



Configuring Frame Relay

This chapter tells how to configure the Cisco router to connect to a central-site router over a Frame Relay line and provides verification steps and troubleshooting tips.

This chapter contains the following sections:

- [Before You Begin](#)
- [Frame Relay](#)
- [Frame Relay with an Internal DSU/CSU](#)
- [ISDN as the Backup WAN Connection](#)
- [ISDN as a Backup Connection with Dialer Profiles](#)
- [ISDN as a Backup Connection with Floating Static Routes](#)

Before You Begin

The configurations in this chapter are based on the following assumptions:

- Your Cisco router hardware is correctly installed in accordance with the Hardware Installation Guide for your Cisco router.
- Your Cisco router is connected to a central-site router over Frame Relay.
- Your Cisco router is using multilink Point-to-Point Protocol (PPP).

Before you begin configuration, be aware of the following:

- You need to enter the commands in the order shown in the task tables.
- The values shown in *italic* are examples. For the values shown, you should instead enter values appropriate for your network.
- You should be familiar with Cisco IOS software and its conventions.

**Note**

To use the verification steps described in this chapter, you must be familiar with Cisco IOS commands and command modes. When you use the verification steps, you need to change to different command modes. If you are not familiar with command modes, see the [“Understanding Command Modes”](#) section in the [“Introduction to Router Configuration”](#) chapter.

Frame Relay

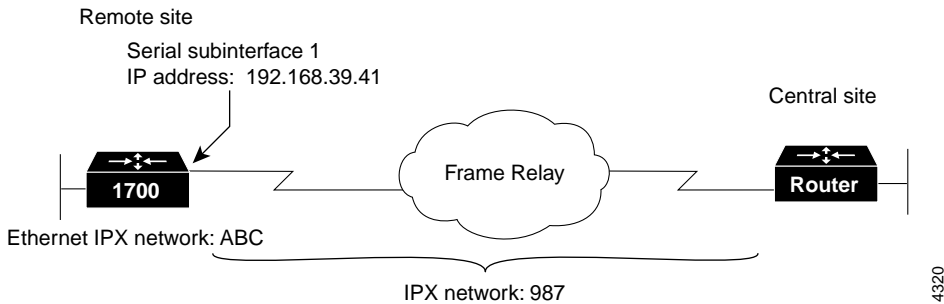
This section describes how to configure a basic Frame Relay connection to the central-site router.

These are the major tasks in configuring your router:

- [Configuring Global Parameters](#)
- [Configuring Security](#)
- [Configuring the Fast Ethernet Interface](#)
- [Configuring the Serial Interface for a Frame Relay Connection](#)
- [Configuring the Point-to-Point Frame Relay Connection](#)
- [Configuring Routing Parameters](#)

[Figure 7-1](#) shows the configuration example used in this section.

Figure 7-1 Configuration Example—Frame Relay



Configuring Global Parameters

Follow these steps to configure the router for global parameters.

	Command	Task
Step 1	configure terminal	Enter configuration mode.
Step 2	service timestamps debug datetime msec	Configure the router to show the date and time of all debug messages. This command is optional, but it is recommended if you use debug commands to troubleshoot your configuration.
Step 3	service timestamps log datetime msec	Configure the router to show the date and time of all log messages. This command is optional, but it is recommended if you use the verification steps described in this guide. This feature is enabled for all the command output examples shown in this guide.
Step 4	ipx routing 0060.834f.66dd	Enable Internetwork Packet Exchange (IPX) routing, and configure the router with an IPX address.

Configuring Security

Follow these steps to configure the router with security measures.

	Command	Task
Step 1	hostname <i>Router</i>	Configure the router with a host name, which is used in prompts and default configuration filenames. For PPP authentication, the host name entered with this command must match the username of the central-site router.
Step 2	enable password <i><user></i>	Specify a password to prevent unauthorized access to the router.

Configuring the Fast Ethernet Interface

Follow these steps to configure the Fast Ethernet interface, which connects your router to the local network.

	Command	Task
Step 1	interface fastethernet0	Enter configuration mode for the Fast Ethernet interface.
Step 2	ip address <i>172.16.25.1 255.255.255.0</i>	Configure this interface with an IP address and a subnet mask.
Step 3	ipx network <i>ABC</i>	Enable IPX routing on this interface.
Step 4	no shutdown	Enable the interface and the configuration changes that you have just made on the interface.
Step 5	exit	Exit configuration mode for this interface.

Configuring the Serial Interface for a Frame Relay Connection

Follow these steps to configure the serial interface for Frame Relay packet encapsulation.

	Command	Task
Step 1	interface Serial0	Enter configuration mode for the serial interface.
Step 2	encapsulation frame-relay	Set the encapsulation method on this interface to Frame Relay.
Step 3	no shutdown	Enable the configuration changes on this interface.

Verifying Your Configuration

You can verify your configuration to this point by confirming that a permanent virtual circuit (PVC) is active on the Frame Relay line, as follows:

Step 1 Wait 60 seconds after entering the **encapsulation frame-relay** command.

Step 2 From privileged EXEC command mode, enter the **show frame-relay pvc** command. You should see output similar to the following:

```
Router# show frame-relay pvc
```

```
PVC Statistics for interface Serial0 (Frame Relay DTE)
```

```
DLCI = 17, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.1
```

```

input pkts 45          output pkts 52          in bytes 7764
out bytes 9958         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
pvc create time 00:30:59, last time pvc status changed 00:19:21

```

Step 3 Confirm that the “PVC STATUS=ACTIVE” message appears in the command output, as shown in the example.

Step 4 Record the number shown in the “DLCI=” message. (In this example, the number is “17.”) You use this number to finish configuring the Frame Relay interface.

- Step 5** If there is no output after you enter the command, use the **show interface serial0** command to determine whether the serial interface is active. An example of this command is in the next section, “[Configuring the Point-to-Point Frame Relay Connection](#).” The first line of the command output should be as follows:

```
Serial0 is up, line protocol is up
```

If the first line of the command output is “Serial0 is up, line protocol is down,” you should confirm that the Local Management Interface (LMI) type for the Frame Relay switch is correct by checking for the “LMI type is CISCO” message in the same command output.

- Step 6** To continue configuration, reenter global configuration mode.
-

Configuring the Point-to-Point Frame Relay Connection

Follow these steps to configure the Frame Relay interface, which connects your router to the central-site router over the wide-area network.

	Command	Task
Step 1	interface Serial0.1 point-to-point	Enter configuration mode for the serial subinterface, and specify this interface as a point-to-point connection.
Step 2	ip address 192.168.39.40 255.255.255.0	Configure this interface with an IP address and a subnet mask.
Step 3	ipx network 987	Enable IPX routing on this interface.
Step 4	frame-relay interface-dlci 17	Assign a data link connection identifier (DLCI) to the Frame Relay subinterface. If you are unsure of the DLCI, use the number that you recorded in Step 4 of the “ Verifying Your Configuration ” section on page 7-5 .

	Command	Task
Step 5	snapshot client 5 60	<p>Enable snapshot routing. Because your router is dialing into a central-site router, it is considered the client router.</p> <p>The first number is the amount of “active time” (in minutes) during which routing updates are exchanged between your router and the central-site router.</p> <p>The second number is the amount of “quiet time” (in minutes) during which routing entries are frozen and remain unchanged.</p>
Step 6	no shutdown	Enable the interface and the configuration changes that you have just made on the interface.
Step 7	exit	Exit configuration mode for this interface.

Verifying Your Configuration

You can verify your configuration to this point by

- [Confirming That the Line Is Up](#)
- [Confirming That the Frame Relay Maps are Active](#)
- [Confirming Connectivity to the Central-Site Router](#)

Confirming That the Line Is Up

To verify that the line is up, perform the following steps:

-
- Step 1** From the privileged EXEC command mode, enter the **show interface serial0** command. You should see output similar to the following:
- ```
Router# show interface serial0

Serial0 is up, line protocol is up
 Hardware is QUICC Serial
 ___MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load
 1/255
 Encapsulation FRAME-RELAY, loopback not set, keepalive set (10 sec)
 LMI enq sent 163, LMI stat recvd 136, LMI upd recvd 0, DTE LMI up
```

```

LMI enq recvd 39, LMI stat sent 0, LMI upd sent 0
LMI DLCI 1023 LMI type is CISCO frame relay DTE
Broadcast queue 0/64, broadcasts sent/dropped 27/0, interface
broadcasts 28
Last input 00:00:01, output 00:00:05, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/64/0 (size/threshold/drops)
 Conversations 0/1 (active/max active)
 Reserved Conversations 0/0 (allocated/max allocated)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
 1813 packets input, 109641 bytes, 0 no buffer
 Received 1576 broadcasts, 0 runts, 0 giants
 13 input errors, 0 CRC, 13 frame, 0 overrun, 0 ignored, 0 abort
 1848 packets output, 117260 bytes, 0 underruns
 0 output errors, 0 collisions, 32 interface resets
 0 output buffer failures, 0 output buffers swapped out
 29 carrier transitions
DCD=up DSR=up DTR=up RTS=up CTS=up

```

- Step 2** Confirm that the following messages appear in the command output:
- “Serial0 is up, line protocol is up”—The Frame Relay connection is active.
  - “LMI enq sent 163, LMI stat recvd 136”—The connection is sending and receiving data. The number shown in your output will probably be different.
  - “LMI type is CISCO”—The LMI type is configured correctly for the router.
- Step 3** If all the message do not appear in the command output, take the following steps:
- a. Confirm with the Frame Relay service provider that the LMI setting is correct for your line.
  - b. Confirm that keepalives are set and that the router is receiving LMI updates.
- Step 4** To continue configuration, reenter global configuration mode.
-

## Confirming That the Frame Relay Maps are Active

You can verify that the frame relay maps are active by performing the following steps:

- 
- Step 1** From the privileged EXEC command mode, enter the **show frame-relay map** command. You should see output similar to the following:

```
Router# show frame-relay map
Serial0.1 (up): point-to-point dlci, dlci 17(0x11,0x410), broadcast,
 status defined, active
```

- Step 2** Confirm that the “status defined, active” message appears for each serial subinterface, as shown in the example.

- Step 3** If the message does not appear, proceed as follows:

- a. Confirm that the central-site router is connected and configured.
- b. Check with the Frame Relay carrier to verify that the line is operating correctly.

- Step 4** To continue configuration, reenter global configuration mode.
- 

## Confirming Connectivity to the Central-Site Router

You can verify connectivity to the central site router by performing the following steps:

- 
- Step 1** From the privileged EXEC command mode, enter the **ping** command, followed by the IP address of the central-site router. You should see output similar to the following:

```
Router# ping 192.168.38.40

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 192.168.38.40, timeout is 2
seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/32/32
ms
Router#
```

- Step 2** Note the percentage in the “Success rate” line, as shown in the example. If the success rate is 60 percent or greater, this verification step is successful.
- Step 3** To continue configuration, reenter global configuration mode.
- 

## Configuring Routing Parameters

Follow these steps to configure the Frame Relay interface for Enhanced Interior Gateway Routing Protocol (EIGRP) routing.

|        | Command                   | Task                                                                                                                 |
|--------|---------------------------|----------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>router eigrp</b> 202   | Configure the IP EIGRP routing process.                                                                              |
| Step 2 | <b>network</b> 172.16.0.0 | To specify a list of networks for the EIGRP routing process, enter the IP address of the directly connected network. |
| Step 3 | <b>ip classless</b>       | Configure the router to forward packets addressed to a subnet of a network with no network default route.            |
| Step 4 | <b>exit</b>               | Exit router configuration mode.                                                                                      |

## Configuring Command-Line Access to the Router

Follow these steps to configure parameters that control access to the router.

|        | Command                      | Task                                                                                              |
|--------|------------------------------|---------------------------------------------------------------------------------------------------|
| Step 1 | <b>line console</b> 0        | Specify the console terminal line.                                                                |
| Step 2 | <b>exec-timeout</b> 5        | Set the interval in minutes that the EXEC command interpreter waits until user input is detected. |
| Step 3 | <b>line vty</b> 0 4          | Specify a virtual terminal for remote console access.                                             |
| Step 4 | <b>password</b> <lineaccess> | Specify a password on the line.                                                                   |

|        | Command      | Task                                                |
|--------|--------------|-----------------------------------------------------|
| Step 5 | <b>login</b> | Enable password checking at terminal session login. |
| Step 6 | <b>end</b>   | Exit configuration mode.                            |

## Frame Relay with an Internal DSU/CSU

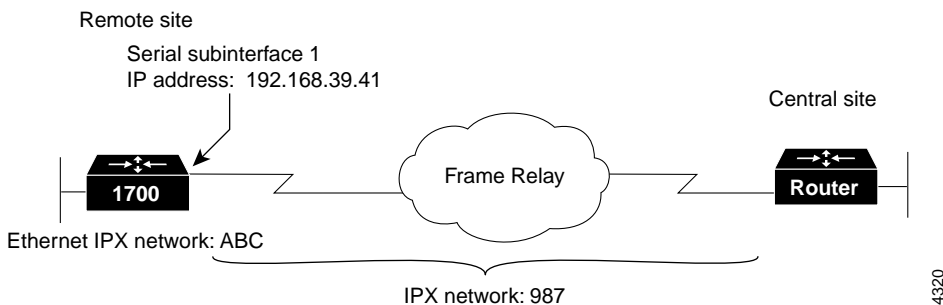
This section tells how to configure the Cisco router with an internal data service unit/channel service unit (DSU/CSU) for Frame Relay. In addition to the assumptions described in the “[Before You Begin](#)” section of this chapter, this configuration assumes that the internal DSU/CSU is a switched 56-kbps interface.

These are the major tasks in configuring your router:

- [Configuring Global Parameters](#)
- [Configuring Security](#)
- [Configuring the Fast Ethernet Interface](#)
- [Configuring the Frame Relay Interface](#)
- [Configuring the Frame Relay Subinterface](#)
- [Configuring Routing Parameters](#)
- [Configuring Command-Line Access to the Router](#)

Figure 7-2 shows the configuration example used in this section.

**Figure 7-2 Configuration Example—Frame Relay Internal DSU/CSU**



## Configuring Global Parameters

Follow these steps to configure the router for global parameters.

|        | Command                                       | Task                                                                                                                                                                                                                                                                   |
|--------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>configure terminal</b>                     | Enter configuration mode.                                                                                                                                                                                                                                              |
| Step 2 | <b>service timestamps debug datetime msec</b> | Configure the router to show the date and time of all debug messages.<br><br>This command is optional, but it is recommended if you use debug commands to troubleshoot your configuration.                                                                             |
| Step 3 | <b>service timestamps log datetime msec</b>   | Configure the router to show the date and time of all log messages.<br><br>This command is optional, but it is recommended if you use the verification steps described in this guide. This feature is enabled for all the command output examples shown in this guide. |
| Step 4 | <b>ipx routing 0060.834f.66dd</b>             | Enable IPX routing, and configure the router with an IPX address.                                                                                                                                                                                                      |

## Configuring Security

Follow these steps to configure the router with security measures.

|        | Command                                    | Task                                                                                                                                                                                                                            |
|--------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>hostname</b> <i>Router</i>              | Configure the router with a host name, which is used in prompts and default configuration filenames.<br><br>For PPP authentication, the host name entered with this command must match the username of the central-site router. |
| Step 2 | <b>enable password</b> <i>&lt;user&gt;</i> | Specify a password to prevent unauthorized access to the router.                                                                                                                                                                |

## Configuring the Fast Ethernet Interface

Follow these steps to configure the Fast Ethernet interface, which connects your router to the local network.

|        | Command                                              | Task                                                                                         |
|--------|------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Step 1 | <b>interface fastethernet0</b>                       | Enter configuration mode for the Fast Ethernet interface.                                    |
| Step 2 | <b>ip address</b> <i>172.16.25.1 255.255.255.224</i> | Configure this interface with an IP address and a subnet mask.                               |
| Step 3 | <b>ipx network</b> <i>ABC</i>                        | Enable IPX routing on this interface.                                                        |
| Step 4 | <b>no shutdown</b>                                   | Enable the interface and the configuration changes that you have just made on the interface. |
| Step 5 | <b>exit</b>                                          | Exit configuration mode for this interface.                                                  |

## Configuring the Frame Relay Interface

Follow these steps to configure the serial interface, which connects your router to the central-site router over the wide-area network.

|        | Command                                     | Task                                                                                                                                                                                                                                                                                                                                                 |
|--------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>interface Serial0</b>                    | Enter configuration mode for the serial interface.                                                                                                                                                                                                                                                                                                   |
| Step 2 | <b>no ip address</b>                        | Disable IP routing on this interface.                                                                                                                                                                                                                                                                                                                |
| Step 3 | <b>encapsulation frame-relay</b>            | Set the encapsulation method on this interface to Frame Relay.                                                                                                                                                                                                                                                                                       |
| Step 4 | <b>service-module 56k clock source line</b> | Configure the clock source for the 56-kbps DSU/CSU module.<br><br>In most applications, the DSU/CSU should be configured with the <b>clock source line</b> command. For back-to-back DSU/CSU configurations, configure one DSU/CSU with the <b>clock source internal</b> command, and configure the other with the <b>clock source line</b> command. |
| Step 5 | <b>service-module 56k network type dds</b>  | Configure this interface to transmit packets in switched dial-up mode or digital data service mode using the 56-kbps DSU/CSU module.<br><br>If the clock rate has not been set correctly with the <b>service-module 56k clock source line</b> command, this command will not be accepted by the router.                                              |

## Verifying Your Configuration

You can verify your configuration to this point by

- [Confirming That the Line Is Up](#)
- [Confirming That the Interface Is Receiving a Line Signal](#)

## Confirming That the Line Is Up

You can verify that the line is up by performing the following steps:

- Step 1** From the privileged EXEC command mode, enter the **show interface serial 0** command. You should see command output similar to the following:

```
Router# show interface serial0
Serial0 is up, line protocol is up
 Hardware is QUICC Serial
 MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load
 1/255
 Encapsulation FRAME-RELAY, loopback not set, keepalive set (10 sec)
 LMI enq sent 163, LMI stat recvd 136, LMI upd recvd 0, DTE LMI up
 LMI enq recvd 39, LMI stat sent 0, LMI upd sent 0
 LMI DLCI 1023 LMI type is CISCO frame relay DTE
 Broadcast queue 0/64, broadcasts sent/dropped 27/0, interface
 broadcasts 28
 Last input 00:00:01, output 00:00:05, output hang never
 Last clearing of "show interface" counters never
 Input queue: 0/75/0 (size/max/drops); Total output drops: 0
 Queueing strategy: weighted fair
 Output queue: 0/64/0 (size/threshold/drops)
 Conversations 0/1 (active/max active)
 Reserved Conversations 0/0 (allocated/max allocated)
 5 minute input rate 0 bits/sec, 0 packets/sec
 5 minute output rate 0 bits/sec, 0 packets/sec
 1813 packets input, 109641 bytes, 0 no buffer
 Received 1576 broadcasts, 0 runts, 0 giants
 13 input errors, 0 CRC, 13 frame, 0 overrun, 0 ignored, 0 abort
 1848 packets output, 117260 bytes, 0 underruns
 0 output errors, 0 collisions, 32 interface resets
 0 output buffer failures, 0 output buffers swapped out
 29 carrier transitions
 DCD=up DSR=up DTR=up RTS=up CTS=up
```

- Step 2** Confirm that the “Serial0 is up, line protocol is up” message appears in the command output.
- Step 3** To continue configuration, reenter global configuration mode.

## Confirming That the Interface Is Receiving a Line Signal

You can verify that the interface is receiving a line signal by performing the following steps:

- Step 1** From the privileged EXEC command mode, enter the **show service module serial0** command. You should see command output similar to the following:

```
Router# show service-module serial0
Module type is 4-wire Switched 56K in DDS mode,
Current line rate is 56 Kbits/sec and role is Telco side,
Last clearing of alarm counters 21:23:25
 oos/oof : 0,
 loss of signal : 0,
 loss of sealing current: 0,
 CSU/DSU loopback : 0,
 loopback from remote : 0,
 DTE loopback : 0,
 line loopback : 0,
```

- Step 2** Confirm that the “loss of signal” message shows zero, which means that there are no problems with the interface receiving a line signal.
- Step 3** To continue configuration, reenter global configuration mode.

## Configuring the Frame Relay Subinterface

Follow these steps to configure the Frame Relay subinterface network addresses.

|        | Command                                     | Task                                                                                                             |
|--------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>interface Serial0.1 point-to-point</b>   | Enter configuration mode for the serial subinterface, and specify this interface as a point-to-point connection. |
| Step 2 | <b>ip address 172.16.26.1 255.255.255.0</b> | Configure this interface with an IP address and a subnet mask.                                                   |
| Step 3 | <b>ipx network 987</b>                      | Enable IPX routing on this interface.                                                                            |
| Step 4 | <b>frame-relay interface-dlci 17</b>        | Assign a DLCI to the Frame Relay subinterface.                                                                   |

|         | Command                                              | Task                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 5  | <b>ip address</b> <i>192.168.38.41 255.255.255.0</i> | Configure this interface with an IP address and a subnet mask.                                                                                                                                                                                                                                                                                                                                                            |
| Step 6  | <b>ipx network</b> <i>456</i>                        | Enable IPX routing on this interface.                                                                                                                                                                                                                                                                                                                                                                                     |
| Step 7  | <b>snapshot client</b> <i>5 60</i>                   | Enable snapshot routing. Because your router is dialing into a central-site router, it is considered the client router.<br><br>The first number is the amount of “active time” (in minutes) during which routing updates are exchanged between your router and the central-site router.<br><br>The second number is the amount of “quiet time” (in minutes) during which routing entries are frozen and remain unchanged. |
| Step 8  | <b>frame-relay interface-dlci</b> <i>17</i>          | Assign a DLCI to the Frame Relay subinterface.                                                                                                                                                                                                                                                                                                                                                                            |
| Step 9  | <b>no shutdown</b>                                   | Enable the interface and the configuration changes that you have just made on the interface.                                                                                                                                                                                                                                                                                                                              |
| Step 10 | <b>exit</b>                                          | Exit configuration mode for the serial interface.                                                                                                                                                                                                                                                                                                                                                                         |

## Configuring Routing Parameters

Follow these steps to configure the Frame Relay interface for EIGRP routing.

|        | Command                          | Task                                                                                                                 |
|--------|----------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>router eigrp</b> <i>202</i>   | Configure the IP EIGRP routing process.                                                                              |
| Step 2 | <b>network</b> <i>172.16.0.0</i> | To specify a list of networks for the EIGRP routing process, enter the IP address of the directly connected network. |

|        | Command             | Task                                                                                                      |
|--------|---------------------|-----------------------------------------------------------------------------------------------------------|
| Step 3 | <b>ip classless</b> | Configure the router to forward packets addressed to a subnet of a network with no network default route. |
| Step 4 | <b>exit</b>         | Exit router configuration mode.                                                                           |

## Configuring Command-Line Access to the Router

Follow these steps to configure parameters that control access to the router.

|        | Command                            | Task                                                                                                |
|--------|------------------------------------|-----------------------------------------------------------------------------------------------------|
| Step 1 | <b>line console 0</b>              | Specify the console terminal line.                                                                  |
| Step 2 | <b>exec-timeout 5</b>              | Set the interval (in minutes) that the EXEC command interpreter waits until user input is detected. |
| Step 3 | <b>line vty 0 4</b>                | Specify a virtual terminal for remote console access.                                               |
| Step 4 | <b>password &lt;lineaccess&gt;</b> | Specify a password on the line.                                                                     |
| Step 5 | <b>login</b>                       | Enable password checking at terminal session login.                                                 |
| Step 6 | <b>end</b>                         | Exit configuration mode.                                                                            |

## ISDN as the Backup WAN Connection

This section tells how to configure ISDN to operate as a secondary, or backup, WAN connection. With ISDN as a backup WAN connection, the router can continue to operate if the main WAN connection is down. This configuration is typically used on an ISDN WAN interface card that is installed in a Cisco router. The router onboard WAN port is the primary, or main, WAN connection, and the card WAN port is the secondary connection.

In addition to the assumptions listed in the “[Before You Begin](#)” section of this chapter, the configuration is based on the following assumptions:

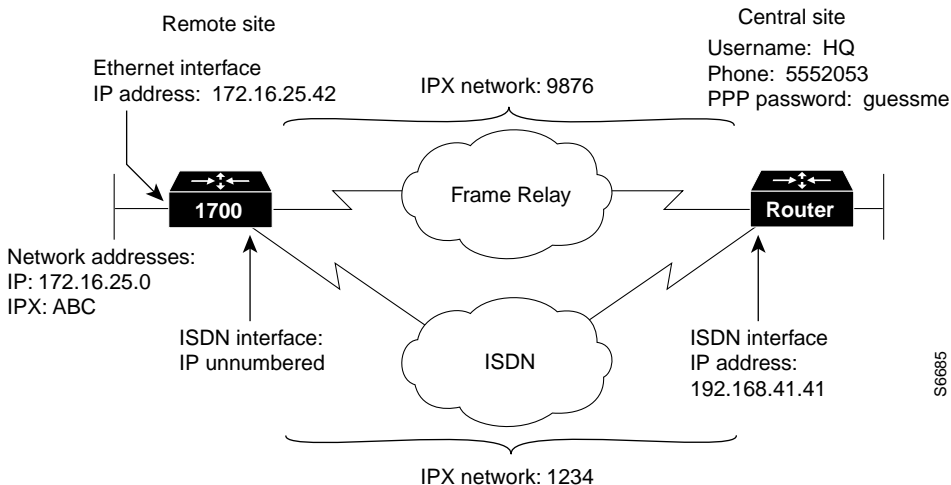
- Frame Relay is used as the primary WAN connection to the central site.
- The ISDN line is used as the secondary WAN connection to the central site.

These are the major tasks in configuring your router:

- [Configuring Global Parameters](#)
- [Configuring Security](#)
- [Configuring the Fast Ethernet Interface](#)
- [Configuring the Frame Relay Interface](#)
- [Configuring the ISDN Interface](#)
- [Configuring Protocols and Dialing Behavior](#)
- [Configuring Command-Line Access to the Router](#)

Figure 7-3 shows the configuration example used in this section.

**Figure 7-3 Configuration Example—ISDN as Backup Connection**



## Configuring Global Parameters

Follow these steps to configure the router for some global parameters.

|        | Command                                       | Task                                                                                                                                                                                                                                                                   |
|--------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>configure terminal</b>                     | Enter configuration mode.                                                                                                                                                                                                                                              |
| Step 2 | <b>service timestamps debug datetime msec</b> | Configure the router to show the date and time of all debug messages.<br><br>This command is optional, but it is recommended if you use debug commands to troubleshoot your configuration.                                                                             |
| Step 3 | <b>service timestamps log datetime msec</b>   | Configure the router to show the date and time of all log messages.<br><br>This command is optional, but it is recommended if you use the verification steps described in this guide. This feature is enabled for all the command output examples shown in this guide. |
| Step 4 | <b>ipx routing 0060.834f.66dd</b>             | Configure the router with its IPX address.                                                                                                                                                                                                                             |

|        | Command                                 | Task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 5 | <b>isdn switch-type</b> <i>basic-ni</i> | <p>Configure the type of central office switch being used on the ISDN interface. Use the keyword that matches the ISDN switch type that you are using:</p> <ul style="list-style-type: none"> <li>• <b>basic-1tr6</b>—German 1TR6 ISDN switches</li> <li>• <b>basic-5ess</b>—Basic rate 5ESS switches</li> <li>• <b>basic-dms100</b>—NT DMS-100 basic rate switches</li> <li>• <b>basic-net3</b>—NET3 ISDN switches</li> <li>• <b>basic-ni</b>—National ISDN-1 switches</li> <li>• <b>basic-nwnet3</b>—Norway NET3 switches (phase 1)</li> <li>• <b>basic-nznet3</b>—New Zealand NET3 switches</li> <li>• <b>basic-ts013</b>—Australian TS013 switches</li> <li>• <b>ntt</b>—Japanese NTT ISDN switches</li> <li>• <b>vn2</b>—French VN2 ISDN switches</li> <li>• <b>vn3</b>—French VN3 ISDN switches</li> </ul> |

## Configuring Security

Follow these steps to configure the router with security measures.

|        | Command                                            | Task                                                                                                                                                                                                                                                                                                         |
|--------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>hostname</b> <i>Router</i>                      | Configure the router with a host name, which is used in prompts and default configuration filenames.<br><br>For PPP authentication, the host name entered with this command must match the username of the central-site router.                                                                              |
| Step 2 | <b>enable password</b> <i>&lt;user&gt;</i>         | Specify a password to prevent unauthorized access to the router.                                                                                                                                                                                                                                             |
| Step 3 | <b>username</b> <i>HQ password &lt;guessme&gt;</i> | Specify the password used during caller identification and Challenge Handshake Authentication Protocol (CHAP) and Password Authentication Protocol (PAP) authentication.<br><br>For CHAP and PAP authentication, the username entered with this command must match the host name of the central-site router. |

## Configuring the Fast Ethernet Interface

Follow these steps to configure the Fast Ethernet interface, which connects your router to the local network.

|        | Command                                            | Task                                                           |
|--------|----------------------------------------------------|----------------------------------------------------------------|
| Step 1 | <b>interface fastethernet0</b>                     | Enter configuration mode for the Fast Ethernet interface.      |
| Step 2 | <b>ip address</b> <i>172.16.25.1 255.255.255.0</i> | Configure this interface with an IP address and a subnet mask. |
| Step 3 | <b>ipx network</b> <i>ABC</i>                      | Configure the Fast Ethernet interface IPX network number.      |

|        | Command            | Task                                                                                         |
|--------|--------------------|----------------------------------------------------------------------------------------------|
| Step 4 | <b>no shutdown</b> | Enable the interface and the configuration changes that you have just made on the interface. |
| Step 5 | <b>exit</b>        | Exit configuration mode for the this interface.                                              |

## Configuring the Frame Relay Interface

Follow these steps to configure the Frame Relay interface, which connects your router to the central-site router over the wide-area network.

|        | Command                                     | Task                                                                                                                                                                                                                                                                                                                                                                                              |
|--------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>interface Serial0</b>                    | Enter configuration mode for the serial interface.                                                                                                                                                                                                                                                                                                                                                |
| Step 2 | <b>encapsulation frame-relay</b>            | Set the encapsulation method on this interface to Frame Relay.                                                                                                                                                                                                                                                                                                                                    |
| Step 3 | <b>interface Serial0.1 point-to-point</b>   | Enter configuration mode for the serial subinterface and specify this interface as a point-to-point connection.                                                                                                                                                                                                                                                                                   |
| Step 4 | <b>backup interface BRI0</b>                | Configure the BRI interface to act as a backup line for this interface.                                                                                                                                                                                                                                                                                                                           |
| Step 5 | <b>backup delay 10 10</b>                   | Define when the ISDN line is used as a backup for this interface: <ul style="list-style-type: none"> <li>• The first number is the amount of time (in seconds) that the Frame Relay line is down before the ISDN line comes up as the backup line.</li> <li>• The second number is amount of time (in seconds) after the Frame Relay line comes back up until the ISDN line goes down.</li> </ul> |
| Step 6 | <b>ip address 172.16.26.1 255.255.255.0</b> | Configure this interface with an IP address.                                                                                                                                                                                                                                                                                                                                                      |
| Step 7 | <b>ipx network 9876</b>                     | Enable IPX routing on this interface.                                                                                                                                                                                                                                                                                                                                                             |

|         | Command                                     | Task                                                                                         |
|---------|---------------------------------------------|----------------------------------------------------------------------------------------------|
| Step 8  | <b>frame-relay interface-dlci</b> <i>17</i> | Assign a (DLCI) to the Frame Relay subinterface.                                             |
| Step 9  | <b>no shutdown</b>                          | Enable the interface and the configuration changes that you have just made on the interface. |
| Step 10 | <b>exit</b>                                 | Exit configuration mode for this interface.                                                  |

## Configuring the ISDN Interface

Follow these steps to configure the ISDN line to act as a backup connection in the event of failure of the Frame Relay connection.

|        | Command                            | Task                                                                                                                                                                                                                                          |
|--------|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>interface BRI0</b>              | Enter configuration mode for the ISDN interface.                                                                                                                                                                                              |
| Step 2 | <b>isdn spid1</b> <i>555987601</i> | Enter the service profile identifier (SPID) number assigned by the ISDN service provider to the B1 channel.<br><br>This step is required only when the service provider has assigned a SPID to your ISDN line. Not all ISDN lines have SPIDs. |
| Step 3 | <b>isdn spid2</b> <i>555987602</i> | Define the SPID number assigned by the ISDN service provider to the B2 channel.<br><br>This step is required only when the service provider has assigned a SPID to your ISDN line. Not all ISDN lines have SPIDs.                             |
| Step 4 | <b>ip unnumbered fastethernet0</b> | Enable IP routing on this interface without assigning an IP address.                                                                                                                                                                          |
| Step 5 | <b>ipx network</b> <i>1234</i>     | Define the IPX network number for this interface.                                                                                                                                                                                             |
| Step 6 | <b>encapsulation ppp</b>           | Set the encapsulation method on this interface to PPP.                                                                                                                                                                                        |

|         | Command                            | Task                                                                                                                                                                                     |
|---------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 7  | <b>dialer string</b> 5552053       | Specify the telephone number that this interface dials to connect to the central-site router.<br><br>This command is used when the interface is connecting to only a single remote site. |
| Step 8  | <b>dialer-group</b> 1              | Assign this interface to a dialer group.                                                                                                                                                 |
| Step 9  | <b>ppp authentication chap pap</b> | Enable CHAP and PAP authentication on this interface. CHAP authentication is attempted first. If the central-site router does not support CHAP, then PAP is used for authentication.     |
| Step 10 | <b>ppp multilink</b>               | Enable multilink PPP on this interface.                                                                                                                                                  |
| Step 11 | <b>no shutdown</b>                 | Enable the interface and the configuration changes that you have just made on the interface.                                                                                             |
| Step 12 | <b>exit</b>                        | Exit configuration mode for this interface.                                                                                                                                              |

## Verifying Your Configuration

You can verify your configuration by confirming connectivity to the central-site router, as follows:

- Step 1** From the privileged EXEC command mode, enter the **ping** command, followed by the IP address of the central-site route to have the router dial the remote router. You should see command output similar to the following:

```
Router# ping 192.168.37.40

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.37.40, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 40/43/48 ms
Router#
*Mar 1 03:37:46.526: %LINK-3-UPDOWN: Interface BRI0:1, changed state
to up
*Mar 1 03:37:46.923: %LINEPROTO-5-UPDOWN: Line protocol on Interface
BRI0:1, changed state to up
*Mar 1 03:37:46.939: %LINK-3-UPDOWN: Interface Virtual-Access1,
changed state to up
```

```
*Mar 1 03:37:47.923: %LINEPROTO-5-UPDOWN: Line protocol on Interface
Virtual-Access1, changed state to up
*Mar 1 03:35:57.217: %ISDN-6-CONNECT: Interface BRI0:1 is now
connected to 5552053 HQ
```

- Step 2** Wait for the “ISDN-6-CONNECT” message.
- Step 3** Enter the **ping** command, followed by the IP address of the central-site router, a second time:

```
Router# ping 192.168.37.40

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.37.40, timeout is 2 seconds:
.!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/43/48
ms
Router#
*Mar 1 03:37:46.526: %LINK-3-UPDOWN: Interface BRI0:1, changed state
to up
*Mar 1 03:37:46.923: %LINEPROTO-5-UPDOWN: Line protocol on Interface
BRI0:1, changed state to up
*Mar 1 03:37:46.939: %LINK-3-UPDOWN: Interface Virtual-Access1,
changed state to up
*Mar 1 03:37:47.923: %LINEPROTO-5-UPDOWN: Line protocol on Interface
Virtual-Access1, changed state to up
*Mar 1 03:35:57.217: %ISDN-6-CONNECT: Interface BRI0:1 is now
connected to 5552053 HQ
```

- Step 4** If the success rate is 100 percent, this verification step is successful.
- Step 5** If the success rate is less than 60 percent, take the following steps:
- a. Use the **show frame-relay pvc** command to confirm that the DLCI for the Frame Relay interface is active.
  - b. Use the **show interface serial0** command to confirm that the “Serial0 is up, line protocol is up” message is displayed in the command output.
- Step 6** To continue configuration, reenter global configuration mode.

## Configuring Protocols and Dialing Behavior

Follow these steps to configure how and when the ISDN line connects to the central-site router.

|        | Command                                  | Task                                                                                                                                             |
|--------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>router eigrp 202</b>                  | Configure the IP (EIGRP) routing process.                                                                                                        |
| Step 2 | <b>network 172.16.0.0</b>                | To specify a list of networks for the EIGRP routing process, enter the IP address of the directly connected network.                             |
| Step 3 | <b>ip classless</b>                      | Specify that the router does not forward packets that are destined for a subnet of a network that has no network default route.                  |
| Step 4 | <b>dialer-list 1 protocol ip permit</b>  | Specify an access list both by list number and by protocol (IP) to define the packets of interest that can trigger a called to the destination.  |
| Step 5 | <b>dialer-list 1 protocol ipx permit</b> | Specify an access list both by list number and by protocol (IPX) to define the packets of interest that can trigger a called to the destination. |
| Step 6 | <b>exit</b>                              | Exit router configuration mode.                                                                                                                  |

## Configuring Command-Line Access to the Router

Follow these steps to configure parameters that control access to the router.

|        | Command                            | Task                                                                                   |
|--------|------------------------------------|----------------------------------------------------------------------------------------|
| Step 1 | <b>line console 0</b>              | Specify the console terminal line.                                                     |
| Step 2 | <b>exec-timeout 5</b>              | Set the interval that the EXEC command interpreter waits until user input is detected. |
| Step 3 | <b>line vty 0 4</b>                | Specify a virtual terminal for remote console access.                                  |
| Step 4 | <b>password &lt;lineaccess&gt;</b> | Specify a password on the line.                                                        |
| Step 5 | <b>login</b>                       | Enable password checking at terminal session login.                                    |
| Step 6 | <b>end</b>                         | Exit configuration mode.                                                               |

## Verifying Your Configuration

To verify your router configuration to this point, confirm that the ISDN connects dynamically to the remote site when the Frame Relay connection is disconnected. Follow these steps:

- 
- Step 1 Remove the cable that connects the router to the Frame Relay services, or otherwise force the DLCI(s) to become inactive. This action brings the line protocol down.
  - Step 2 When the router generates routing updates, the ISDN line should begin dialing. If the ISDN line does not dial, use the **ping** command as described in the [“Configuring the ISDN Interface”](#) section.
  - Step 3 Reconnect the cable that connects the router to the Frame Relay services, or force the DLCI(s) to become active. The ISDN line should disconnect dynamically.
- 

## Troubleshooting Problems with ISDN as Frame Relay Backup Line

If you are having problems, follow some or all of these steps:

- 
- Step 1 Confirm that you used the **broadcast** keyword in the **dialer map** command. This keyword causes dialing to occur with a flash routing update. If you do not use the **broadcast** keyword, routing updates do not trigger dialing on the ISDN line.
  - Step 2 If you want to use the ISDN line even when the Frame Relay line is connected, use dialer profiles. Otherwise, the ISDN line operates in backup mode only.
  - Step 3 If you are having problems, you can use some or all of the following debug commands:
    - **debug dialer events**
    - **debug isdn events**
    - **debug isdn q931**
    - **debug isdn q921**
    - **debug ppp negotiation**

- **debug ppp authentication**
- **debug ppp multilink events**

**Caution**

---

If you are not familiar with Cisco IOS debug commands, you should read the [“Using Debug Commands”](#) section in the [“Introduction to Router Configuration”](#) chapter before attempting any debugging.

---

## ISDN as a Backup Connection with Dialer Profiles

This section describes how to configure ISDN to operate as a secondary, or backup, WAN connection by using dialer profiles to connect to multiple central-site routers.

In addition to the assumptions listed in the [“Before You Begin”](#) section at the beginning of this chapter, this configuration is based on the following additional assumptions:

- The Frame Relay service provides end-to-end status of the Frame Relay connection.

This means that if the router primary serial WAN connection (in this example, Frame Relay) goes down, the Frame Relay switch sends LMI updates to the central-site router, indicating that the line has gone down.

- Your router connects to two different central-site routers.

These are the major tasks in configuring your router:

- [Configuring Global Parameters](#)
- [Configuring Security](#)
- [Configuring the Fast Ethernet Interface](#)
- [Configuring the Serial Interface](#)
- [Configuring the Primary Connection to the First Central-Site Router](#)
- [Configuring the Primary Connection to the Second Central-Site Router](#)
- [Configuring the ISDN Interface](#)
- [Configuring the Backup Connection to the First Central-Site Router](#)
- [Configuring the Backup Connection to the Second Central-Site Router](#)
- [Configuring Routing Protocols](#)
- [Configuring Command-Line Access to the Router](#)

## Configuring Global Parameters

Follow these steps to configure the router for global parameters.

|        | Command                                       | Task                                                                                                                                                                                                                                                                   |
|--------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>configure terminal</b>                     | Enter configuration mode.                                                                                                                                                                                                                                              |
| Step 2 | <b>service timestamps debug datetime msec</b> | Configure the router to show the date and time of all debug messages.<br><br>This command is optional, but it is recommended if you use debug commands to troubleshoot your configuration.                                                                             |
| Step 3 | <b>service timestamps log datetime msec</b>   | Configure the router to show the date and time of all log messages.<br><br>This command is optional, but it is recommended if you use the verification steps described in this guide. This feature is enabled for all the command output examples shown in this guide. |

|        | Command                                 | Task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 4 | <b>isdn switch-type</b> <i>basic-ni</i> | <p>Configure the type of central office switch being used on the ISDN interface. Use the keyword that matches the ISDN switch type that you are using:</p> <ul style="list-style-type: none"> <li>• <b>basic-1tr6</b>—German 1TR6 ISDN switches</li> <li>• <b>basic-5ess</b>—Basic rate 5ESS switches</li> <li>• <b>basic-dms100</b>—NT DMS-100 basic rate switches</li> <li>• <b>basic-net3</b>—NET3 ISDN switches</li> <li>• <b>basic-ni</b>—National ISDN-1 switches</li> <li>• <b>basic-nwnet3</b>—Norway NET3 switches (phase 1)</li> <li>• <b>basic-nznet3</b>—New Zealand NET3 switches</li> <li>• <b>basic-ts013</b>—Australian TS013 switches</li> <li>• <b>ntt</b>—Japanese NTT ISDN switches</li> <li>• <b>vn2</b>—French VN2 ISDN switches</li> <li>• <b>vn3</b>—French VN3 ISDN switches</li> </ul> |

## Configuring Security

Follow these steps to configure the router with security measures.

|        | Command                                                            | Task                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>hostname</b> <i>Router</i>                                      | <p>Configure the router with a host name, which is used in prompts and default configuration filenames.</p> <p>For PPP authentication, the host name entered with this command must match the username of the central-site router.</p>                                                                                                                                                                                            |
| Step 2 | <b>enable password</b> <i>&lt;user&gt;</i>                         | Specify a password to prevent unauthorized access to the router.                                                                                                                                                                                                                                                                                                                                                                  |
| Step 3 | <b>username</b> <i>HQ1</i> <b>password</b> <i>&lt;guessme1&gt;</i> | <p>Specify the password used during caller identification and CHAP and PAP authentication.</p> <p>This password applies only to one of the central-site routers. For security reasons, a different password should be used for each remote location that the router dials on the backup ISDN line.</p> <p>For PPP authentication, the username entered with this command must match the host name of the central-site router.</p> |
| Step 4 | <b>username</b> <i>HQ2</i> <b>password</b> <i>&lt;guessme2&gt;</i> | <p>Specify the password used during caller identification and CHAP and PAP authentication.</p> <p>This password applies only to one of the central-site routers. For security reasons, a different password should be used for each remote location that the router dials on the backup ISDN line.</p> <p>For PPP authentication, the username entered with this command must match the host name of the central-site router.</p> |

## Configuring the Fast Ethernet Interface

Follow these steps to configure the Fast Ethernet interface, which connects your router to the local network.

|        | Command                                            | Task                                                               |
|--------|----------------------------------------------------|--------------------------------------------------------------------|
| Step 1 | <b>interface fastethernet0</b>                     | Enter configuration mode for this interface.                       |
| Step 2 | <b>ip address</b> <i>172.16.20.1 255.255.255.0</i> | Configure this interface with an Ethernet address.                 |
| Step 3 | <b>no ip route-cache</b>                           | Disable fast switching and autonomous switching on this interface. |
| Step 4 | <b>ip mroute-cache</b>                             | Enable IP multicast fast switching on this interface.              |
| Step 5 | <b>no shutdown</b>                                 | Enable the configuration changes for this interface.               |
| Step 6 | <b>exit</b>                                        | Exit configuration mode for this interface.                        |

## Configuring the Serial Interface

Follow these steps to configure the serial interface, which connects your router to the central-site router over the wide-area network.

|        | Command                          | Task                                                    |
|--------|----------------------------------|---------------------------------------------------------|
| Step 1 | <b>interface serial0</b>         | Enter configuration mode for this interface.            |
| Step 2 | <b>no ip address</b>             | Disable IP processing for this interface.               |
| Step 3 | <b>encapsulation frame-relay</b> | Configure this interface for Frame Relay encapsulation. |
| Step 4 | <b>no shutdown</b>               | Enable the configuration changes for this interface.    |
| Step 5 | <b>exit</b>                      | Exit configuration mode for this interface.             |

## Configuring the Primary Connection to the First Central-Site Router

Follow these steps to configure a Frame Relay connection to a central-site router.

|        | Command                                      | Task                                                                                                                                                                                                                                                                                                                                                                                              |
|--------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>interface serial0.1 point-to-point</b>    | Create a subinterface, and enter configuration mode for the interface.                                                                                                                                                                                                                                                                                                                            |
| Step 2 | <b>backup delay 10 10</b>                    | Define when the ISDN line is used as a backup for this interface: <ul style="list-style-type: none"> <li>• The first number is the amount of time (in seconds) that the Frame Relay line is down before the ISDN line comes up as the backup line.</li> <li>• The second number is amount of time (in seconds) after the Frame Relay line comes back up until the ISDN line goes down.</li> </ul> |
| Step 3 | <b>backup interface Dialer1</b>              | Configure the BRI interface to act as a dial backup line for this subinterface.                                                                                                                                                                                                                                                                                                                   |
| Step 4 | <b>ip address 172.16.30.40 255.255.255.0</b> | Configure this subinterface with an IP address.                                                                                                                                                                                                                                                                                                                                                   |
| Step 5 | <b>ipx network AABB</b>                      | Configure this subinterface with an IPX network address.                                                                                                                                                                                                                                                                                                                                          |
| Step 6 | <b>frame-relay interface-dlci 17</b>         | Assign a DLCI to this subinterface.                                                                                                                                                                                                                                                                                                                                                               |
| Step 7 | <b>no shutdown</b>                           | Enable the configuration changes for this subinterface.                                                                                                                                                                                                                                                                                                                                           |
| Step 8 | <b>exit</b>                                  | Exit configuration mode for this subinterface.                                                                                                                                                                                                                                                                                                                                                    |

## Configuring the Primary Connection to the Second Central-Site Router

Follow these steps to configure a Frame Relay connection to a second central-site router.

|        | Command                                      | Task                                                                                                                                                                                                                                                                                                                                                                                              |
|--------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>interface serial0.2 point-to-point</b>    | Create a subinterface, and enter configuration mode for the interface.                                                                                                                                                                                                                                                                                                                            |
| Step 2 | <b>backup delay 10 10</b>                    | Define when the ISDN line is used as a backup for this interface: <ul style="list-style-type: none"> <li>• The first number is the amount of time (in seconds) that the Frame Relay line is down before the ISDN line comes up as the backup line.</li> <li>• The second number is amount of time (in seconds) after the Frame Relay line comes back up until the ISDN line goes down.</li> </ul> |
| Step 3 | <b>backup interface Dialer2</b>              | Configure the BRI interface to act as a dial backup line for this subinterface.                                                                                                                                                                                                                                                                                                                   |
| Step 4 | <b>ip address 172.16.40.40 255.255.255.0</b> | Configure this subinterface with an IP address.                                                                                                                                                                                                                                                                                                                                                   |
| Step 5 | <b>ipx network BBCC</b>                      | Configure this subinterface with an IPX network address.                                                                                                                                                                                                                                                                                                                                          |
| Step 6 | <b>frame-relay interface-dlci 18</b>         | Assign a DLCI to this subinterface.                                                                                                                                                                                                                                                                                                                                                               |
| Step 7 | <b>no shutdown</b>                           | Enable the configuration changes for this subinterface.                                                                                                                                                                                                                                                                                                                                           |
| Step 8 | <b>exit</b>                                  | Exit configuration mode for this subinterface.                                                                                                                                                                                                                                                                                                                                                    |

## Configuring the ISDN Interface

Follow these steps to configure the ISDN line to act as a backup connection in the event of failure of the Frame Relay connection.

|        | Command                     | Task                                                   |
|--------|-----------------------------|--------------------------------------------------------|
| Step 1 | <b>interface BRI0</b>       | Enter configuration mode for this interface.           |
| Step 2 | <b>encapsulation ppp</b>    | Configure this interface for PPP packet encapsulation. |
| Step 3 | <b>dialer pool-member 1</b> | Assign this interface to a dialer pool.                |
| Step 4 | <b>no shutdown</b>          | Enable the configuration changes on this interface.    |
| Step 5 | <b>exit</b>                 | Exit configuration mode for this interface.            |

## Configuring the Backup Connection to the First Central-Site Router

Follow these steps to configure the ISDN backup connection to one central-site router.

|        | Command                            | Task                                                                                                                                                                                                                                                                                        |
|--------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>interface Dialer1</b>           | Create an ISDN dialer interface, and enter configuration mode for the interface.<br><br>The number that you assign in this command must match the number you assigned with the <b>backup interface</b> command when you configured the primary connection to the first central-site router. |
| Step 2 | <b>ip unnumbered fastethernet0</b> | Enable IP routing without assigning an IP address.                                                                                                                                                                                                                                          |
| Step 3 | <b>encapsulation ppp</b>           | Configure this interface for PPP packet encapsulation.                                                                                                                                                                                                                                      |

|         | Command                              | Task                                                                                                                                                                                                                                                                                                |
|---------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 4  | <b>ipx network</b> <i>DCBA</i>       | Configure this interface with an IPX network number.                                                                                                                                                                                                                                                |
| Step 5  | <b>dialer remote-name</b> <i>HQ1</i> | Configure the name of the central-site router that this interface dials.<br><br>The name that you enter with this command should be the same name that you entered with the <b>username password</b> command in the “ <a href="#">Configuring Security</a> ” section on <a href="#">page 7-32</a> . |
| Step 6  | <b>dialer string</b> <i>5551234</i>  | Configure the number that the interface dials to connect to the central-site router.                                                                                                                                                                                                                |
| Step 7  | <b>dialer max-call</b> <i>1</i>      | Specify that the router can have only one call connected to the first central-site router at any one time.                                                                                                                                                                                          |
| Step 8  | <b>dialer pool</b> <i>1</i>          | Assign this interface to a dialer pool.                                                                                                                                                                                                                                                             |
| Step 9  | <b>dialer-group</b> <i>1</i>         | Assign this interface to a dialer group.                                                                                                                                                                                                                                                            |
| Step 10 | <b>ppp authentication chap pap</b>   | Enable CHAP and PAP authentication on this interface. CHAP authentication is attempted first. If the central-site router does not support CHAP, then PAP is used for authentication.                                                                                                                |
| Step 11 | <b>no shutdown</b>                   | Enable the configuration changes for this interface.                                                                                                                                                                                                                                                |
| Step 12 | <b>exit</b>                          | Exit configuration mode for this subinterface.                                                                                                                                                                                                                                                      |

## Configuring the Backup Connection to the Second Central-Site Router

Follow these steps to configure the ISDN backup connection to a second central-site router.

|         | Command                            | Task                                                                                                                                                                                                                                                                                                |
|---------|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1  | <b>interface Dialer2</b>           | Create an ISDN dialer interface, and enter configuration mode for the interface.<br><br>The number that you assign in this command must match the number you assigned with the <b>backup interface</b> command when you configured the primary connection to the second central-site router.        |
| Step 2  | <b>ip unnumbered fastethernet0</b> | Enable IP routing without assigning an IP address.                                                                                                                                                                                                                                                  |
| Step 3  | <b>encapsulation ppp</b>           | Configure this interface for PPP packet encapsulation.                                                                                                                                                                                                                                              |
| Step 4  | <b>ipx network ABCD</b>            | Configure this interface with an IPX network number.                                                                                                                                                                                                                                                |
| Step 5  | <b>dialer remote-name HQ2</b>      | Configure the name of the central-site router that this interface dials.<br><br>The name that you enter with this command should be the same name that you entered with the <b>username password</b> command in the “ <a href="#">Configuring Security</a> ” section on <a href="#">page 7-32</a> . |
| Step 6  | <b>dialer string 5551122</b>       | Configure the number that the interface dials to connect to the central-site router.                                                                                                                                                                                                                |
| Step 7  | <b>dialer max-call 1</b>           | Specify that the router can have only one call connected to the first central-site router at any one time.                                                                                                                                                                                          |
| Step 8  | <b>dialer pool 1</b>               | Assign this interface to a dialer pool.                                                                                                                                                                                                                                                             |
| Step 9  | <b>dialer-group 1</b>              | Assign this interface to a dialer group.                                                                                                                                                                                                                                                            |
| Step 10 | <b>ppp authentication chap pap</b> | Enable CHAP and PAP authentication on this interface. CHAP authentication is attempted first. If the central-site router does not support CHAP, then PAP is used for authentication.                                                                                                                |

|         | Command            | Task                                                 |
|---------|--------------------|------------------------------------------------------|
| Step 11 | <b>no shutdown</b> | Enable the configuration changes for this interface. |
| Step 12 | <b>exit</b>        | Exit configuration mode for this subinterface.       |

## Configuring Routing Protocols

Follow these steps to configure the router for EIGRP routing.

|        | Command                   | Task                                                |
|--------|---------------------------|-----------------------------------------------------|
| Step 1 | <b>router eigrp 1</b>     | Configure the router for IP EIGRP routing.          |
| Step 2 | <b>network 172.16.0.0</b> | Configure the IP network address for EIGRP routing. |
| Step 3 | <b>exit</b>               | Exit router configuration mode.                     |

## Configuring Command-Line Access to the Router

Follow these steps to configure parameters that control access to the router.

|        | Command                            | Task                                                                                                |
|--------|------------------------------------|-----------------------------------------------------------------------------------------------------|
| Step 1 | <b>line console 0</b>              | Specify the console terminal line.                                                                  |
| Step 2 | <b>exec-timeout 5</b>              | Set the interval (in minutes) that the EXEC command interpreter waits until user input is detected. |
| Step 3 | <b>line vty 0 4</b>                | Specify a virtual terminal for remote console access.                                               |
| Step 4 | <b>password &lt;lineaccess&gt;</b> | Specify a password on the line.                                                                     |
| Step 5 | <b>login</b>                       | Enable password checking at terminal session login.                                                 |
| Step 6 | <b>end</b>                         | Exit configuration mode.                                                                            |

# ISDN as a Backup Connection with Floating Static Routes

When the router makes routing decisions, static routes normally take precedence over learned routes. If you have configured static routes, the router usually sends data over these routes before using routes that it has learned and stored in the routing table.

However, when the ISDN line is used as a backup connection and is configured with static routes, the primary WAN connection (the Frame Relay line) does not come back up when the ISDN line is used. Floating static routes enable the ISDN line to use static routes to the central-site router until the main WAN connection, the Frame Relay line, is active again.

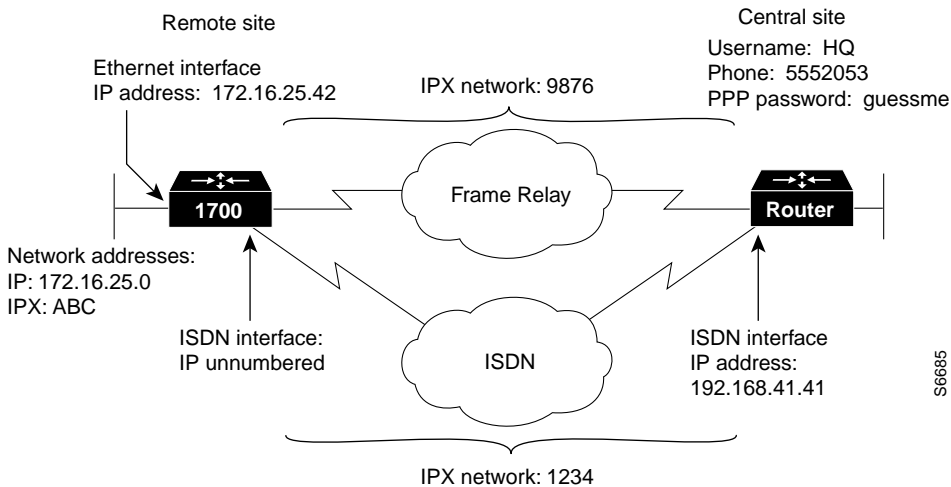
This section describes how to configure ISDN to operate as a secondary, or backup, WAN connection with floating static routes.

These are the major tasks in configuring your router:

- [Configuring Global Parameters](#)
- [Configuring Security](#)
- [Configuring the Fast Ethernet Interface](#)
- [Configuring the Frame Relay Interface](#)
- [Configuring the Frame Relay Subinterface](#)
- [Configuring the ISDN Interface](#)
- [Configuring EIGRP Routing](#)
- [Configuring When the Router Dials Out](#)
- [Configuring Command-Line Access to the Router](#)

Figure 7-4 shows the configuration example used in this section.

Figure 7-4 Configuration Example—ISDN as Backup Connection with Floating Static Routes



## Assumptions

In addition to the assumptions listed in the “[Before You Begin](#)” section of this chapter, the configuration in this section is based on the following assumptions:

- Frame Relay is being used as the primary WAN connection to the central site.
- You are routing IP data.
- The ISDN line is the being used as the secondary WAN connection to the central site.

## Configuring Global Parameters

Follow these steps to configure the router for some global parameters.

|        | Command                                       | Task                                                                                                                                                                                                                                                                   |
|--------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>configure terminal</b>                     | Enter configuration mode.                                                                                                                                                                                                                                              |
| Step 2 | <b>service timestamps debug datetime msec</b> | Configure the router to show the date and time of all debug messages.<br><br>This command is optional, but it is recommended if you use debug commands to troubleshoot your configuration.                                                                             |
| Step 3 | <b>service timestamps log datetime msec</b>   | Configure the router to show the date and time of all log messages.<br><br>This command is optional, but it is recommended if you use the verification steps described in this guide. This feature is enabled for all the command output examples shown in this guide. |

|        | Command                                 | Task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 4 | <b>isdn switch-type</b> <i>basic-ni</i> | <p>Configure the type of central office switch being used on the ISDN interface. Use the keyword that matches the ISDN switch type that you are using:</p> <ul style="list-style-type: none"> <li>• <b>basic-1tr6</b>—German 1TR6 ISDN switches</li> <li>• <b>basic-5ess</b>—Basic rate 5ESS switches</li> <li>• <b>basic-dms100</b>—NT DMS-100 basic rate switches</li> <li>• <b>basic-net3</b>—NET3 ISDN switches</li> <li>• <b>basic-ni</b>—National ISDN-1 switches</li> <li>• <b>basic-nwnet3</b>—Norway NET3 switches (phase 1)</li> <li>• <b>basic-nznet3</b>—New Zealand NET3 switches</li> <li>• <b>basic-ts013</b>—Australian TS013 switches</li> <li>• <b>ntt</b>—Japanese NTT ISDN switches</li> <li>• <b>vn2</b>—French VN2 ISDN switches</li> <li>• <b>vn3</b>—French VN3 ISDN switches</li> </ul> |

## Configuring Security

Follow these steps to configure the router with security measures.

|        | Command                       | Task                                                                                                                                                                                                                                   |
|--------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>hostname</b> <i>Router</i> | <p>Configure the router with a host name, which is used in prompts and default configuration filenames.</p> <p>For PPP authentication, the host name entered with this command must match the username of the central-site router.</p> |

|        | Command                                                          | Task                                                                                                                                                                                                                        |
|--------|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 2 | <b>enable password</b> <i>&lt;user&gt;</i>                       | Specify a password to prevent unauthorized access to the router.                                                                                                                                                            |
| Step 3 | <b>username</b> <i>HQ</i> <b>password</b> <i>&lt;guessme&gt;</i> | Specify the password used during caller identification and CHAP and PAP authentication.<br><br>For CHAP and PAP authentication, the username entered with this command must match the host name of the central-site router. |

## Configuring the Fast Ethernet Interface

Follow these steps to configure the Fast Ethernet interface, which connects your router to the local network.

|        | Command                                                     | Task                                                                                         |
|--------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Step 1 | <b>interface fastethernet0</b>                              | Enter configuration mode for the Fast Ethernet interface.                                    |
| Step 2 | <b>ip address</b> <i>172.16.25.1</i> <i>255.255.255.224</i> | Configure this interface with an IP address and a subnet mask.                               |
| Step 3 | <b>no shutdown</b>                                          | Enable the interface and the configuration changes that you have just made on the interface. |
| Step 4 | <b>exit</b>                                                 | Exit configuration mode for the this interface.                                              |

## Configuring the Frame Relay Interface

Follow these steps to configure parameters for the Frame Relay interface, which connects your router to the central-site router over the wide-area network.

|        | Command                          | Task                                                                                         |
|--------|----------------------------------|----------------------------------------------------------------------------------------------|
| Step 1 | <b>interface Serial0</b>         | Enter configuration mode for the serial interface.                                           |
| Step 2 | <b>no ip address</b>             | Disable IP routing on this interface.                                                        |
| Step 3 | <b>encapsulation frame-relay</b> | Set the encapsulation method on this interface to Frame Relay.                               |
| Step 4 | <b>no shutdown</b>               | Enable the interface and the configuration changes that you have just made on the interface. |
| Step 5 | <b>exit</b>                      | Exit configuration mode for this interface.                                                  |

## Configuring the Frame Relay Subinterface

Follow these steps to configure the Frame Relay subinterface network addresses.

|        | Command                                       | Task                                                                                                                                                                                                                                    |
|--------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>interface serial0.1 point-to-point</b>     | Enter configuration mode for the serial subinterface, and specify this interface as a point-to-point connection.                                                                                                                        |
| Step 2 | <b>ip address 192.168.39.41 255.255.255.0</b> | Configure this subinterface with an IP address.                                                                                                                                                                                         |
| Step 3 | <b>ipx network 9876</b>                       | Configure this subinterface with an IPX network number.                                                                                                                                                                                 |
| Step 4 | <b>frame-relay interface-dlci 17</b>          | Assign a DLCI to the Frame Relay subinterface. If you are unsure of the DLCI, use the number that you recorded in <a href="#">Step 4</a> of the “ <a href="#">Verifying Your Configuration</a> ” section on <a href="#">page 7-28</a> . |
| Step 5 | <b>exit</b>                                   | Exit configuration mode for this interface.                                                                                                                                                                                             |

## Configuring the ISDN Interface

Follow these steps to configure parameters for the ISDN interface, which connects your router to the central-site router if for some reason the Frame Relay connection fails.

|        | Command                            | Task                                                                                                                                                                                                              |
|--------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>interface BRI0</b>              | Enter configuration mode for the ISDN interface.                                                                                                                                                                  |
| Step 2 | <b>isdn spid1 555987601</b>        | Enter the SPID number assigned by the ISDN service provider to the B1 channel.<br><br>This step is required only when the service provider has assigned a SPID to your ISDN line. Not all ISDN lines have SPIDs.  |
| Step 3 | <b>isdn spid2 555987602</b>        | Define the SPID number assigned by the ISDN service provider to the B2 channel.<br><br>This step is required only when the service provider has assigned a SPID to your ISDN line. Not all ISDN lines have SPIDs. |
| Step 4 | <b>ip unnumbered fastethernet0</b> | Enable IP routing on this interface without assigning an IP address.                                                                                                                                              |
| Step 5 | <b>encapsulation ppp</b>           | Set the encapsulation method on this interface to PPP.                                                                                                                                                            |
| Step 6 | <b>ipx network 1234</b>            | Configure this interface with an IPX network number.                                                                                                                                                              |
| Step 7 | <b>ipx delay 200</b>               | Configure this interface to exchange routing information while the ISDN line is up. Routing updates do not bring up the ISDN line if it is down.                                                                  |
| Step 8 | <b>no ip route-cache</b>           | Disable fast switching and autonomous switching on this interface.                                                                                                                                                |
| Step 9 | <b>ipx watchdog-spoof</b>          | Set the router to respond to local server watchdog packets on behalf of a remote client (called <i>spoofing</i> ).                                                                                                |

|         | Command                            | Task                                                                                                                                                                                 |
|---------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 10 | <b>dialer idle-timeout</b> 300     | Configure the ISDN line to go down after a specified number of seconds with no network traffic.                                                                                      |
| Step 11 | <b>dialer string</b> 5552053       | Configure the telephone number that this interface dials to reach the central site.                                                                                                  |
| Step 12 | <b>dialer-group</b> 1              | Assign this interface to a dialer group.                                                                                                                                             |
| Step 13 | <b>no fair-queue</b>               | Disable weighted fair queuing for this interface.                                                                                                                                    |
| Step 14 | <b>ppp authentication chap pap</b> | Enable CHAP and PAP authentication on this interface. CHAP authentication is attempted first. If the central-site router does not support CHAP, then PAP is used for authentication. |
| Step 15 | <b>ppp multilink</b>               | Enable multilink PPP on this interface.                                                                                                                                              |
| Step 16 | <b>no shutdown</b>                 | Enable the interface and the configuration changes that you have just made on the interface.                                                                                         |
| Step 17 | <b>exit</b>                        | Exit configuration mode for this interface.                                                                                                                                          |

## Configuring EIGRP Routing

Follow these steps to configure the router for EIGRP and IP routing parameters that the router uses to connect to the central-site router.

|        | Command                    | Task                                                                                                                   |
|--------|----------------------------|------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>router eigrp</b> 202    | Configure the IP EIGRP routing process.                                                                                |
| Step 2 | <b>network</b> 172.16.0.0  | Specify a list of networks for the EIGRP routing process by entering the IP address of the directly connected network. |
| Step 3 | <b>network</b> 192.168.0.0 | To specify a list of networks for the EIGRP routing process, enter the IP address of the directly connected network.   |

|        | Command             | Task                                                                                                                            |
|--------|---------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Step 4 | <b>ip classless</b> | Specify that the router does not forward packets that are destined for a subnet of a network that has no network default route. |
| Step 5 | <b>exit</b>         | Exit router configuration mode.                                                                                                 |

## Configuring When the Router Dials Out

Follow these steps to configure access lists and static routes that determine when the ISDN line dials the central-site router.

|         | Command                                                     | Task                                                                    |
|---------|-------------------------------------------------------------|-------------------------------------------------------------------------|
| Step 1  | <b>ip route 0.0.0.0 0.0.0.0 192.168.41.41 150</b>           | Establish a static IP route to the remote network.                      |
| Step 2  | <b>ip route 192.168.41.41 255.255.0.0 BRI0</b>              | Establish a static IP route on the BRI interface to the remote network. |
| Step 3  | <b>access-list 101 deny ip any 224.0.0.0 31.255.255.255</b> | Define a standard access list based on network variables.               |
| Step 4  | <b>access-list 101 permit ip any any</b>                    | Define a standard access list based on network variables.               |
| Step 5  | <b>access-list 900 deny any any all any 457</b>             | Define a standard access list based on network variables.               |
| Step 6  | <b>access-list 900 deny rip any rip any rip</b>             | Define a standard access list based on network variables.               |
| Step 7  | <b>access-list 900 deny sap any sap any sap</b>             | Define a standard access list based on network variables.               |
| Step 8  | <b>access-list 900 permit any any all any all</b>           | Define a standard access list based on network variables.               |
| Step 9  | <b>ipx route CBA 1234.0000.0c75.c689 floating-static</b>    | Define a floating static IPX route to the central-site network.         |
| Step 10 | <b>ipx route CCB 1234.0000.0c75.c689 floating-static</b>    | Define a floating static IPX route to the central-site network.         |

|         | Command                                                                    | Task                                                                                                                                          |
|---------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Step 11 | <b>ipx route</b> <i>5E11 1234.0000.0c75.c689</i><br><b>floating-static</b> | Define a floating static IPX route to the central-site network.                                                                               |
| Step 12 | <b>ipx sap</b> <i>4 MRKT_SERV</i><br><i>5E11.0000.0000.0001 452 2</i>      | Define a static route to an IPX server on the central-site network.                                                                           |
| Step 13 | <b>ipx sap</b> <i>4 ENG_SERV CCB.0000.0000.0001</i><br><i>452 2</i>        | Define a static route to an IPX server on the central-site network.                                                                           |
| Step 14 | <b>ipx sap</b> <i>4 CORP_SERV CBA.0000.0000.0001</i><br><i>452 2</i>       | Define a static route to an IPX server on the central-site network.                                                                           |
| Step 15 | <b>dialer-list</b> <i>1 protocol ipx list 900</i>                          | Specify a dialer list both by list number and by protocol (IPX) to define the packets of interest that can trigger a call to the destination. |
| Step 16 | <b>dialer-list</b> <i>1 protocol ip list 101</i>                           | Specify a dialer list both by list number and by protocol (IP) to define the packets of interest that can trigger a call to the destination.  |

## Configuring Command-Line Access to the Router

Follow these steps to configure parameters that control access to the router.

|        | Command                                   | Task                                                                                                |
|--------|-------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Step 1 | <b>line console</b> <i>0</i>              | Specify the console terminal line.                                                                  |
| Step 2 | <b>exec-timeout</b> <i>5</i>              | Set the interval (in minutes) that the EXEC command interpreter waits until user input is detected. |
| Step 3 | <b>line vty</b> <i>0 4</i>                | Specify a virtual terminal for remote console access.                                               |
| Step 4 | <b>password</b> <i>&lt;lineaccess&gt;</i> | Specify a password on the line.                                                                     |
| Step 5 | <b>login</b>                              | Enable password checking at terminal session login.                                                 |
| Step 6 | <b>end</b>                                | Exit configuration mode.                                                                            |

## Verifying Your Configuration

Follow these steps to verify that the ISDN line is configured to back up the Frame Relay line:

- 
- Step 1 Bring the Frame Relay connection down. This clears the routing table of all routes learned from the Frame Relay interface.
  - Step 2 Use the **ping** command to test connectivity to any central-site router that is on the 192.168.0.0 network. This should cause the ISDN line to connect dynamically and dial the central-site router.
  - Step 3 Bring the Frame Relay connection back up, and confirm that the ISDN link disconnects.
- 

## Troubleshooting Floating Static Route Problems

If you are having problems or if the output that you received during the verification steps is very different from that shown in the command output examples, you can troubleshoot your router with the Cisco IOS debug commands. The debug commands provide extensive command output that is not included in this document.



### Caution

---

If you are not familiar with Cisco IOS debug commands, you should read the “[Using Debug Commands](#)” section in the “[Introduction to Router Configuration](#)” chapter before attempting any debugging.

---

Following are debug commands that are helpful when troubleshooting ISDN with IP and IPX routing. Follow these commands with the **ping** command to display debug output:

- **debug dialer events**
- **debug isdn events**
- **debug isdn q931**
- **debug isdn q921**
- **debug ppp negotiation**

- **debug ppp authentication**
- **debug ppp multilink events**

