice Switch 7400/15000/20000 Software Installation*. Use the procedures for configuring a new processor card and for adding application features to an LPT.
3	Connect the frame relay customer premise equipment to the respective ports.
4	Create *FrAtm* component instances and bind them to the same ports. See FR-ATM interface configuration (page 12).
5	Provision FR-ATM connections following the procedures for this configuration. See Configuring a FR-ATM SIWF NPVC (page 52).

--End--

Procedure job aid

ATM-centric deployment model (model 3)



Migrating from model 1 to model 2

Model 1 is a frame relay network leveraging another carrier's ATM network. Model 2 consists of interconnected Nortel Multiservice Switch frame relay and ATM subnetworks. The migration from model 1 to model 2 is likely to occur as the network gradually replaces DPRS trunks in the backbone with ATM trunking capabilities.

The key attributes of this migration strategy are:

- The service provider can research and explore the use of relatively new ATM technology within the ATM portion of the network.
- The service provider can crossconnect frame relay and ATM end points through the FR-ATM gateway.
- The migration permits a cell-only relay path through the ATM portion of the network.
- The migration permits early trial of a thin-layer adaptation of FR-ATM in selected nodes in the ATM portion of the network. This is important for new offerings of frame relay features based on evolving ATM networking and traffic management capabilities.

The figure Migration from model 1 to model 2 (page 209) illustrates the migration of the FR-ATM service between these two deployment models.

When backbone conversion occurs gradually, you can migrate the gateway capability from the edge into the middle of the network, keeping pace with the backbone conversion.

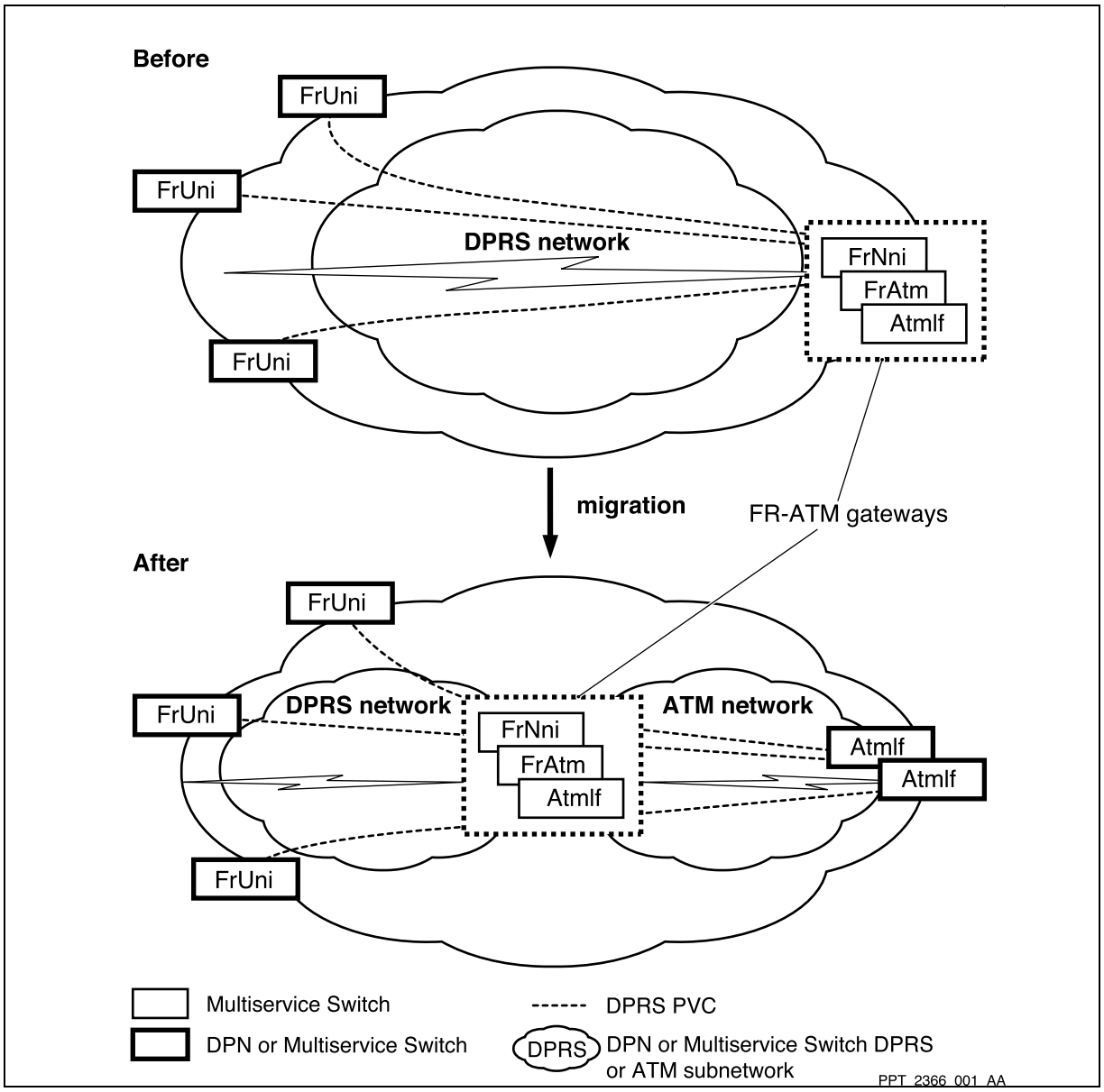
Procedure steps

Step	Action
1	Select a source node along the edge of the network where the gateway service is unnecessary due to the replacement of DPRS trunking by the ATM backbone.
2	Select a target node that needs this gateway service to carry traffic from the ATM backbone to the DPRS backbone.
3	Transfer the provisioning of the gateway from the source node to the target node.
4	For each connection that transits the gateway, insert the additional hops required to cross the ATM backbone from the ATM UNI to the gateway.

--End--

Procedure job aid

Migration from model 1 to model 2



Migrating from model 1 to model 3

Model 1 is a frame relay network leveraging another carrier's ATM network. Model 3 is an ATM-centric network. The migration from model 1 to model 3 is likely to occur if the network replaces DPRS trunks in the backbone with ATM trunking capabilities, before migrating the FR-ATM capability. In this case the backbone conversion to ATM occurs while DPRS trunking is preserved by using ATM logical trunking, before any migration to FR-ATM.

This migration strategy leverages the installed base of pure frame relay networks to allow FR-ATM crossconnections. At the same time, it exploits the maturity of the DPRS end-to-end networking capability as long as possible.

The figure Migration from model 1 to model 3 (page 211) illustrates the migration of FR-ATM service between these two models.

When the migration is complete, the network is ATM-centric and assumes the key attributes associated with this model. See ATM-centric deployment (page 206). You can time this migration strategy so that the evolving ATM networking capability is mature enough to successfully support widespread use of the FR-ATM service. Use ATM logical trunks in the intermediate phase of this migration.

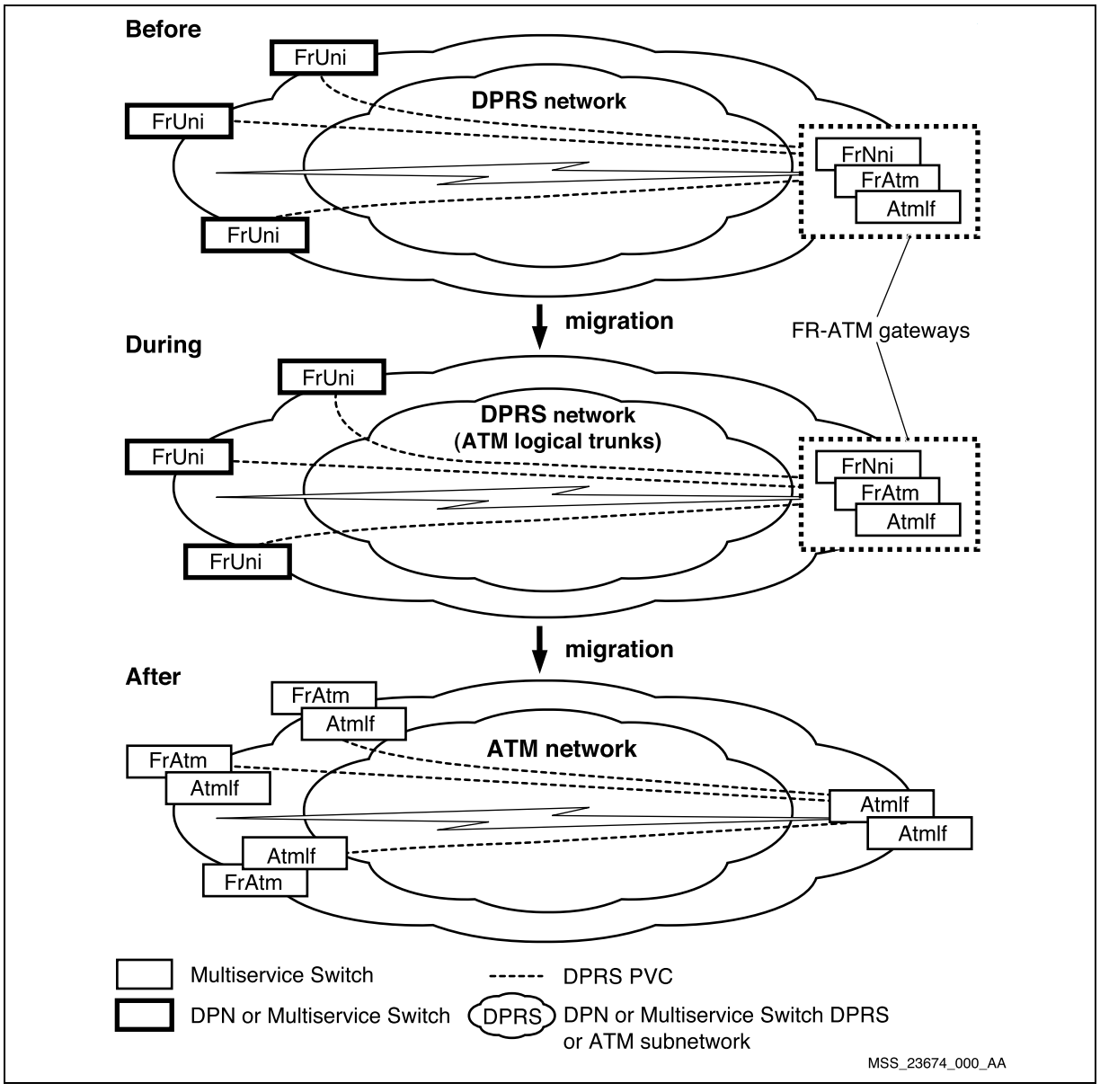
Procedure steps

Step	Action
1	Migrate the DPRS subnetwork that the ATM logical trunks will carry. See NN10600-710 *Nortel Multiservice Switch 7400/15000/20000 ATM Configuration Management*.
2	Select the nodes where the FR UNI service is currently deployed in the form of *FrUni* component instances.
3	On each of the selected FPs where FR-ATM will replace FR UNI, install and load the required *frameRelayAtm* component. See NN10600-270 *Nortel Multiservice Switch 7400/15000/20000 Software Installation*. Use the procedure for adding application features to an LPT.
4	Create *FrAtm* component instances. Bind them to the same ports by copying the provisioning from the current *FrUni* component to the corresponding instance of the *FrAtm* component. To provision a FR-ATM interface, see FR-ATM interface configuration (page 12).
5	Provision FR-ATM connections following the procedures described for this configuration. See Configuring a FR-ATM SIWF NPVC (page 52).
6	Remove the FR-ATM gateway as it is no longer necessary.

--End--

Procedure job aid

Migration from model 1 to model 3



Migrating from model 2 to model 3

Model 2 consists of interconnected Nortel Multiservice Switch frame relay and ATM subnetworks. Model 3 is an ATM-centric network. This migration from model 2 to model 3 is likely to occur when the DPRS backbone is completely eliminated from the network. The elimination of the DPRS backbone can occur as the last phase of the migration process that starts in Migrating from model 1 to model 2 (page 208).

There is a benefit to this migration strategy. When the network provider is ready to complete the backbone conversion from a DPRS backbone to an ATM backbone, the thin-layer FR-ATM adaptation is completely tested. This means the provider can move to a universal offering of frame relay using this capability. The provider can time this move so that the evolving ATM networking capability is mature enough to successfully support the widespread use of the service.

If the trunk migration is complete so that the backbone consists of an ATM backbone, use this procedure for migrating from an inter-subnetwork gateway to service interworking.

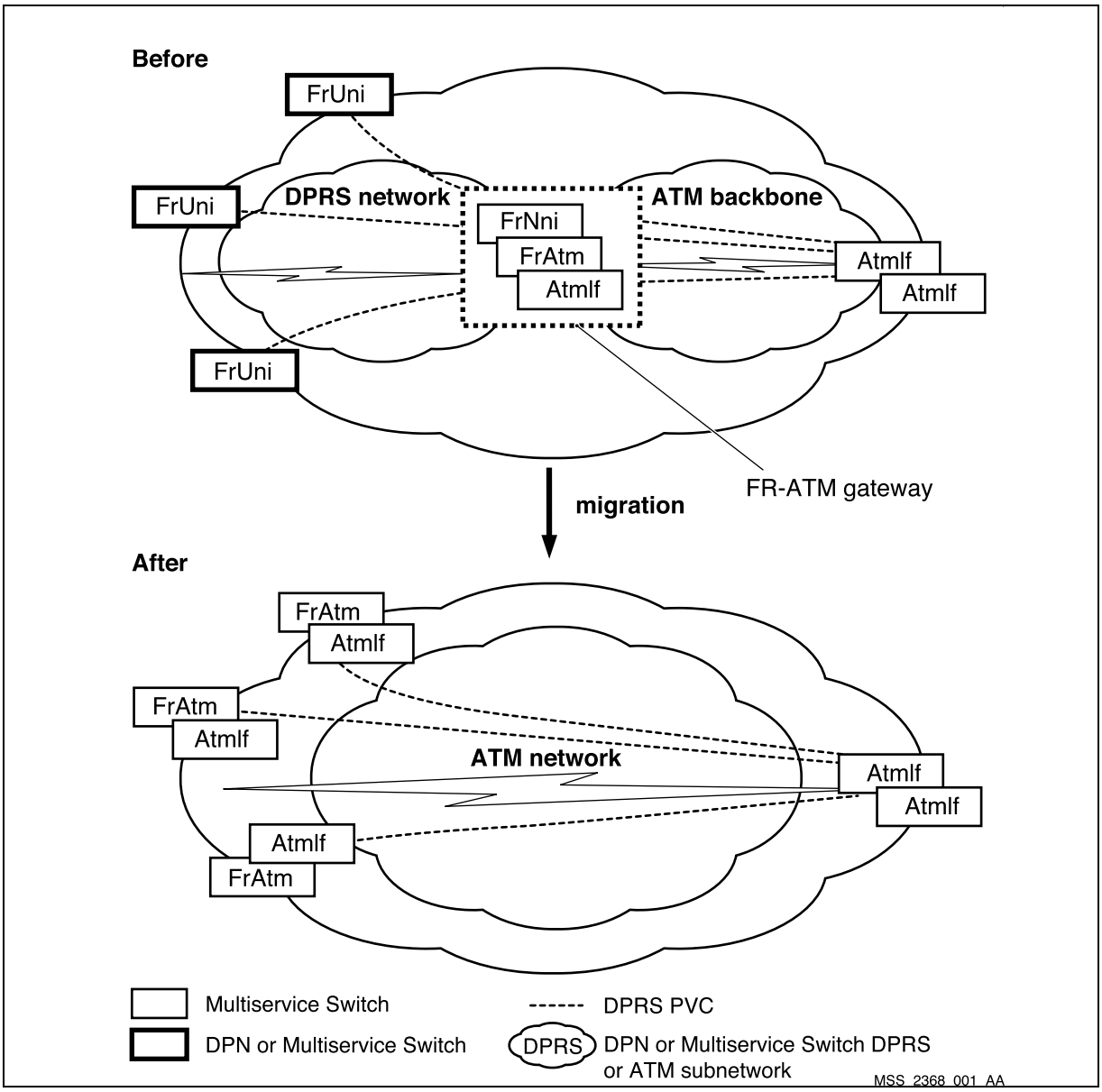
The figure Migration from model 2 to model 3 (page 213) illustrates the migration of the FR-ATM service between these two models.

Procedure steps

Step	Action
1	Select the nodes where the FR UNI service is currently deployed in the form of *FrUni* component instances. Apply the procedure for migrating from leveraged ATM network to service interworking in Migrating from model 1 to model 3 (page 210).
	--End--

Procedure job aid

Migration from model 2 to model 3



Compliance with standards

Nortel Multiservice Switch FR-ATM service conforms with the following specifications:

- ITU-T I.555 *Frame Relay Bearer Service Interworking*, November 1993
- Frame Relay Forum FRF.8 *Frame Relay / ATM PVC Service Interworking Implementation Agreement*, Frame Relay Forum, April 14 1995.
- Frame Relay Forum FRF.8.1 *Frame Relay / ATM PVC Service Interworking Implementation Agreement*, Frame Relay Forum Technical Committee, February 2000.
- Frame Relay Forum FRF.5 *Frame Relay / ATM PVC Network Interworking Implementation Agreement*, Frame Relay Forum, December 1994.

The following terms indicate the level of compliance with these standards:

- **Noted**: This term is used where the specification provides clarification, non-specific information, or background information.
- **Not applicable**: This term is used when the information in the text does not relate directly to the frame relay to ATM (FR-ATM) interworking function.
- **Complies**: This term is used when Nortel Multiservice Switch FR-ATM interworking function fully complies with the text for this section.

Navigation

- Compliance with ITU-T I.555 (page 214)
- Compliance with FRF.8 (page 215)
- Compliance with FRF.8.1 (page 217)
- Compliance with FRF.5 (page 218)

Compliance with ITU-T I.555

This feature complies with ITU-T I.555 *Frame Relay Bearer Service Interworking*, November 1993.

The table Compliance with I.555 (page 215) details the compliance with exceptions and clarifications.

Compliance with I.555

I.555	Compliance
Section 1 Introduction	Noted.
Section 2 Definitions and abbreviations	Noted.
Section 3 Interworking between Frame Relaying and Frame Switching	Not applicable.
Section 4 Interworking between FRBS and X.25/X.31	Not applicable.
Section 5 Interworking/interconnecting LANs and FRBS	Not applicable.
Section 6 Interworking between FRBS and Circuit Switched Service by Port Access	Not applicable.
Section 7 Interworking between FRBS and B-ISDN	Noted. Sections listed below.
Section 7.1 General description	Noted.
Section 7.2 Interworking requirements	Noted. Sections listed below.
Section 7.2.1 Interworking in the C-plane	Noted. This section does not apply to PVCs.
Section 7.2.2 Interworking in the U-plane	Noted. Sections listed below.
Section 7.2.2.1 Network interworking (Scenario 1)	Complies.
Section 7.2.2.2 Network interworking (Scenario 2)	Complies.
Section 7.2.2.3 Service interworking	Complies.
Section 7.2.2.4 Interworking of loss priority and congestion management	Noted. Sections listed below.
Section 7.2.2.4.1 Discard eligibility and loss priority mapping	Complies.
Section 7.2.2.4.2 Congestion indication mapping	Complies
Appendix I Interworking/interconnection of LANs and FRBS	Not applicable.

Compliance with FRF.8

This feature complies with Frame Relay Forum FRF.8 *Frame Relay / ATM PVC Service Interworking Implementation Agreement*, Frame Relay Forum, April 14 1995.

The table Compliance with FRF.8 (page 216) details the compliance with exceptions and clarifications.

Compliance with FRF.8

FRF.8	Compliance
Section 1.0 Introduction	Noted.
Section 2.0 References	Noted.
Section 3.0 Frame Relay/ATM Service Interworking	Complies.
Section 4.0 Frame Relay/ATM Service Interworking Parameter Mapping	Noted. Sections listed below.
Section 4.1 Frame Formatting and Delimiting	Complies.
Section 4.2 Discard Eligibility and Cell Loss Priority Mapping	Complies.
Section 4.3 Congestion Indication	Complies.
Section 4.4 Command/Response Field	Complies.
Section 4.5 DLCI Field	Complies.
Section 5.0 Additional FR-ATM Interworking Aspects	Noted. Sections listed below.
Section 5.1 Traffic Management	Complies, with one exception. ABR Service Category is not supported.
Section 5.2 PVC Management Interworking	Complies. See Notes at the end of this table.
Section 5.3 Upper Layer User Protocol Encapsulation	Complies.
Section 5.3.1 Encapsulation Mapping in Translation Mode	Sections listed below.
Section 5.3.1.1 Bridged PDUs	Complies.
Section 5.3.1.2 Routed PDUs	Complies.
Section 5.3.1.3 Connection Oriented Protocols	Complies.
Section 5.3.1.4 Fragmentation and Reassembly	The fragmentation and reassembly option is not supported.
Section 5.4 Address Resolution	Complies. ARP and InARP translation is supported.
Section 6.0 Operation for the Common Part of the AAL Type 5	Complies.
Multiservice Switch FR-ATM interworking function does not delete the corresponding ATM PVC. The ATM PVC remains configured and available. Multiservice Switch FR-ATM interworking function sends AIS along the ATM PVC. This indicates that the existing ATM PVC is inactive. This method is in full compliance with the text explicitly stated in the ITU-T I.555 Annex B, section B.2.2. This method prevents resource and bandwidth waste by avoiding traffic coming from the ATM-attached device. Alarm generation is not subject to standards recommendation. Multiservice Switch FR-ATM-generated alarms provide additional value to network operations.	

Compliance with FRF.8.1

This feature complies with Frame Relay Forum FRF.8.1 *Frame Relay / ATM PVC Service Interworking Implementation Agreement*, Frame Relay Forum Technical Committee, February 2000.

The table Compliance with FRF.8.1 (page 217) details the compliance with exceptions and clarifications.

Compliance with FRF.8.1

FRF.8.1	Compliance
Section 1.0 Introduction	Noted.
Section 2.0 Reference Model	Noted.
Section 3.0 Frame Relay/ATM Service Interworking	Complies.
Section 4.0 Frame Relay/ATM Service Interworking Parameter Mapping	Noted. Sections listed below.
Section 4.1 Frame Formatting and Delimiting	Complies.
Section 4.2 Discard Eligibility and Cell Loss Priority Mapping	Complies.
Section 4.2.1 Frame Relay to ATM Direction	Complies.
Section 4.2.2 ATM to Frame Relay Direction	Complies.
Section 4.3 Congestion Indication	Complies.
Section 4.3.1 Congestion Indication - Forward	Complies.
Section 4.3.2 Congestion Indication - Backward	Complies.
Section 4.4 Command/Response Field	Complies.
Section 4.4.1 Frame Relay to ATM Direction	Complies.
Section 4.4.2 ATM to ATM Direction	Complies.
Section 4.5 DLCI Field	Complies.
Section 5.0 Additional FR-ATM Interworking Aspects	Noted. Sections listed below.
Section 5.1 Traffic Management	Complies, with one exception. ABR Service Category is not supported.
Section 5.2 PVC Management Interworking	Complies. See Notes at the end of this table.
Section 5.2.1 Frame Relay PVC Management Procedures	Complies.
Section 5.2.2 ATM PVC Management Procedures	Complies.
Section 5.3 Upper Layer User Protocol Encapsulation	Complies.
Section 5.3.1 Encapsulation Mapping in Translation Mode	Sections listed below.
(1 of 2)	

Compliance with FRF.8.1 (continued)

FRF.8.1	Compliance
Section 5.4 Address Resolution	Complies. ARP and InARP translation is supported.
Section 6.0 Operation for the Common Part of the AAL Type 5	Complies.
Multiservice Switch FR-ATM interworking function does not delete the corresponding ATM PVC. The ATM PVC remains configured and available. Multiservice Switch FR-ATM interworking function sends AIS along the ATM PVC. This indicates that the existing ATM PVC is inactive. This method is in full compliance with the text explicitly stated in the ITU-T I.555 Annex B, section B.2.2. This method prevents resource and bandwidth waste by avoiding traffic coming from the ATM-attached device. Alarm generation is not subject to standards recommendation. Multiservice Switch FR-ATM-generated alarms provide additional value to network operations.	
(2 of 2)	

Compliance with FRF.5

This feature complies with Frame Relay Forum FRF.5 *Frame Relay / ATM PVC Network Interworking Implementation Agreement*, Frame Relay Forum, December 1994.

The table Compliance with FRF.5 (page 218) details the compliance with exceptions and clarifications.

Compliance with FRF.5

FRF.5	Compliance
Section 1.0 Introduction	Noted.
Section 2.0 Relevant Standards	Noted.
Section 3.0 Frame Relay / ATM Interworking Scenarios	Complies.
Section 4.0 Detailed Network Interworking Functions	Noted. Sections listed below.
Section 4.1 Frame Formatting and Delimiting	Complies, with exceptions: 2-octet is the only address field format supported in the present release.
Section 4.2 Error Detection	Complies.
Section 4.3 Connection Multiplexing	Complies, with the exception: in the case of 1:1 connection multiplexing.
Section 4.4 Discard Eligibility and Cell Loss Priority Mapping	Complies.
Section 4.5 Congestion Indication	Noted. Sections listed below.
(1 of 2)	

Compliance with FRF.5 (continued)

FRF.5	Compliance
Section 4.5.1 Congestion Indication (Forward)	Complies.
Section 4.5.2 Congestion Indication (Backward)	Complies, with exceptions: the EFCI to BECN mapping is performed on a per-DLCI basis.
Section 5.0 FR-ATM Interworking Aspects	Noted. Sections listed below.
Section 5.1 Traffic Management	Complies, with exceptions: the present release supports method 2, option 2 (1-1 mapping).
Section 5.2 PVC Management	Complies.
Section 5.3 Description of Upper Layer User Protocol Encapsulation Methods	Noted.
Section 5.4 Operations and Maintenance	Noted. Sections listed below.
Section 5.4.1 Operations for the Common Part of the AAL Type 5	Does not comply.

(2 of 2)

Procedure conventions

This document uses the following procedure conventions:

- You can enter commands using full component and attribute names, or you can abbreviate them. The commands used in the procedures contain the full component and attribute names in the first instance. In the second instance, the component and attribute names are abbreviated. For more information on abbreviating component and attribute names, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*. All component and attribute names are formatted in italics.
- The introduction of every procedure states whether you must perform the procedure in operational mode or provisioning mode. For more information on these modes, see Operational mode (page 220) or Provisioning mode (page 221).
- When you complete a procedure, you can verify your changes and then activate them as the new node configuration. For more information on completing configuration changes and exiting provisioning mode, see Activating configuration changes (page 221).

Operational mode

Procedures contained within this document can either be performed in operational mode or provisioning mode. When you initially log into a node, you are in operational mode. Nortel Multiservice Switch systems use the following command prompt when you are in operational mode:

```
#>
```

where:
is the current command number

In operational mode, you work with operational components and attributes. In operational mode, you can

- list operational components and display operational attributes to determine the current operating parameters for the node
- control the state of parts of the node by locking and unlocking components

- set certain operational attributes and enter commands to perform diagnostic tests

Provisioning mode

To change from operational mode to provisioning mode, type the following command at the operator prompt:

```
start Prov
```

Only one user can be in provisioning mode at a time. Nortel Multiservice Switch systems use the following command prompt whenever you are in provisioning mode:

```
PROV #>
```

where:

is the current command number

In provisioning mode, you work with the provisionable components and attributes that contain the current and future configurations of the node. You can add and delete components, and display and set provisionable attributes. For information on completing the configuration changes, exiting provisioning mode, and returning to operational mode see Activating configuration changes (page 221).

For information on operational and provisionable attributes, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*.

Activating configuration changes

Several procedures in this document ask that you complete the configuration changes. When you complete the configuration changes, you are activating the configuration changes, confirming that you want to activate them, and saving the changes. You are instructed to complete the configuration changes only at the end of procedures that you perform in provisioning mode.

CAUTION

Activating a provisioning view can affect service

Activating a provisioning view can result in a CP reload or restart, causing all services on the node to fail. See NN10600-050 *Nortel Multiservice Switch 7400/15000/20000 Command Reference*, for more information.

CAUTION
Risk of service failure
When you activate the provisioning changes (see step 3), you have 20 minutes to confirm these changes. If you do not confirm these changes within 20 minutes, the shelf resets and all services on the node fail.

1 Verify that the provisioning changes you have made are acceptable.

```
check Prov
```

Correct any errors and then verify the provisioning changes again.

2 If you want to store the provisioning changes in a file, save the provisioning view.

```
save -f(<filename>) Prov
```

3 If you want these changes as well as other changes made in the edit view to take effect immediately, activate, confirm, and commit the provisioning changes.

```
activate Prov
confirm Prov
commit Prov
```

4 End the provisioning session.

```
end Prov
```

Nortel Multiservice Switch 7400/15000/20000

Operations: Frame Relay to ATM Interworking

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