



Configuring ISDN

This chapter describes how to configure a Cisco router to dial into a central-site router over an ISDN line and provides verification steps and troubleshooting tips.

This chapter contains the following sections:

- [Before You Begin](#)
- [Dial-Up ISDN Connection to a Central-Site Router](#)
- [Dial-Up ISDN Connection with Dialer Profiles](#)
- [Leased-Line ISDN Connection to a Central-Site Router](#)
- [Dial-In ISDN BRI Pool](#)

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 using multilink Point-to-Point Protocol (PPP).
- Your ISDN line is installed and correctly configured. Refer to the “Configuring the ISDN Line” chapter in the Hardware Installation Guide for more information on ordering and configuring your ISDN line.

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.

Dial-Up ISDN Connection to a Central-Site Router

This section tells how to configure your Cisco router for Internetwork Packet Exchange (IPX) when dialing out over an ISDN line. Configure your router for IP if you want to use Internet services, such as the World Wide Web, or if the network that you are dialing into uses IP. Configure your router for IPX if your network uses IPX network services, such as NetWare file servers or print servers.

This configuration assumes that the Cisco router is dialing into a central-site router.

**Note**

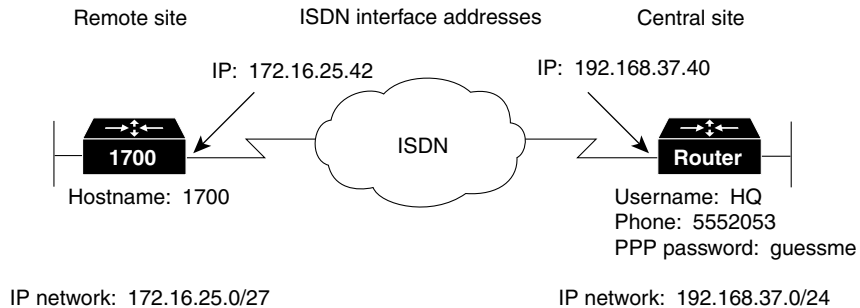
If you are using IP but not IPX on your network, do not enter the commands that include the **ipx** keyword.

These are the major tasks in configuring your router:

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

Figure 5-1 shows the configuration example used in this section.

Figure 5-1 ISDN Configuration Example—Dial-Up ISDN Connection to Central Site Router



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Configuring Global Parameters

Follow these steps to configure the router for global parameters.

	Command	Task
Step 1	<code>configure terminal</code>	Enter configuration mode.
Step 2	<code>service timestamps debug datetime msec</code>	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	<code>service timestamps log datetime msec</code>	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.

	Command	Task
Step 4	isdn switch-type <i>basic-ni</i>	<p>Configure the type of central office switch 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"> • basic-1tr6—German 1TR6 ISDN switches • basic-5ess—Basic rate 5ESS switches • basic-dms100—NT DMS-100 basic rate switches • basic-net3—NET3 ISDN switches • basic-ni—National ISDN-1 switches • basic-nwnet3—Norway NET3 switches (phase 1) • basic-nznet3—New Zealand NET3 switches • basic-ts013—Australian TS013 switches • ntt—Japanese NTT ISDN switches • vn2—French VN2 ISDN switches • vn3—French VN3 ISDN switches
Step 5	ipx routing <i>0060.834f.66dd</i>	(Optional) 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	enable password <i><user></i>	Specify a password to prevent unauthorized access to the router.
Step 2	hostname <i>Router</i>	Configure the router with a host name, which is used in prompts and default configuration file names. For PPP authentication, the host name entered with this command must match the username of the central-site router.
Step 3	username <i>HQ</i> password <i><guessme></i>	Specify the password used during caller identification and Challenge Handshake Authentication Protocol (CHAP) and Password Authentication Protocol (PAP) authentication. 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	interface fastethernet0	Enter configuration mode for the Fast Ethernet interface.
Step 2	ip address <i>172.16.25.42 255.255.255.224</i>	Configure this interface with an IP address and a subnet mask.
Step 3	ipx network <i>ABC</i>	(Optional) Enable IPX routing on this interface and assign the interface with an IPX network address.

	Command	Task
Step 4	no shutdown	Enable the interface and the configuration changes you have just made on the interface.
Step 5	exit	Exit configuration mode for this interface.

Verifying Your Configuration

You can verify your configuration by checking that the Fast Ethernet interface has the correct IP address:

Step 1 From the privileged EXEC command mode, enter the **show arp** command:

```
Router# show arp
```

Step 2 You should see command output similar to the following:

```
Protocol Address          Age (min)  Hardware
Addr   Type   Interface
Internet 171.16.25.42      -         0060.834f.66dd  ARPA   Fast
Ethernet0
Router#
```

Step 3 The IP address, as shown in the command output example, should be your router Fast Ethernet IP address. If it is not, then reenter the IP address with **ip address** interface command.

Step 4 To continue configuration, reenter global configuration mode.

Configuring the ISDN Interface

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

	Command	Task
Step 1	interface BRI0	Enter configuration mode for the ISDN interface.
Step 2	description <i>ISDN connectivity</i>	Add a description of this interface to help you remember what is attached to it.
Step 3	isdn spid1 <i>555987601</i>	Enter the service profile identifier (SPID) number assigned by the ISDN service provider to the B1 channel. 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	isdn spid2 <i>555987602</i>	Define the SPID number assigned by the ISDN service provider to the B2 channel. This step is required only when the service provider has assigned a SPID to your ISDN line. Not all ISDN lines have SPIDs.
Step 5	ip unnumbered fastethernet0	Enable IP routing on this interface without assigning an IP address.
Step 6	dialer map ip <i>192.168.37.40</i> name <i>HQ</i> <i>5552053</i>	Configure this interface to place a call to multiple sites and to authenticate calls from multiple sites based on IP address and dialer string (phone number). The name you enter after the name keyword in this command must match the name entered with the username command in the “ Configuring Security ” section on page 5-4.
Step 7	ipx network <i>123</i>	(Optional) Enable IPX routing on this interface and assign an IPX network address to the interface.
Step 8	no ipx route-cache	(Optional) Disable IPX fast switching on this interface.
Step 9	ipx watchdog-spoof	(Optional) Set the router to respond to local server watchdog packets on behalf of a remote client (called <i>spoofing</i>).

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	Command	Task
Step 10	dialer map ipx 123.0000.0003.eccb name HQ broadcast 5552053	(Optional) Configure this interface to call multiple sites, based on IPX address and dialer string (phone number).
Step 11	dialer load-threshold 70	Configure bandwidth on demand by setting the maximum load before the router places another call to a destination.
Step 12	dialer-group 1	Assign the dialer interface to a dialer group.
Step 13	no fair-queue	Disable weighted fair queuing on this interface.
Step 14	encapsulation ppp	Configure this interface for PPP encapsulation.
Step 15	ppp authentication chap pap	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 16	ppp multilink	Enable multilink PPP on this interface.
Step 17	no shutdown	Enable the interface and the configuration changes you have just made on the interface.
Step 18	exit	Exit configuration mode for this interface.

Verifying Your Configuration

You can verify your configuration to this point by confirming the ISDN line status:

- Step 1** From the privileged EXEC command mode, enter the **show isdn status** command.

You should see command output similar to the following:

```
Router# show isdn status
The current ISDN Switchtype = basic-5ess
ISDN BRI0 interface
  Layer 1 Status:
    ACTIVE
  Layer 2 Status:
    TEI = 80, State = MULTIPLE_FRAME_ESTABLISHED
```

```
Layer 3 Status:
  No Active Layer 3 Call(s)
Activated dsl 0 CCBs = 0
Total Allocated ISDN CCBs =
```

- Step 2** Confirm that the current ISDN switch type matches the actual switch type that you are using. In the output example, the switch type is “basic-5ess.”
- Step 3** Confirm that the “Layer 1 status: ACTIVE” message appears in the command output. In the output example, the status is “ACTIVE.”
- Step 4** Confirm that the “State = MULTIPLE_FRAME_ESTABLISHED” message appears in the command output. The output example shows this message.
- In some cases, you might see a “State = TEI_ASSIGNED” message instead of the “State = MULTIPLE_FRAME_ESTABLISHED” message. This message also means that the ISDN line is correctly configured.
- Step 5** To continue configuration, reenter global configuration mode.
-

Tips

If you are having problems, do the following:

- Make sure that you entered the **no shutdown** command for the ISDN interface while in interface configuration mode. This enables the configuration changes that you made on the interface.
- Make sure that any external Network Termination 1 (NT1) equipment is functioning correctly. Refer to the documentation that came with the NT1.
- Check with the ISDN service provider to make sure that the ISDN line is correctly configured.

Configuring Static Routes and Dialing Behavior

Follow these steps to configure some parameters that control how and when the router dials the central-site router.

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	Command	Task
Step 1	ip route <i>0.0.0.0 0.0.0.0 192.168.37.40</i>	Establish a static IP route to the remote network.
Step 2	ip route <i>192.168.37.40 255.255.255.255</i> BRI0	Establish a static IP route to the central-site router through this interface.
Step 3	access-list <i>101 permit icmp any any</i>	Define a standard access list based on Internet Control Message Protocol (ICMP) traffic.
Step 4	access-list <i>101 permit ip any any</i>	Define a standard access list based on IP traffic.
Step 5	dialer-list <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.
Step 6	access-list <i>900 deny any any all any 457</i>	(Optional) Define a standard access list based on IPX network variables.
Step 7	access-list <i>900 deny rip any rip any rip</i>	(Optional) Define a standard access list based on IPX network variables.
Step 8	access-list <i>deny sap and sap any sap</i>	(Optional) Define a standard access list based on IPX network variables.
Step 9	access-list <i>900 permit any any all any all</i>	(Optional) Define a standard access list based on IPX network variables.
Step 10	dialer-list <i>1 protocol ipx list 900</i>	(Optional) Specify an access list both by list number and by protocol (IPX) to define the packets that will trigger the router to make a call to the destination.

Verifying Your Configuration

You can verify your configuration to this point by

- [Confirming the Static IP Route](#)
- [Confirming the IPX Route](#)
- [Confirming Connectivity to the Central-Site Router](#)
- [Confirming Multilink PPP Configuration for the B1 Channel](#)
- [Confirming Multilink PPP Configuration for the B2 Channel](#)

Confirming the Static IP Route

You can verify your configuration by confirming the static IP route:

Step 1 From the privileged EXEC command mode, enter the **show ip route** command.

Substitute the IP address of the central-site router ISDN interface for the IP address shown in the example.

Step 2 Confirm that the “directly connected via BRI” message (shown in the output example) appears in the command output:

```
Router# show ip route 192.168.37.40
Routing entry for 192.168.37.40/32
  Known via "connected", distance 0, metric 0 (connected)
  Routing Descriptor Blocks:
  * directly connected, via BRI0
    Route metric is 0, traffic share count is 1
```

Step 3 To continue configuration, reenter global configuration mode.

Confirming the IPX Route

Step 1 From the privileged EXEC command mode, enter the **show ipx route** command. You should see command output similar to the following:

```
Router# show ipx route 123
Codes: C - Connected primary network, c - Connected secondary
network
       S - Static, F - Floating static, L - Local (internal), W -
IPXWAN
```

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```
R - RIP, E - EIGRP, N - NLSP, X - External, A - Aggregate
s - seconds, u - uses
```

```
2 Total IPX routes. Up to 1 parallel paths and 16 hops allowed.
```

```
No default route known.
```

```
C          123 (PPP),          BR0
```

- Step 2** Confirm that the IPX network number (123, in this example) matches the IPX network number that you configured with the **ipx network** command when you configured the Fast Ethernet interface.
- Step 3** To continue configuration, reenter global configuration mode.
-

Confirming Connectivity to the Central-Site Router

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

- 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 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** Note the percentage in the “Success rate” line. If the success rate is 60 percent (3/5) or greater, your router is successfully transferring data to the central-site router.

Step 3 To continue configuration, reenter global configuration mode.

Confirming Multilink PPP Configuration for the B1 Channel

Perform the two verification procedures in this section to verify that multilink PPP is configured on the ISDN B1 channel.

For the first verification procedure, perform these steps:

Step 1 From the privileged EXEC mode, confirm that the ISDN is connected to the remote site by entering the **ping** command, followed by the IP address of the central-site router:

```
Router# ping 192.168.37.40
```

Step 2 Enter the **show ppp multilink** command.

Step 3 Confirm that the “Master link is Virtual-Access1” message appears in the command output.

```
Router# show ppp multilink
Bundle HQ, 1 member, Master link is Virtual-Access1
Dialer Interface is BRI0
  0 lost fragments, 0 reordered, 0 unassigned, sequence 0x0/0x0
rcvd/sent
  0 discarded, 0 lost received, 1/255 load
Member Link: 1
BRI0:1
```

Step 4 If you do not see the message in the output, do one or both of the following:

- Confirm that multilink PPP is configured on the central-site router that you are connecting to.
- If multilink PPP is configured on the central-site router, use the **show interface** command as described in the second verification procedure.

Step 5 To continue configuration, reenter global configuration mode.

For the second verification procedure, perform these steps:

-
- Step 1** From the privileged EXEC command mode, confirm that the ISDN line is connected to the remote site by entering the **ping** command, followed by the IP address of the central-site router:

```
Router# ping 192.168.37.40
```

- Step 2** Enter the **show interface virtual-access 1** command.

- Step 3** Confirm that the “Open: IPCP” message appears in the command output:

```
Router# show interface virtual-access 1
```

```
Virtual-Access1 is up, line protocol is up
  Hardware is Virtual Access interface
  MTU 1500 bytes, BW 64 Kbit, DLY 100000 usec, rely 255/255, load
  1/255
  Encapsulation PPP, loopback not set, keepalive set (10 sec)
  DTR is pulsed for 5 seconds on reset
  LCP Open, multilink Open
  Open: IPCP
  Last input 00:00:01, output never, output hang never
  Last clearing of "show interface" counters 00:54:41
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    708 packets input, 150742 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    709 packets output, 157653 bytes, 0 underruns
    0 output errors, 0 collisions, 0 interface resets
    0 output buffer failures, 0 output buffers swapped out
    0 carrier transitions
```

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

Confirming Multilink PPP Configuration for the B2 Channel

Perform the two procedure in this section to verify that multilink PPP is configured on the ISDN B2 channel.

-
- Step 1** From the privileged EXEC command mode, confirm that the ISDN line is connected to the remote site by entering the **ping** command, followed by the IP address of the central-site router:

```
Router# ping 192.168.37.40
```

- Step 2** Create enough network traffic so that the second ISDN B channel dials the remote site.



Note One way to perform Step 2 is to reduce the amount of data needed to cause the second B channel to dial. To reduce the amount (called the *threshold*), use the **dialer load-threshold** command, which is described in Step 11 of the [“Configuring the ISDN Interface” section on page 5-6](#).

- Step 3** Check LEDs B1 and B2.
If both LEDs are lit solid, multilink PPP is correctly configured for both ISDN B channels.
- Step 4** To continue configuration, reenter global configuration mode.
-

Tips

If you are having problems, do the following:

- Confirm that your router is configured with the correct IP address.
- Confirm that you have correctly configured the static IP routes with the **ip route** command.

Configuring Command-Line Access to the Router

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

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

Troubleshooting

If you are having problems or the if output that you received during the verification steps is very different from that shown in the command output examples, you can troubleshoot your router, using 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 routing. Follow these commands with the **ping** command to display the debug output:

- **debug dialer events**
- **debug isdn events**
- **debug isdn q931**

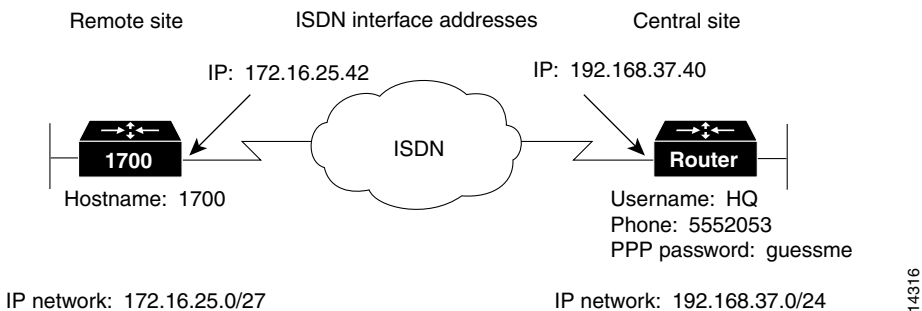
- **debug isdn q921**
- **debug ppp negotiation**
- **debug ppp authentication**
- **debug ppp multilink events**

Dial-Up ISDN Connection with Dialer Profiles

This section describes how to configure dialer profiles for ISDN. If you followed the instructions for configuring ISDN in the previous sections of this chapter, you might not have to perform all of the steps shown in this section.

Figure 5-2 shows the configuration example used in this section.

Figure 5-2 ISDN Configuration Example—Dial-Up ISDN Connection with Dialer Profiles



These are the major tasks in configuring your router:

- [Configuring Global Parameters](#)
- [Configuring Security](#)
- [Configuring the Fast Ethernet Interface](#)
- [Configuring the ISDN Interface](#)
- [Configuring the Dialer Interface](#)
- [Configuring When the Router Dials Out](#)
- [Configuring Command-Line Access to the Router](#)

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.

	Command	Task
Step 4	isdn switch-type <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"> • basic-1tr6—German 1TR6 ISDN switches • basic-5ess—Basic rate 5ESS switches • basic-dms100—NT DMS-100 basic rate switches • basic-net3—NET3 ISDN switches • basic-ni—National ISDN-1 switches • basic-nwnet3—Norway NET3 switches (phase 1) • basic-nznet3—New Zealand NET3 switches • basic-ts013—Australian TS013 switches • ntt—Japanese NTT ISDN switches • vn2—French VN2 ISDN switches • vn3—French VN3 ISDN switches

Verifying Your Configuration

You can verify your configuration to this point by checking the ISDN line status as follows:

Step 1 From the privileged EXEC command mode, enter the **show isdn status** command.

You should see command output similar to the following:

```
Router# show isdn status
The current ISDN Switchtype = basic-5ess
ISDN BRI0 interface
  Layer 1 Status:
    ACTIVE
```

```

Layer 2 Status:
  TEI = 80, State = MULTIPLE_FRAME_ESTABLISHED
Layer 3 Status:
  No Active Layer 3 Call(s)
Activated dsl 0 CCBs = 0
Total Allocated ISDN CCBs =

```

- Step 2** Confirm that the current ISDN switch type matches the actual switch type that you are using.
- Step 3** Confirm that the “Layer 1 status: ACTIVE” message appears in the command output, as shown in the output example.
- Step 4** Confirm that the “State = MULTIPLE_FRAME_ESTABLISHED” message appears in the command output, as shown in the output example.



Note In some cases, you might see a “State = TEI_ASSIGNED” message instead of the “State = MULTIPLE_FRAME_ESTABLISHED” message. This message also means that the ISDN line is correctly configured.

- Step 5** To continue configuration, reenter global configuration mode.
-

Tips

If you are having problems, do the following:

- Make sure that any external NT1 is functioning correctly. Refer to the documentation that came with the NT1.
- Check with the ISDN service provider to make sure that the ISDN line is correctly configured.

Configuring Security

Follow these steps to configure the router with security measures.

	Command	Task
Step 1	<code>hostname Router</code>	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	<code>enable password <user></code>	Specify a password to prevent unauthorized access to the router.
Step 3	<code>username HQ password <guessme></code>	Specify the password that will be used during CHAP caller identification and PAP. For PPP 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	<code>interface fastethernet0</code>	Enter configuration mode for the Fast Ethernet interface.
Step 2	<code>ip address 172.16.25.42 255.255.255.224</code>	Configure this interface with an IP address and a subnet mask.
Step 3	<code>ipx network ABC</code>	Enable IPX routing on this interface.
Step 4	<code>no shutdown</code>	Enable the interface and the configuration changes you have just made on the interface.
Step 5	<code>exit</code>	Exit configuration mode for this interface.

Configuring the ISDN Interface

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

	Command	Task
Step 1	interface BRI0	Enter configuration mode for the ISDN interface.
Step 2	description <i>ISDN connectivity</i>	Add a description of the ISDN interface to help you remember what is attached to it.
Step 3	isdn spid1 <i>555987601</i>	Enter the SPID number that has been assigned by the ISDN service provider for the B1 channel. This step is required only when the service provider has assigned a SPID to your ISDN line. Not all ISDN lines required SPIDs.
Step 4	isdn spid2 <i>555987602</i>	Define the SPID number that has been assigned by the ISDN service provider for the B2 channel. This step is required only when the service provider has assigned a SPID to your ISDN line. Not all ISDN lines required SPIDs.
Step 5	no ip address	Disable IP routing on this interface.
Step 6	dialer pool-member <i>1</i>	Put this interface in a dialing pool. As an option, you can also assign a priority to the interface with this command.
Step 7	encapsulation ppp	Set the encapsulation method on this interface to PPP.
Step 8	ppp authentication chap pap	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 9	ppp multilink	Enable multilink PPP on this interface.

	Command	Task
Step 10	no shutdown	Enable the interface and the configuration changes you have just made on the interface.
Step 11	exit	Exit configuration mode for this interface.

Configuring the Dialer Interface

Follow these steps to create a dialer interface and configure it for dial-on-demand routing (DDR).

	Command	Task
Step 1	interface <i>Dialer10</i>	Create a dialer interface.
Step 2	ip unnumbered fastethernet0	Enable IP routing on this interface without assigning an IP address.
Step 3	ipx network <i>123</i>	Enable IPX routing on this interface.
Step 4	no ipx route-cache	Disable IPX fast switching on this interface.
Step 5	ipx watchdog-spoof	Set the router to respond to a local server watchdog packets on behalf of a remote client (called <i>spoofing</i>).
Step 6	dialer remote-name <i>HQ</i>	Specify the central-site router CHAP authentication name.
Step 7	dialer string <i>5552053</i>	Specify the string (telephone number) to be called for this interface when calling a single site.
Step 8	dialer pool <i>1</i>	Put this interface in a dialing pool. As an option, you can also assign a priority to the interface with this command.
Step 9	dialer-group <i>1</i>	Assign the dialer interface to a dialer group.
Step 10	encapsulation ppp	Set the encapsulation method on this interface to PPP.

	Command	Task
Step 11	ppp authentication chap pap	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 12	ppp multilink	Enable multilink PPP on this interface.
Step 13	no shutdown	Enable the interface and the configuration changes you have just made on the interface.
Step 14	exit	Exit configuration mode for this interface.

Verifying Your Configuration

You can verify your configuration to this point by confirming the Multilink PPP Configuration for the B1 Channel.

-
- Step 1** Confirm that the ISDN is up and connected to the central-site router.
- Step 2** From the privileged EXEC command mode, enter the **show ppp multilink** command.
- Step 3** Confirm that the “Master link is Virtual-Access1” message appears in the command output, as shown in the output example.

```
Router# show ppp multilink
  Bundle HQ, 1 member, Master link is Virtual-Access1
Dialer Interface is BRI0
  0 lost fragments, 0 reordered, 0 unassigned, sequence 0x0/0x0
rcvd/sent
  0 discarded, 0 lost received, 1/255 load
Member Link: 1
BRI0:1
```

- Step 4** Return to the privileged EXEC command mode, and enter the **show interface** command.
- Step 5** Confirm that the “LCP Open, multilink Open” message appears in the command output, as shown in the output example.

```
Router# show interface bri 0 1 2
BRI0:1 is up, line protocol is up
  Hardware is BRI with U interface and external S bus interface
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec, rely 255/255, load
3/255
```

```

Encapsulation PPP, loopback not set, keepalive set (10 sec)
LCP Open, multilink Open
Last input 00:00:00, output 00:00:00, output hang never
Last clearing of "show interface" counters never
Queueing strategy: fifo...

```

Step 6 To continue configuration, reenter global configuration mode.

Configuring When the Router Dials Out

Follow these steps to configure parameters that control how and when the router dials the central-site router.

	Command	Task
Step 1	ip route <i>192.168.37.0 255.255.255.0 192.168.37.40</i>	Establish a static IP route to the remote network.
Step 2	ip route <i>192.168.37.40 255.255.255.255 BRI0</i>	Establish a static IP route to the remote network through the router BRI.
Step 3	access-list <i>101 permit icmp any any</i>	Define a standard access list based on your network.
Step 4	access-list <i>101 deny ip any any</i>	Define a standard access list based on your network.
Step 5	access-list <i>900 deny any any all any 457</i>	Define a standard access list based on your network.
Step 6	access-list <i>900 deny rip any rip any rip</i>	Define a standard access list based on your network.
Step 7	access-list <i>900 deny sap any sap any sap</i>	Define a standard access list based on your network.
Step 8	access-list <i>900 permit any any all any all</i>	Define a standard access list based on your network.

	Command	Task
Step 9	<code>dialer-list 1 protocol ip list 101</code>	Specify an access list both by list number and by protocol (IP) to define the packets of interest that can trigger a call to the destination.
Step 10	<code>dialer-list 1 protocol ipx list 900</code>	Specify an access list both by list number and by protocol (IPX) to define the packets of interest that can trigger a call to the destination.

Verifying Your Configuration

You can verify your configuration to this point by

- [Confirming the IP Static Route](#)
- [Confirming Connectivity to the Central-Site Router](#)

Confirming the IP Static Route

You can verify your configuration to this point by checking the static IP route as follows:

-
- Step 1** From the privileged EXEC command mode, enter the **show ip route** command. Substitute the IP address of the central-site router ISDN interface for the IP address shown in the example.
- Step 2** Confirm that the “directly connected via BRI” message appears, as shown in the command output.
- ```
Router# show ip route 192.168.37.40
Routing entry for 192.168.37.40/32
 Known via "connected", distance 0, metric 0 (connected)
 Routing Descriptor Blocks:
 * directly connected, via BRI0
```
- Step 3** To continue configuration, reenter global configuration mode.
-

## Confirming Connectivity to the Central-Site Router

You can verify your configuration to this point by testing 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 central-site router. You should see 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, as shown in the command output example.

- Step 3** Enter the **ping** command, followed by the IP address of the central-site router again:

```
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
```

If the success rate, as shown in the command output, is 100 percent, this verification step is successful.

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

---

## Tips

If you are having problems, do the following:

- Make sure that the router is configured with the correct IP address.
- Make sure that the router is configured with the correct static routes.

## Configuring Command-Line Access to the Router

Follow these steps to configure parameters that control access to the router, such as what type of terminal line can be used with the router, how long the user has to input a command before the router times out, and what password is used to start a terminal session with the router.

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

## Troubleshooting Dialer Profile 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, using 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.

---

The following are debug commands that are helpful in troubleshooting dialer profiles with ISDN. You need to follow most of these commands with the **ping** command to display debug output:

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

## Leased-Line ISDN Connection to a Central-Site Router

This section describes how to configure the router so that it uses the ISDN line as a leased-line connection to the central-site router. Unlike a switched connection to the central-site router, in which the router dials the central-site router only when it detects specified types and amounts of data traffic, a leased-line ISDN connection is always connected to the central office switch.

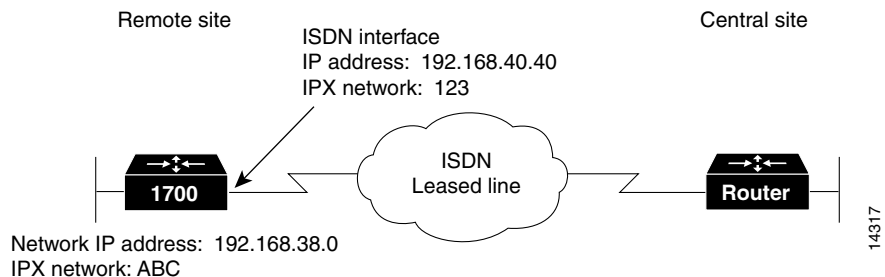
In addition to the assumptions described in the “[Before You Begin](#)” section at the beginning of this chapter, this configuration is based on the additional assumption that both ISDN B channels are connecting to the same central-site router.

These are the major tasks in configuring your router for a leased-line ISDN connection:

- [Configuring Global Parameters](#)
- [Configuring Security](#)
- [Configuring IPX Routing](#)
- [Configuring the ISDN Line for Leased Line](#)
- [Configuring the Fast Ethernet Interface](#)
- [Clearing the ISDN Interface](#)
- [Configuring the ISDN Subinterfaces](#)
- [Configuring Dynamic IP Routing](#)
- [Configuring Command-Line Access to the Router](#)

Figure 5-3 shows the configuration example that is used in this section.

**Figure 5-3 ISDN Configuration Example—Leased-Line Connection to a Central-Site Router**



## Configuring Global Parameters

Follow these steps to configure the router for global parameters.

|               | <b>Command</b>                                | <b>Task</b>                                                                                                                                                                                                                                                                   |
|---------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>configure terminal</b>                     | Enter configuration mode.                                                                                                                                                                                                                                                     |
| <b>Step 2</b> | <b>service timestamps debug datetime msec</b> | <p>Configure the router to show the date and time of all debug messages.</p> <p>This command is optional, but it is recommended if you use debug commands to troubleshoot your configuration.</p>                                                                             |
| <b>Step 3</b> | <b>service timestamps log datetime msec</b>   | <p>Configure the router to show the date and time of all log messages.</p> <p>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.</p> |

|        | Command                                 | Task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 4 | <b>isdn switch-type</b> <i>basic-ni</i> | <p>Configure the type of central office switch 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>enable password</b> <i>&lt;user&gt;</i>                       | Specify a password to prevent unauthorized access to the router.                                                                                                                                                                |
| Step 2 | <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 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 IPX Routing

Perform this step to enable IPX routing on the router. The default setting for the router is “IPX routing disabled.”

| Command                                  | Task                                                              |
|------------------------------------------|-------------------------------------------------------------------|
| <b>ipx routing</b> <i>0060.834f.66dd</i> | Enable IPX routing, and configure the router with an IPX address. |

## Configuring the ISDN Line for Leased Line

Follow these steps to set up the ISDN line for a leased-line configuration.

|        | Command                                    | Task                                                                                                                                                                                                      |
|--------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>multilink virtual-template</b> <i>1</i> | Define a virtual template from which this multilink PPP bundle interface can replicate its interface parameters.                                                                                          |
| Step 2 | <b>isdn leased-line BRI0</b> <i>128</i>    | Configure the BRI interface to use the ISDN physical connection as a leased-line service. If you want to combine both B channels into a single data pipe, enter the <i>128</i> keyword with this command. |

## Configuring the Fast Ethernet Interface

Use this table 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>192.168.38.42 255.255.255.0</i> | Configure this interface with an IP address and a subnet mask.                 |
| Step 3 | <b>ipx network</b> <i>ABC</i>                        | Configure this interface with an IPX network address.                          |
| Step 4 | <b>interface virtual-template</b> <i>1</i>           | Associate the virtual template with this interface.                            |
| Step 5 | <b>ip address</b> <i>192.168.40.40 255.255.255.0</i> | Configure the virtual template interface with an IP address and a subnet mask. |
| Step 6 | <b>ipx network</b> <i>123</i>                        | Configure the virtual template interface with an IPX network address.          |
| Step 7 | <b>encapsulation ppp</b>                             | Set the encapsulation method on this interface to PPP.                         |
| Step 8 | <b>ppp multilink</b>                                 | Enable multilink PPP on this interface.                                        |

|         | Command            | Task                                                                                    |
|---------|--------------------|-----------------------------------------------------------------------------------------|
| Step 9  | <b>no shutdown</b> | Enable the interface and the configuration changes you have just made on the interface. |
| Step 10 | <b>exit</b>        | Exit configuration mode for this interface.                                             |

## Clearing the ISDN Interface

Follow these steps to clear the IP address from the ISDN interface.

|        | Command               | Task                                            |
|--------|-----------------------|-------------------------------------------------|
| Step 1 | <b>interface BRI0</b> | Enter configuration mode for the BRI interface. |
| Step 2 | <b>no ip address</b>  | Disable IP routing on the BRI0 interface.       |
| Step 3 | <b>exit</b>           | Exit configuration mode for this interface.     |

## Configuring the ISDN Subinterfaces

Follow these steps to create and configure two ISDN subinterfaces, which connect your router to the central-site router over the wide-area network.

|        | Command                                | Task                                                                 |
|--------|----------------------------------------|----------------------------------------------------------------------|
| Step 1 | <b>interface BRI0:1</b>                | Enter configuration mode for the BRI0:1 subinterface                 |
| Step 2 | <b>ip unnumbered Virtual-Template/</b> | Enable IP routing on this interface without assigning an IP address. |
| Step 3 | <b>encapsulation ppp</b>               | Set the encapsulation method on this interface to PPP.               |
| Step 4 | <b>ppp multilink</b>                   | Enable multilink PPP on this interface.                              |
| Step 5 | <b>interface BRI0:2</b>                | Enter configuration mode for the BRI0:2 subinterface.                |

## Leased-Line ISDN Connection to a Central-Site Router

|        | Command                                | Task                                                                 |
|--------|----------------------------------------|----------------------------------------------------------------------|
| Step 6 | <b>ip unnumbered Virtual-Template/</b> | Enable IP routing on this interface without assigning an IP address. |
| Step 7 | <b>encapsulation ppp</b>               | Set the encapsulation method on this interface to PPP.               |
| Step 8 | <b>ppp multilink</b>                   | Enable multilink PPP on this interface.                              |
| Step 9 | <b>exit</b>                            | Exit configuration mode for this interface.                          |

## Configuring Dynamic IP Routing

Follow these steps to configure the router for dynamic IP routing.

|        | Command                                       | Task                                                                                                      |
|--------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Step 1 | <b>ip classless</b>                           | Configure the router to forward packets addressed to a subnet of a network with no network default route. |
| Step 2 | <b>ip route 0.0.0.0 0.0.0.0 192.168.40.41</b> | Specify dynamic routing.                                                                                  |

## Verifying Your Configuration

You can verify your configuration by confirming connectivity to the central-site router.

- 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 central-site router. You should see 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, as shown in the command output example.

**Step 3** Enter the **ping** command, followed by the IP address of the central-site router again:

```
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
```

If the success rate is 100 percent, this verification step is successful.

**Step 4** If the router is not successfully transferring data to the central-site router (if the success rate is less than 60 percent), do the following:

- Use the **show ip route** command to confirm that the routing table entries for the central-site router are correct.
- Use the **show interface bri0** command to confirm that the ISDN interface is active and that IPCP, IPXCP, and Multilink are shown as “Open.”

**Step 5** To continue configuration, reenter global configuration mode.

---

## Configuring Command-Line Access to the Router

Follow these steps to configure parameters that control access to the router, such as what type of terminal line is used with the router, how long the router waits for a user entry before it times out, and what password is used to start a terminal session with the router.

|        | Command                                             | Task                                                                                                      |
|--------|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Step 1 | <code>ip classless</code>                           | Configure the router to forward packets addressed to a subnet of a network with no network default route. |
| Step 2 | <code>ip route 0.0.0.0 0.0.0.0 192.168.40.41</code> | Specify dynamic routing.                                                                                  |
| Step 3 | <code>ip classless</code>                           | Configure the router to forward packets addressed to a subnet of a network with no network default route. |
| Step 4 | <code>ip route 0.0.0.0 0.0.0.0 192.168.40.41</code> | Specify dynamic routing.                                                                                  |
| Step 5 | <code>ip classless</code>                           | Configure the router to forward packets addressed to a subnet of a network with no network default route. |
| Step 6 | <code>ip route 0.0.0.0 0.0.0.0 192.168.40.41</code> | Specify dynamic routing.                                                                                  |

## Troubleshooting Problems with Leased Lines

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, using 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.

The following debug commands are helpful in troubleshooting an ISDN leased line. Follow these commands with the **ping** command to display debug output.

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

## Dial-In ISDN BRI Pool

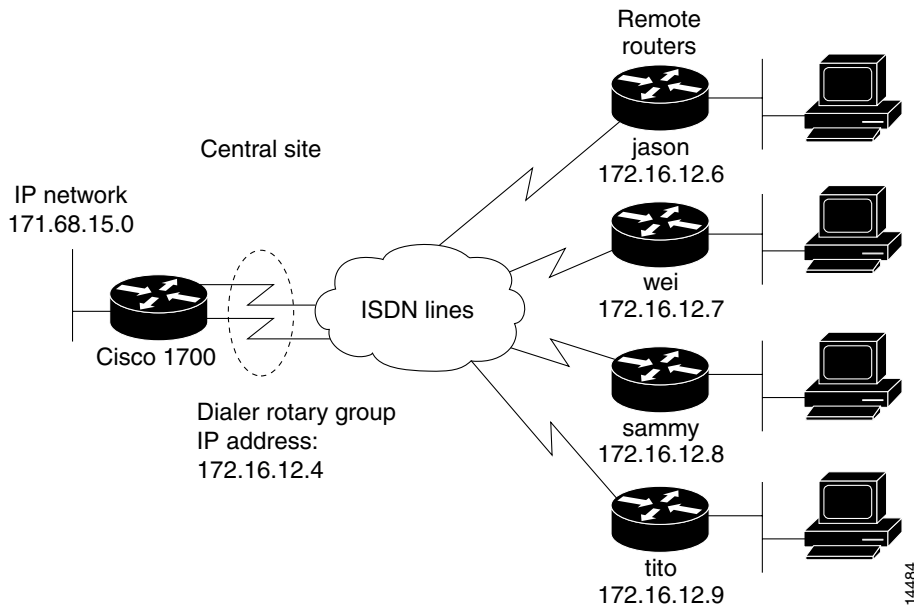
This section describes how to configure a Cisco router with two ISDN BRI interfaces to function as a dial-in server. In this example, the Cisco router functions as the central-site router that accepts dial-in connections from remote routers.

These are the major tasks in configuring your router for dial-in ISDN connections:

- [Configuring Global Parameters](#)
- [Configuring Security](#)
- [Configuring the Fast Ethernet Interface](#)
- [Configuring the ISDN Interfaces](#)
- [Configuring a Dialer Interface](#)
- [Configuring EIGRP Routing](#)
- [Configuring IP Static Routes and Dial-In Parameters](#)
- [Configuring Command-Line Access to the Router](#)

Figure 5-4 shows the configuration example used in this section.

Figure 5-4 ISDN Configuration Example—Dial-In ISDN BRI Pool



## Configuring Global Parameters

Follow these steps to configure global router parameters.

|        | Command                                             | Task                                                                                                                                                                                       |
|--------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <code>configure terminal</code>                     | Enter configuration mode.                                                                                                                                                                  |
| Step 2 | <code>service timestamps debug datetime msec</code> | 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. |

|        | Command                                           | Task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 3 | <code>service timestamps log datetime msec</code> | <p>Configure the router to show the date and time of all log messages.</p> <p>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.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Step 4 | <code>isdn switch-type <i>basic-ni</i></code>     | <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 security measures.

|        | Command                                                                                                                                                                                                                                                                           | Task                                                                                                                                                                                                                                                                                              |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>enable password</b> <i>&lt;user&gt;</i>                                                                                                                                                                                                                                        | Specify a password to prevent unauthorized access to the router.                                                                                                                                                                                                                                  |
| Step 2 | <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 3 | <b>username</b> <i>jason</i> <b>password</b> <i>&lt;foot&gt;</i><br><b>username</b> <i>wei</i> <b>password</b> <i>&lt;letmein&gt;</i><br><b>username</b> <i>sammy</i> <b>password</b> <i>&lt;bar&gt;</i><br><b>username</b> <i>tito</i> <b>password</b> <i>&lt;knockknock&gt;</i> | Specify the password used during caller identification and CHAP and PAP authentication.<br><br>For CHAP and PAP authentication, the host name of every remote router that dials into the Cisco router must be entered with this command, along with the password used to authenticate 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 this interface.                                 |
| Step 2 | <b>ip address</b> <i>171.68.15.33 255.255.255.248</i> | Configure this interface with an IP address and a subnet mask.               |
| Step 3 | <b>no shutdown</b>                                    | Enable this interface and the configuration changes that you have just made. |
| Step 4 | <b>exit</b>                                           | Exit configuration mode for this interface.                                  |

## Configuring the ISDN Interfaces

Follow these steps to configure the two ISDN interfaces that accept calls from remote routers.

|                | <b>Command</b>                 | <b>Task</b>                                                                                                                                                              |
|----------------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b>  | <b>interface BRI0</b>          | Enter configuration mode for the first ISDN interface.                                                                                                                   |
| <b>Step 2</b>  | <b>no ip address</b>           | Remove any IP addresses that might be assigned to this interface.                                                                                                        |
| <b>Step 3</b>  | <b>encapsulation ppp</b>       | Configure the interface for PPP packet encapsulation.                                                                                                                    |
| <b>Step 4</b>  | <b>dialer rotary-group 100</b> | Configure this interface to be included in the dialer rotary group that you will configure in the <a href="#">“Configuring a Dialer Interface”</a> section on page 5-44. |
| <b>Step 5</b>  | <b>no fair queue</b>           | Disable weighted fair queuing on this interface.                                                                                                                         |
| <b>Step 6</b>  | <b>no shutdown</b>             | Enable this interface and the configuration changes you have just made.                                                                                                  |
| <b>Step 7</b>  | <b>exit</b>                    | Exit configuration mode for this interface.                                                                                                                              |
| <b>Step 8</b>  | <b>interface BRI1</b>          | Enter configuration mode for the second ISDN interface.                                                                                                                  |
| <b>Step 9</b>  | <b>no ip address</b>           | Remove any IP addresses that might be assigned to this interface.                                                                                                        |
| <b>Step 10</b> | <b>encapsulation ppp</b>       | Configure the interface for PPP packet encapsulation.                                                                                                                    |
| <b>Step 11</b> | <b>dialer rotary-group 100</b> | Configure this interface to be included in the dialer rotary group that you will configure in the <a href="#">“Configuring a Dialer Interface”</a> section on page 5-44. |
| <b>Step 12</b> | <b>no fair queue</b>           | Disable weighted fair queuing on this interface.                                                                                                                         |

|         | Command            | Task                                                                    |
|---------|--------------------|-------------------------------------------------------------------------|
| Step 13 | <b>no shutdown</b> | Enable this interface and the configuration changes you have just made. |
| Step 14 | <b>exit</b>        | Exit configuration mode for this interface.                             |

## Configuring a Dialer Interface

Follow these steps to configure the two ISDN interfaces as one dialer interface that accepts calls from remote routers.

|        | Command                                                                                                                                                                                                                                                       | Task                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>interface dialer 100</b>                                                                                                                                                                                                                                   | Create a dialer rotary group interface, and enter configuration mode for that interface. The number (in this example, 100) is an integer that you select to identify the interface.                                                                                                                                                                                                                  |
| Step 2 | <b>ip address 172.16.12.4 255.255.255.240</b>                                                                                                                                                                                                                 | Configure this interface with an IP address.                                                                                                                                                                                                                                                                                                                                                         |
| Step 3 | <b>encapsulation ppp</b>                                                                                                                                                                                                                                      | Configure this interface for PPP encapsulation.                                                                                                                                                                                                                                                                                                                                                      |
| Step 4 | <b>dialer in-band</b>                                                                                                                                                                                                                                         | Specify that DDR is supported on this interface.                                                                                                                                                                                                                                                                                                                                                     |
| Step 5 | <b>dialer idle-timeout 300</b>                                                                                                                                                                                                                                | Configure the ISDN line to go down after a specified number of seconds elapses with no network traffic.                                                                                                                                                                                                                                                                                              |
| Step 6 | <b>dialer map ip 172.16.12.6 name jason broadcast 5553756</b><br><b>dialer map ip 172.16.12.7 name wei broadcast 5553756</b><br><b>dialer map ip 172.16.12.8 name sammy broadcast 5553756</b><br><b>dialer map ip 172.16.12.9 name tito broadcast 5553756</b> | Configure this interface to receive and authenticate calls from multiple sites, based on IP address and dialer string. You must enter this command for every remote router that will dial into your router.<br><br>The name you enter after the <b>name</b> keyword in this command must match the name entered with the <b>username</b> command in the “Configuring Security” section on page 5-41. |

|                | <b>Command</b>                         | <b>Task</b>                                                                                                       |
|----------------|----------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>Step 7</b>  | <b>dialer load-threshold</b> <i>70</i> | Configure bandwidth on demand by setting the maximum load before the router places another call to a destination. |
| <b>Step 8</b>  | <b>dialer-group</b> <i>1</i>           | Assign the dialer interface to a dialer group.                                                                    |
| <b>Step 9</b>  | <b>no fair-queue</b>                   | Disable weighted fair queuing on this interface.                                                                  |
| <b>Step 10</b> | <b>ppp multilink</b>                   | Enable multilink PPP on this interface.                                                                           |
| <b>Step 11</b> | <b>ppp authentication chap</b>         | Enable CHAP or PAP authentication on this interface.                                                              |
| <b>Step 12</b> | <b>no shutdown</b>                     | Enable the dialer interface and the configuration changes that you have just made.                                |
| <b>Step 13</b> | <b>exit</b>                            | Exit configuration mode for this interface.                                                                       |

## Configuring EIGRP Routing

Follow these steps to configure the router for Enhanced Interior Gateway Routing Protocol (EIGRP) and IP routing parameters that the router uses to connect to the central-site router.

|               | <b>Command</b>                   | <b>Task</b>                                                                                                            |
|---------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>router eigrp</b> <i>109</i>   | Configure the IP EIGRP routing process, and enter router configuration mode.                                           |
| <b>Step 2</b> | <b>network</b> <i>171.68.0.0</i> | Specify a list of networks for the EIGRP routing process by entering the IP address of the directly connected network. |
| <b>Step 3</b> | <b>redistribute static</b>       | Configure the router to distribute IP static routers from one routing domain to another.                               |
| <b>Step 4</b> | <b>exit</b>                      | Exit router configuration mode.                                                                                        |

## Configuring IP Static Routes and Dial-In Parameters

Follow these steps to configure an IP static router and the access lists that define what type of network traffic the router will accept.

|        | Command                                                        | Task                                                                                                                                         |
|--------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>ip route</b> <i>171.68.0.0 255.255.255.240 171.68.12.1</i>  | Configure an IP static route used to route data received from remote routers.                                                                |
| Step 2 | <b>access-list</b> <i>101 deny ip any host 255.255.255.255</i> | Define a standard access list based on IP network variables.                                                                                 |
| Step 3 | <b>access-list</b> <i>101 permit ip any any</i>                | Define a standard access list based on IP network variables.                                                                                 |
| Step 4 | <b>dialer-list</b> <i>1 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, such as what type of terminal line can be used with the router, how long the router waits for a user entry before it times out, and what password is used to start a terminal session with 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 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.                                                        |

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

