



Configuring ISDN BRI

This chapter describes tasks that are required to use an ISDN BRI line. It provides an overview of the ISDN technologies currently available and describes features that you can configure in an ISDN BRI circuit-switched internetworking environment. This information is included in the following main sections:

- [ISDN Overview](#)
- [How to Configure ISDN BRI](#)
- [Monitoring and Maintaining ISDN Interfaces](#)
- [Troubleshooting ISDN Interfaces](#)
- [Configuration Examples for ISDN BRI](#)

This chapter describes configuration of the ISDN BRI. See the chapter [“Configuring ISDN PRI”](#) for information about configuring the ISDN PRI.

This chapter does not address routing issues, dialer configuration, and dial backup. For information about those topics, see the chapters in the “Dial-on-Demand Routing Configuration” part of this publication.

For hardware technical descriptions and for information about installing the router interfaces, refer to the appropriate hardware installation and maintenance publication for your particular product.

To identify the hardware platform or software image information associated with a feature, use the Feature Navigator on Cisco.com to search for information about the feature or refer to the software release notes for a specific release. For more information, see the “Identifying Supported Platforms” section in the “Using Cisco IOS Software” chapter.

For a complete description of the BRI commands in this chapter, refer to the *Cisco IOS Dial Technologies Command Reference*. To locate documentation of other commands that appear in this chapter, use the command reference master index or search online.

ISDN Overview

Basic ISDN service is described in the section [“ISDN Service”](#) in the chapter [“Overview of Dial Interfaces, Controllers, and Lines.”](#) To summarize, Cisco IOS software supports both the ISDN BRI and the ISDN PRI.

ISDN BRI provides two bearer (B) channels, each capable of transferring voice or data at 64 kbps, and one 16 kbps data (D) signaling channel, which is used by the telephone network to carry instructions about how to handle each of the B channels. ISDN BRI (also referred to as 2 B + D) provides a maximum transmission speed of 128 kbps, but many users use only half the available bandwidth.

Figure 9 in the chapter “Overview of Dial Interfaces, Controllers, and Lines” illustrates the channel assignment for each ISDN type.

Requesting BRI Line and Switch Configuration from a Telco Service Provider

Before configuring ISDN BRI on your Cisco router, you must order a correctly configured ISDN line from your telecommunications service provider. This process varies from provider to provider on a national and international basis. However, some general guidelines follow:

- Ask for two channels to be called by one number.
- Ask for delivery of calling line identification. Providers sometimes call this CLI or automatic number identification (ANI).
- If the router will be the only device attached to the BRI, ask for point-to-point service and a data-only line.
- If the router will be attached to an ISDN bus (to which other ISDN devices might be attached), ask for point-to-multipoint service (subaddressing is required) and a voice-and-data line.

When you order ISDN service for switches used in North America, request the BRI switch configuration attributes specified in Table 19.

Table 19 North American ISDN BRI Switch Type Configuration Information

Switch Type	Configuration
DMS-100 BRI Custom	2 B channels for voice and data. 2 directory numbers assigned by service provider. 2 service profile identifiers (SPIDs) required; assigned by service provider. Functional signaling. Dynamic terminal endpoint identifier (TEI) assignment. Maximum number of keys = 64. Release key = no, or key number = no. Ringing indicator = no. EKTS = no. PVC = 2. Request delivery of calling line ID on Centrex lines. Set speed for ISDN calls to 56 kbps outside local exchange. Directory number 1 can hunt to directory number 2.

Table 19 North American ISDN BRI Switch Type Configuration Information (continued)

Switch Type	Configuration
5ESS Custom BRI	For Data Only 2 B channels for data. Point to point. Terminal type = E. 1 directory number (DN) assigned by service provider. MTERM = 1. Request delivery of calling line ID on Centrex lines. Set speed for ISDN calls to 56 kbps outside local exchange. For Voice and Data (Use these values only if you have an ISDN telephone connected.) 2 B channels for voice or data. Multipoint. Terminal type = D. 2 directory numbers assigned by service provider. 2 SPIDs required; assigned by service provider. MTERM = 2. Number of call appearances = 1. Display = No. Ringing/idle call appearances = idle. Autohold = no. Onetouch = no. Request delivery of calling line ID on Centrex lines. Set speed for ISDN calls to 56 kbps outside local exchange. Directory number 1 can hunt to directory number 2.
5ESS National ISDN (NI) BRI	Terminal type = A. 2 B channels for voice and data. 2 directory numbers assigned by service provider. 2 SPIDs required; assigned by service provider. Set speed for ISDN calls to 56 kbps outside local exchange. Directory number 1 can hunt to directory number 2.
EZ-ISDN 1	For Voice and Data • ISDN Ordering Code for Cisco 766/776 Series = Capability S • ISDN Ordering Code for Cisco 1604 Series = Capability R 2 B channels featuring alternate voice and circuit-switched data. Non-EKTS voice features include the following: • Flexible Calling • Call Forwarding Variable • Additional Call Offering • Calling Number Identification (includes Redirecting Number Delivery)

Interface Configuration

The Cisco IOS software also provides custom features for configuring the ISDN BRI interface that provide such capability as call screening, called party number verification, ISDN default cause code override, and for European and Australian customers, Dialed Number Identification Service (DNIS)-plus-ISDN-subaddress binding to allow multiple binds between a dialer profile and an ISDN B channel.

Dynamic Multiple Encapsulations

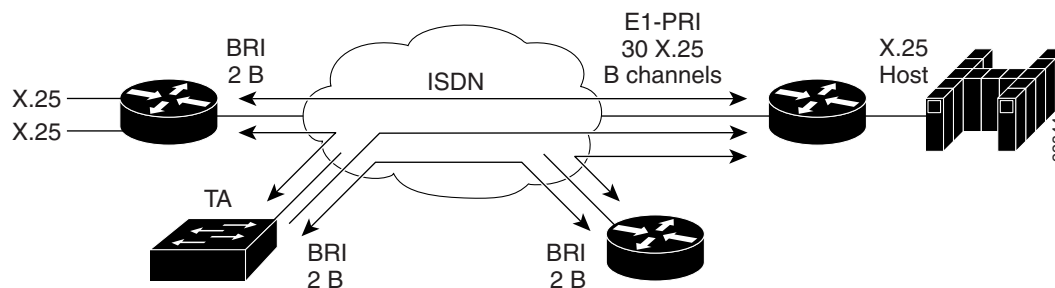
Before Cisco IOS Release 12.1, encapsulation techniques such as Frame Relay, High-Level Data Link Control (HDLC), Link Access Procedure, Balanced- Terminal Adapter (LAPB-TA), and X.25 could support only one ISDN B-channel connection over the entire link. HDLC and PPP could support multiple B channels, but the entire ISDN link needed to use the same encapsulation. The Dynamic Multiple Encapsulations feature introduced in Cisco IOS Release 12.1 allows various encapsulation types and per-user configurations on the same ISDN B channel at different times according to the type of incoming call.

With the Dynamic Multiple Encapsulations feature, once calling line identification (CLID) binding is completed, the topmost interface is always used for all configuration and data structures. The ISDN B channel becomes a forwarding device, and the configuration on the D channel is ignored, thereby allowing the different encapsulation types and per-user configurations. Dynamic multiple encapsulations provide support for packet assembler/disassembler (PAD) traffic and X.25 encapsulated and switched packets. For X.25 encapsulations, the configurations reside on the dialer profile.

Dynamic multiple encapsulation is especially important in Europe, where ISDN is relatively expensive and maximum use of all 30 B channels on the same ISDN link is desirable. Further, the feature removes the need to statically dedicate channels to a particular encapsulation and configuration type, and improves channel usage.

Figure 31 shows a typical configuration for an X.25 network in Europe. The Dynamic Multiple Encapsulations feature allows use of all 30 B channels, and supports calls that originate in diverse areas of the network and converge on the same ISDN PRI.

Figure 31 European X.25 Network



Interface Configuration Options

You can also optionally configure snapshot routing for ISDN interfaces. Snapshot routing is a method of learning remote routes dynamically and keeping the routes available for a specified period of time, even though routing updates are not exchanged during that period. See the chapter “Configuring Snapshot Routing” later in this guide for detailed information about snapshot routing.

To place calls on an ISDN interface, you must configure it with dial-on-demand routing (DDR). For configuration information about ISDN using DDR, see the “Dial-on-Demand Routing Configuration” part of this publication. For command information, refer to the *Cisco IOS Dial Technologies Command Reference*.

To configure bandwidth on demand, see the chapters “Configuring Legacy DDR Spokes” or “Configuring Legacy DDR Hubs” later in this publication.

ISDN Cause Codes

A cause code is an information element (IE) that indicates why an ISDN call failed or was otherwise disconnected. When the originating gateway receives a Release Complete message, it generates a tone corresponding to the cause code in the message.

[Table 20](#) lists the default cause codes that the VoIP (Voice over IP) gateway sends to the switch when a call fails at the gateway, and the corresponding tones that it generates.

Table 20 Cause Codes Generated by the Cisco VoIP Gateway

Cause Code	Description	Explanation	Tone
1	Unallocated (unassigned) number	The ISDN number is not assigned to any destination equipment.	Reorder
3	No route to destination	The call was routed through an intermediate network that does not serve the destination address.	Reorder
16	Normal call clearing	Normal call clearing has occurred.	Dial
17	User busy	The called system acknowledged the connection request but was unable to accept the call because all B channels were in use.	Busy
19	No answer from user (user alerted)	The destination responded to the connection request but failed to complete the connection within the prescribed time. The problem is at the remote end of the connection.	Reorder
28	Invalid number format	The connection could not be established because the destination address was presented in an unrecognizable format or because the destination address was incomplete.	Reorder
34	No circuit/channel available	The connection could not be established because no appropriate channel was available to take the call.	Reorder

For a complete list of ISDN cause codes that are generated by the switch, refer to “Appendix B: ISDN Switch Types, Codes and Values” in the *Cisco IOS Debug Command Reference*.

Although the VoIP gateway generates the cause codes listed in [Table 20](#) by default, there are commands introduced in previous Cisco IOS releases that can override these defaults, allowing the gateway to send different cause codes to the switch. The following commands override the default cause codes:

- **isdn disconnect-cause**—Sends the specified cause code to the switch when a call is disconnected.
- **isdn network-failure-cause**—Sends the specified cause code to the switch when a call fails because of internal network failures.
- **isdn voice-call-failure**—Sends the specified cause code to the switch when an inbound voice call fails with no specific cause code.

When you implement these commands, the configured cause codes are sent to the switch; otherwise, the default cause codes of the voice application are sent. For a complete description of these commands, refer to the *Cisco IOS Dial Technologies Command Reference*.

How to Configure ISDN BRI

To configure ISDN lines and interfaces, perform the tasks in the following sections:

- [Configuring the ISDN BRI Switch](#) (Required)
- [Specifying Interface Characteristics for an ISDN BRI](#) (As required)
- [Configuring ISDN Semipermanent Connections](#) (As required)
- [Configuring ISDN BRI for Leased-Line Service](#) (As required)

See the sections “[Monitoring and Maintaining ISDN Interfaces](#)” and “[Troubleshooting ISDN Interfaces](#)” later in this chapter for tips on maintaining your network. See the section “[Configuration Examples for ISDN BRI](#)” at the end of this chapter for configuration examples.

To configure ISDN BRI for voice, video, and fax applications, refer to the *Cisco IOS Voice, Video, and Fax Applications Configuration Guide*.

Configuring the ISDN BRI Switch

To configure the ISDN switch type, perform the following tasks:

- [Configuring the Switch Type](#) (Required)
- [Checking and Setting the Buffers](#) (As required)

Also see to the “[Multiple ISDN Switch Types Feature](#)” section for information about configuring multiple switch types.

Configuring the Switch Type

To configure the switch type, use the following command in global configuration mode:

Command	Purpose
Router(config)# isdn switch-type <i>switch-type</i>	Selects the service provider switch type; see Table 19 for switch types.

The section “[Global ISDN and BRI Interface Switch Type Example](#)” later in this chapter provides an example of configuring the ISDN BRI switch.

[Table 21](#) lists the ISDN BRI service provider switch types.

Table 21 ISDN Service Provider BRI Switch Types

Switch Type Keywords	Description/Use	Central Office (CO) Switch Type?
Voice/PBX Systems		
basic-qsig	PINX (PBX) switch with QSIG signaling per Q.931	
Australia, Europe, and UK		
basic-1tr6	German 1TR6 ISDN switch	Yes
basic-net3	NET3 ISDN BRI for Norway NET3, Australia NET3, and New Zealand NET3 switches; covers ETSI-compliant Euro-ISDN E-DSS1 signaling system	Yes
vn3	French VN3 ISDN BRI switch	Yes
Japan		
ntt	Japanese NTT ISDN BRI switch	
North America		
basic-5ess	Lucent (AT&T) basic rate 5ESS switch	Yes
basic-dms100	Nortel basic rate DMS-100 switch	Yes
basic-ni	National ISDN switch	Yes
All Users		
none	No switch defined	

**Note**

The command parser will still accept the following switch type keywords: **basic-nwnet3**, **vn2**, and **basic-net3**; however, when viewing the NVRAM configuration, the **basic-net3** or **vn3** switch type keywords are displayed respectively.

Checking and Setting the Buffers

When configuring a BRI, after the system comes up, make sure enough buffers are in the free list of the buffer pool that matches the maximum transmission unit (MTU) of your BRI interface. If not, you must reconfigure buffers in order for the BRI interfaces to function properly.

To check the MTU size and the buffers, use the following commands in EXEC mode as needed:

Command	Purpose
Router# show interfaces bri <i>number</i>	Displays the MTU size.
Router# show buffers	Displays the free buffers.

To configure the buffers and the MTU size, use the following commands in global configuration mode as needed:

Command	Purpose
Router(config)# buffers big permanent <i>number</i>	Configures the buffers.
Router(config)# buffers big max-free <i>number</i>	
Router(config)# buffers big min-free <i>number</i>	
Router(config)# buffers big initial <i>number</i>	

Multiple ISDN Switch Types Feature

The Cisco IOS software provides an enhanced Multiple ISDN Switch Types feature that allows you to apply an ISDN switch type to a specific ISDN interface and configure more than one ISDN switch type per router. This feature allows both ISDN BRI and ISDN PRI to run simultaneously on platforms that support both interface types. See the section [“Configuring Multiple ISDN Switch Types”](#) in the chapter [“Configuring ISDN PRI”](#) for information about configuring this feature.

Specifying Interface Characteristics for an ISDN BRI

Perform the tasks in the following sections to set interface characteristics for an ISDN BRI, whether it is the only BRI in a router or is one of many. Each of the BRIIs can be configured separately.

- [Specifying the Interface and Its IP Address](#) (Required)
- [Configuring CLI Screening](#) (As Required)
- [Configuring Encapsulation on ISDN BRI](#) (Required)
- [Configuring Network Addressing](#) (Required)
- [Configuring TEI Negotiation Timing](#) (Optional)
- [Configuring CLI Screening](#) (Optional)
- [Configuring Called Party Number Verification](#) (Optional)
- [Configuring ISDN Calling Number Identification](#) (Optional)
- [Configuring the Line Speed for Calls Not ISDN End to End](#) (Optional)
- [Configuring a Fast Rollover Delay](#) (Optional)
- [Overriding ISDN Application Default Cause Codes](#) (Optional)
- [Configuring Inclusion of the Sending Complete Information Element](#) (Optional)
- [Configuring DNIS-plus-ISDN-Subaddress Binding](#) (Optional)
- [Screening Incoming V.110 Modem Calls](#) (Optional)
- [Disabling V.110 Padding](#) (Optional)

Specifying the Interface and Its IP Address

To specify an ISDN BRI and enter interface configuration mode, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# interface bri <i>number</i>	Specifies the interface and begins interface configuration mode.
	Cisco 7200 series router only	
	Router(config)# interface bri <i>slot/port</i>	
Step 2	Router(config-if)# ip address <i>address mask</i>	Specifies an IP address for the interface.

Specifying ISDN SPIDs

Some service providers use SPIDs to define the services subscribed to by the ISDN device that is accessing the ISDN service provider. The service provider assigns the ISDN device one or more SPIDs when you first subscribe to the service. If you are using a service provider that requires SPIDs, your ISDN device cannot place or receive calls until it sends a valid, assigned SPID to the service provider when accessing the switch to initialize the connection.

Currently, only the DMS-100 and NI switch types require SPIDs. The AT&T 5ESS switch type may support a SPID, but we recommend that you set up that ISDN service without SPIDs. In addition, SPIDs have significance at the local access ISDN interface only. Remote routers never receive the SPID.

A SPID is usually a seven-digit telephone number with some optional numbers. However, service providers may use different numbering schemes. For the DMS-100 switch type, two SPIDs are assigned, one for each B channel.

To define the SPIDs and the local directory number (LDN) on the router, use the following commands in interface configuration mode as needed:

Command	Purpose
Router(config-if)# isdn spid1 <i>spid-number</i> [<i>ldn</i>]	Specifies a SPID and local directory number for the B1 channel.
Router(config-if)# isdn spid2 <i>spid-number</i> [<i>ldn</i>]	Specifies a SPID and local directory number for the B2 channel.

The LDN is optional but might be necessary if the router is to answer calls made to the second directory number.

Configuring Encapsulation on ISDN BRI

Each ISDN B channel is treated as a synchronous serial line, and the default serial encapsulation is HDLC. The Dynamic Multiple Encapsulations feature allows incoming calls over ISDN to be assigned an encapsulation type such as Frame Relay, PPP, and X.25 based on CLID or DNIS. PPP encapsulation is configured for most ISDN communication.

To configure encapsulation, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# encapsulation [ppp lapb frame-relay]	Configures encapsulation type.

Verifying the Dynamic Multiple Encapsulations Feature

To verify dialer interfaces configured for binding and see statistics on each physical interface bound to the dialer interface, use the **show interfaces EXEC** command.

The following example shows that the output under the B channel keeps all hardware counts that are not displayed under any logical or virtual access interface. The line in the report that states “Interface is bound to Dialer0 (Encapsulation LAPB)” indicates that this B interface is bound to the dialer 0 interface and the encapsulation running over this connection is LAPB, not PPP, which is the encapsulation configured on the D interface and inherited by the B channel.

```
Router# show interfaces bri0:1

BRI0:1 is up, line protocol is up
  Hardware is BRI
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
  Interface is bound to Dialer0 (Encapsulation LAPB)
  LCP Open, multilink Open
  Last input 00:00:31, output 00:00:03, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 1 packets/sec
  5 minute output rate 0 bits/sec, 1 packets/sec
    110 packets input, 13994 bytes, 0 no buffer
    Received 91 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    135 packets output, 14175 bytes, 0 underruns
    0 output errors, 0 collisions, 12 interface resets
    0 output buffer failures, 0 output buffers swapped out
    8 carrier transitions
```

Any protocol configuration and states should be displayed from the dialer 0 interface.

Encapsulation Configuration Notes

The router might need to communicate with devices that require a different encapsulation protocol or the router might send traffic over a Frame Relay or X.25 network. The Dynamic Multiple Encapsulations feature provides bidirectional support of all serial encapsulations except Frame Relay.

For more information, see the sections [“Sending Traffic over Frame Relay, X.25, or LAPB Networks”](#) in the chapters [“Configuring Legacy DDR Spokes”](#) and [“Configuring Legacy DDR Hubs”](#) later in this publication.

To configure the router for automatic detection of encapsulation type on incoming calls, or to configure encapsulation for Cisco 700 and 800 series (formerly Combinet) router compatibility, see the section [“Configuring Automatic Detection of Encapsulation Type”](#) in the chapter [“Configuring ISDN Special Signaling”](#) later in this publication.

Configuring Network Addressing

The steps in this section support the primary goals of network addressing:

- Define which packets are *interesting* and will thus cause the router to make an outgoing call.
- Define the remote host where the calls are going.
- Specify whether broadcast messages will be sent.
- Specify the dialing string to use in the call.

Intermediate steps that use shared argument values tie the host identification and dial string to the interesting packets to be sent to that host.

To configure network addressing, use the following commands beginning in interface configuration mode:

	Command	Purpose
Step 1	Router(config-if)# dialer map protocol next-hop-address name hostname speed [56 64] dial-string[:isdn-subaddress]	(Most locations) Configures a serial interface or ISDN interface to call one or multiple sites or to receive calls from multiple sites.
	OR Router(config-if)# dialer map protocol next-hop-address name hostname spc [speed 56 64] [broadcast] dial-string[:isdn-subaddress]	(Germany) Uses the command keyword that enables ISDN semipermanent connections.
Step 2	Router(config-if)# dialer-group group-number	Assigns the interface to a dialer group to control access to the interface.
Step 3	Router(config-if)# exit	Exits to global configuration mode.
Step 4	Router(config)# dialer-list dialer-group protocol protocol-name {permit deny list access-list-number access-group}	Defines a dial-on-demand routing (DDR) dialer list for dialing by protocol or by a combination of a protocol and an access list.
Step 5	Router(config)# access-list access-list-number {deny permit} protocol source address source-mask destination destination-mask	Defines an access list permitting or denying access to specified protocols, sources, or destinations. Permitted packets cause the router to place a call to the destination protocol address.

German networks allow semipermanent connections between customer routers with BRIs and the 1TR6 basic rate switches in the exchange. Semipermanent connections are less expensive than leased lines.



Note

The access list reference in [Step 5](#) of this task is an example of the **access-list** commands allowed by different protocols. Some protocols might require a different command form or might require multiple commands. Refer to the relevant protocol chapter in the network protocol configuration guide (the *Cisco IOS Novell IPX Configuration Guide*, for example) for more information about setting up access lists for a protocol.

For more information about defining outgoing call numbers, see the chapters “Configuring Legacy DDR Hubs” and “Configuring Legacy DDR Spokes” later in this publication.

Configuring TEI Negotiation Timing

You can configure ISDN TEI negotiation on individual ISDN interfaces. TEI negotiation is useful for switches that may deactivate Layers 1 or 2 when there are no active calls. Typically, this setting is used for ISDN service offerings in Europe and connections to DMS-100 switches that are designed to initiate TEI negotiation.

By default, TEI negotiation occurs when the router is powered up. The TEI negotiation value configured on an interface overrides the default or global TEI value. For example, if you configure **isdn tei first-call** globally and **isdn tei powerup** on BRI interface 0, then TEI negotiation **powerup** is the value applied to BRI interface 0. It is not necessary to configure TEI negotiation unless you wish to override the default value (**isdn tei powerup**).

To apply TEI negotiation to a specific BRI interface, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# isdn tei [first-call powerup]	Determines when ISDN TEI negotiation occurs.

Configuring CLI Screening

CLI screening adds a level of security by allowing you to screen incoming calls. You can verify that the calling line ID is from an expected origin. CLI screening requires a local switch that is capable of delivering the CLI to the router.

To configure CLI screening, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# isdn caller <i>number</i>	Configures caller ID screening.



Note

If caller ID screening is configured and the local switch does not deliver caller IDs, the router rejects all calls.



Note

In earlier releases of the Cisco IOS software, ISDN accepted all synchronous calls and performed some minimal CLI screening before accepting or rejecting a call. Beginning with Cisco IOS Release 12.1 software, DDR provides a separate process that screens for the profile of the caller. The new screening process also checks that enough resources are available to accept the call and that the call conforms to predetermined rules. When the call is found acceptable, the screening process searches for a matching profile for the caller. The call is accepted only when there is a matching profile.

Configuring Called Party Number Verification

When multiple devices are attached to an ISDN BRI, you can ensure that only a single device answers an incoming call by verifying the number or subaddress in the incoming call against the configured number or subaddress or both of the device.

You can specify that the router verify a called-party number or subaddress number in the incoming setup message for ISDN BRI calls, if the number is delivered by the switch. You can do so by configuring the number that is allowed. To configure verification, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# isdn answer1 [called-party-number][:subaddress]	Specifies that the router verify a called-party number or subaddress number in the incoming setup message.

Verifying the called-party number ensures that only the desired router responds to an incoming call. If you want to allow an additional number for the router, you can configure it, too.

To configure a second number to be allowed, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# isdn answer2 [called-party-number][:subaddress]	Specifies that the router verify a second called-party number or subaddress number in the incoming setup message.

Configuring ISDN Calling Number Identification

A router with an ISDN BRI interface might need to supply the ISDN network with a billing number for outgoing calls. Some networks offer better pricing on calls in which the number is presented. When configured, this information is included in the outgoing call Setup message.

To configure the interface to identify the billing number, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# isdn calling-number calling-number	Specifies the calling party number.

This command can be used with all switch types except German 1TR6 ISDN BRI switches.

Configuring the Line Speed for Calls Not ISDN End to End

When calls are made at 56 kbps but delivered by the ISDN network at 64 kbps, the incoming data can be corrupted. However, on ISDN calls, if the receiving side is informed that the call is not an ISDN call from end to end, it can set the line speed for the incoming call.

To set the speed for incoming calls recognized as not ISDN end to end, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# isdn not-end-to-end {56 64}	Sets the speed to be used for incoming calls recognized as not ISDN end to end.

Configuring a Fast Rollover Delay

Sometimes a router attempts to dial a call on an ISDN B channel before a previous call is completely torn down. The fast rollover fails because the second call is made to a different number before the B channel is released from the unsuccessful call. This failure might occur in the following ISDN configurations:

- The two B channels of the BRI are not configured as a hunt group, but have separate numbers defined.
- The B channel is not released by the ISDN switch until after Release Complete signal is processed.

You need to configure this delay if a BRI on a remote peer has two phone numbers configured one for each B channel you are dialing into this BRI, you have a dialer map for each phone number, and the first call succeeds but a second call fails with no channel available.

To configure a fast rollover delay, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# isdn fast-rollover-delay <i>seconds</i>	Defines a fast rollover delay.

A delay of 5 seconds should cover most cases. Configure sufficient delay to make sure the ISDN RELEASE_COMPLETE message has been sent or received before making the fast rollover call. Use the **debug isdn q931** command to display this information. This pattern of failed second calls is a rare occurrence.

Overriding ISDN Application Default Cause Codes

The ISDN Cause Code Override function is useful for overriding the default cause code of ISDN applications. When this feature is implemented, the configured cause code is sent to the switch; otherwise, default cause codes of the application are sent.

To configure ISDN cause code overrides, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# isdn disconnect-cause { <i>cause-code-number</i> busy not-available }	Specifies the ISDN cause code to send to the switch.

ISDN Cause Code Override Configuration Example

The following example sends a BUSY cause code to the switch when an application fails to complete the call:

```
interface serial 0:23
 isdn disconnect-cause busy
```

Verifying ISDN Cause Code Override

To verify that the ISDN Cause Code Override feature is operating correctly, enter the **debug q931** command. The **debug q931** command displays a report of any configuration irregularities.

Configuring Inclusion of the Sending Complete Information Element

In some geographic locations, such as Hong Kong and Taiwan, ISDN switches require that the Sending Complete information element be included in the outgoing Setup message to indicate that the entire number is included. This information element is generally not required in other locations.

To configure the interface to include the Sending Complete information element in the outgoing call Setup message, use the following command in interface configuration mode:

Command	Purpose
Router(config-if) # isdn sending-complete	Includes the Sending Complete information element in the outgoing call Setup message.

Configuring DNIS-plus-ISDN-Subaddress Binding

To configure DNIS-plus-ISDN-subaddress binding, use the following command in global configuration mode

Command	Purpose
Router(config) # dialer called <i>DNIS:subaddress</i>	Binds a DNIS to an ISDN subaddress.



Note

This command allows multiple binds between a dialer profile and an ISDN B channel. The configuration requires an ISDN subaddress, which is used in Europe and Australia.

See the section [“DNIS-plus-ISDN-Subaddress Binding Example”](#) later in this chapter for a configuration example.

Screening Incoming V.110 Modem Calls

You can screen incoming V.110 modem calls and reject calls that do not have the communications settings configured as the network expects them to be.

To selectively accept incoming V.110 modem calls based on data bit, parity, and stop bit modem communications, use the following command in interface configuration mode:

Command	Purpose
Router(config-if) # isdn v110 only [databits {5 7 8}] [parity {even mark none odd space}] [stopbits {1 1.5 2}]	Selectively accepts incoming V.110 calls based on data bit, parity, and stop bit modem communication settings.

Disabling V.110 Padding

In networks with devices such as terminal adapters (TAs) and global system for mobile communication (GSM) handsets that do not fully conform to the V.110 modem standard, you will need to disable V.110 padding. To disable the padded V.110 modem speed report required by the V.110 modem standard, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# no isdn v110 padding	Disables the padded modem speed report required by the V.110 modem standard.

Configuring ISDN Semipermanent Connections

German networks allow semipermanent connections between customer routers with BRI interfaces and the 1TR6 basic rate switches in the exchange. Australian networks allow semipermanent connections between ISDN PRI interfaces and the TS-014 primary rate switches in the exchange. Semipermanent connections are offered at better pricing than leased lines.

Configuring BRI interfaces for semipermanent connection requires only that you use a keyword that indicates semipermanent connections when you are setting up network addressing as described in the previous section of this chapter.

To configure a BRI for semipermanent connections, follow this procedure:

- | | |
|---------------|--|
| Step 1 | Set up the ISDN lines and ports as described in the sections “Configuring the ISDN BRI Switch” and “Specifying Interface Characteristics for an ISDN BRI” or for ISDN PRI, see the section “How to Configure ISDN PRI” in the chapter “Configuring ISDN PRI” later in this manual. |
| Step 2 | Configure DDR on a selected interface, as described in the “Dial-on-Demand Routing Configuration” part of this publication. |

To begin DDR network addressing, use the following command in interface configuration mode

Command	Purpose
Router(config-if)# dialer map protocol next-hop-address name hostname spc [speed 56 64] [broadcast] dial-string[: <i>isdn-subaddress</i>]	Defines the remote recipient’s protocol address, host name, and dialing string; indicates semipermanent connections; optionally, provides the ISDN subaddress; and sets the dialer speed to 56 or 64 kbps, as needed.

Configuring ISDN BRI for Leased-Line Service

To configure ISDN BRI for leased line service, perform the tasks in one of the following sections as needed and available:

- [Configuring Leased-Line Service at Normal Speeds](#) (Available in Japan and Germany)
- [Configuring Leased-Line Service at 128 Kbps](#) (Available only in Japan)

**Note**

Once an ISDN BRI interface is configured for access over leased lines, it is no longer a dialer interface, and signaling over the D channel no longer applies. Although the interface is called **interface bri n**, it is configured as a synchronous serial interface having the default High-Level Data Link (HDLC) encapsulation. However, the Cisco IOS commands that set the physical characteristics of a serial interface (such as the pulse time) do not apply to this interface.

Configuring Leased-Line Service at Normal Speeds

This service is offered in Japan and Germany and no call setup or teardown is involved. Data is placed on the ISDN interface similar to the way data is placed on a leased line connected to a serial port.

To configure the BRI to use the ISDN connection as a leased-line service, use the following commands in global configuration mode:

	Command	Purpose
Step 1	Router(config)# isdn switch-type <i>switch-type</i>	Configures the BRI switch type, as specified by the local service provider.
Step 2	Router(config)# isdn leased-line bri <i>number</i> 128	Specifies the BRI interface number.

To disable leased-line service if you no longer want to support it on a specified ISDN BRI, use the following command in global configuration mode:

Command	Purpose
Router(config)# no isdn leased-line bri <i>number</i>	Removes leased line configuration from a specified ISDN BRI interface.

Configuring Leased-Line Service at 128 Kbps

The Cisco IOS software supports leased-line service at 128 kbps via ISDN BR. This service combines two B channels into a single pipe. This feature requires one or more ISDN BRI hardware interfaces that support channel aggregation and service provider support for ISDN channel aggregation at 128 kbps. When this software first became available, service providers offered support for ISDN channel aggregation at 128 kbps only in Japan.

**Note**

This feature is not supported on the Cisco 2500 series router because its BRI hardware does not support channel aggregation.

To enable leased-line service at 128 kbps on a specified ISDN BRI, use the following commands in global configuration mode:

	Command	Purpose
Step 1	Router(config)# isdn switch-type <i>switch-type</i>	Selects the service provider switch type.
Step 2	Router(config)# isdn leased-line bri <i>number</i> 128	Configures a specified BRI for access over leased lines.

To complete the configuration of the interface, see the chapter “Configure a Synchronous Serial Ports” in this publication.

To remove the leased-line service configuration from a specified ISDN BRI, use the following command in global configuration mode:

Command	Purpose
Router(config)# no isdn leased-line bri <i>number</i>	Removes leased-line configuration from a specified ISDN BRI interface.

Monitoring and Maintaining ISDN Interfaces

To monitor and maintain ISDN interfaces, use the following commands in EXEC mode as needed:

Command	Purpose
Router> show interfaces bri <i>number</i> Cisco 7200 series routers only Router> show interfaces bri <i>slot/port</i>	Displays information about the physical attributes of the ISDN BRI B and D channels.
Router> show controllers bri <i>number</i> Cisco 7200 series routers only Router> show controllers bri <i>slot/port</i>	Displays protocol information about the ISDN B and D channels.
Router> show isdn { active history memory status timers }	Displays information about calls, history, memory, status, and Layer 2 and Layer 3 timers.
Router> show dialer interface bri <i>number</i>	Obtains general diagnostic information about the specified interface.

Troubleshooting ISDN Interfaces

To test the ISDN configuration of the router, use the following commands in EXEC mode as needed:

Command	Purpose
Router# show controllers bri <i>number</i>	Checks Layer 1 (physical layer) of the BRI.
Router# debug q921	Checks Layer 2 (data link layer).
Router# debug isdn events Router# debug q931 Router# debug dialer Router# show dialer	Checks Layer 3 (network layer).

Refer to the *Cisco IOS Debug Command Reference* for more information about the **debug** commands.

Configuration Examples for ISDN BRI

This section provides the following ISDN BRI configuration examples:

- [Global ISDN and BRI Interface Switch Type Example](#)
- [BRI Connected to a PBX Example](#)
- [Multilink PPP on a BRI Interface Example](#)
- [Dialer Rotary Groups Example](#)
- [Compression Examples](#)
- [Multilink PPP and Compression Example](#)
- [Voice over ISDN Examples](#)
- [DNIS-plus-ISDN-Subaddress Binding Example](#)
- [Screening Incoming V.110 Modem Calls Example](#)
- [ISDN BRI Leased-Line Configuration Example](#)

Global ISDN and BRI Interface Switch Type Example

The following example shows a global National ISDN switch type (keyword **basic-ni**) and an interface-level NET3 ISDN switch type (keyword **basic-net3**). The **basic-net3** keyword is applied to BRI interface 0 and overrides the global switch setting.

```
isdn switch-type basic-ni
!
interface BRI0
 isdn switch-type basic-net3
```

BRI Connected to a PBX Example

The following example provides a simple partial configuration of a BRI interface that is connected to a PBX. This interface is connected to a switch that uses SPID numbers.

```
interface BRI0
 description connected to pbx line 61885
 ip address 10.1.1.3 255.255.255.0
 encapsulation ppp
 isdn spid1 123
 dialer map ip 10.1.1.1 name mutter 61886
 dialer map ip 10.1.1.2 name rudder 61884
 dialer map ip 10.1.1.4 name flutter 61888
 dialer-group 1
 no fair-queue
 ppp authentication chap
```

Multilink PPP on a BRI Interface Example

The following example enables Multilink PPP on BRI 0:

```
interface BRI0
 description Enables PPP Multilink on BRI 0
 ip address 10.1.1.1 255.255.255.0
```

```
encapsulation ppp
dialer map ip 10.1.1.2 name coaster 14195291357
dialer map ip 10.1.1.3 name roaster speed 56 14098759854
ppp authentication chap
ppp multilink
dialer-group 1
```

Dialer Rotary Groups Example

The following example configures BRI interfaces to connect into a rotary group (using the **dialer-group** command) and then configures a dialer interface for that dialer group. This configuration permits IP packets to trigger calls.

```
interface BRI 0
description connected into a rotary group
encapsulation ppp
dialer rotary-group 1

interface BRI 1
no ip address
encapsulation ppp
dialer rotary-group 1

interface BRI 2
encapsulation ppp
dialer rotary-group 1

interface BRI 3
no ip address
encapsulation ppp
dialer rotary-group 1

interface BRI 4
encapsulation ppp
dialer rotary-group 1

interface Dialer 0
description Dialer group controlling the BRIs
ip address 10.1.1.1 255.255.255.0
encapsulation ppp
dialer map ip 10.1.1.2 name angus 14802616900
dialer-group 1
ppp authentication chap

dialer-list 1 protocol ip permit
```

Compression Examples

The following example enables predictor compression on BRI 0:

```
interface BRI0
description Enables predictor compression on BRI 0
ip address 10.1.1.1 255.255.255.0
encapsulation ppp
dialer map ip 10.1.1.2 name bon 14195291357
compress predictor
ppp authentication chap
dialer-group 1
```

The following example enables stacker compression on BRI 0:

```
interface BRI0
```

```
description Enables stac compression on BRI 0
ip address 10.1.1.1 255.255.255.0
encapsulation ppp
dialer map ip 10.1.1.2 name malcom 14195291357
compress stac
ppp authentication chap
dialer-group 1
```

Multilink PPP and Compression Example

The following example enables Multilink PPP and stacker compression on BRI 0:

```
interface BRI0
description Enables PPP Multilink and stac compression on BRI 0
ip address 10.1.1.1 255.255.255.0
encapsulation ppp
dialer map ip 10.1.1.2 name rudd 14195291357
ppp authentication chap
compress stac
ppp multilink
dialer-group 1
```

Voice over ISDN Examples

The following example allows incoming voice calls to be answered on BRI 0:

```
interface bri0
description Allows incoming voice calls to be answered on BRI 0
ip address 10.1.1.1 255.255.255.0
encapsulation ppp
isdn incoming-voice data
dialer map ip 10.1.1.2 name starstruck 14038182344
ppp authentication chap
dialer-group 1
```

The following example allows outgoing voice calls on BRI 1:

```
interface bri1
description Places an outgoing call as a voice call on BRI 1
ip address 10.1.1.1 255.255.255.0
encapsulation ppp
dialer map ip 10.1.1.2 name angus class calltype 19091238877
ppp authentication chap
dialer-group 1

map-class dialer calltype
dialer voice-call
```

For more configuration examples of voice calls over ISDN, refer to the *Cisco IOS Voice, Video, and Fax Configuration Guide*.

DNIS-plus-ISDN-Subaddress Binding Example

The following example configures a dialer profile for a receiver with DNIS 12345 and ISDN subaddress 6789:

```
dialer called 12345:6789
```

For additional configuration examples, see the sections [“Dynamic Multiple Encapsulations”](#) and [“Verifying the Dynamic Multiple Encapsulations Feature”](#) in the chapter [“Configuring Peer-to-Peer DDR with Dialer Profiles”](#) in this publication.

Screening Incoming V.110 Modem Calls Example

The following example filters out all V.110 modem calls except those with communication settings of 8 data bits, no parity bit, and 1 stop bit:

```
interface serial 0:23
 isdn v110 only databits 8 parity none stopbits 1
```

ISDN BRI Leased-Line Configuration Example

The following example configures the BRI 0 interface for leased-line access at 128 kbps. Because of the leased-line–not dialed–environment, configuration of ISDN called and calling numbers are not needed and not used. The BRI 0 interface is henceforth treated as a synchronous serial interface, with the default HDLC encapsulation.

```
isdn leased-line bri 0 128
```

The following example configures the BRI 0 interface for PPP encapsulation:

```
interface bri 0
 ip address 10.1.1.2 255.255.255.0
 encapsulation ppp
 bandwidth 128
```