Frame Relay Extended Addressing

This document describes Extended Addressing for Frame Relay and includes the following sections:

Feature Overview

Frame Relay Extended Addressing implements a 23-bit Data Link Connection Identifier (DLCI) on Network-to-Network Interfaces (NNIs). This 23-bit DLCI supports values between 16 and 8388607.

Benefits

The standard 10-bit DLCI field only permits DLCI values between 16 and 1007. This is adequate for User-to-Network Interfaces (UNIs), but does not meet some network's NNI interface requirements.

The 23-bit DLCIs in Frame Relay Extended Addressing resolves this problem by supporting DLCI values between 16 and 8388607.

Restrictions

Support for Frame Relay Extended Addressing is restricted to the following features and commands.

Note Frame Relay Extended Addressing supports only the features and commands listed in this section. Commands and features *not* listed in this section are *not* supported by Extended Addressing.

Features supported by Frame Relay Extended Addressing

- Switched Permanent Virtual Circuits (PVCs)
- NNI with event driven procedures (sub-interfaces are *not* supported)
- Switching Diagnostics
- Simple Network Management Protocol (SNMP) support for Cisco Frame Relay MIB

Note For general Frame Relay configuration information and examples, refer to the "Configuring Frame Relay" chapter in the *Wide-Area Networking Configuration Guid*e.

New Frame Relay configuration commands supported by Frame Relay Extended Addressing

- **encapsulation frame-relay extended**

Note See the "Command Reference" section for information on this new encapsulation option.

Existing Frame Relay configuration commands supported by Frame Relay Extended Addressing

- **frame-relay route**
- **show frame-relay pvc**
- **show frame-relay route**
- **logging event dlci-status-change**

Note Please see the document *Frame Relay Commands* for more information on Frame Relay configuration commands

Frame Relay Event Driven Procedure commands supported by Frame Relay Extended Addressing

- **debug frame-relay nni extended**
- **frame-relay country-code**
- **frame-relay network-id**
- **frame-relay nni-annex1**
- **show frame-relay inactive-reason**

Note Please refer to the document *FRF2.1 Annex 1* for additional information on these commands.

Switching Diagnostics and Troubleshooting feature commands supported by Frame Relay Extended Addressing

The following commands for the Switching Diagnostics and Troubleshooting feature are supported with Extended Addressing:

- **debug frame-relay switching**

Note Please refer to the document *Frame Relay Switching Diagnostics and Troubleshooting* for additional information on these commands.

Related Features and Technologies

- Frame Relay Switching Diagnostics and Troubleshooting
- FRF2.1 Annex 1: Event Driven Procedures for Frame Relay

Related Documents

- *FRF2.1 Annex 1* (note: this document describes the Event Driven Procedures for Frame Relay)
- *Frame Relay Switching Diagnostics and Troubleshooting*
- *Frame Relay Commands* (Frame Relay Command Reference)
- *Cisco IOS Release 12.0 Wide-Area Networking Command Reference*
- *Cisco IOS Release 12.0 Wide-Area Networking Configuration Guide*
- *Cisco IOS Release 12.0 Network Protocols Command Reference, Part 1*
- *Cisco IOS Release 12.0 Network Protocols Configuration Guide, Part 1*
- *Cisco IOS Switching Services Command Reference*

Supported Platforms

Frame Relay Extended Addressing is supported on Engine 0, 1 and 2 line cards in the Cisco 12000 series Gigabit Switch Routers (GSR).

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.

To obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to 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.

Prerequisites

- Cisco IOS software release 12.0(17)S or higher must be installed.

Configuration Tasks

See the following sections to configure and verify Frame Relay Extended Addressing:

- General Guidelines for Switched PVC Configuration, page 4: provides information on the use of DLCI values in switched PVCs with Extended Addressing.
- Configuring Frame Relay Extended Addressing, page 5: provides instructions on the commands used to configure switched PVCs with Extended Addressing.
- Verifying the Frame Relay Interface and Switched PVCs, page 8: provides information on the commands used to verify the status of the switched PVC and DLCI values.

General Guidelines for Switched PVC Configuration

The DLCI number has a per-hop significance, not an end-to-end significance: the two interfaces connected together via POS links must have the same DLCI number, but the two interfaces that form the switched PVC can use different DLCI numbers.

Example

Figure 1 shows a generic PVC configuration:

- a DLCI value of “100” could be used for the hop from the left router to the middle router.
- a DLCI value of “5000” could be used for the hop from the right router and the middle router.
- The PVC could be configured between the middle router using these two different DLCI values.

Note The two DLCI values can both be in the standard range (16-1007), in the Extended Addressing range (16-8388607), or a combination of the two (one standard DLCI and one Extended DLCI). See “Configuration Examples” for detailed configuration information.

Note Changing a previously configured interface between standard and extended addressing will cause all existing routes to disappear from the interface.
Example: if an interface is already configured with standard addressing, typing "encapsulation frame-relay extended" will cause all existing routes to disappear from the interface. These routes must be re-entered. This will also occur if an interface with Extended Addressing is re-configured as a standard Frame-Relay interface.

Figure 1 Generic Frame Relay Switched PVC example

Configuring Frame Relay Extended Addressing

This section contains instructions to configure a switched Frame Relay PVC with Extended Addressing. Please note the following before beginning:

- A new Frame Relay encapsulation type has been added to enable Extended Addressing**.** See "Command Reference" for more information.
- Frame Relay Extended Addressing supports only the commands and features detailed in the "Restrictions" section.
- Frame Relay Extended Addressing supports the following signalling modes:
  - FRF2.1 Annex 1: event driven NNI procedures
  - No keepalives
- It is possible to configure switching between an interface with Extended Addressing and an interface with standard (non-extended) addressing. This section contains instructions for both scenarios.

Note Changing a previously configured interface between standard and extended addressing will cause all existing routes to disappear from the interface.

This section contains configuration instructions for the following two scenarios:

- Configuring a Switched PVC between two Interfaces with Frame Relay Extended Addressing, page 6
- Configuring a Switched PVC between Extended Addressing and Non-Extended Addressing Interfaces, page 7

Configuring a Switched PVC between two Interfaces with Frame Relay Extended Addressing

This section contains instructions to configure a PVC between two interfaces with Extended Addressing.

- Table 1 provides the commands to configure the first interface on a switched PVC with Frame Relay Extended Addressing.
- Table 2 provides the commands to configure the second interface with Frame Relay Extended Addressing on the PVC.

Table 1 Configure Frame Relay Switching, Extended Addressing Encapsulation and Switched PVCs on first port

	Command	Purpose
Step 1	`Router(config)# frame-relay switching`	Enables Frame Relay switching.
Step 2	`Router(config)# interface` *interface*`[`*slot*`/`*port*`]`	Specifies interface for configuration mode.
Step 3	`Router(config-if)# encapsulation frame-relay extended`	Turns on Extended Addressing encapsulation for the specified interface.
Step 4	`Router(config-if)# frame-relay nni-annex1`	Turns on annex1 event driven feature.
Step 5	`Router(config-if)# frame-relay route` *dlci* `interface` *interface*`[`*slot*`/`*port*`]` *dlci*	Adds PVC from one slot/port to another slot/port. The DLCI value with Extended Addressing is between 16 and 8388607.
Step 6	`Router(config-if)# exit`	Exits from PVC configured interface.

Table 2 Configure Extended Addressing Encapsulation and Switched PVCs on second port

	Command	Purpose
Step 1	`Router(config)# interface` *interface*`[`*slot*`/`*port*`]`	Specifies interface for configuration mode for second slot/port PVC configuration.
Step 2	`Router(config-if)# encapsulation frame-relay extended`	Turns on Extended Addressing encapsulation for the specified interface.
Step 3	`Router(config-if)# frame-relay nni-annex1`	Turns on annex1 event driven feature for second slot/port configuration.
Step 4	`Router(config-if)# frame-relay route` *dlci* `interface` *interface*`[`*slot*`/`*port*`]` *dlci*	Adds PVC from second slot/port to first slot/port. The DLCI value with Extended Addressing is between 16 and 8388607.
Step 5	`Router(config-if)# end`	PVCs have now been added to both slot/ports.

Note Changing a previously configured interface between standard and extended addressing will cause all existing routes to disappear from the interface.

Configuring a Switched PVC between Extended Addressing and Non-Extended Addressing Interfaces

A PVC can also be configured for switching between an extended address and a non-extended address.

Note The DLCI values for the two interfaces in a switched PVC can be different. See General Guidelines for Switched PVC Configuration, page 4 for additional information on the use of DLCI values.

A sample configuration is show in this section:

- Table 3 provides the commands to configure a switched PVC for the first interface with standard Frame Relay DLCI values.
- Table 4 provides the commands to configure the second interface with Frame Relay Extended Addressing on the PVC (extended DLCI values).

Table 3 Configure the First Interface with Standard DLCI Values

	Command	Purpose
Step 1	`Router(config)# frame-relay switching`	Enables Frame Relay switching.
Step 2	`Router(config)# interface interface[slot/port]`	Specifies interface for configuration mode.
Step 3	`Router(config-if)# encapsulation frame-relay`	Turns on standard frame-relay encapsulation for the specified interface.
Step 4	`Router(config-if)#  frame-relay intf-type dce`	Specifies the interface type.
Step 5	`Router(config-if)# frame-relay route dlci interface interface[slot/port] dlci`	Adds PVC from one slot/port to another slot/port. The DLCI value for a standard (non-extended) interface is between 16 and 1007.
Step 6	`Router(config-if)# exit`	Exits from PVC configured interface.

Table 4 Configure the Second Interface with Extended Addressing

	Command	Purpose
Step 1	`Router(config)# interface interface[slot/port]`	Specifies interface for configuration mode for second slot/port PVC configuration.
Step 2	`Router(config-if)# encapsulation frame-relay extended`	Turns on Extended Addressing encapsulation for the specified interface.
Step 3	`Router(config-if)# frame-relay nni-annex1`	Turns on annex1 event driven feature for second slot/port configuration.
Step 4	`Router(config-if)# frame-relay route dlci interface interface[slot/port] dlci`	Adds PVC from second slot/port to first slot/port. The DLCI value with Extended Addressing is between 16 and 8388607.
Step 5	`Router(config-if)# end`	PVCs have now been added to both slot/ports.

Note Changing a previously configured interface between standard and extended addressing will cause all existing routes to disappear from the interface.

Verifying the Frame Relay Interface and Switched PVCs

Use the following show commands to verify that Frame Relay switched PVCs are enabled:

Command	Purpose
`Router# show frame-relay route`	Displays switched Frame Relay PVCs.
`Router# show frame-relay pvc`	Displays all PVCs configured on the router.

Configuration Examples

This section provides the following configuration examples:

Frame Relay Interface and Switched PVCs configuration

```
router#config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
router(config)#frame-relay switching
router(config)#interface pos3/1
router(config-if)#encapsulation frame-relay extended
router(config-if)#frame-relay nni-annex1
router(config-if)#frame-relay route 5000 interface pos3/0 200
router(config-if)#exit
router(config)#interface pos3/0
router(config-if)#encapsulation frame-relay
router(config-if)#frame-relay intf-type dce
router(config-if)#frame-relay route 200 interface pos3/1 5000
router(config-if)#end
router#
008619: 3w4d: %SYS-5-CONFIG_I: Configured from console by console
router#show running interface pos3/1
Building configuration...

Current configuration:
!
interface POS3/1
 no ip address
 no ip directed-broadcast
 encapsulation frame-relay extended
 crc 16
 clock source internal
 frame-relay intf-type nni
 frame-relay nni-annex1
 frame-relay route 5000 interface POS3/0 200
 frame-relay lapf n201 4470
end
```

show frame-relay pvc interface

```
router#show frame-relay pvc interface pos3/1 4000

PVC Statistics for interface POS3/1 (Frame Relay NNI)

DLCI = 4000, DLCI USAGE = SWITCHED, PVC STATUS = INACTIVE, INTERFACE = POS3/1
  LOCAL PVC STATUS = INACTIVE, NNI PVC STATUS = ACTIVE

  input pkts 5             output pkts 5            in bytes 520
  out bytes 520            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
  switched pkts 10
  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
  pvc create time 3w4d, last time pvc status changed 1w0d
```

show frame-relay route

```
router#show frame-relay route
Input Intf      Input Dlci      Output Intf     Output Dlci     Status
POS3/1          21              POS3/0          20              inactive
POS3/1          230             POS5/0          230             inactive
POS3/2          100             POS5/2          100             inactive
POS3/2          230             POS5/2          230             inactive
POS5/0          100             POS3/1          100             inactive
POS5/0          230             POS3/1          230             inactive
POS5/2          100             POS3/2          100             inactive
POS5/2          230             POS3/2          230             inactive
POS3/1         2100             POS5/0          100             inactive
```

Note Extended interfaces have their routes shown at the bottom of the list. This is true only for the interfaces with "extended" encapsulation: if a DCE interface routes to an Extended Address interface, the route will be shown as per normal ordering.

Command Reference

To enable Extended Addressing for Frame Relay, a new a new encapsulation type has been added to the command **encapsulation frame-relay**:

- **encapsulation frame-relay extended**

All other commands used with this feature are documented in the Cisco IOS Release 12.0 command reference publications. These publications are summarized in the "Related Documents" section.

encapsulation frame-relay [extended]

To enable Extended Addressing for Frame Relay, a new option has been added to the **encapsulation frame-relay** interface configuration command.

Use the **encapsulation frame-relay extended** interface configuration command to enable Extended Addressing. To disable Frame Relay Extended Addressing encapsulation, use the no form of this command.

encapsulation frame-relay [extended]

no encapsulation frame-relay [extended]

Syntax Description

extended	This option enables 23-bit DLCIs for Frame Relay NNI interfaces to support DLCI values between 16 and 8388607.

Defaults

No default behavior or values.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	The **encapsulation frame-relay** command was introduced.
12.0(17)S	The command was modified to include the **[extended]** option.

Usage Guidelines

Frame Relay Extended Addressing supports DLCI values between 16 and 8388607. Support for Extended Addressing is restricted to the following features:

- Switched Permanent Virtual Circuits (PVCs)
- NNI with event driven procedures (sub-interfaces are *not* supported)
- Switching Diagnostics
- Simple Network Management Protocol (SNMP) support for Cisco Frame Relay MIB

See the "Restrictions" section for more information on other commands and features supported with Frame Relay Extended Addressing.

Examples

The following example configures Cisco Frame Relay encapsulation on interface serial 1:

```
interface serial 1
encapsulation frame-relay extended
```

Debug Commands

No new or modified debug commands were introduced with Frame Relay Extended Addressing.

See the "Restrictions" section for more information on the debug commands supported by Extended Addressing through the feature "Switching Diagnostics and Troubleshooting".

Glossary

CLI—Command Line Interface

DCE—Data Circuit-terminating Equipment

DLCI—Data Link Connection Identifier

NNI—Network-to-Network Interface

POS—PAcket Over Sonnet

PVC—Permanent Virtual Circuit

SNMP—Simple Network Management Protocol

UNI—User-to-Network Interface