

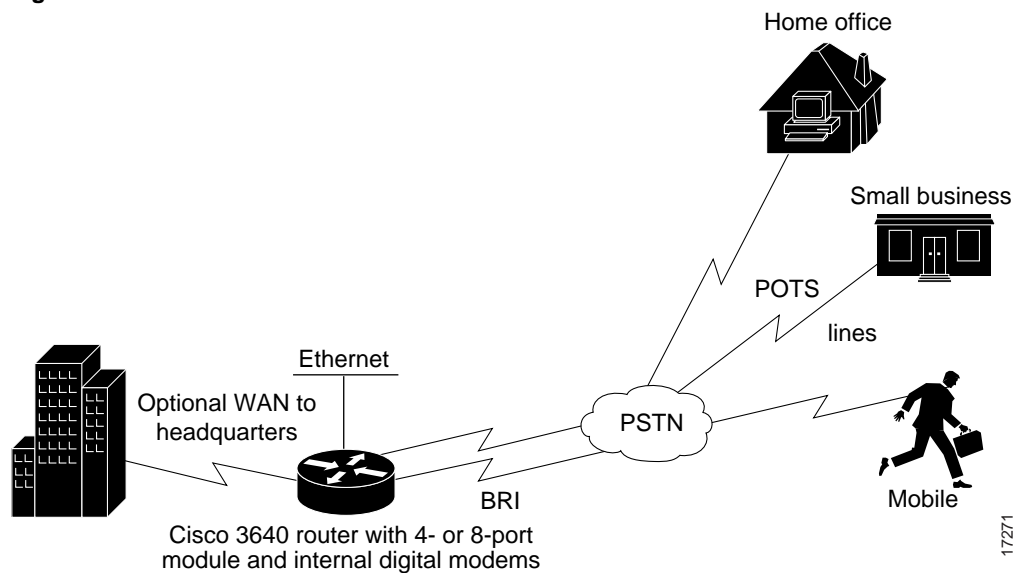
# Modem over ISDN BRI for the Cisco 3640 Router

## Feature Summary

The Modem over Integrated Services Digital Network (ISDN) Basic Rate Interface (BRI) feature for the Cisco 3640 modular access router lowers the cost of remote access by offering high-speed modem and ISDN connectivity for mobile customers, home-offices, and other remote-access users. Branch offices and enterprises can support analog modem users who call over the public switched telephone network (PSTN) into BRI interfaces in Cisco 3640 routers.

Analog modem calls arrive at a speed of 33.6 kilobits per second (kbps) via the PSTN. The router's digital modems accept the modem calls at connection speeds as fast as 56 kbps, adhering to the V.90 standard. As shown in Figure 1, the Cisco 3640 router in this way provides rapid access to email and other network services.

**Figure 1** Modem over ISDN BRI Feature



## Benefits

The following are benefits of using Modem over ISDN BRI:

- Supports cost-effective and readily available BRI service
- Provides remote modem users with rapid Internet and LAN/WAN access
- Allows flexible remote access application support

## List of Terms

**BRI**—Basic Rate Interface. ISDN interface composed of two B channels and one D channel for circuit-switched communication of voice, video, and data.

**ISDN**—Integrated Services Digital Network. Communication protocol, offered by telephone companies, that permits telephone networks to carry data, voice, and other source traffic.

**NM**—network module.

**POTS**—Plain Old Telephone Service. Basic telephone service supplying standard single-line telephones, telephone lines, and access to the public switched telephone network.

**PRI**—Primary Rate Interface. ISDN interface to primary rate access. Primary rate access consists of a single 64-Kbps D channel plus 23 (T1) or 30 (E1) B channels for voice or data.

**PSTN**—public switched telephone network. PSTN refers to the local telephone company.

**SPID**—service profile identifier. Number that some service providers use to define the services to which an ISDN device subscribes. The ISDN device uses the SPID when accessing the switch that initializes the connection to a service provider.

**TEI**—terminal endpoint identifier. In ISDN, a number that identifies a specific connection endpoint within a service access point.

**VIC**—voice interface card.

**WIC**—wide-area network (WAN) interface card.

## Restrictions

This feature requires specific hardware and software:

- At least one of the digital modem network modules listed below—the number in the model name indicates the number of digital modems that can be connected to the module.
  - NM-6DM
  - NM-12DM
  - NM-18DM
  - NM-24DM
  - NM-30DM

These digital modem network modules do not have their own network connections, but instead handle analog calls passing through other router interfaces. BRI modules can provide their ISDN connectivity. Other modules, such as Ethernet, can provide connectivity to the LAN. The digital modem module acts as a pool of available modems that can be used for both incoming and outgoing calls. Digital modem network modules do not support BRI VIC or WIC interfaces.

- At least one of the following Cisco BRI network modules:
  - NM-4B-S/T—Four-port ISDN BRI network module, minimum version 800-01236-03
  - NM-4B-U—Four-port ISDN BRI with integrated NT-1 network module, minimum version 800-01238-06
  - NM-8B-S/T—Eight-port ISDN BRI network module, minimum version 800-01237-03
  - NM-8B-U—Eight-port ISDN BRI with integrated NT-1 network module, minimum version 800-01239-06

The version level is available from the **show diag** command, which displays the version number as the part number. If your BRI network module is a version lower than those cited above or you need more details, see Cisco Connection Online (CCO) for the field notice, *Using Digital Modems with the Cisco 3600 Basic Rate Interface (BRI) Network Module Upgrade* (access product field notices are at <http://www.cisco.com/warp/customer/770/42.html>). If your existing Cisco BRI network module is one of those listed above and does not support the Modem over ISDN BRI feature, Cisco will upgrade the module at no charge.

- To support the Modem over ISDN BRI feature, V.90 modem portware—for instructions on downloading this software or obtaining it otherwise, see the *Cisco 3600 Series Modem Portware Upgrade Configuration Note* on CCO.

## Platforms

This feature is supported on the Cisco 3640 router.

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**Note** Due to Cisco 3620 slot limitations, the Modem over ISDN BRI feature is not supported on the Cisco 3620 router.

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## Prerequisites

Before you can configure a Cisco 3640 router to provide Modem over ISDN BRI connectivity, you must perform the tasks listed below:

- Obtain BRI service from your telecommunications provider. The BRI line must be provisioned at the switch to support voice calls.
- Install a four-port or eight-port BRI network module into your Cisco router. Depending on the type of network module and your BRI service, you might also need to install an external network terminator (NT-1).
- Install a supported digital modem network module into the Cisco 3640 router.
- 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 so the BRI interfaces function properly. To check the MTU of your interfaces, use the **show interfaces bri** command. The **show buffers** command displays the free buffer space. Use the **buffers** global configuration command to make adjustments to initial buffer pool settings and to the limits at which temporary buffers are created and destroyed.

For details about software configuration, see the Cisco IOS Release 12.0 software document, *Dial Solutions Configuration Guide*. For more information about the physical characteristics of the BRI network modules and their digital modem support, or instructions on how to install the network or modem modules, either see the Cisco 3600 series *Network Module Hardware Installation Guide* that came with your BRI network module or view the up-to-date information on CCO.

## Supported MIBS and RFCs

None.

## Configuration Tasks

The Modem over ISDN BRI feature is part of interface configuration for BRI. You configure the BRI interface after you have configured the ISDN global characteristics, which are switch type and TEI negotiation timing. These characteristics can also be defined for each BRI interface, as shown in the steps below. For details on the global and interface configuration commands, see the Cisco IOS software document, *Dial Solutions Configuration Guide*.

To set up the BRI interface characteristics, set the global parameters and then configure each interface separately. Perform the following configuration tasks:

Step	Command	Purpose
1	Router(config)# <b>isdn switch-type</b> <i>switch-type</i>	Configure the global ISDN switch type to match the service provider switch type. For a list of keywords, refer to Table 1.
2	Router(config)# <b>isdn tei</b> [ <b>first-call</b>   <b>powerup</b> ]	Configure when the ISDN Terminal Endpoint Identifier (TEI) negotiation occurs. If this command is not used, negotiation occurs when the router is powered on.  The <b>first-call</b> option is primarily used in European ISDN switch types, such as NET3 networks. The <b>powerup</b> option should be used in most other locations.
3	Router(config-if)# <b>interface bri</b> <i>slot/port</i>	Enter interface configuration mode to configure parameters for the specified interface.  <i>slot</i> is the location of the BRI module. Valid values are from 0 to 3.  <i>port</i> is an interface number. Valid values are from 0 to 7 if the module is an eight-port BRI network module, or from 0 to 4 if the module is a four-port BRI network module.
4	Router(config-if)# <b>ip address</b> <i>ip-address</i> <i>mask</i>	Specify an IP address and subnet for the interface. You can also specify that there is no IP address. For information about IP addressing, see the IOS software document, <i>Network Protocols Configuration Guide, Part 1</i> .

Step	Command	Purpose
5	<code>Router(config-if)#encapsulation ppp</code>	Enable Point-to-Point Protocol (PPP) encapsulation on the BRI interface. PPP encapsulation is configured for most ISDN communication.  If the router needs to communicate with devices that require a different encapsulation protocol, needs to detect encapsulation on incoming calls automatically, or needs to send traffic over a Frame Relay or X.25 network, see the Cisco IOS software document, <i>Dial Solutions Configuration Guide</i> .
6	<code>Router(config-if)#dialer map protocol next-hop-address name hostname speed 56   64 dial-string[:isdn-subaddress]</code>  <code>Router(config-if)#dialer map protocol next-hop-address name hostname spc [speed 56   64] [broadcast] dial-string[:isdn-subaddress]</code>	(Optional, Most locations) Define the remote recipient's protocol address, host name, and dialing string; optionally, provide the ISDN subaddress; set the dialer speed to 56 or 64 kbps, as needed.  or (Optional, Germany) Use the command keyword that enables ISDN semipermanent connections.
7	<code>Router(config-if)#dialer-group group-number</code>	(Optional) Assign the interface to a dialer group to control access to the interface.
8	<code>Router(config-if)#dialer-list dialer-group list access-list-number</code>	(Optional) Associate the dialer group number with an access list number.
9	<code>Router(config-if)#access-list access-list-number {deny   permit} protocol source address source-mask destination destination-mask</code>	(Optional) Define 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.
10	<code>Router(config-if)#no ip-directed broadcast</code>	(Optional) Disable the translation of directed broadcast to physical broadcasts.
11	<code>Router(config-if)#isdn switch-type switch-type</code>	(Optional) Configure the interface ISDN switch type to match the service provider switch type. The interface ISDN switch type overrides the global ISDN switch type on the interface.  For a list of keywords, refer to Table 1.
12	<code>Router(config-if)#isdn tei [first-call   powerup]</code>	(Optional) Determine when ISDN TEI negotiation occurs for an individual interface. This overrides the global configuration command.

Step	Command	Purpose
13	Router(config-if)# <b>isdn spid1</b> <i>spid-number</i> [ <i>ldn</i> ]	Specify a SPID and local directory number for the B1 channel. Currently, only the DMS-100 and NI-1 switch types require SPIDs. Although the 5ESS switch type might support a SPID, we recommend that you set up that ISDN service without SPIDs.
14	Router(config-if)# <b>isdn spid2</b> <i>spid-number</i> [ <i>ldn</i> ]	Specify a SPID and local directory number for the B2 channel.
15	Router(config-if)# <b>isdn caller</b> <i>number</i>	(Optional) Configure caller ID screening.
16	Router(config-if)# <b>isdn answer1</b> [ <i>called-party-number</i> ] [: <i>subaddress</i> ]	(Optional) Configure called-party number verification for a called-party number or subaddress number in the incoming setup message.
17	Router(config-if)# <b>isdn calling-number</b> <i>calling-number</i>	(Optional) Specify the calling-party number.
18	Router(config-if)# <b>isdn not-end-to-end</b> [56   64]	(Optional) Configure the speed for incoming calls not recognized as ISDN end-to-end.
19	Router(config-if)# <b>isdn incoming-voice</b> <b>modem</b>	Route incoming voice calls to the modem and treat them as analog data. This step is required for the Modem over ISDN BRI feature.
20	Router(config-if)# <b>isdn modem-busy-cause</b> { <i>number</i>   <b>busy</b>   <b>not available</b> }	(Optional) Specify the message that is returned when no modem is available for a call. This command is optional for the Modem over ISDN BRI feature.  <i>number</i> is a 1- to 3-digit number. Valid values are from 1 to 127, denoting a Q.931 error cause code.  <b>busy</b> specifies that the message will be "USER BUSY" when modems are unavailable.  <b>not available</b> specifies that the message will be "CHANNEL NOT AVAILABLE" when modems are unavailable.
21	Router(config-if)# <b>isdn</b> <b>fast-rollover-delay</b> <i>seconds</i>	(Optional) Configure a fast rollover delay.
22	Router(config-if)# <b>isdn sending-complete</b>	(Optional) Configure the BRI interface to include the Sending Complete information element in the outgoing call Setup message. Used in some geographic locations, such as Hong Kong and Taiwan, where the sending complete information element is required in the outgoing call setup message.

**Table 1 ISDN Switch Types**

Country	ISDN Switch Type	Description
Australia	basic-ts013	Australian TS013 switches
Europe	basic-net3	ETSI ISDN switches (UK and others)
	basic-nwnet3	Norwegian NET3 ISDN switches (phase 1, no longer exist, basic-net3 used instead)
	basic-1tr6	National German ISDN switches
	basic-vn2	National French ISDN switches
	basic-vn3	National French ISDN switches
Japan	ntt	Japanese NTT ISDN switches
New Zealand	basic-nznet3	New Zealand NET3 switches (no longer exist, basic-net3 used instead)
North America	basic-5ess	Custom 5ESS switch
	basic-dms100	NT DMS-100 switch
	basic-ni	National ISDN switches

## Verify

To verify the ISDN BRI interface configuration, use the commands demonstrated below. The text shown in bold displays the results of configuration steps such as those shown in the “Configuration Tasks” section on page 4.

**Step 1** The **show running-config** command in EXEC mode shows the current configuration running on the terminal. The example below shows some of the command output that is relevant to B RI configuration tasks.

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**Note** The **show startup-config** shows the configuration stored in NVRAM or in a location specified by the CONFIG\_FILE environment variable.

---

```
Building configuration...

Current configuration:
!
version 12.0
no service udp-small-servers
service tcp-small-servers
!
hostname Router
!
enable secret 5 $1$c8xi$tObplXsIS.jDeo43yZgq50
enable password xxx
!
username xxxx password x 11x5xx07
no ip domain-lookup
ip host Labhost 10.17.12.1
ip host Labhost2 10.17.12.2
ip name-server 10.70.169.21
!
interface Ethernet0
```

```
ip address 10.17.12.100 255.255.255.192
no ip mroute-cache
no ip route-cache
no mop enabled

...
interface BRI1/7
description (408) 555-3777
ip address 10.1.1.26 255.255.255.1
no ip directed-broadcast
encapsulation ppp
no ip route-cache
no ip mroute-cache
no keepalive
shutdown
dialer idle-timeout 180
dialer map ip 10.1.1.9 name MDial1 14085550715
dialer map ip 10.1.1.14 name MDial2 14085553775
dialer-group 1
isdn switch-type basic-5ess
isdn incoming-voice modem
modem-busy-cause busy
no fair-queue
no cdp enable
ppp authentication chap
ppp multilink
...
!
interface Group-Async1
ip unnumbered Loopback0
no ip directed-broadcast
ip tcp header-compression passive
async mode interactive
peer default ip address pool default
no fair-queue
group-range 65 70
hold-queue 10 in
!
router igrp 109
network 10.21.0.0
!
ip local pool local 10.21.50.85 10.21.50.89
ip local pool default 10.1.1.1 10.1.1.253
ip classless
ip route 0.0.0.0 0.0.0.0 10.21.48.1
!
!
map-class dialer VOICE
dialer voice-call
!
map-class dialer DATA
dialer-list 1 protocol ip list 101
tacacs-server host 10.69.2.74
tacacs-server host 10.92.15.197
snmp-server community isdn RW
snmp-server enable traps isdn call-information
snmp-server host 10.69.3.154 traps isdn
```

- Step 2** The **show interfaces bri number** command displays information about the physical attributes of the ISDN BRI B and D channels. *number* is the slot location of the BRI module. Valid values are from 0 to 3.

```
BRI0:1 is down, line protocol is down
Hardware is BRI
MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec, rely 255/255, load 1/255
Internet address is 10.1.1.3/27
Encapsulation PPP, loopback not set, keepalive not set
LCP Closed
Closed: IPCP
Last input never, output never, 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, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  0 packets input, 0 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  0 packets output, 0 bytes, 0 underruns
  0 output errors, 0 collisions, 7 interface resets
  0 output buffer failures, 0 output buffers swapped out
  0 carrier transitions
```

## Configuration Examples

The following examples show configuration of just the Modem over ISDN BRI feature using the interface configuration commands for each interface, as well as a complete configuration example showing global configuration, BRI interfaces, and modem configuration.

### Example 1: BRI Interfaces

The example below shows how to configure each BRI interface on a Cisco 3640 router for the Modem over ISDN BRI feature.

```
interface BRI0/0
no ip address
no ip directed-broadcast
encapsulation ppp
isdn switch-type basic-ni
isdn spid1 0444000101 9194440001
isdn spid2 0444001101 9194440011
isdn incoming-voice modem
no shut
!
interface BRI0/1
no ip address
no ip directed-broadcast
encapsulation ppp
isdn switch-type basic-ni
isdn spid1 0444000201 9194440002
isdn spid2 0444001201 9194440012
isdn incoming-voice modem
no shut
!
```

## Configuration Examples

---

```
interface BRI0/2
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0444000301 9194440003
  isdn spid2 0444001301 9194440013
  isdn incoming-voice modem
  no shut
!
interface BRI0/3
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0444000401 9194440004
  isdn spid2 0444001401 9194440014
  isdn incoming-voice modem
  no shut
!
interface BRI0/4
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0444000501 9194440005
  isdn spid2 0444001501 9194440015
  isdn incoming-voice modem
  no shut
!
interface BRI0/5
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0444000601 9194440006
  isdn spid2 0444001601 9194440016
  isdn incoming-voice modem
  no shut
!
interface BRI0/6
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0444000701 9194440007
  isdn spid2 0444001701 9194440017
  isdn incoming-voice modem
  no shut
!
interface BRI0/7
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0444000801 9194440008
  isdn spid2 0444001801 9194440018
  isdn incoming-voice modem
  no shut
!
```

```
interface BRI2/0
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000101 9195550001
  isdn spid2 0555001101 9195550011
  isdn incoming-voice modem
  no shut
!
interface BRI2/1
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000201 9195550002
  isdn spid2 0555001201 9195550012
  isdn incoming-voice modem
  no shut
!
interface BRI2/2
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000301 9195550003
  isdn spid2 0555001301 9195550013
  isdn incoming-voice modem
  no shut
!
interface BRI2/3
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000401 9195550004
  isdn spid2 0555001401 9195550014
  isdn incoming-voice modem
  no shut
!
interface BRI2/4
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000501 9195550005
  isdn spid2 0555001501 9195550015
  isdn incoming-voice modem
  no shut
!
interface BRI2/5
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000601 9195550006
  isdn spid2 0555001601 9195550016
  isdn incoming-voice modem
  no shut
!
```

```
interface BRI2/6
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000701 9195550007
  isdn spid2 0555001701 9195550017
  isdn incoming-voice modem
  no shut
!
interface BRI2/7
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000801 9195550008
  isdn spid2 0555001801 9195550018
  isdn incoming-voice modem
  no shut
!
!
```

## Example 2: Complete Configuration

The example below shows a complete configuration for a dial-in router, including a global command, BRI interface configuration, and modem configuration including group-async and dialer commands.

```
version 12.0
service timestamps debug datetime localtime
service timestamps log uptime
no service password-encryption
service udp-small-servers
service tcp-small-servers
!
hostname MBRI_IN
!
no logging buffered
enable password xxx
!
```

The following lines are used for the ppp chap authentication. Each username and password is associated with one dialer interface.

```
username async1 password devtest
username async2 password devtest
username async3 password devtest
username async4 password devtest
username async5 password devtest
username async6 password devtest
username async7 password devtest
username async8 password devtest
username async9 password devtest
username async10 password devtest
username async11 password devtest
username async12 password devtest
username async13 password devtest
username async14 password devtest
username async15 password devtest
username async16 password devtest
username async17 password devtest
username async18 password devtest
username async19 password devtest
username async20 password devtest
username async21 password devtest
username async22 password devtest
username async23 password devtest
username async24 password devtest
username async25 password devtest
username async26 password devtest
username async27 password devtest
username async28 password devtest
username async29 password devtest
username async30 password devtest
username FLOYD password devtest
username MBRI_OUT password devtest
ip subnet-zero
no ip domain-lookup
!
isdn switch-type basic-5ess
!

interface BRI0/0
 no ip address
 no ip directed-broadcast
 encapsulation ppp
 isdn switch-type basic-ni
 isdn spid1 0444000101 9194440001
 isdn spid2 0444001101 9194440011
 isdn incoming-voice modem
 no shut
!
interface BRI0/1
 no ip address
 no ip directed-broadcast
 encapsulation ppp
 isdn switch-type basic-ni
 isdn spid1 0444000201 9194440002
 isdn spid2 0444001201 9194440012
 isdn incoming-voice modem
 no shut
```

```
!  
interface BRI0/2  
  no ip address  
  no ip directed-broadcast  
  encapsulation ppp  
  isdn switch-type basic-ni  
  isdn spid1 0444000301 9194440003  
  isdn spid2 0444001301 9194440013  
  isdn incoming-voice modem  
  no shut  
!  
interface BRI0/3  
  no ip address  
  no ip directed-broadcast  
  encapsulation ppp  
  isdn switch-type basic-ni  
  isdn spid1 0444000401 9194440004  
  isdn spid2 0444001401 9194440014  
  isdn incoming-voice modem  
  no shut  
!  
interface BRI0/4  
  no ip address  
  no ip directed-broadcast  
  encapsulation ppp  
  isdn switch-type basic-ni  
  isdn spid1 0444000501 9194440005  
  isdn spid2 0444001501 9194440015  
  isdn incoming-voice modem  
  no shut  
!  
interface BRI0/5  
  no ip address  
  no ip directed-broadcast  
  encapsulation ppp  
  isdn switch-type basic-ni  
  isdn spid1 0444000601 9194440006  
  isdn spid2 0444001601 9194440016  
  isdn incoming-voice modem  
  no shut  
!  
interface BRI0/6  
  no ip address  
  no ip directed-broadcast  
  encapsulation ppp  
  isdn switch-type basic-ni  
  isdn spid1 0444000701 9194440007  
  isdn spid2 0444001701 9194440017  
  isdn incoming-voice modem  
  no shut  
!  
interface BRI0/7  
  no ip address  
  no ip directed-broadcast  
  encapsulation ppp  
  isdn switch-type basic-ni  
  isdn spid1 0444000801 9194440008  
  isdn spid2 0444001801 9194440018  
  isdn incoming-voice modem  
  no shut  
!
```

```
interface BRI2/0
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000101 9195550001
  isdn spid2 0555001101 9195550011
  isdn incoming-voice modem
  no shut
!
interface BRI2/1
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000201 9195550002
  isdn spid2 0555001201 9195550012
  isdn incoming-voice modem
  no shut
!
interface BRI2/2
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000301 9195550003
  isdn spid2 0555001301 9195550013
  isdn incoming-voice modem
  no shut
!
interface BRI2/3
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000401 9195550004
  isdn spid2 0555001401 9195550014
  isdn incoming-voice modem
  no shut
!
interface BRI2/4
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000501 9195550005
  isdn spid2 0555001501 9195550015
  isdn incoming-voice modem
  no shut
!
interface BRI2/5
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000601 9195550006
  isdn spid2 0555001601 9195550016
  isdn incoming-voice modem
  no shut
!
```

```
interface BRI2/6
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000701 9195550007
  isdn spid2 0555001701 9195550017
  isdn incoming-voice modem
  no shut
!
interface BRI2/7
  no ip address
  no ip directed-broadcast
  encapsulation ppp
  isdn switch-type basic-ni
  isdn spid1 0555000801 9195550008
  isdn spid2 0555001801 9195550018
  isdn incoming-voice modem
  no shut
!
interface Ethernet1/0
  ip address 10.18.16.123 255.255.255.192
  no ip directed-broadcast
  no shut
!
```

The section below defines a group-async interface for grouping all the digital modems and configuring them together. Group-async configuration is much easier than configuring all 30 digital modems individually.

```
interface Group-Async1
  ip unnumbered Ethernet3/1
  no ip directed-broadcast
  encapsulation ppp
  load-interval 30
  dialer in-band
  dialer pool-member 1
  async default routing
  async mode dedicated
  no peer default ip address
  no cdp enable
  ppp authentication chap
  group-range 96 125
  hold-queue 10 in
```

The following section defines dialer interfaces, associates IP addresses, and sets all the authentication parameters required during the call establishment.

```
interface Dialer1
 ip address 10.1.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async1
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async1
 ppp chap password devtest
!
interface Dialer2
 ip address 10.2.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async2
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async2
 ppp chap password devtest
!
interface Dialer3
 ip address 10.3.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async3
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async3
 ppp chap password devtest
!
interface Dialer4
 ip address 10.4.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async4
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async4
 ppp chap password devtest
!
```

## Configuration Examples

---

```
interface Dialer5
 ip address 10.5.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async5
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async5
 ppp chap password devtest

!
interface Dialer6
 ip address 10.6.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async6
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async6
 ppp chap password devtest

!
interface Dialer7
 ip address 10.7.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async7
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async7
 ppp chap password devtest

!
interface Dialer8
 ip address 10.8.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async8
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async8
 ppp chap password devtest

!
interface Dialer9
 ip address 10.9.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async9
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async9
 ppp chap password devtest

!
```

```
interface Dialer10
 ip address 10.10.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async10
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async10
 ppp chap password devtest

!
interface Dialer11
 ip address 10.11.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async11
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async11
 ppp chap password devtest

!
interface Dialer12
 ip address 10.12.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async12
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async12
 ppp chap password devtest

!
interface Dialer13
 ip address 10.13.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async13
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async13
 ppp chap password devtest

!
interface Dialer14
 ip address 10.14.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async14
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async14
 ppp chap password devtest

!
```

```
interface Dialer15
 ip address 10.15.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async15
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async15
 ppp chap password devtest

!
interface Dialer16
 ip address 10.16.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async16
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async16
 ppp chap password devtest

!
interface Dialer17
 ip address 10.17.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async17
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async17
 ppp chap password devtest

!
interface Dialer18
 ip address 10.18.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async18
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async18
 ppp chap password devtest

!
interface Dialer19
 ip address 10.19.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async19
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async19
 ppp chap password devtest

!
```

```
interface Dialer20
 ip address 10.20.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async20
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async20
 ppp chap password devtest

!
interface Dialer21
 ip address 10.21.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async21
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async21
 ppp chap password devtest

!
interface Dialer22
 ip address 10.22.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async22
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async22
 ppp chap password devtest

!
interface Dialer23
 ip address 10.23.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async23
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async23
 ppp chap password devtest

!
interface Dialer24
 ip address 10.24.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async24
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async24
 ppp chap password devtest

!
```

## Configuration Examples

---

```
interface Dialer25
 ip address 10.25.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async25
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async25
 ppp chap password devtest

!
interface Dialer26
 ip address 10.26.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async26
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async26
 ppp chap password devtest

!
interface Dialer27
 ip address 10.27.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async27
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async27
 ppp chap password devtest

!
interface Dialer28
 ip address 10.28.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async28
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async28
 ppp chap password devtest

!
interface Dialer29
 ip address 10.29.0.1 255.255.0.0
 no ip directed-broadcast
 encapsulation ppp
 dialer remote-name async29
 dialer pool 1
 dialer-group 1
 no cdp enable
 ppp authentication chap callin
 ppp chap hostname async29
 ppp chap password devtest

!
```

```

interface Dialer30
  ip address 10.30.0.1 255.255.0.0
  no ip directed-broadcast
  encapsulation ppp
  dialer remote-name async30
  dialer pool 1
  dialer-group 1
  no cdp enable
  ppp authentication chap callin
  ppp chap hostname async30
  ppp chap password devtest

!
no ip classless

```

The following lines define routes that send incoming packets out via specific interfaces.

```

ip route 0.0.0.0 0.0.0.0 10.18.16.193
ip route 10.91.0.1 255.255.255.255 10.1.0.2
ip route 10.91.0.2 255.255.255.255 10.2.0.2
ip route 10.91.0.3 255.255.255.255 10.3.0.2
ip route 10.91.0.4 255.255.255.255 10.4.0.2
ip route 10.91.0.5 255.255.255.255 10.5.0.2
ip route 10.91.0.6 255.255.255.255 10.6.0.2
ip route 10.91.0.7 255.255.255.255 10.7.0.2
ip route 10.91.0.8 255.255.255.255 10.8.0.2
ip route 10.91.0.9 255.255.255.255 10.9.0.2
ip route 10.91.0.10 255.255.255.255 10.10.0.2
ip route 10.91.0.11 255.255.255.255 10.11.0.2
ip route 10.91.0.12 255.255.255.255 10.12.0.2
ip route 10.91.0.13 255.255.255.255 10.13.0.2
ip route 10.91.0.14 255.255.255.255 10.14.0.2
ip route 10.91.0.15 255.255.255.255 10.15.0.2
ip route 10.91.0.16 255.255.255.255 10.16.0.2
ip route 10.91.0.17 255.255.255.255 10.17.0.2
ip route 10.91.0.18 255.255.255.255 10.18.0.2
ip route 10.91.0.19 255.255.255.255 10.19.0.2
ip route 10.91.0.20 255.255.255.255 10.20.0.2
ip route 10.91.0.21 255.255.255.255 10.21.0.2
ip route 10.91.0.22 255.255.255.255 10.22.0.2
ip route 10.91.0.23 255.255.255.255 10.23.0.2
ip route 10.91.0.24 255.255.255.255 10.24.0.2
ip route 10.91.0.25 255.255.255.255 10.25.0.2
ip route 10.91.0.26 255.255.255.255 10.26.0.2
ip route 10.91.0.27 255.255.255.255 10.27.0.2
ip route 10.91.0.28 255.255.255.255 10.28.0.2
ip route 10.91.0.29 255.255.255.255 10.29.0.2
ip route 10.91.0.30 255.255.255.255 10.30.0.2
ip route 10.18.0.0 255.255.0.0 Ethernet3/1
!
dialer-list 1 protocol ip permit
!
!
line con 0
  exec-timeout 0 0
  transport input none

```

The section below configures the lines associated with the digital modems.

```
line 96 125
  exec-timeout 0 0
  modem InOut
  transport input all
  stopbits 1
  flowcontrol hardware
line aux 0
  exec-timeout 0 0
line vty 0 4
  exec-timeout 0 0
  password lab
  login
line vty 5 60
  exec-timeout 0 0
  password lab
  login
!
end
```

## Command Reference

This section documents new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.0 *Command Reference*.

- **isdn incoming-voice**
- **isdn modem-busy-cause**

## isdn incoming-voice

To route all incoming voice calls to the modem and treat them as analog data, or to ensure that calls bypass the modems and are treated as digital data, use the **isdn incoming-voice** interface configuration command. Use the **no** form of this command to disable the setting.

```
isdn incoming-voice {data [56 | 64] | modem [56 | 64]}
no isdn incoming-voice {data [56 | 64] | modem [56 | 64]}
```

### Syntax Description

<b>data</b>	Specifies that incoming voice calls bypass the modems and are handled as digital data.
<b>modem</b>	Specifies that incoming voice calls are passed over to the digital modems, where they negotiate the appropriate modem connection with the far-end modem.
<b>56</b>	Specifies that the bandwidth for this connection is 56 kbps.
<b>64</b>	Specifies that the bandwidth for this connection is 64 kbps. If no argument is entered for either the <b>data</b> or <b>modem</b> keywords, the default value is 64.

### Default

```
isdn incoming-voice data 64
```

### Command Mode

Interface configuration

### Usage Guidelines

This command first appeared in Cisco IOS Release 11.1. It became available for BRI interfaces in Cisco IOS Release 12.0(2)XC and Cisco IOS Release 12.0(3)T.

Unless you specify otherwise, all calls received by the router and characterized as voice calls are treated as normal ISDN calls, which are handled as digital data and not passed over to the modem. To establish speedier connections for analog calls to the router, use the **isdn incoming-voice** command with the **modem** keyword to have voice calls routed through digital modems (as pulse-code modulated analog data) instead of being treated as digital data.

### Example

The following example routes all incoming voice calls through the modem as analog data:

```
interface BRI 0/0
 isdn incoming-voice modem
```

## isdn modem-busy-cause

Use the **isdn modem-busy-cause** command to specify an error cause code that is returned when all modems in the modem pool are busy and unavailable to accept an incoming call. Use the **no** form of this command to disable this feature.

```
isdn modem-busy-cause {number | busy | not available}  
no isdn modem-busy-cause
```

### Syntax Description

<i>number</i>	Specifies an ITU Q.931 standard error cause code of up to three digits, from 1 to 127.
<b>busy</b>	Specifies that the modem reports “USER BUSY” as the error message to the switch.
<b>not available</b>	Specifies that the modem returns “CHANNEL NOT AVAILABLE” as the message to the switch.

### Default

If the command is not used and all modems in the pool are busy, error cause code “21” (call rejected) is sent as the error message.

### Command Mode

Interface configuration

### Usage Guidelines

This command first appeared in Cisco IOS Release 11.1 when it was available for PRI interfaces. It became available for BRI interfaces in Cisco IOS Release 12.0(2)XC and Cisco IOS Release 12.0(3)T.

Using this command distinguishes call errors due to busy modems from other call errors (for instance, busy B channels) that might return the same ISDN default error code of 21.

### Example

The following example configures an error cause code of “47” (resources unavailable) to be returned when no modems in a pool are available:

```
interface BRI 1/1  
  isdn modem-busy-cause 47
```