Frame Relay to ATM Service Interworking (FRF.8) on the 7200 Series Router Using Inverse Multiplexing Over ATM (IMA)

Document ID: 42147

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Introduction

The Broadband Forum (formerly the Frame Relay Forum) defines the Frame Relay–to–ATM service interworking function in its FRF.8 implementation agreement. A typical configuration of FRF.8 consists of a Frame Relay endpoint, an ATM endpoint, and an interworking (IWF) device. A Cisco 7200 series router with a PA–A3 port adapter can provide the interworking functions as of Cisco IOS® Software Release 12.1(5)T. Cisco 2600 and 3600 series routers and the MC3810 also can provide the interworking functions as well. The Frame Relay–to–ATM Service Interworking (FRF.8) feature benefits internet service providers that need to link Frame Relay and ATM networks, especially those networks with ATM backbones and Frame Relay end users.

Inverse Multiplexing over ATM (IMA) is a Broadband Forum specification (af–phy–0086.000). It involves inverse multiplexing and de–multiplexing of ATM cells in a cyclical fashion among physical links grouped to form a higher–bandwidth and logical link. The rate of the logical link is approximately the sum of the rate of the physical links in the IMA group. Streams of cells are distributed in a round–robin manner across the multiple T1/E1 links and reassembled at the destination to form the original cell stream. Sequencing is provided using IMA Control Protocol (ICP) cells.

This document presents a sample configuration for FRF.8 on a 7200 series router with a PA–8T1–IMA.

Prerequisites

Requirements

Before attempting this configuration, ensure that you meet these requirements:

- Understand router configurations for both Frame–Relay and ATM / IMA.
- Familiar with encapsulation types, frame, cell formats and layer 1 troubleshooting.
- Understand cabling.
Related topics not covered in this document can be found in the Related Information section at the end of this document and are indicated throughout.

**Components Used**

This document is not restricted to specific software and hardware versions outside of the feature requirements. The following list of equipment was used for this document. The hardware and software used are for example only and not a recommendation for actual network topologies. Consult your Cisco SE for product placement and software decisions.

<table>
<thead>
<tr>
<th>Device Name</th>
<th>Chassis Type</th>
<th>NI</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR_Router</td>
<td>2610</td>
<td>WIC-1DSU-T1=</td>
<td>12.2(13)T1</td>
</tr>
<tr>
<td>Frame Relay Switch (Not pictured)</td>
<td>2610</td>
<td>WIC-1DSU-T1=</td>
<td>12.2(5d)</td>
</tr>
<tr>
<td>IWF_Router (NPE300)</td>
<td>7206VXR</td>
<td>PA-A3-8T1IMA=, PA-4T1=</td>
<td>12.2(15)T1</td>
</tr>
<tr>
<td>ATM Router</td>
<td>3640</td>
<td>NM-8T1-IMA=</td>
<td>12.2(8)T8</td>
</tr>
</tbody>
</table>

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

**Conventions**

For more information on document conventions, refer to Cisco Technical Tips Conventions.

**Configure**

In this section, you are presented with the information to configure the features described in this document.

**Note:** To find additional information on the commands used in this document, use the Command Lookup Tool (registered customers only).

**Network Diagram**

This document uses this network setup:

![Network Diagram](image)

**Configurations**

This document uses these configurations:

- **FR_Router** (Frame Relay Endpoint)
- Interworking Function **IWF_Router** (FRF8)
### ATM_Router (ATM Endpoint)

- **hostname** FR_Router
  
  - interface Serial0/0
    - ip address 172.16.1.1 255.255.255.240
    - encapsulation frame-relay IETF
    - frame-relay map ip 172.16.1.1 100 broadcast
    - frame-relay map ip 172.16.1.2 100 broadcast
    - frame-relay interface-dlci 100
    - frame-relay lmi-type ansi

  !--- In this example, the frame-relay map statement for 172.16.1.1 is included to allow pings to the local interface from within the router. It is not a requirement.

### FR_Router (Frame Relay Endpoint)

- **hostname** FR_Router
  
  - controller T1 5/0
    - framing esf
    - linecode b8zs
    - channel-group 0 timeslots 1-24

  !--- Configure channel-group for multi-channel port adapters.

  - interface Serial5/0:0
    - no ip address
    - encapsulation frame-relay IETF
    - frame-relay interface-dlci 101 switched
    - frame-relay lmi-type ansi

  ! interface ATM4/0
  - no ip address
  - clock source internal
  - ima-group 0

  !--- Assigns interface ATM4/0 to IMA-GROUP 0.

  - interface ATM4/1
    - no ip address
    - clock source internal
    - ima-group 0

  !--- Assigns interface ATM4/1 to IMA-GROUP 0.

  - interface ATM4/ima0
    - no ip address
    - no atm ilmi-keepalive

  ! interface ATM4/ima0.2 multipoint
    - pvc 10/100
      - encapsulation aal5mux fr-atm-srv
      - ubr 1489

  !--- Refer to Configuring Traffic Shaping on Frame Relay to ATM
connect neko Serial5/0:0 101 ATM4/ima0 10/100 service-interworking

--- Creates a connection to attach Frame-Relay DLCI 101 to ATM PVC 10/100 over a connection named "neko" and configures FRF.8 encapsulation.

--- Refer to Configuring Traffic Shaping on Frame Relay to ATM Service Interworking (FRF.8) PVCs for details on configuring traffic shaping for your PVCs.

### ATM Router (ATM Endpoint)

```
hostname ATM_Router

interface ATM0/0
ima-group 0
!
interface ATM0/1
ima-group 0
!
interface ATM0/IMA0
   no ip address
   no atm ilmi-keepalive
!
interface ATM0/IMA0.2 multipoint
   ip address 172.16.1.2 255.255.255.240
   pvc 10/100
     protocol ip 172.16.1.1
     protocol ip 172.16.1.2

--- In this example, the protocol map statement for 172.16.1.2 is included to allow pings to the local interface from within the router. It is not a requirement.

  ubr 1489

--- Refer to Configuring Traffic Shaping on Frame Relay to ATM Service Interworking (FRF.8) PVCs for details on configuring traffic shaping for your PVCs.
```

**Note:** While configuring the IWF_Router, until the connect statement is issued the VC shows as "INAC" after issuing the `show atm vc` or `show atm pvc vpi/vci` commands. Also, the Frame Relay DLCI does not show listed after issuing the `show frame pvc` command (see output below). The reason for this is that FRF.8 is providing a "cross-connect" between two interfaces; the connection is not valid until they are linked by the `connect (global level)` command.

```
IWF_Router# show atm vc
VCD / Peak Avg/Min Burst
Interface Name VPI VCI Type Encaps SC Kbps Kbps Cells Sts
4/ima0.2  2 10 100 PVC FRATMSRV UBR 1389 INAC

IWF_Router# conf t
Enter configuration commands, one per line. End with CNTL/Z.
IWF_Router(config)# connect neko Serial5/0:0 101 ATM4/ima0 10/100 service-interworking
IWF_Router(config-frf8)# ^Z
IWF_Router# 1d03h: %SYS-5-CONFIG_I: Configured from console by vty0 (Cisco)
IWF_Router# IWF_Router# show atm vc
VCD / Peak Avg/Min Burst
Interface Name VPI VCI Type Encaps SC Kbps Kbps Cells Sts
```

--- Refer to Configuring Traffic Shaping on Frame Relay to ATM Service Interworking (FRF.8) PVCs for details on configuring traffic shaping for your PVCs.
IWF_Router# show frame-relay pvc

PVC Statistics for interface Serial5/0:0 (Frame Relay DTE)
IWF_Router# conf t
IWF_Router(config)# connect neko Serial5/0:0 101 ATM4/ima0 10/100 service-interworking
IWF_Router(config-frf8)# ^Z
IWF_Router#

1d03h: %SYS-5-CONFIG_I: Configured from console by vty0 (171.69.104.116)

IWF_Router# show frame-relay pvc

PVC Statistics for interface Serial5/0:0 (Frame Relay DTE)

<table>
<thead>
<tr>
<th>Active</th>
<th>Inactive</th>
<th>Deleted</th>
<th>Static</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Switched</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unused</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

DLCI = 101, DLCI USAGE = FRF.8, PVC STATUS = ACTIVE, INTERFACE = Serial5/0:0

input pkts 0 output pkts 0 in bytes 0
out bytes 0 dropped pkts 0 in pkts dropped 0
out pkts dropped 0 out bytes dropped 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
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
switched pkts 0
Detailed packet drop counters:
no out intf 0 out intf down 0 no out PVC 0
in PVC down 0 out PVC down 0 pkt too big 0
shaping Q full 0 pkt above DE 0 policing drop 0
pvc create time 00:00:10, last time pvc status changed 00:00:09

Verify

This section provides information you can use to confirm your configuration is working properly.

Certain show commands are supported by the Output Interpreter Tool (registered customers only), which allows you to view an analysis of show command output.

Note: Before issuing debug commands, refer to Important Information on Debug Commands.

- ping and debug ip icmp With this configuration, you should be able to ping and monitor the responses using debug ip icmp.

FR_Router# term mon
FR_Router# debug ip icmp
ICMP packet debugging is on
FR_Router# ping 172.16.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/11/12 ms
FR_Router#
5d03h: ICMP: echo reply rcvd, src 172.16.1.2, dst 172.16.1.1
5d03h: ICMP: echo reply rcvd, src 172.16.1.2, dst 172.16.1.1
5d03h: ICMP: echo reply rcvd, src 172.16.1.2, dst 172.16.1.1
5d03h: ICMP: echo reply rcvd, src 172.16.1.2, dst 172.16.1.1
5d03h: ICMP: echo reply rcvd, src 172.16.1.2, dst 172.16.1.1
FR_Router# un all
All possible debugging has been turned off

ATM_Router# term mon
ATM_Router# debug ip icmp
ICMP packet debugging is on
ATM_Router# ping 172.16.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/10/12 ms
ATM_Router#
04:04:45: ICMP: echo reply rcvd, src 172.16.1.1, dst 172.16.1.2
04:04:45: ICMP: echo reply rcvd, src 172.16.1.1, dst 172.16.1.2
04:04:45: ICMP: echo reply rcvd, src 172.16.1.1, dst 172.16.1.2
04:04:45: ICMP: echo reply rcvd, src 172.16.1.1, dst 172.16.1.2
04:04:45: ICMP: echo reply rcvd, src 172.16.1.2, dst 172.16.1.2
ATM_Router# un all
All possible debugging has been turned off

• show connection name {name}
View information, including the configured interworking parameters, about the specified connection.

IWF_Router# show connection ?
   all       All Connections
   elements  Show Connection Elements
   id        ID Number
   name      Connection Name
   port      Port Number

IWF_Router# show connect all

ID  Name    Segment 1        Segment 2               State
============================================================================
 3   neko    Serial5/0:0 101  ATM4/ima0 10/100        UP

IWF_Router# show connect id 3

FR/ATM Service Interworking Connection: neko
  Status = UP
  Segment 1 = Serial5/0:0 DLCI 101
  Segment 2 = ATM4/ima0 VPI 10 VCI 100
  Interworking Parameters -
      service translation
      efc−bit 0
d−bit map−clp

• show ima interface
The show ima interface atm command provides information about all configured IMA groups or a specific group. Documents for troubleshooting IMA connections are referenced in the Related Information section of this document.

show ima interface atm [slot] /ima[group−number] [detail]

IWF_Router# show ima interface

ATM4/ima0 is up
  ImaGroupState: NearEnd = operational, FarEnd = operational
  ImaGroupFailureStatus = noFailure
IMA Group Current Configuration:
  ImaGroupMinNumTxLinks = 1   ImaGroupMinNumRxLinks = 1
  ImaGroupDiffDelayMax = 25   ImaGroupNetXClkMode = common (ctc)
  ImaGroupFrameLength = 128   ImaTestProcStatus = disabled
  ImaGroupTestLink = 0        ImaGroupTestPattern = 0xFF
IMA Link Information:
ATM_Router# show ima interface

Interface ATM0/IMA0 is up
  Group index is 84
  Ne state is operational, failure status is noFailure
  Active links bitmap 0x3
IMA Group Current Configuration:
  Tx/Rx configured links bitmap 0x3/0x3
  Tx/Rx minimum required links 1/1
  Maximum allowed diff delay is 25ms, Tx frame length 128
  Ne Tx clock mode CTC, configured timing reference link ATM0/0
  Test pattern procedure is disabled
IMA Group Current Counters (time elapsed 372 seconds):
  0 Ne Failures, 0 Fe Failures, 0 Unavail Secs
IMA Group Total Counters (last 32 15 minute intervals):
  2 Ne Failures, 2 Fe Failures, 53 Unavail Secs
IMA link Information:

<table>
<thead>
<tr>
<th>Link</th>
<th>Physical Status</th>
<th>NearEnd Rx Status</th>
<th>Test Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM0/0</td>
<td>up</td>
<td>active</td>
<td>disabled</td>
</tr>
<tr>
<td>ATM0/1</td>
<td>up</td>
<td>active</td>
<td>disabled</td>
</tr>
</tbody>
</table>

show interface atm

The show interface atm command output for a subinterface represents a sum of the per-VC counters on that subinterface. The following sample output of the show interface atm command for a main interface as well as a subinterface. This illustrates that only layer-2 information, such as ATM Adaptation Layer 5 (AAL5) counters and Operations, Administration and Maintenance (OAM) cell counts, is displayed on the subinterface. Since the subinterface counter reflects layer-2 information only, the counters on the main interface and the subinterface may be different. Note that this difference enhances the ability to determine where packets are being dropped. For example, an arriving packet may pass layer-2 checks, such as the AAL5 cyclic redundancy check (CRC), and be forwarded to the main interface where an inbound IP ACL specifies a drop action for the source or destination IP address. This packet would increment the drop counter only on the VC and the subinterface, and not on the main interface.

IWF_Router# show interface atm4/ima0
ATM4/ima0 is up, line protocol is up
  Hardware is IMA PA
  MTU 4470 bytes, sub MTU 4470, BW 3046 Kbit, DLY 20000 usec,
  reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ATM, loopback not set
  Encapsulation(s): AAL5
  1023 maximum active VCs, 1 current VCCs
  VC Auto Creation Disabled.
  VC idle disconnect time: 300 seconds
  0 carrier transitions
  Last input 09:04:45, output 03:39:25, output hang never
  Last clearing of "show interface" counters 08:44:27
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: Per VC Queueing
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
  38289 packets input, 39370916 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  38278 packets output, 39368227 bytes, 0 underruns
  0 output errors, 0 collisions, 0 interface resets
  0 output buffer failures, 0 output buffers swapped out

IWF_Router# show int atm4/ima0.2
ATM4/ima0.2 is up, line protocol is up
show interface atm0/ima0
ATM0/IMA0 is up, line protocol is up
Hardware is ATM IMA
MTU 4470 bytes, sub MTU 4470, BW 3072 Kbit, DLY 20000 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ATM, loopback not set
Encapsulation(s): AAL5
VC idle disconnect time: 300 seconds
Last input 03:38:45, output 03:38:45, output hang never
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: None
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
38285 packets input, 39521963 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
38324 packets output, 39527696 bytes, 0 underruns
0 output errors, 0 collisions, 2 interface resets
0 output buffer failures, 0 output buffers swapped out
show atm vc
Display the router's virtual circuit (VC) table and confirm the ATM PVC is using "FRATMSRV" encapsulation. Notice that the VPI/VCI values in this example are the same. In a back–to–back ATM configuration the same PVC values are used in absence of an ATM switch, which performs the function of switching between virtual connections (VPI/VCI).

show atm pvc
Displays per–vc statistics and allows viewing of packet counters (pre/post–sar) transmitted and received on a virtual circuit. For information on how to manage your PVC with OAM, refer to Using OAM for PVC Management. Otherwise the PVC status always displays "UP", regardless of true PVC status.
show atm pvc 10/100
ATM4/IMA0.2: VCD: 2, VPI: 10, VCI: 10
UBR, PeakRate: 1389
AAL5−FRATMSRV, etype:0x15, Flags: 0x23, VCmode: 0x0
OAM frequency: 0 second(s), OAM retry frequency: 1 second(s)
OAM up retry count: 3, OAM down retry count: 5
OAM Loopback status: OAM Disabled
OAM Managed VC Status: Not Managed
ILMI Managed VC status: Not Managed
InARP DISABLED
Transmit priority 4
InPRoc: 5, OutPRoc: 0, Broadcasts: 0
InFast: 38105, OutFast: 38136, InAS: 0, OutAS: 0
InPktDrops: 0, OutPktDrops: 0/0/0 (holdq/outputq/total)
CrcErrors: 0, SarTimeOuts: 0, OversizedSDUs: 0, LengthViolation: 0, CPIErrors: 0
Out CLP=1 Pkts: 0
OAM cells received: 0
F5 InEndloop: 0, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI: 0
F4 InEndloop: 0, F4 InSegloop: 0, F4 InAIS: 0, F4 InRDI: 0
OAM cells sent: 0
F5 OutEndloop: 0, F5 OutSegloop: 0, F5 OutRDI: 0
F4 OutEndloop: 0, F4 OutSegloop: 0, F4 OutRDI: 0
OAM cell drops: 0
Status: UP

show atm pvc 10/100
ATM0/IMA0.2: VCD: 3, VPI: 10, VCI: 10
UBR, PeakRate: 1489
AAL5−LLC/SNAP, etype:0x0, Flags: 0x20, VCmode: 0x0
OAM frequency: 0 second(s), OAM retry frequency: 1 second(s)
OAM up retry count: 3, OAM down retry count: 5
OAM Loopback status: OAM Disabled
OAM VC state: Not Managed
ILMI VC state: Not Managed
InARP frequency: 15 minutes(s)
Transmit priority 4
InPRoc: 38173, OutPRoc: 38161, Broadcasts: 0
InFast: 9, OutFast: 9, InAS: 0, OutAS: 0
InPktDrops: 0, OutPktDrops: 0/0/0 (holdq/outputq/total)
CrcErrors: 0, SarTimeOuts: 0, OversizedSDUs: 0, LengthViolation: 0, CPIErrors: 0
OAM cells received: 0
F5 InEndloop: 0, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI: 0
F4 InEndloop: 0, F4 InSegloop: 0, F4 InAIS: 0, F4 InRDI: 0
OAM cells sent: 0
F5 OutEndloop: 0, F5 OutSegloop: 0, F5 OutRDI: 0
F4 OutEndloop: 0, F4 OutSegloop: 0, F4 OutRDI: 0
OAM cell drops: 0
Status: UP

show interface serial
Confirm that the interface is configured as the data terminal equipment (DTE). In this example clocking is being provided to both frame relay routers by the Frame−relay switch (not pictured). As a result, both sides are configured for DTE. In a back−to−back configuration, one side needs to be configured for DCE and the other for DTE to ensure proper timing.

show interface s5/0:0
Serial5/0:0 is up, line protocol is up
Hardware is Multichannel T1
MTU 1500 bytes, BW 1536 Kbit, DLY 20000 usec,
reliability 255/255, txload 47/255, rxload 48/255
Encapsulation FRAME−RELAY IETF, crc 16, Data non−inverted
Keepalive set (10 sec)
LMI enq sent 846, LMI stat recv 846, LMI upd recv 0, DTE LMI up
LMI enq recv 0, LMI stat sent 0, LMI upd sent 0
LMI DLCI 0 LMI type is ANSI Annex D frame relay DTE
FR SVC disabled, LAPF state down
Broadcast queue 0/64, broadcasts sent/dropped 0/0, interface broadcasts 0
Last input 00:00:02, output 00:00:00, output hang never
Last clearing of "show interface" counters 02:20:54
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)

Conversations 0/1/16 (active/max active/max total)
Reserved Conversations 0/0 (allocated/max allocated)
Available Bandwidth 1152 kilobits/sec

5 minute input rate 291000 bits/sec, 50 packets/sec
5 minute output rate 289000 bits/sec, 50 packets/sec

24221 packets input, 24052050 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort

24150 packets output, 23900260 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 output buffer failures, 0 output buffers swapped out
0 carrier transitions

no alarm present
Timeslot(s) Used: 1-24, subrate: 64Kb/s, transmit delay is 0 flags

FR_Router# show interface s0/0
Serial0/0 is up, line protocol is up
Hardware is PQUICC with Fractional T1 CSU/DSU
Internet address is 172.16.1.1/28
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
reliability 255/255, txload 62/255, rxload 62/255
Encapsulation FRAME−RELAY IETF, loopback not set
Keepalive set (10 sec)
LMI enq sent 43280, LMI stat recvd 43264, LMI upd recvd 0, DTE LMI up
LMI enq recvd 12, LMI stat sent 0, LMI upd sent 0
LMI DLCI 0 LMI type is ANSI Annex D frame relay DTE
Broadcast queue 0/64, broadcasts sent/dropped 5722/0, interface broadcasts 0
Last input 00:00:00, output 00:00:00, output hang never
Last clearing of "show interface" counters 5d00h
Input queue: 1/75/1/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)

Conversations 0/1/256 (active/max active/max total)
Reserved Conversations 0/0 (allocated/max allocated)
Available Bandwidth 1158 kilobits/sec

5 minute input rate 379000 bits/sec, 49 packets/sec
5 minute output rate 381000 bits/sec, 49 packets/sec

85211 packets input, 39422145 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 2 giants, 0 throttles
2561 input errors, 655 CRC, 1866 frame, 0 overrun, 0 ignored, 38 abort

85426 packets output, 39745386 bytes, 0 underruns
0 output errors, 0 collisions, 11 interface resets
0 output buffer failures, 0 output buffers swapped out
1 carrier transitions

DCE=up DSR=up DTR=up RTS=up CTS=up

FR_Router# show frame-relay lmi
LMI Statistics for interface Serial1/0 (Frame Relay DTE) LMI TYPE = ANSI
Invalid Unnumbered info 0
Invalid Prot Disc 0
Invalid dummy Call Ref 0
Invalid Msg Type 0
Invalid Status Message 0
Invalid Lock Shift 0
Invalid Information ID 0
Invalid Report IE Len 0
Invalid Report Request 0
Invalid Keep IE Len 0
Num Status Enq. Sent 43307
Num Status msgs Rcvd 43291
Num Update Status Rcvd 0
Num Status Timeouts 16
IWF_Router# show frame-relay lmi

LMI Statistics for interface Serial5/0:0 (Frame Relay DTE) LMI TYPE = ANSI
Invalid Unnumbered info 0         Invalid Prot Disc 0
Invalid dummy Call Ref 0           Invalid Msg Type 0
Invalid Status Message 0           Invalid Lock Shift 0
Invalid Information ID 0           Invalid Report IE Len 0
Invalid Report Request 0           Invalid Keep IE Len 0
Num Status Enq. Sent 910           Num Status msgs Rcvd 910
Num Update Status Rcvd 0           Num Status Timeouts

IWF_Router# show frame-relay pvc

PVC Statistics for interface Serial5/0:0 (Frame Relay DTE)

<table>
<thead>
<tr>
<th>Active</th>
<th>Inactive</th>
<th>Deleted</th>
<th>Static</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Switched</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unused</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

DLCI = 101, DLCI USAGE = FRF.8, PVC STATUS = ACTIVE, INTERFACE = Serial5/0:0

input pkts 38131 output pkts 38104 in bytes 39353832
out bytes 39200552 dropped pkts 0 in pkts dropped 0
out pkts dropped 0 out bytes dropped 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
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec

switched pkts 38131
Detailed packet drop counters:
no out intf 0 out intf down 0 no out PVC 0
in PVC down 0 out PVC down 0 pkt too big 0
shaping Q full 0 pkt above DE 0 policing drop 0
pvc create time 01:02:23, last time pvc status changed 01:02:23

FR_Router# show frame-relay pvc

PVC Statistics for interface Serial0/0 (Frame Relay DTE)

<table>
<thead>
<tr>
<th>Active</th>
<th>Inactive</th>
<th>Deleted</th>
<th>Static</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Switched</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unused</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

DLCI = 100, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0/0

input pkts 38207 output pkts 38272 in bytes 39160532
out bytes 39215788 dropped pkts 0 in pkts dropped 0
out pkts dropped 0 out bytes dropped 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 2 out bcast bytes 68
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
pvc create time 06:11:46, last time pvc status changed 02:44:54
Troubleshoot

This section provides information you can use to troubleshoot your configuration.

Troubleshooting Commands

Certain `show` commands are supported by the Output Interpreter Tool (registered customers only), which allows you to view an analysis of `show` command output.

**Note:** Before issuing `debug` commands, refer to Important Information on Debug Commands.

- **debug frame lmi** Confirm incrementing out and in LMI packets. The following output was generated on the FR_Router. Notice that the sequence numbers increment for each transmit and the sequence number seen from the switch does the same. For more information on troubleshooting LMI, please refer to the Related Information section of this document.

```
FR_Router# term mon
FR_Router# debug frame lmi
Frame Relay LMI debugging is on
Displaying all Frame Relay LMI data
FR_Router#
5d04h: Serial0/0(out): StEnq, myseq 140, yourseen 139, DTE up
5d04h: datagramstart = 0x2C01254, datagramsize = 14
5d04h: FR encap = 0x000103085d04h: 00 75 95 01 01 01 03 02 8C 8B
5d04h:
5d04h: Serial0/0(in): Status, myseq 140
5d04h: RT IE 1, length 1, type 1
5d04h: KA IE 3, length 2, yourseq 140, myseq 140
5d04h: Serial0/0(out): StEnq, myseq 141, yourseen 140, DTE up
5d04h: datagramstart = 0x2C014D4, datagramsize = 14
5d04h: FR encap = 0x00010308
5d04h: 00 75 95 01 01 01 03 02 8D 8C
5d04h:
5d04h: Serial0/0(in): Status, myseq 141
5d04h: RT IE 1, length 1, type 1
5d04h: KA IE 3, length 2, yourseq 141, myseq 141
FR_Router#
FR_Router# un all
All possible debugging has been turned off
```

- **debug atm packet interface atm vpi vci** and **debug frame-relay packet** Capture a packet-level decode on the particular endpoint. Extreme caution should be used when debugging with these commands. As you will see, a lot of output will be generated. Note when viewing, the debug direction of traffic is indicated with (O) for outbound and (I) for inbound. Since the atm debugging decodes the entire packet (post-sar) we can now tell the the first (I) inbound is a routed packet with source of 172.16.1.1 and destination 172.16.1.2 over VPI 10 VCI 100. Note the payload portion is ABCD, this is the default for ping on Cisco routers. The payload can be changed with the extended ping command.

<table>
<thead>
<tr>
<th>Hex</th>
<th>Binary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>AC 10 01 01</td>
</tr>
<tr>
<td></td>
<td>172.16.1.1</td>
</tr>
<tr>
<td>Destination</td>
<td>AC 10 01 02</td>
</tr>
<tr>
<td></td>
<td>172.16.1.2</td>
</tr>
<tr>
<td>VPI</td>
<td>0xA</td>
</tr>
<tr>
<td>VCI</td>
<td>0x64</td>
</tr>
</tbody>
</table>

ATM_Router# term mon
ATM_Router#debug atm packet int atm0/ima0.2
ATM packets debugging is on
Displaying packets on interface ATM0/IMA0.2 only
ATM_Router# 04:37:43: ATM0/IMA0.2(I):
VCD:0x3 VPI:0xA VCI:0x64 Type:0x0 SAP:AAAA CTL:03 OUI:0000000 TYPE:0800 Length:0x70
04:37:43: 4500 0064 605B 0000 FE01 021A AC10 0101 AC10 0102 0800 BAD8 1F72 03CF 0000
04:37:43: ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD
04:37:43: ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD
04:37:43: ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD
04:37:43: ABCD ABCD ABCD ABCD ABCD
04:37:43:
04:37:43: ATM0/IMA0.2(O):
VCD:0x3 VPI:0xA VCI:0x64 DM:0x100 SAP:AAAA CTL:03 OUI:0000000 TYPE:0800 Length:0x70
04:37:43: 4500 0064 605B 0000 FF01 011A AC10 0102 AC10 0101 0000 C2D8 1F72 03CF 0000
04:37:43: ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD
04:37:43: ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD
04:37:43: ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD
04:37:43: ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD ABCD
04:37:43: <balance of output omitted>
ATM_Router# un all
All possible debugging has been turned off
FR_Router# term mon
FR_Router# debug frame-relay packet int s0/0
Frame Relay packet debugging is on
Displaying packets on interface Serial0/0 only
FR_Router# ping 172.16.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/17/20 ms
FR_Router# 5d04h: Serial0/0(o): dlci 100(0x1841), NLPID 0x3CC(IP), datagramsize 104
5d04h: Serial0/0(i): dlci 100(0x1841), NLPID 0x3CC(IP), datagramsize 104
5d04h: Serial0/0(o): dlci 100(0x1841), NLPID 0x3CC(IP), datagramsize 104
5d04h: Serial0/0(i): dlci 100(0x1841), NLPID 0x3CC(IP), datagramsize 104
5d04h: Serial0/0(o): dlci 100(0x1841), NLPID 0x3CC(IP), datagramsize 104
5d04h: Serial0/0(i): dlci 100(0x1841), NLPID 0x3CC(IP), datagramsize 104
5d04h: Serial0/0(o): dlci 100(0x1841), NLPID 0x3CC(IP), datagramsize 104
5d04h: Serial0/0(i): dlci 100(0x1841), NLPID 0x3CC(IP), datagramsize 104
5d04h: Serial0/0(o): dlci 100(0x1841), NLPID 0x3CC(IP), datagramsize 104
5d04h: Serial0/0(i): dlci 100(0x1841), NLPID 0x3CC(IP), datagramsize 104
FR_Router# un all
All possible debugging has been turned off

Changing the Data pattern for ping

FR_Router# ping ip
Target IP address: 172.16.1.2
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y
Source address or interface:
Type of service [0]:
Set DF bit in IP header? [no]:
Validate reply data? [no]:
Data pattern [0xABCD]:

Further interface-specific troubleshooting tips can be found in technology related documents below.
Related Information

- ATM Technology Support
- Frame Relay–to–ATM Service Interworking (FRF.8)
- ATM to Frame Relay Interworking Technology Support
- Using OAM for PVC Management
- Why Can't I Ping My ATM Interface?
- Configuring Traffic Shaping on Frame Relay to ATM Service Interworking (FRF.8) PVCs
- Inverse Multiplexing over ATM (IMA) Technology Support
- Inverse Multiplexing Over ATM (IMA) on Cisco 2600 and 3600 Routers
- Inverse Multiplexing Over ATM on Cisco 7X00 Routers and ATM Switches
- Troubleshooting ATM Links on the 7x00 IMA Port Adapter
- Troubleshooting ATM IMA Links on Cisco 2600 and 3600 Routers
- Frame Relay Switching Diagnostics and Troubleshooting
- Using debug frame-relay lmi
- Tools & Resources – Cisco Systems (registered customers only)
- Technical Support & Documentation – Cisco Systems