



Configuring Frame Relay-ATM Interworking

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The Frame Relay-ATM Interworking features enable Frame Relay and ATM networks to exchange data, despite differing network protocols. There are two types of Frame Relay-ATM Interworking:

- [FRF.5 Frame Relay-ATM Network Interworking, page 2](#)
- [FRF.8 Frame Relay-ATM Service Interworking, page 3](#)

For further general information about Frame Relay-ATM Interworking, see the "Wide-Area Networking Overview" chapter at the beginning of this book.

For a description of the commands used to configure Frame Relay-ATM Interworking, refer to the chapter "Frame Relay-ATM Interworking Commands" in the *Cisco IOS Wide-Area Networking Command Reference*. To locate documentation of other commands that appear in this chapter, use the command reference master index or search online.

To identify the hardware platform or software image information associated with a feature, use the Feature Navigator on Cisco.com to search for information about the feature or refer to the software release notes for a specific release. For more information, see the section "Identifying Supported Platforms" in the chapter "Using Cisco IOS Software."

For Cisco IOS Release 12.2, Frame Relay-ATM Interworking is supported on the following platforms and interface types:

- Cisco MC3810: T1/E1 ATM interface
- Cisco 3600 series routers: OC-3 and inverse multiplexing over ATM (IMA) network modules
- Cisco 2600 series routers: OC-3 and IMA network modules
- Cisco 7200 series routers: all Cisco 7200 series ATM interface types
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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information



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about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites

If the end station is a Cisco router that is connected to an FRF.8 router or switch in translation mode, you must configure the end station with IETF encapsulation (not Cisco encapsulation, which is the default). To do so, you use the **encapsulation frame relay ietf** command.

IETF encapsulation on the end station is not required for FRF.8 in transparent mode (or for FRF.5 in translation mode or transparent mode). The FRF.5 or FRF.8 router or switch itself does not need IETF encapsulation in translation mode or transparent mode.

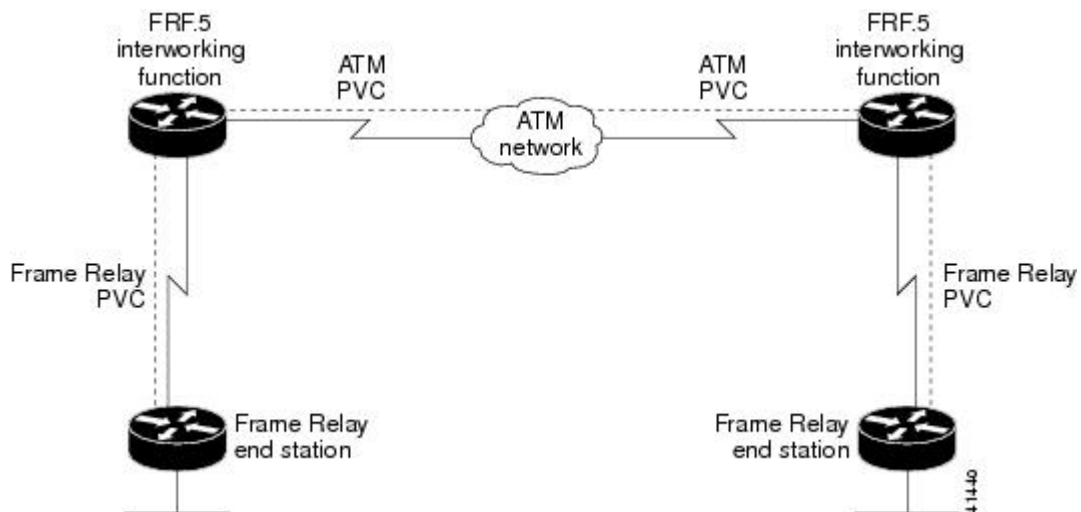
Information About Frame Relay-ATM Interworking

- [FRF.5 Frame Relay-ATM Network Interworking, page 2](#)
- [FRF.8 Frame Relay-ATM Service Interworking, page 3](#)

FRF.5 Frame Relay-ATM Network Interworking

FRF.5 provides network interworking functionality that allows Frame Relay end users to communicate over an intermediate ATM network that supports FRF.5. Multiprotocol encapsulation and other higher-layer procedures are transported transparently, just as they would be over leased lines. The figure below illustrates this concept.

Figure 1 Frame Relay-to-ATM Network Interworking (FRF.5)



FRF.5 describes network interworking requirements between Frame Relay Bearer Services and Broadband ISDN (BISDN) permanent virtual circuit (PVC) services.

The FRF.5 standard is defined by the Frame Relay Forum Document Number FRF.5: *Frame Relay/ATM PVC Network Interworking Implementation Agreement*. For more information about which sections of this implementation agreement are supported by Cisco IOS software, see the appendix "Frame Relay-ATM Interworking Supported Standards" in this book.

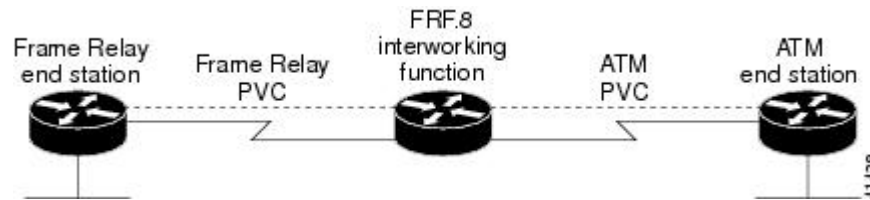
**Note**

On Cisco 7200 series routers, Frame Relay-ATM interworking does not support congestion management bit mapping.

FRF.8 Frame Relay-ATM Service Interworking

FRF.8 provides service interworking functionality that allows a Frame Relay end user to communicate with an ATM end user. Traffic is translated by a protocol converter that provides communication between dissimilar Frame Relay and ATM equipment. The figure below illustrates this concept.

Figure 2 *Frame Relay-to-ATM Service Interworking (FRF.8)*



FRF.8 describes a one-to-one mapping between a Frame Relay and an ATM PVC.

The FRF.8 standard is defined by the Frame Relay Forum Document Number FRF.8: *Frame Relay/ATM PVC Network Service Interworking Implementation Agreement*. For more information about which sections of this implementation agreement are supported, see the appendix "Frame Relay-ATM Interworking Supported Standards" in this book.

**Note**

On Cisco 7200 series routers, Frame Relay-ATM interworking does not support congestion management bit mapping.

How to Configure Frame Relay-ATM Interworking

- [Configuring and Verifying FRF.5, page 3](#)
- [Configuring and Verifying FRF.8, page 8](#)
- [Monitoring and Maintaining Frame Relay-to-ATM Interworking, page 11](#)

Configuring and Verifying FRF.5

- [Configuring an FRF.5 One-to-One Network Interworking Connection, page 4](#)
- [Configuring an FRF.5 Many-to-One Network Interworking Connection, page 5](#)
- [Verifying FRF.5 Configuration, page 6](#)

Configuring an FRF.5 One-to-One Network Interworking Connection

To configure FRF.5 encapsulation for a one-to-one connection between two Frame Relay end users over an intermediate ATM network, use the following commands beginning in global configuration mode:

SUMMARY STEPS

1. Router(config)# **interface serial** *number*
2. Router(config-if)# **frame-relay interface-dlci** *dlci* **switched**
3. Router(config)# **interface atm** *number*
4. Router(config-if)# **pvc** [*PVC-name*] *vpi* / *vci*
5. Router(config-if-atm-vc)# **encapsulation aal5mux frame-relay**
6. Router(config)# **connect** *connection-name* *FR-interface* *FR-DLCI* *ATM-interface* *ATM-PVC* **network-interworking**
7. Do one of the following:
 - Router(config-frf5)# **clp-bit** {**0** | **1** | **map-de**}
 -
 -
 - Router(config-frf5)# **de-bit map-clp**
8. Router(config-frf5)# **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	Router(config)# interface serial <i>number</i>	Configures the Frame Relay interface and enters interface configuration mode.
Step 2	Router(config-if)# frame-relay interface-dlci <i>dlci</i> switched	Configures a switched Frame Relay DLCI.
Step 3	Router(config)# interface atm <i>number</i>	Configures the ATM interface and enters interface configuration mode.
Step 4	Router(config-if)# pvc [<i>PVC-name</i>] <i>vpi</i> / <i>vci</i>	Creates the ATM PVC and virtual path identifier/virtual channel identifier (VPI/VCI). The VCI is a 16-bit field in the header of the ATM cell.
Step 5	Router(config-if-atm-vc)# encapsulation aal5mux frame-relay	Configures the ATM adaption layer (AAL) and encapsulation type for the ATM PVC.
Step 6	Router(config)# connect <i>connection-name</i> <i>FR-interface</i> <i>FR-DLCI</i> <i>ATM-interface</i> <i>ATM-PVC</i> network-interworking	Creates a connection to connect the Frame Relay DLCI to the ATM PVC and configures FRF.5 encapsulation.

Command or Action	Purpose
Step 7 Do one of the following: <ul style="list-style-type: none"> • Router(config-frf5)# clp-bit {0 1 map-de} • • • Router(config-frf5)# de-bit map-clp 	(On Cisco MC3810, 2600 series, and 3600 series routers only) Sets the ATM cell loss priority (CLP) field in the ATM cell header. (On Cisco MC3810, 2600 series, and 3600 series routers only) Sets discard eligible (DE) bit mapping from ATM to Frame Relay.
Step 8 Router(config-frf5)# end	Ends configuration mode and enters EXEC mode. Use the exit command to exit a submode and reenter global configuration command mode.

To disconnect the FRF.5 interworking connection, use the **shutdown** connect subcommand.

Configuring an FRF.5 Many-to-One Network Interworking Connection

To configure FRF.5 encapsulation for a many-to-one connection between two Frame Relay end users over an intermediate ATM network, use the following commands beginning in global configuration command mode:

SUMMARY STEPS

1. Router(config)# **interface serial** *number*
2. Router(config-if)# **frame-relay interface-dlci** *dlci* **switched**
3. Router(config)# **vc-group** *group-name*
4. Router(config-vc-group)# *FR-interface-name* **FR-DLCI**[*FR-SSCS-DLCI*]
5. Router(config)# **interface atm** *number*
6. Router(config-if)# **pvc** [*PVC-name*] *vpi* / *vci*
7. Router(config-if-atm-vc)# **encapsulation aal5mux frame-relay**
8. Router(config)# **connect** *connection-name* **vc-group** *group-name* *ATM-interface* *ATM-vpi/vci*
9. Do one of the following:
 - Router(config-frf5)# **clp-bit** {0 | 1 | **map-de**}
 -
 -
 -
10. Router(config-frf5)# **end**

DETAILED STEPS

Command or Action	Purpose
Step 1 Router(config)# interface serial <i>number</i>	Configures the Frame Relay interface and enters interface configuration mode.
Step 2 Router(config-if)# frame-relay interface-dlci <i>dlci</i> switched	Configures a switched Frame Relay DLCI.

	Command or Action	Purpose
Step 3	Router(config)# vc-group <i>group-name</i>	Assigns multiple Frame Relay DLCIs to a VC group.
Step 4	Router(config-vc-group)# <i>FR-interface-name</i> <i>FR-DLCI</i> [<i>FR-SSCS-DLCI</i>]	Specifies the Frame Relay DLCIs in the VC group and maps them to the Frame Relay-SSCS DLCIs. If the optional Frame Relay-SSCS DLCI value is not specified, its value will default to 1022.
Step 5	Router(config)# interface atm <i>number</i>	Configures the ATM interface and enters interface configuration mode.
Step 6	Router(config-if)# pvc [<i>PVC-name</i>] <i>vpi / vci</i>	Creates the ATM PVC and VPI/VCI. The VCI is a 16-bit field in the header of the ATM cell.
Step 7	Router(config-if-atm-vc)# encapsulation aal5mux frame-relay	Configures the AAL and encapsulation type for the ATM PVC.
Step 8	Router(config)# connect <i>connection-name</i> vc-group <i>group-name</i> <i>ATM-interface</i> <i>ATM-vpi/vci</i>	Creates a connection to connect the VC group to the ATM PVC.
Step 9	Do one of the following: <ul style="list-style-type: none"> Router(config-frf5)# clp-bit {0 1 map-de} . . . <p>Example:</p> <pre>Router(config-frf5)# de-bit map-clp</pre>	(On Cisco MC3810, 2600 series, and 3600 series routers only) Sets the ATM CLP field in the ATM cell header. (On Cisco MC3810, 2600 series, and 3600 series routers only) Sets DE bit mapping from ATM to Frame Relay.
Step 10	Router(config-frf5)# end	Ends configuration mode and enters EXEC mode. Use the exit command to exit a submode and reenter global configuration command mode.

To disconnect the FRF.5 interworking connection, use the **shutdown** connect subcommand.

Verifying FRF.5 Configuration

To verify correct configuration of the Frame Relay-to-ATM Network Interworking (FRF.5) feature, perform the following tasks:

SUMMARY STEPS

1. Enter the **show connect id** EXEC command to view information, including interworking parameters set, for the specified connection identifier:
2. Enter the **show connect port** EXEC command to view information about the connection on a specific interface:
3. Enter the **show frame-relay pvc** EXEC command to view statistics about Frame Relay interfaces:
4. Enter the **show atm pvc** EXEC command to view ATM PVCs and statistics:

DETAILED STEPS

Step 1 Enter the **show connect id** EXEC command to view information, including interworking parameters set, for the specified connection identifier:

Example:

```
Router# show connect id 5
FR/ATM Network Interworking Connection: network-1
Status      - UP
Segment 1 - VC-Group network-1
Segment 2 - ATM3/0 VPI 1 VCI 34
Interworking Parameters -
de-bit map-clp
clp-bit map-de
```

Step 2 Enter the **show connect port** EXEC command to view information about the connection on a specific interface:

Example:

```
Router# show connect port atm3/0
ID  Name                Segment 1                Segment 2                State
=====
5   network-1            VC-Group network-1      ATM3/0 1/34              UP
```

Step 3 Enter the **show frame-relay pvc** EXEC command to view statistics about Frame Relay interfaces:

Example:

```
Router# show frame-relay pvc
PVC Statistics for interface Serial1/0 (Frame Relay DCE)
      Active      Inactive      Deleted      Static
Local          0             0             0             0
Switched       1             0             0             0
Unused         0             0             0             0
DLCI = 18, DLCI USAGE = FRF.5, PVC STATUS = ACTIVE, INTERFACE =
Serial1/0
  input pkts 22          output pkts 21          in bytes 2140
  out bytes 2110        dropped pkts 0          in FECN pkts 0
  in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
  in DE pkts 0          out DE pkts 0
  out bcast pkts 0      out bcast bytes 0      Num Pkts
Switched 22
pvc create time 02:02:49, last time pvc status changed 02:02:42
```

Step 4 Enter the **show atm pvc** EXEC command to view ATM PVCs and statistics:

Example:

```
Router# show atm pvc
Interface  VCD/  Peak  Avg/Min  Burst  Sts
Name      VPI   VCI   Type    Encaps  SC    Kbps   Kbps    Cells
3/0       10    32    PVC     FR-ATM  UBR   155000
UP
```

Configuring and Verifying FRF.8

- [Configuring an FRF.8 Service Interworking Connection, page 8](#)
- [Verifying FRF.8 Configuration, page 9](#)

Configuring an FRF.8 Service Interworking Connection

To configure FRF.8 one-to-one protocol mapping between a Frame Relay end user and an ATM end user, use the following commands beginning in global configuration command mode:

SUMMARY STEPS

1. Router(config)# **interface serial** *number*
2. Router(config-if)# **frame-relay interface-dlci** *dlci* **switched**
3. Router(config)# **interface atm** *number*
4. Router(config-if)# **pvc** [*PVC-name*] *vpi* / *vci*
5. Router(config-if)# **encapsulation aal5mux fr-atm-srv**
6. Router(config)# **connect** *connection-name* *FR-interface* *FR-DLCI* *ATM-interface* *ATM-vpi* / *vci* **service-interworking**
7. Do one of the following:
 - Router(config-frf8)# **clp-bit** {**0** | **1** | **map-de**}
 -
 -
 -
8. Router(config-frf8)# **service translation**
9. Router(config-frf8)# **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	Router(config)# interface serial <i>number</i>	Configures the Frame Relay interface and enters interface configuration mode.
Step 2	Router(config-if)# frame-relay interface-dlci <i>dlci</i> switched	Configures a switched Frame Relay DLCI.
Step 3	Router(config)# interface atm <i>number</i>	Configures the ATM interface and enters interface configuration mode.
Step 4	Router(config-if)# pvc [<i>PVC-name</i>] <i>vpi</i> / <i>vci</i>	Creates the ATM PVC and virtual path identifier/virtual channel identifier (VPI/VCI). The VCI is a 16-bit field in the header of the ATM cell.
Step 5	Router(config-if)# encapsulation aal5mux fr-atm-srv	Configures the ATM adaption layer (AAL) and encapsulation type for the ATM PVC.

Command or Action	Purpose
<p>Step 6 Router(config)# connect <i>connection-name FR-interface FR-DLCI ATM-interface ATM-vpi / vci service-interworking</i></p>	<p>Creates a connection to connect the Frame Relay DLCI to the ATM PVC and configures FRF.8 encapsulation.</p>
<p>Step 7 Do one of the following:</p> <ul style="list-style-type: none"> • Router(config-frf8)# clp-bit {0 1 map-de} • • • <p>Example:</p> <pre>Router(config-frf8)# de-bit {0 1 map-clp</pre> <p>Example:</p> <p>Example:</p> <p>Example:</p> <p>Example:</p> <pre>Router(config-frf8)# efci-bit {0 map-fecn</pre>	<p>(On Cisco MC3810, 2600 series, and 3600 series routers only) Sets the ATM cell loss priority (CLP) field in the ATM cell header.</p> <p>(On Cisco MC3810, 2600 series, and 3600 series routers only) Sets the Frame Relay discard eligible (DE) bit field in the Frame Relay cell header.</p> <p>(On Cisco MC3810, 2600 series, and 3600 series routers only) Sets the explicit forward congestion indication (EFCI) bit field in the ATM cell header.</p>
<p>Step 8 Router(config-frf8)# service translation</p>	<p>Enables upper layer user protocol encapsulation for Frame Relay-to-ATM service interworking.</p>
<p>Step 9 Router(config-frf8)# end</p>	<p>Ends configuration mode and enters EXEC mode.</p> <p>Use the exit command to exit a submode and reenter global configuration command mode.</p>

To disconnect the FRF.8 interworking connection, use the **shutdown** connect subcommand.

Verifying FRF.8 Configuration

To verify correct configuration of the Frame Relay-to-ATM Service Interworking (FRF.8) feature, perform the following tasks:

SUMMARY STEPS

1. Enter the **show connect id** EXEC command to view information, including interworking parameters set, about the specified connection identifier:
2. Enter the **show connect port** EXEC command to view information about the connection on a specific interface:
3. Enter the **show frame-relay pvc** EXEC command to view statistics about Frame Relay interfaces:
4. Enter the **show atm pvc** EXEC command to view ATM PVCs and statistics:

DETAILED STEPS

Step 1 Enter the **show connect id** EXEC command to view information, including interworking parameters set, about the specified connection identifier:

Example:

```
Router# show connect id 10
FR/ATM Service Interworking Connection: service-1
  Status      - UP
  Segment 1 - Serial1/0 DLCI 16
  Segment 2 - ATM3/0 VPI 1 VCI 32
Interworking Parameters -
  service translation
  efci-bit 0
  de-bit map-clp
  clp-bit map-de
```

Step 2 Enter the **show connect port** EXEC command to view information about the connection on a specific interface:

Example:

```
Router# show connect port atm3/0
ID Name          Segment 1          Segment 2          State
=====
10 service-1      Serial1/0 16      ATM3/0 1/32        UP
```

Step 3 Enter the **show frame-relay pvc** EXEC command to view statistics about Frame Relay interfaces:

Example:

```
Router# show frame-relay pvc
PVC Statistics for interface Serial1/0 (Frame Relay DCE)
      Active      Inactive      Deleted      Static
Local          0              0              0              0
Switched       1              0              0              0
Unused         0              0              0              0
DLCI = 18, DLCI USAGE = FRF.5, PVC STATUS = ACTIVE, INTERFACE =
Serial1/0
  input pkts 22          output pkts 21          in bytes 2140
  out bytes 2110        dropped pkts 0          in FECN pkts 0
  in BECN pkts 0        out FECN pkts 0        out BECN pkts 0
  in DE pkts 0          out DE pkts 0
  out bcast pkts 0      out bcast bytes 0      Num Pkts
Switched 22
  pvc create time 02:02:49, last time pvc status changed 02:02:42
```

Step 4 Enter the **show atm pvc** EXEC command to view ATM PVCs and statistics:

Example:

```

Router# show atm pvc
          VCD/
Interface Name  VPI  VCI  Type  Encaps  SC      Peak  Avg/Min  Burst  Sts
3/0       10    1    32   PVC    FRATMSRV  UBR   155000

```

Monitoring and Maintaining Frame Relay-to-ATM Interworking

To display the status of the virtual circuits and the Frame Relay-to-ATM interworking connections, use any of the following commands in EXEC mode

Command	Purpose
Router# show atm pvc [signalling interface <i>vcd</i>]	Displays all ATM PVCs, switched virtual circuits (SVCs), and traffic information. Use the signalling keyword to display ATM interface signalling information for all interfaces. Use the interface keyword to display all PVCs and SVCs on the interface or subinterface. Use the <i>vcd</i> argument to specify the ATM VCD number (1-1023) about which to display information.
Router# show connect [all <i>element</i> <i>ID</i> <i>name</i> <i>port</i>]	Displays connection statistics. Use the optional all keyword to display statistics about all connections. Use the optional <i>element</i> , <i>ID</i> , <i>name</i> , and <i>port</i> arguments to display particular connection details.
Router# show frame-relay pvc	Displays statistics about Frame Relay interfaces.
Router# show vc-group	Displays the names of all VC groups.

Configuration Examples for Frame Relay-ATM Interworking

- [FRF.5 One-to-One Connection Example, page 11](#)
- [FRF.5 Many-to-One Connection Example, page 12](#)
- [FRF.8 Service Interworking Example, page 12](#)

FRF.5 One-to-One Connection Example

The following example shows how to configure an FRF.5 one-to-one connection:

```

! Configure a switched Frame Relay DLCI
!
interface serial0
 frame-relay interface-dlci 100 switched
!
! Configure ATM PVC with FRF.5 encapsulation

```

```

!
interface atm3/0
 pvc 0/32
  encapsulation aal5mux frame-relay
!
! Create a connection to connect Frame Relay DLCI 100 to ATM PVC 0/32
!
connect serial0 100 atm3/0 0/32 network-interworking
 clp-bit 1
 de-bit map-clp

```

**Note**

Congestion management parameters are not available for Frame Relay-ATM Interworking on the Cisco 7200 series routers.

FRF.5 Many-to-One Connection Example

The following example shows how to configure an FRF.5 many-to-one connection:

```

! Configure a Frame Relay VC group
!
! The vc-group command assigns Frame Relay DLCI 16, 17, 18,
! and 19 to a VC group named 'friends'.
!
vc-group friends
 serial0 16 16
 serial0 17 17
 serial0 18 18
 serial0 19 19
!
! Configure an ATM PVC with FRF.5 encapsulation
!
interface atm3/0
 pvc 0/32
  encapsulation aal5mux frame-relay
!
! Create a connection which connects VC group 'friends' to ATM PVC 0/32
! and configure FR DE field mapping to match ATM CLP field
!
connect vc-group friends atm3/0 0/32
 de-bit map-clp

```

**Note**

Congestion management parameters are not available for Frame Relay-ATM Interworking on the Cisco 7200 series routers.

FRF.8 Service Interworking Example

The following example shows how to configure an FRF.8 service interworking connection:

```

! Configure a switched Frame Relay DLCI
!
interface serial 0
 frame-relay interface-dlci 100 switched
!
! Configure an ATM PVC with FRF.8 encapsulation
!
interface atm1/0
 pvc 0/32
  encapsulation aal5mux fr-atm-srv
!
! Create a connection that connects Frame Relay DLCI 100 to ATM PVC 1/32

```

```
!  
connect service-1 Serial0 100 ATM3/0 0/32 service-interworking  
efci-bit map-fecn
```

**Note**

Congestion management parameters are not available for Frame Relay-ATM Interworking on the Cisco 7200 series routers.

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