



# Frame Relay Switching Diagnostics and Troubleshooting

---

This feature module describes the Frame Relay Switching Diagnostics and Troubleshooting feature. It includes information on the benefits of the new feature, supported platforms, related documents, and more.

This document includes the following sections:

- Feature Overview, page 1
- Supported Platforms, page 2
- Supported Standards, MIBs, and RFCs, page 2
- Configuration Tasks, page 2
- Monitoring and Maintaining Frame Relay Switching, page 3
- Configuration Examples, page 3
- Command Reference, page 3
- Debug Commands, page 10

## Feature Overview

The Frame Relay Switching Diagnostics and Troubleshooting feature enhances Frame Relay switching functionality by providing tools to diagnose problems in switched Frame Relay networks.

Before this feature was introduced, the **show frame-relay pvc** command displayed the number of packets dropped from switched permanent virtual circuits (PVCs). With the Frame Relay Switching Diagnostics and Troubleshooting feature, the **show frame-relay pvc** command has been enhanced so that in addition to the number of packets dropped, it now displays detailed reasons why packets were dropped. The command has also been enhanced to display the local PVC status, the Network-to-Network (NNI) PVC status, and the overall PVC status.

If a problem is observed, the new **debug frame-relay switching** command can be used to display the status of packets on switched PVCs at regular intervals. This new debug command displays information such as the number of packets that were switched, why packets were dropped, and changes in status of physical links and PVCs. Debug information is displayed only when there has been a change from one configured interval to the next.

## Benefits

The Frame Relay Switching Diagnostics and Troubleshooting feature provides tools for diagnosing problems in switched Frame Relay networks. If packets are being dropped from switched PVCs, network administrators can use these tools to quickly find out why. In addition, the NNI status display has been enhanced to give a more accurate picture of overall PVC health.

## Restrictions

The Frame Relay Switching Diagnostics and Troubleshooting feature is not supported on terminated PVCs.

## Related Documents

*Cisco IOS Wide-Area Networking Configuration Guide*, Release 12.0

*Cisco IOS Wide-Area Networking Command Reference*, Release 12.0

## Supported Platforms

Cisco 12000 series

## Supported Standards, MIBs, and RFCs

### Standards

No new or modified standards are supported by this feature.

### MIBs

No new or modified MIBs are supported by this feature.

For descriptions of supported MIBs and how to use MIBs, see the Cisco MIB web site on Cisco Connection Online (CCO) at <http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>.

### RFCs

No new or modified RFCs are supported by this feature.

## Configuration Tasks

None.

# Monitoring and Maintaining Frame Relay Switching

To diagnose problems in switched Frame Relay networks, use one or both of the following privileged EXEC commands:

Command	Purpose
Router# <code>show frame-relay pvc</code>	Displays statistics about PVCs for Frame Relay interfaces.
Router# <code>debug frame-relay switching</code>	Displays debug messages for switched Frame Relay PVCs.

## Configuration Examples

None.

## Command Reference

This section documents modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.0 command reference publications.

# show frame-relay pvc

To display statistics about PVCs for Frame Relay interfaces, use the **show frame-relay pvc** EXEC command.

```
show frame-relay pvc [type] [number] [dlci]
```

Syntax Description		
	<i>type</i>	(Optional) Interface type.
	<i>number</i>	(Optional) Interface number.
	<i>dlci</i>	(Optional) One of the specific DLCI numbers used on the interface. Statistics for the specified PVC display when a DLCI is also specified.

Command Modes	
	EXEC

Command History	Release	Modification
	10.0	This command was introduced.
	12.0(12)S	This command was modified to display reasons for packet drops and complete PVC status information for switched PVCs.

## Usage Guidelines

### Statistics Reporting

To obtain statistics about PVCs on all Frame Relay interfaces, use this command with no arguments. Per-VC counters are not incremented at all when either autonomous or SSE switching is configured; therefore, PVC values will be inaccurate if either switching method is used.

### DCE, DTE, and Logical Interfaces

When the interface is configured as a DCE and the data-link connection identifier (DLCI) usage is SWITCHED, the value displayed in the PVC STATUS field is determined by the status of outgoing interfaces (up or down) and the status of the outgoing PVC. The status of the outgoing PVC is updated in the Local Management Interface (LMI) message exchange. PVCs terminated on a DCE interface use the status of the interface to set the PVC STATUS.

In the case of a hybrid DTE switch, the PVC status on the DTE side is determined by the PVC status reported by the external Frame Relay network through the LMI.

If the outgoing interface is a tunnel, the PVC status is determined by what is learned from the tunnel.

### Traffic Shaping

Congestion control mechanisms are currently not supported on switched PVCs, but the switch passes forward explicit congestion notification (FECN) bits, backward explicit congestion notification (BECN) bits, and discard eligibility (DE) bits unchanged from entry to exit points in the network.

If an LMI status report indicates that a PVC is not active, then it is marked as inactive. A PVC is marked as deleted if it is not listed in a periodic LMI status message.

## Examples

## Switched PVC Example

Following is sample output from the **show frame-relay pvc** command for a switched Frame Relay PVC:

```
FRSW-2# show frame-relay pvc 16

PVC Statistics for interface POS5/0 (Frame Relay NNI)

DLCI = 16, DLCI USAGE = SWITCHED, PVC STATUS = INACTIVE, INTERFACE = POS5/0
LOCAL PVC STATUS = INACTIVE, NNI PVC STATUS = ACTIVE

input pkts 0          output pkts 0          in bytes 0
out bytes 0           dropped pkts 100       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 pkts 0     out bcast bytes 0
switched pkts 0
Detailed packet drop counters:
no out intf 0        out intf down 100     no out PVC 0
in PVC down 0       out PVC down 0        pkt too big 0
pvc create time 00:25:32, last time pvc status changed 00:06:31
```

Table 1 describes the fields shown in the display relevant switched PVCs.

**Table 1** *show frame-relay pvc* Field Descriptions for Switched PVCs

Field	Description
PVC STATUS	Status of the PVC. The DCE device reports the status, and the DTE device receives the status. The PVC status is exchanged using the LMI protocol: <ul style="list-style-type: none"> <li>ACTIVE—The PVC is operational and can transmit packets.</li> <li>INACTIVE—The PVC is configured, but down.</li> <li>DELETED—The PVC is not present (DTE device only), which means that no status is received from the LMI protocol.</li> </ul> <p>If the <b>frame-relay end-to-end keepalive</b> command is used, the end-to-end keepalive (EEK) status is reported in addition to the LMI status. For example:</p> <ul style="list-style-type: none"> <li>ACTIVE (EEK UP) —The PVC is operational according to LMI and end-to-end keepalives.</li> <li>ACTIVE (EEK DOWN)—The PVC is operational according to LMI, but end-to-end keepalive has failed.</li> </ul>
LOCAL PVC STATUS <sup>1</sup>	Status of PVC locally configured on the NNI interface.
NNI PVC STATUS <sup>1</sup>	Status of PVC learned over the NNI link.
no out intf <sup>2</sup>	Number of packets dropped because there is no output interface.
out intf down <sup>2</sup>	Number of packets dropped because the output interface is down.
no out PVC <sup>2</sup>	Number of packets dropped because the outgoing PVC is not configured.
in PVC down <sup>2</sup>	Number of packets dropped because the incoming PVC is inactive.
out PVC down <sup>2</sup>	Number of packets dropped because the outgoing PVC is inactive.
pkt too big <sup>2</sup>	Number of packets dropped because the packet size is greater than media maximum transmission unit (MTU).

## ■ show frame-relay pvc

- 1 The LOCAL PVC STATUS and NNI PVC STATUS fields are displayed only for PVCs configured on Frame Relay NNI interface types. These fields are not displayed if the PVC is configured on DCE or DTE interface types.
- 2 The detailed packet drop fields are displayed for switched Frame Relay PVCs only. These fields are not displayed for terminated PVCs.

### DCE Interface with Traffic Shaping

The following is sample output from the **show frame-relay pvc** command:

```
Router# show frame-relay pvc
PVC Statistics for interface Serial (Frame Relay DCE)

DLCI = 22, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial3/1:1.1

input pkts 9   output pkts 300008   in bytes 2754
out bytes 161802283   dropped pkts 0   in FECN pkts 0
in BECN pkts 1   out FECN pkts 0   out BECN pkts 0
in DE pkts 0   out DE pkts 0
outbcast pkts 0   outbcast bytes 0
  Shaping adapts to ForeSight   in ForeSight signals 1304
  pvc create time 1d05h, last time pvc status changed 00:11:00
```

If the circuit is configured for shaping to adapt to BECN, it is indicated in the display:

```
Shaping adapts to BECN
```

If traffic shaping on the circuit does not adapt to either BECN or ForeSight, nothing extra shows:

```
DLCI = 100, DLCI USAGE = SWITCHED, PVC STATUS = ACTIVE

input pkts 0   output pkts 0   in bytes 0
out bytes 0   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
outbcast pkts 0   outbcast bytes 0
pvc create time 0:03:03 last time pvc status changed 0:03:03
  Num Pkts Switched 0
```

### Multipoint Subinterfaces Example

The following is sample output from the **show frame-relay pvc** command for multipoint subinterfaces. The output displays both the subinterface number and the DLCI. This display is the same whether the PVC is configured for static or dynamic addressing.

```
DLCI = 300, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.103

input pkts 10   output pkts 7   in bytes 6222
out bytes 6034   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
outbcast pkts 0   outbcast bytes 0
pvc create time 0:13:11 last time pvc status changed 0:11:46

DLCI = 400, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.104

input pkts 20   output pkts 8   in bytes 5624
out bytes 5222   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
outbcast pkts 0   outbcast bytes 0
pvc create time 0:03:57 last time pvc status changed 0:03:48
```

Table 2 describes the fields shown in the displays.

**Table 2** *show frame-relay pvc Field Descriptions*

Field	Description
DLCI	One of the DLCI numbers for the PVC.
DLCI USAGE	Lists SWITCHED when the router or access server is used as a switch, or LOCAL when the router or access server is used as a DTE.
PVC STATUS	<p>Status of the PVC. The DCE device reports the status, and the DTE device receives the status. When you disable the Local Management Interface (LMI) mechanism on the interface (by using the <b>no keepalive</b> command), the PVC status is STATIC. Otherwise, the PVC status is exchanged using the LMI protocol:</p> <ul style="list-style-type: none"> <li>• STATIC—LMI is disabled on the interface.</li> <li>• ACTIVE— The PVC is operational and can transmit packets.</li> <li>• INACTIVE—The PVC is configured, but down.</li> <li>• DELETED—The PVC is not present (DTE device only), which means that no status is received from the LMI protocol.</li> </ul> <p>If the <b>frame-relay end-to-end keepalive</b> command is used, the end-to-end keepalive (EEK) status is reported in addition to the LMI status. For example:</p> <ul style="list-style-type: none"> <li>• ACTIVE (EEK UP) —The PVC is operational according to LMI and end-to-end keepalives.</li> <li>• ACTIVE (EEK DOWN)—The PVC is operational according to LMI, but end-to-end keepalive has failed.</li> </ul>
INTERFACE = Serial0.103	Specific subinterface associated with this DLCI.
input pkts	Number of packets received on this PVC.
output pkts	Number of packets sent on this PVC.
in bytes	Number of bytes received.
out bytes	Number of bytes sent.
dropped pkts	Number of packets dropped by the router at Frame Relay level because an active outbound DLCI was not found.
in FECN pkts	Number of packets received with the FECN bit set.
in BECN pkts	Number of packets received with the BECN bit set.
out FECN pkts	Number of packets sent with the FECN bit set.
out BECN pkts	Number of packets sent with the BECN bit set.
in DE pkts	Number of DE packets received.
out DE pkts	Number of DE packets sent.
outcast pkts	Number of output broadcast packets.
outcast bytes	Number of output broadcast bytes.
pvc create time	Time the PVC was created.

**Table 2** *show frame-relay pvc Field Descriptions*

Field	Description
last time pvc status changed	Time the PVC changed status (active to inactive).
Num Pkts Switched	Number of packets switched within the router or access server; this PVC is the source PVC.

1 DLCI = data-link connection identifier.

### DTE Interface Without Traffic Shaping Example

The following is sample output from the **show frame-relay pvc** command with no traffic shaping configured on the interface.

```
Router# show frame-relay pvc

PVC Statistics for interface Serial1 (Frame Relay DTE)

DLCI = 100, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial1

  input pkts 0          output pkts 0          in bytes 0
  out bytes 0          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 pkts 0     out bcast bytes 0
```

### DTE Interface With Traffic Shaping Example

The following is sample output from the **show frame-relay pvc** command when traffic shaping is in effect:

```
Router# show frame-relay pvc

PVC Statistics for interface Serial1 (Frame Relay DTE)

DLCI = 101, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial1
input pkts 14046   output pkts 4339   in bytes 960362
  out bytes 675566   dropped pkts 0       in FECN pkts 0
  in BECN pkts 148   out FECN pkts 0     out BECN pkts 0
  in DE pkts 44      out DE pkts 0
  out bcast pkts 4034      out bcast bytes 427346
pvc create time 11:59:29, last time pvc status changed 11:59:29
CIR 64000          BC 8000           BE 1600           limit 2000         interval 125
mincir 32000       byte incremen 500           BECN response yes
pkts 9776          bytes 838676       pkts delayed 0     bytes delayed 0
shaping inactive

List Queue Args
1      4      byte-count 100
  Output queues: (queue #: size/max/drops)
    0: 0/20/0 1: 0/20/0 2: 0/20/0 3: 0/20/0 4: 0/20/0
    5: 0/20/0 6: 0/20/0 7: 0/20/0 8: 0/20/0 9: 0/20/0
   10: 0/20/0 11: 0/20/0 12: 0/20/0 13: 0/20/0 14: 0/20/0
   15: 0/20/0 16: 0/20/0
```

Table 3 describes the additional fields shown in the display when traffic shaping is in effect.

**Table 3** *show frame-relay pvc Field Descriptions with Traffic Shaping in Effect*

Field	Description
CIR	Current CIR <sup>1</sup> , in bits per second.
BC	Current Bc <sup>2</sup> , in bits.
BE	Current Be <sup>3</sup> , in bits.
limit	Maximum number of bytes transmitted per internal interval (excess plus sustained).
interval	Interval being used internally (may be smaller than the interval derived from Bc/CIR; this happens when the router determines that traffic flow will be more stable with a smaller configured interval).
mincir	Minimum CIR for the PVC.
inremen	Number of bytes that will be sustained per internal interval.
BECN response	Frame Relay has BECN Adaptation configured.
List Queue Args	Identifier and parameter values for a custom queue list defined for the PVC. These identifiers and values correspond to the command <b>queue-list 1 queue 4 byte-count 100</b> .
Output queues	Output queues used for the PVC, with the current size, the maximum size, and the number of dropped frames shown for each queue.

- 1 CIR = committed information rate.
- 2 Bc = committed burst size.
- 3 Be = excess burst size.

# Debug Commands

This section documents the new **debug** command related to the Frame Relay Switching Diagnostics and Troubleshooting feature.

# debug frame-relay switching

To display debug messages for switched Frame Relay PVCs, use the **debug frame-relay switching EXEC** command. To disable Frame Relay switching debugging, use the **no** form of this command.

**debug frame-relay switching interface** *interface* *dlci* [**interval** *interval*]

**no debug frame-relay switching**

Syntax Description		
	<b>interface</b> <i>interface</i>	Name of the Frame Relay interface.
	<i>dlci</i>	DLCI number of the switched PVC to be debugged.
	<b>interval</b> <i>interval</i>	(Optional) Interval in seconds at which debugging messages will be updated.

**Defaults** The default interval is 1 second.

Command History	Release	Modification
	12.0(12)S	This command was introduced.

**Usage Guidelines** The **debug frame-relay switching** command can be used only on switched Frame Relay PVCs, not terminated PVCs.

Debug statistics are displayed only if they have changed.



**Note**

Although statistics are displayed at configured intervals, there may be a delay between the occurrence of a debug event (such as a packet drop) and the display of that event. The delay may be as much as the configured interval plus 10 seconds.

**Examples** The following example shows sample output for the **debug frame-relay switching** command:

```
FRSWDiag-2# debug frame-relay switching interface pos 2/2 116 interval 1
Frame Relay switching debugging is on
Display frame switching debug on interface POS2/2 dlci 116
02:09:00: POS2/2 dlci 116: 230074 packets switched to POS2/3 dlci 116
02:09:00: POS2/2 dlci 116: 115037 packets output
02:09:00: POS2/2 dlci 116: Incoming PVC status changed to ACTIVE
02:09:00: POS2/2 dlci 116: Outgoing PVC status changed to ACTIVE
02:09:00: POS2/2 dlci 116: Incoming interface hardware module state changed to UP
02:09:00: POS2/2 dlci 116: Outgoing interface hardware module state changed to UP
02:09:11: POS2/2 dlci 116: 6812 packets switched to POS2/3 dlci 116
02:09:11: POS2/2 dlci 116: 3406 packets output
02:09:23: POS2/2 dlci 116: 8032 packets switched to POS2/3 dlci 116
02:09:23: POS2/2 dlci 116: 4016 packets output
```

■ debug frame-relay switching