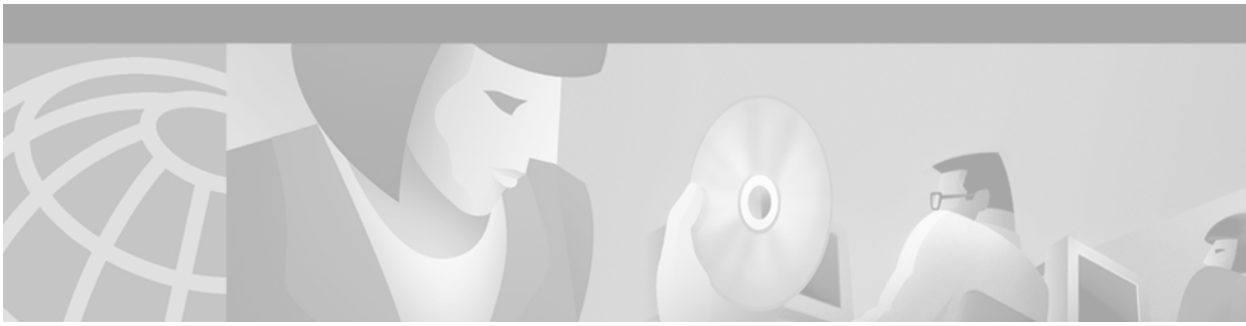


Configuring ISDN Interfaces for Voice

This chapter explains how to configure ISDN Basic Rate Interface (BRI) and Primary Rate Interface (PRI) ports for voice support and contains the following sections:

For a complete description of the commands used to configure ISDN interfaces for voice, refer to the *Cisco IOS Dial Technologies Command Reference* and the *Cisco IOS Voice, Video, and Fax Command Reference*. To locate documentation of other commands that appear in this chapter, use the command reference master index or search online.

To identify the hardware platform or software image information associated with a feature in this chapter, 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.

The following Cisco devices provide ISDN interfaces for voice applications:

- Cisco 2600 series routers (ISDN BRI and PRI interfaces)
- Cisco 3600 series routers (ISDN BRI and PRI interfaces)
- Cisco 7200 series routers (ISDN PRI interfaces only)
- Cisco MC3810 multiservice concentrator (ISDN BRI interfaces only)
- Cisco AS5300 universal access servers (ISDN PRI interfaces only)
- Cisco AS5800 universal access servers (ISDN PRI interfaces only)

The following documents provide additional information to help implement ISDN interfaces for voice:

- *Cisco IOS IP Configuration Guide*
- *Cisco IOS IP Command Reference*
- *Cisco IOS Dial Technologies Configuration Guide*
- *Cisco IOS Dial Technologies Command Reference*
- *Cisco IOS IOS Voice, Video, and Fax Command Reference*
- *Voice Network Module and Voice Interface Card Configuration Note*
- *Cisco Network Module Hardware Installation Guide*
- *Cisco WAN Interface Cards Hardware Installation Guide*

- *Update to Cisco WAN Interface Cards Hardware Installation Guide*
- *Voice over IP for the Cisco 3600 and Cisco 2600 Series Software Configuration Guide*
- *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*
- *Cisco 7200 Series Configuration Notes*
- *Quick Start Guide: Cisco MC3810 Installation and Startup*
- *Cisco MC3810 Multiservice Concentrator Hardware Installation Guide*

The following documents can help you troubleshoot ISDN, PRI, and BRI connections:

- *Internetwork Troubleshooting Guide*
- *Cisco IOS Debug Command Reference*

ISDN Voice Interface Overview

ISDN voice support provides the following benefits:

- It allows you to bypass Public Switched Telephone Network (PSTN) tariffed services such as trunking and administration.
- It allows your PBXs to be connected directly to a Cisco router so PBX station calls can be routed automatically to the WAN.
- It allows you to configure a voice interface on a Cisco router to emulate either a Terminating Equipment (TE) or Network Termination (NT) interface. Customers with all types of PBXs can send calls through a Cisco router and deliver those calls across the customer network.
- It allows you to configure Layer 2 operation as point-to-point (static terminal endpoint identifier [TEI]) or point-to-multipoint (automatic TEI).

Cisco routing devices support ISDN BRI and ISDN PRI. Both media types use bearer (B) channels and data (D) channels.

ISDN BRI provides two B channels, each capable of transferring voice or data at 64 kbps, and one 16-kbps D channel that carries signaling traffic. The D channel 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.

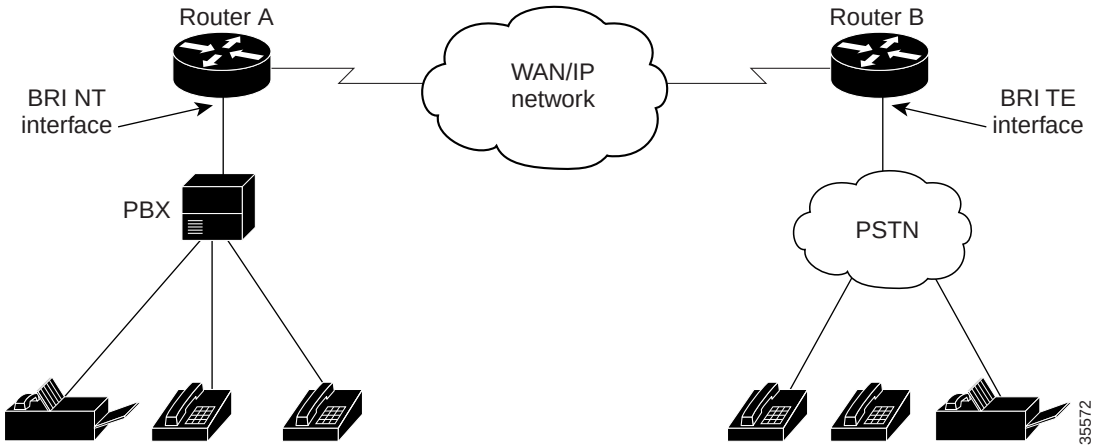
ISDN PRI provides 23 B channels plus a D channel (in North America and Japan) or 30 B channels plus a D channel (in the rest of the world). Similar to the ISDN BRI D channel, the ISDN PRI D channel carries signaling traffic. ISDN PRI is often referred to as “23 B + D” (in North America and Japan) or “30 B + D” (in the rest of the world). The D channel notifies the central office switch to send the incoming call to particular time slots on the Cisco access server or router. Each one of the B channels carries data or voice. The D channel carries signaling for the B channels. The D channel identifies if the call is a circuit-switched digital call or an analog modem call. Analog modem calls are decoded and then sent to the onboard modems. Circuit-switched digital calls are relayed directly to the ISDN processor in the router.

The ISDN BRI NT/TE voice interface card (VIC-2BRI-NT/TE) for the Cisco 2600 and Cisco 3600 series routers and the ISDN BRI voice module (BVM4-NT/TE) for the Cisco MC3810 multiservice concentrator enable Cisco IOS software to replicate the PSTN interface to a PBX that is compatible with European Telecommunications Standards Institute (ETSI) NET3 and QSIG switch types.

Prior to the release of these voice network modules and interface cards, customers with PBXs that implement only the BRI TE interface had to make substantial hardware and software changes on the PBX to implement the NT interface. The implementation of an NT interface on the router allows the customer to connect ISDN PBXs and key systems to a multiservice network with a minimum of configuration changes on the PBX.

The typical application (see Figure 108) allows enterprise customers with a large installed base of legacy telephony equipment to bypass the PSTN.

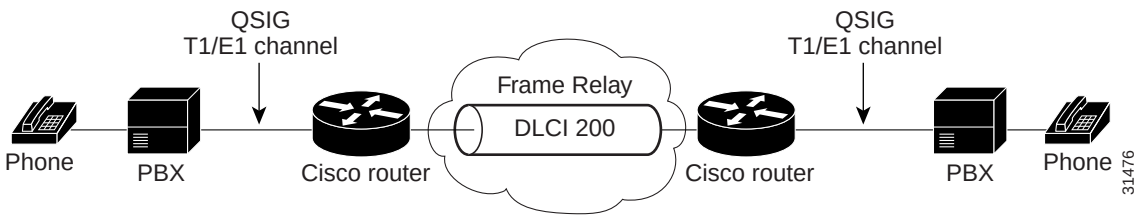
Figure 108 Typical Application Using ISDN BRI NT/TE VICs or ISDN BVMs



QSIG Protocol Support

Integration of QSIG protocol support with Cisco voice switching services allows Cisco devices to connect PBXs, key systems (KTs), and central office switches (COs) that communicate by using the QSIG protocol. The QSIG protocol is becoming the standard for PBX interoperability in Europe and North America. QSIG is a variant of ISDN D-channel voice signaling that is based on the ISDN Q.921 and Q.931 standards. With QSIG, Cisco networks emulate the functionality of the PSTN, and QSIG signaling messages allow the dynamic establishment of voice connections across a Cisco WAN to a peer router, which can then transport the signaling and voice packets to a second PBX, as shown in Figure 109.

Figure 109 QSIG Signaling



The Cisco voice packet network appears to the traditional QSIG PBXs as a distributed transit PBX that can establish calls to any PBX, non-QSIG PBX, or other telephony endpoint served by a Cisco gateway, including non-QSIG endpoints.

When QSIG messages originate and terminate on QSIG endpoints, the QSIG messages are passed transparently across the network; the PBXs are responsible for processing and provisioning the supplementary services. When QSIG and non-QSIG endpoints are linked via a Cisco packet voice gateway, only basic calls are supported. In addition, all switched voice connections must be established and torn down in response to QSIG control messages.

QSIG voice signaling provides the following benefits:

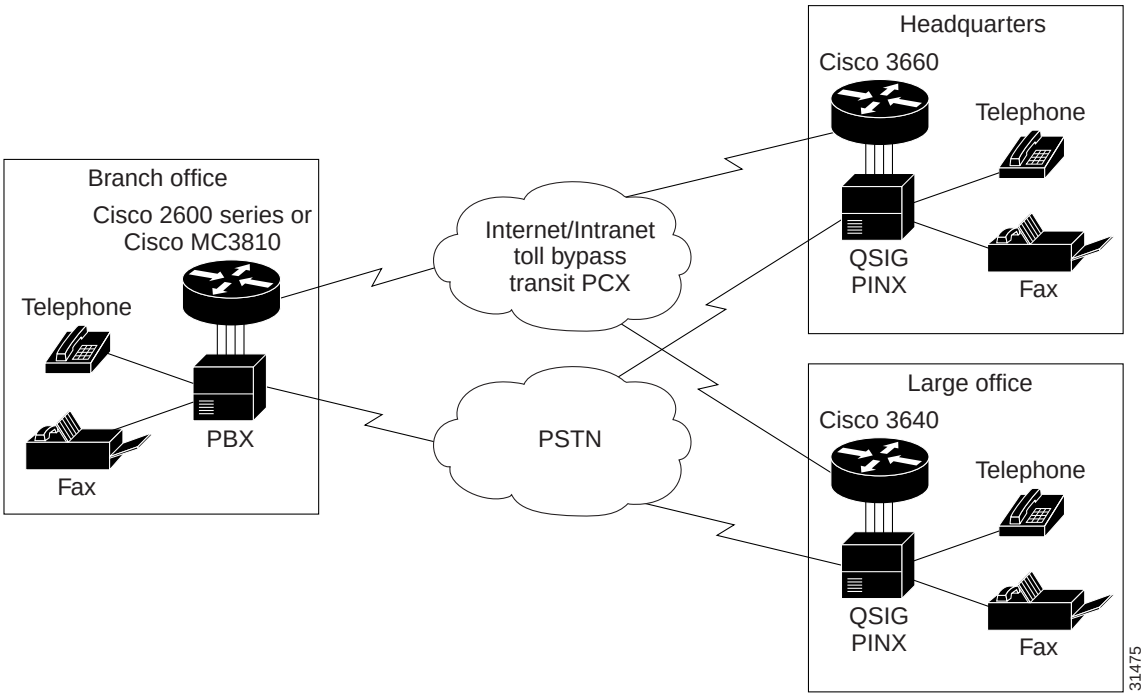
- It provides efficient and cost-effective services on permanent (virtual) circuits or leased lines.
- It allows enterprise networks that include PBX networks to replace leased voice lines with a Cisco WAN.
- It eliminates the need to route connections through multiple tandem PBX hops to reach the desired destination, thereby saving bandwidth, PBX hardware, and switching power.
- It improves voice quality through the single-hop routing provided by voice switching while allowing voice to be compressed more aggressively, resulting in additional savings.
- It supports PBX feature transparency across a WAN, permitting PBX networks to provide advanced features such as calling name and number display, camp-on/callback, network call forwarding, centralized attendant, and centralized message waiting. Usually these capabilities are available on only a single site where users are attached to the same PBX.

QSIG support includes the following capabilities:

- It enables digit forwarding on POTS dial peers.
- On Cisco 2600 series routers, it enables QSIG-switched calls over Voice over Frame Relay (VoFR) and Voice over IP (VoIP) for T1/E1 and BRI voice interface cards.
- On Cisco 3600 series routers, it enables QSIG-switched calls over VoFR, VoIP, and Voice over ATM (VoATM) for T1/E1 and BRI voice interface cards.
- On Cisco 7200 series routers, it enables QSIG-switched calls over VoFR and VoIP on T1/E1 voice interface cards.
- On Cisco MC3810 multiservice concentrators, it enables T1 or E1 PRI and BRI QSIG-switched calls over VoFR, VoIP, and VoATM for Cisco MC3810 digital voice modules (DVMs) and BRI voice module (BVM). QSIG support on the Cisco MC3810 multiservice concentrator was introduced in Cisco IOS Release 12.0(2)T.

Figure 110 shows an example of how QSIG support can enable a toll-bypass application.

Figure 110 QSIG Toll-Bypass Application



QSIG Protocol Stack

QSIG is a variant of ISDN D-channel signaling. The protocol was originally specified by European Computer Manufacturers Association (ECMA), and then was adopted by European Telecommunications Standards Institute (ETSI) and the International Organization for Standardization (ISO). Table 46 identifies the ECMA standards and the OSI layer of the QSIG protocol stack to which they relate.

Table 46 QSIG Protocol Stack

Layer	Standards	Description
Layers 4 to 7	Application mechanisms	End-to-end protocols; network transparent
Layer 3	Multiple ECMA standards	Standards for supplementary services and advance network features
	ECMA-165	QSIG generic functional procedures
	ECMA-142/143	QSIG basic call
Layer 2	ECMA-141	Interface-dependent protocols
Layer 1	I.430 / I.431	PRI and BRI

Switch-Type Configuration Options

To support QSIG at either the global configuration level or the interface configuration level, use the **isdn switch-type** command. For example, if you have a QSIG connection on one line and on the BRI or PRI port, you can configure the ISDN switch type in one of the following combinations:

- Set the global **isdn switch-type** command to support QSIG by entering either the **isdn switch-type basic-qsig** command (BRI) or **isdn switch-type primary-qsig** command (PRI); and set the interface **isdn switch-type** command for the interfaces to a regular central office switch type such as those shown in Table 47.
- Set the global **isdn switch-type** command to support the CO switch type (see Table 47), and set the interface **isdn switch-type** command for the interface to support QSIG.
- Configure the global **isdn switch-type** command to another setting (see Table 47); then set the interface **isdn switch-type** command for **interface bri** to a BRI setting; set the interface **isdn switch-type** command for the serial interface to support QSIG.

Table 47 ISDN CO Switch Types

Country	ISDN Switch Type	Description
Australia	basic-ts013	Australian TS013 switches
Europe	basic-1tr6	German 1TR6 ISDN switches
	basic-nwnet3	Norwegian NET3 ISDN switches (phase 1)
	basic-net3	NET3 ISDN switches (United Kingdom and others)
	vn2	French VN2 ISDN switches
	vn3	French VN3 ISDN switches
Japan	ntt	Japanese NTT ISDN switches
New Zealand	basic-nznet3	New Zealand NET3 switches
North America	basic-5ess	Lucent Technologies basic rate switches
	basic-dms100	NT DMS-100 basic rate switches
	basic-ni1	National ISDN-1 switches

Q.931 Support

Cisco platforms that support Q.931 offer both user- and network-side switch types for ISDN call processing, providing the following benefits:

- User-side PRI enables the Cisco platform to provide a standard ISDN PRI user-side interface to the PSTN.
- Network-side PRI enables the Cisco platform to provide a standard ISDN PRI network-side interface via digital T1/E1 packet voice trunk network modules on Cisco 2600 series and Cisco 3600 series routers.

ISDN Voice Interface Limitations

- Basic-net3 and basic-qsig are the only ISDN switch types currently supported for an NT interface.
- When the ISDN BRI port on the router is configured as an NT port, a “rolled” cable (one with the transmit and receive leads swapped) is needed to connect to a TE interface.
- Layer 1 can be configured only as point-to-point (that is, with one TE connected to each NT). Automatic TEI support will issue only one TEI.

QSIG Support Limitations

The Cisco 2600 series routers do not support VoATM.

The following restrictions apply to the Cisco MC3810 multiservice concentrator:

- QSIG data calls are not supported. All calls with bearer capability indicating a nonvoice type (such as for video telephony) are rejected.
- A Cisco MC3810 multiservice concentrator supports only one T1/E1 interface with direct connectivity to a private integrated services network exchange (PINX).
- The Cisco MC3810 multiservice concentrator supports a maximum of 24 B channels.
- On the Cisco MC3810 multiservice concentrator, if the multiflex trunk module (MFT) is installed in slot 3 and QSIG is configured, the Cisco MC3810 requires a minimum revision of the system control board (SCB) in order to use ISDN and the serial 1 interface simultaneously. ISDN includes ISDN Q.SIG signaling on a digital voice module and the ISDN BRI port of a multiflex trunk module (MFT). (To display the revision of the SCB, use the **show version** command.) Otherwise, serial port 1 is inoperative when ISDN is active.

  When using a newer SCB-06.07 board with QSIG features enabled or the BRI backup feature active, the following constraints are imposed:

  – Serial port 1 is limited to speeds of 3xDS0 (<= 192kbps or 168 kbps).

  – The serial ports does not support async, bisync, and half-duplex.

  – Serial port 0 cannot be set up to run the TDM cross-connect function if serial port 1 is in use, due to FIFO limitations.

  – If slot 3 is empty (no MFT installed) and QSIG features are enabled, serial port 1 cannot be used. This is because hardware on the MFT is used to enable the TDM sharing of serial port 1.

The following restrictions apply to the Cisco 7200 series routers:

- VoATM is not supported.
- BRI is not supported.

ISDN Voice Interface Prerequisite Tasks

Before you can configure a voice interface for ISDN, you must do the following:

- Obtain PRI or BRI service and T1 or E1 service from your service provider, as required. Any BRI lines must be provisioned at the switch to support voice calls.
- Establish a working IP, Frame Relay, or ATM network. At least one network module or WAN interface card must be installed in the router to provide the connection to the LAN or WAN. For more information on installing network modules and interface cards, see the list of documents at the beginning of this chapter.
  - For more information about configuring IP, see the chapter "Voice over IP Overview."
  - For more information about configuring Frame Relay, see the chapter "Configuring Voice over Frame Relay."
  - For more information about configuring ATM, see the chapter "Configuring Voice over ATM."
- Complete your company's dial plan.
- Establish a working telephony network based on your company's dial plan and configure the network for real-time voice traffic. This chapter describes only a portion of the process; for further information, see the chapter "Cisco Voice Telephony."
- Cisco 2600 and Cisco 3600 Series Routers—Install digital T1 or E1 packet voice trunk network modules, BRI voice interface cards, and other voice interface cards as required on your network.
- Cisco 7200 Series Routers—Install a single-port 30-channel T1/E1 high-density voice port adapter.
- Cisco MC3810 Multiservice Concentrators—Install the required digital voice modules (DVMs), BRI voice module (BVM), and multiflex trunk modules.
- All Platforms (As Required):
  - Configure voice card and controller settings.
  - Configure serial and LAN interfaces.
  - Configure voice ports.
  - Configure voice dial peers.

ISDN Voice Interface Configuration Task List

To configure your router for ISDN voice interface support, perform the tasks described in the following sections:

- Configuring ISDN BRI Interfaces, page 591 (required for BRI)
- Configuring ISDN PRI Interfaces, page 598 (required for PRI)

To configure your router for QSIG support, perform the tasks described in the following sections:

- Configuring Global QSIG Support for BRI or PRI, page 600 (required)
- Configuring Controllers for QSIG over PRI, page 601 (required for PRI)
- Configuring BRI Interfaces for QSIG, page 601 (required for BRI)
- Configuring PRI Interfaces for QSIG, page 603 (required for PRI)

To configure your router for Q.931 support, perform the tasks described in the following section:

- Configuring ISDN PRI Q.931 Support, page 609 (required)

Configuring ISDN BRI Interfaces

The steps in this section include commands for configuring an NT interface and a TE interface. To configure an ISDN BRI interface, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# isdn switch-type switch-type`	Configures the telephone company ISDN switch type. For a list of switch types, see Table 48. **Note** The only switch types currently supported for an NT interface are basic-net3 and basic-qsig.

Step 2	**Cisco MC3810 Multiservice Concentrators**
	`Router(config)# interface bri number`
	Other Supported Routers
	`Router(config)# interface bri slot|port`
		Enters interface configuration mode for the specified interface.
		The arguments are as follows:
		• *number*—Voice module (1 to 4).
		• *slot*—Location of the voice network module in the router (1 to 6).
		• *port*—Location of the BRI voice interface card (VIC) in the voice network module. Valid values are 1 or 2.

Step 3	`Router(config-if)# no ip address`	Specifies that there is no IP address for this interface. For information about IP addressing, refer to the *Cisco IOS IP Configuration Guide*.
Step 4	`Router(config-if)# isdn overlap-receiving`	(Optional) Activates overlap signaling to send to the destination PBX. In this mode, the interface waits for possible additional call-control information.
Step 5	`Router(config-if)# isdn twait-disable`	(Optional) Delays a National ISDN BRI switch for a random length of time before activating the Layer 2 interface when the switch starts up. Use this command when the ISDN switch type is basic-ni1.
Step 6	`Router(config-if)# isdn spid1 spid-number [ldn]`	(Optional; TE only) Specifies a service profile identifier (SPID) and optional local directory number for the B1 channel. Currently, only the DMS-100 and NI-1 switch types require SPIDs. Although some switch types might support a SPID, Cisco recommends that you set up ISDN service without SPIDs.
Step 7	`Router(config-if)# isdn spid2 spid-number [ldn]`	(Optional; TE only) Specifies a SPID and optional local directory number for the B2 channel.
Step 8	`Router(config-if)# isdn incoming-voice voice`	Configures the port for incoming voice calls.
Step 9	`Router(config-if)# shutdown`	Turns off the port (prior to setting the port emulation).

	Command	Purpose
Step 10	`Router(config-if)# isdn layer1-emulate {user | network}`	Configures the Layer 1 port mode emulation and clock settings. The keywords are as follows: • **user**—Configures the port as TE and sets it to function as a clock slave. This is the default. • **network**—Configures the port as NT and sets it to function as a clock master.
Step 11	`Router(config-if)# no shutdown`	Turns on the port.
Step 12	`Router(config-if)# network-clock-priority {low | high}`	(Optional; TE only) Configures the priority of the network clock for this BRI voice port. If this port is configured as TE and you want it to be the first-priority BRI voice port for recovering the clock signal from the network NT device, enter **high**. If this BRI voice port is configured as TE and you want it to be a low-priority BRI voice port for recovering the clock signal from the network NT device, enter **low**. The default for the BRI voice module (BVM) is **low.** The default for the BRI VIC is **high**. Do not use this command if this port is configured as NT in Step 10 with the command **isdn layer1-emulate network**.
Step 13	**Cisco MC3810 Multiservice Concentrators Only** `Router(config-if)# [no] line-power`	Controls the power supplied from an NT-configured port to a TE device. The **line-power** command turns the port power on; the **no line-power** command turns it off. The default is **no line-power**.
Step 14	`Router(config-if)# isdn protocol-emulate {user | network}`	Configures the Layer 2 and Layer 3 port protocol emulation. The keywords are as follows: • **user**—Configures the port as TE; the PBX is the master. This is the default. • **network**—Configures the port as NT; the PBX is the slave.
Step 15	`Router(config-if)# isdn sending-complete`	(Optional) Configures the voice port to include the "Sending Complete" information element in the outgoing call setup message. This command is 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.

	Command	Purpose
Step 16	`Router(config-if)# isdn static-tei tei-number`	(Optional) Configures a static ISDN Layer 2 terminal endpoint identifier (TEI). The value of *tei-number* can be from 0 to 64.
Step 17	`Router(config-if)# isdn point-to-point-setup`	(Optional) Configures the ISDN port to send SETUP messages on the static TEI. **Note** A static TEI must be configured in order for this command to be effective.
Step 18	`Router(config-if)# end`	Exits interface configuration mode.

Step 19	**Cisco MC3810 Multiservice Concentrators**
	`Router(config)# clear interface bri number`
	Other Supported Routers
	`Router# clear interface slot|port`
		(Optional) Resets the specified interface. The interface needs to be reset if the static TEI number has been configured in Step 16.
		The arguments are as follows:
		• *number*—Voice module (1 to 4).
		• *slot*—Location of the voice network module in the router (1 to 6).
		• *port*—Location of the BRI VIC in the voice network module. Valid values are 1 or 2.

When you have finished configuring one interface, you must repeat the appropriate steps above for the other interfaces.

Note To complete voice configuration, you must set up your voice ports and dial peers. To do this, see the chapter "Configuring Voice Ports."

Table 48 lists the ISDN switch types.

Table 48 ISDN Switch Types

ISDN Switch Type	Description
basic-qsig	PINX (PBX) switches with QSIG signaling in compliance with Q.931
basic-ts013	Australian TS013 switches
basic-1tr6	German 1TR6 ISDN switches
basic-nwnet3	Norwegian NET3 ISDN switches (phase 1)
basic-net3	NET3 (TBR3) ISDN, Norway NET3, and New Zealand NET3 switches. (This switch type covers the Euro-ISDN E-DSS1 signaling system and is ETSI-compliant.)
vn2	French VN2 ISDN switches
vn3	French VN3 ISDN switches
ntt	Japanese NTT ISDN switches
basic-nznet3	New Zealand NET3 switches
basic-5ess	Lucent Technologies basic rate switches

Table 48 ISDN Switch Types (continued)

ISDN Switch Type	Description
basic-dms100	NT DMS-100 basic rate switches
basic-ni1	National ISDN-1 switches

Verifying ISDN BRI Interface Configuration

To verify the ISDN BRI interface configuration, perform the following steps:

Step 1 Enter the **show running-config** command in EXEC mode to show the current configuration running on the router.

Note The examples show some of the command output that is relevant to BRI configuration tasks. The first example is from a Cisco 2600 series router.

```
Router# show running-config

Building configuration...
Current configuration:
!
version 12.2
!
no service udp-small-servers
service tcp-small-servers
!
hostname Router
!
username xxxx password x 11x5xx07
no ip domain-lookup
ip host Labhost 172.22.66.11
ip host Labhost2 172.22.66.12
ip name-server 172.22.66.21
!
.
.
.
interface BRI1/0
no ip address
no ip directed-broadcast
isdn switch-type basic-net3
isdn overlap-receiving
isdn T306 30000
isdn skipsend-idverify
isdn incoming-voice voice
!
interface BRI1/1
no ip address
no ip directed-broadcast
isdn switch-type basic-net3
isdn overlap-receiving
isdn T306 30000
isdn skipsend-idverify
isdn incoming-voice voice
!
interface BRI2/0
no ip address
```

```
isdn switch-type basic-net3
isdn overlap-receiving
isdn protocol-emulate network
isdn layer1-emulate network
isdn T306-30000
isdn sending-complete
isdn skipsend-idverify
isdn incoming-voice voice
!
interface BRI2/1
no ip address
isdn switch-type basic-net3
isdn overlap-receiving
isdn protocol-emulate network
isdn layer1-emulate network
isdn T306-30000
isdn sending-complete
isdn skipsend-idverify
isdn incoming-voice voice
!
.
.
.
```

The following example is from a Cisco MC3810 multiservice concentrator:

```
Router# show running-config

Building configuration...
Current configuration:
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router
!
no logging console
!
network-clock base-rate 56k
network-clock-select 2 T1 0
network-clock-select 3 system(SCB)
network-clock-select 1 BVM
ip subnet-zero
!
isdn switch-type basic-net3
isdn voice-call-failure 0
call rsvp-sync
!
voice-card 0
!
controller T1 0
 mode atm
 framing esf
 linecode b8zs
!
interface BRI1
no ip address
isdn switch-type basic-net3
isdn protocol-emulate network
isdn layer1-emulate network
isdn incoming-voice voice
isdn T306 30000
```

```
isdn skipsend-idverify
no cdp enable
!
interface BRI2
no ip address
isdn switch-type basic-net3
isdn protocol-emulate network
isdn layer1-emulate network
isdn incoming-voice voice
isdn T306 30000
isdn skipsend-idverify
no cdp enable
!
interface BRI3
no ip address
shutdown
network-clock-priority low
isdn switch-type basic-net3
isdn T306 30000
no cdp enable
!
interface BRI4
no ip address
shutdown
network-clock-priority low
isdn switch-type basic-net3
isdn T306 30000
no cdp enable
!
.
.
.
```

Step 2 Enter the **show interfaces bri** command to display information about the physical attributes of the ISDN BRI B and D channels. The term *spoofing* means that the interface is presenting itself to the IOS software as operational.

The following is sample output from the **show interfaces bri** command for a BRI voice port on a Cisco 2610 router:

```
router# show interfaces bri 1/0

BRI3/1 is up, line protocol is up (spoofing)
  Hardware is Voice NT or TE BRI
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation VOICE, loopback not set
  Last input 00:00:02, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/16 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     26110 packets input, 104781 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     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, 5 interface resets
     0 output buffer failures, 0 output buffers swapped out
     9 carrier transitions
```

The following is sample output from the **show interfaces bri** command for a BRI voice port on a Cisco MC3810 multiservice concentrator:

```
Router# show interfaces bri 1

BRI1 is up, line protocol is up (spoofing)
  Hardware is BVM
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Last input 19:32:19, output 19:32:27, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/1/16 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     13282 packets input, 53486 bytes, 0 no buffer
     Received 1 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     13292 packets output, 53515 bytes, 0 underruns
     0 output errors, 0 collisions, 4 interface resets
     0 output buffer failures, 0 output buffers swapped out
     33 carrier transitions
```

Monitoring and Maintaining ISDN BRI Interfaces

To monitor ISDN interfaces, use these commands as needed:

Command	Purpose

Cisco MC3810 Multiservice Concentrators
`Router# show controllers bri number`
 	
Other Supported Routers
`Router# show controllers bri slot/port`
	Displays information about the ISDN BRI interface.

Cisco MC3810 Multiservice Concentrators
`Router# show voice port [slot/port | summary]`
 	
Other Supported Routers
`Router# show voice port summary`
	Displays information about the BRI voice ports.

`Router# show isdn {memory | status | timers}`	Displays information about memory, status, and Layer 2 and Layer 3 timers.
`Router# debug isdn q921`	Displays data link layer (Layer 2) access procedures that are taking place at the router on the D channel (LAPD) of its ISDN interface. The **no** form of this command disables debugging output.
`Router# debug isdn q931`	Displays information about call setup and teardown of ISDN network connections (Layer 3) between the local router (user side) and the network. The **no** form of this command disables debugging output.

Configuring ISDN PRI Interfaces

With ISDN PRI, signaling in VoIP is handled by ISDN PRI group configuration. After ISDN PRI has been configured, you must enter the **isdn incoming-voice** command on the serial interface (acting as the D channel) to ensure a dial tone.

To configure basic ISDN PRI interface parameters for T1 or E1, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# isdn switch-type switch-type`	Configures the telephone company ISDN switch type. For a list of switch types, see Table 48. **Note** The only switch types currently supported for an NT interface are basic-net3 and basic-qsig.
Step 2	**Cisco AS5800 Access Servers** `Router(config)# controller T1 1/0/0`	Enters controller configuration mode and specifies the T1 0 controller on the T1 card. or
	Cisco AS5800 Access Servers `Router(config)# controller T1 1/0/0:1`	Enters controller configuration mode and specifies the T1 1 controller on the T3 card. or
	Cisco AS5300 Access Servers `Router(config)# controller {T1 | E1} 0`	Enters controller configuration mode and specifies the T1 0 or E1 0 controller.
Step 3	`Router(config-controller)# framing esf`	Defines the framing characteristics.
Step 4	`Router(config-controller)# linecode {ami | b8zs | hdb3}`	Sets the line-encoding method to match that of your telephone company service provider. The keywords are as follows: • **ami**—Alternate mark inversion (AMI) as the line-code type. Valid for T1 or E1 controllers. This is the default for T1 lines. • **b8zs**— 8ZS as the line-code type. Valid for T1 controller only. • **hdb3**—High-density bipolar 3 (hdb3) as the line-code type. Valid for E1 controller only. This is the default for E1 lines.
Step 5	`Router(config-controller)# pri-group timeslots range`	Configures the ISDN PRI group. The *range* argument specifies a range of time slots that make up the PRI group. The range is from 1 to 23.
Step 6	`Router(config-controller)# exit`	Exits controller configuration mode and returns to global configuration mode.

	Command	Purpose
Step 7	**Cisco AS5800 Access Servers** `Router(config)# interface Serial1/0/0:23`	Enters interface configuration mode for the specified first ISDN PRI line on the T1 card. (The ISDN serial interface is the D channel.) or
	Cisco AS5800 Access Servers `Router(config)# interface Serial1/0/0:1:23`	Enters interface configuration mode for the specified first ISDN PRI line on the T3 card. (The ISDN serial interface is the D channel.) or
	Cisco AS5300 Access Servers `Router(config)# interface Serial0:23`	Enters interface configuration mode for the specified first ISDN PRI line. (The ISDN serial interface is the D channel.)
Step 8	**Cisco AS5xxx Access Servers** `Router(config-if)# isdn incoming-voice modem`	Enables incoming ISDN voice calls.
	All Others `Router(config-if)# isdn incoming-voice voice`	

Configuring ISDN PRI Voice Ports

Under most circumstances, the default voice port command values are adequate to configure voice ports to transport voice data over your existing IP network. However, because of the inherent complexities of PBX networks, you might need to configure specific voice port values, depending on the specifications of the devices in your telephony network.

To configure specific voice port parameters, see the chapter “Configuring Voice Ports.”

For more information on specific voice-port configuration commands and additional voice port commands, refer to the *Cisco IOS Voice, Video, and Fax Command Reference.*

Verifying ISDN PRI Configuration

You can check the validity of your voice port configuration by performing the following tasks:

- To verify that the data configured is correct, use the **show voice port** command.
- If you have not configured your device to support Direct Inward Dialing (DID), dial in to the router and verify that you have a dial tone.
- Enter a dual tone multifrequency (DTMF) digit. If the dial tone stops, you have verified two-way voice connectivity with the router.

ISDN PRI Troubleshooting Tips

If you are having trouble connecting a call and you suspect that the problem is associated with voice port configuration, you can try to resolve the problem by performing the following tasks:

- Ping the associated IP address to confirm connectivity. If you cannot successfully ping your destination, refer to the chapter “Configuring IP” in the *Cisco IOS IP Configuration Guide.*

- Determine if the voice feature card (VFC) has been correctly installed. For more information, refer to *Installing Voice-over-IP Feature Cards in Cisco AS5300 Universal Access Servers*, which came with your voice network module (VNM).
- To learn if the VFC is operational, use the **show vfc slot number** command.
- To view layer status information, use the **show isdn status** command. If you receive a status message stating that Layer 1 is deactivated, make sure the cable connection is not loose or disconnected. (This status message indicates a problem at the physical layer.)
- With T1 lines, determine if your a-law setting is correct. With E1 lines, determine if your u-law setting is correct. To configure both a-law and u-law values, use the **cptone** command. For more information about the **cptone** command, refer to the *Cisco IOS Voice, Video, and Fax Command Reference.*
- If dialing cannot occur, use the **debug isdn q931** command to check the ISDN configuration.

Configuring Global QSIG Support for BRI or PRI

If you need additional guidance regarding switch-type configuration, see the section "Switch-Type Configuration Options." The steps in this section apply to both BRI and PRI, except as noted. To do the global configuration of QSIG signaling on the router, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	**BRI Only on Cisco MC3810, 2600, and 3600 Series Routers** `Router(config)# isdn switch-type basic-qsig`	(Optional) Configures the global ISDN switch type.
	PRI Only on Any Supported Router `Router(config)# isdn switch-type primary-qsig`	(Optional) Configures the ISDN switch-type to support QSIG signaling. **Note** You can configure the ISDN switch type by using either this global command or the same command in interface configuration mode, depending on your configuration. If you configure the global **isdn switch-type** command for QSIG support, you do not need to configure the interface **isdn switch-type** command for QSIG. For more information, see "Switch-Type Configuration Options" on page 588. For a list of CO switch types, see Table 47.
Step 2	`Router(config)# dspinterface dspfarm slot/port`	(Cisco 7200 series routers only) Configures the digital signal processor (DSP) farm interface.
Step 3	`Router(config)# card type {t1 | e1} slot`	(Cisco 7200 series routers only) Specifies the card type and slot number. Enter the card type as T1 or E1; specify the slot location by using a value from 1 to 6, depending on your router.

Configuring Controllers for QSIG over PRI

The steps in this section do not apply to BRI. To configure controllers for QSIG signaling over PRI, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# controller {t1 | e1} controller-number`	Enters controller configuration mode for the specified controller. Enter the controller as E1 or T1, specifying 1 for a Cisco MC3810 multiservice concentrator and a *slot/port* location on a Cisco 2600, 3600, or 7200 series router. **Note** On the Cisco MC3810 multiservice concentrator, QSIG is supported only on controller 1.
Step 2	`Router(config-controller)# pri-group timeslots range`	Configures the PRI group for either T1 or E1. The argument is as follows: • *range*—Range of time slots that make up the PRI group. T1 range is 1 to 23. E1 range is 1 to 31. You can configure the PRI group to include all available time slots, or you can configure a select group of time slots for the PRI group.

Configuring BRI Interfaces for QSIG

To configure BRI interfaces for QSIG support, use the following commands beginning in global configuration mode:

	Command	Purpose

Step 1	**Cisco MC3810 Multiservice Concentrators**
	`Router(config)# interface bri number`
	Cisco 2600, and 3600 Series Routers
	`Router(config)# interface bri slot/port`
		Enters interface configuration mode for the specified interface.
		The arguments are as follows:
		• *number*—Voice module (1 to 4).
		• *slot*—Location of the voice network module in the router (1 to 6).
		• *port*—Location of the BRI VIC in the voice network module. Valid values are 1 and 2.

Step 2	**Cisco MC3810, 2600, and 3600 Series Routers Only** `Router(config-if)# isdn static-tei 0`	This command is required. (In previous releases, it was set automatically when the **isdn switch-type basic-qsig** command was issued.)

	Command	Purpose
Step 3	**Cisco MC3810 Multiservice Concentrators Only** `Router(config-if)# isdn layer1-emulate {user | network}`	Configures the Layer 1 port mode emulation and the clock settings. The keywords are as follows: • **user**—Configures the port as TE and sets it to function as a clock slave. This is the default. The term **user** is equivalent to the QSIG term *slave*. • **network**—Configures the port as NT and sets it to function as a clock master. The term **network** is equivalent to the QSIG term *master.*
Step 4	**Cisco MC3810 Multiservice Concentrators Only** `Router(config-if)# network-clock-priority {low | high}`	(TE only) Configures the priority of the network clock for this BRI voice port. If this port is configured as TE and you want it to be the first-priority BRI voice port for recovering the clock signal from the network NT device, enter **high**. If this BRI voice port is configured as TE and you want it to be a low-priority BRI voice port for recovering the clock signal from the network NT device, enter **low**. Do not use this command if this port is configured as NT in Step 3 with the command **isdn layer1-emulate network**.
Step 5	**Cisco 2600 and 3600 Series Routers Only** `Router(config-if)# isdn incoming-voice voice`	Routes incoming voice calls. This is set for voice-capable BRI interfaces by default, except for Cisco 2600 and 3600 series BRI S/T TE voice interface cards, where, unless this command is used, the **isdn incoming-voice modem** configuration setting is converted to **isdn incoming-voice voice** when it receives an incoming call.
Step 6	`Router(config-if)# isdn sending-complete`	(Optional) Configures the voice port to include the "Sending Complete" information element in the outgoing call setup message. This command is 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.
Step 7	**Cisco MC3810, 2600, and 3600 Series Routers Only** `Router(config-if)# isdn switch-type basic-qsig`	(Optional) If the service provider switch type for this BRI port is different from the global ISDN switch type, 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 this interface. See the section "Switch-Type Configuration Options."

	Command	Purpose
Step 8	`Router(config-if)# isdn protocol-emulate {user | network}`	Configures the Layer 2 and Layer 3 port protocol emulation. The keywords are as follows: • **user**—Configures the port as TE; the PINX is the master. This is the default. The term **user** is equivalent to the QSIG term *slave*. • **network**—Configures the port as NT; the PINX is the slave. The term **network** is equivalent to the QSIG term *master.* **Note** On the Cisco MC3810 multiservice concentrator, this command replaces the **isdn switch-type** [**primary-qsig-slave** | **primary-qsig-master**] command.
Step 9	`Router(config-if)# isdn overlap-receiving value`	(Optional) Activates overlap signaling to send to the destination PBX. In this mode, the interface waits for possible additional call-control information from the preceding PINX. **Note** You can leave the default mode of *enbloc*, in which all call establishment information is sent in the setup message without need for additional messages from the preceding PINX.
Step 10	`Router(config-if)# isdn network-failure-cause value`	(Optional) Specifies the cause code to pass to the PBX when a call cannot be placed or completed because of internal network failures. Possible values range from 1 to 127.

Configuring PRI Interfaces for QSIG

To configure PRI interfaces for QSIG support, use the following commands beginning in global configuration mode:

	Command	Purpose

Step 1	**Cisco MC3810 Multiservice Concentrators**
	`Router(config)# interface serial 1:channelnumber`
	Or
	Other Supported Routers
	`Router(config)# interface serial slot/port:channel-number`
		Enters interface configuration mode for the ISDN PRI interface and the specified interface slot location and channel number. Enter the slot location as **1**. For T1, enter the channel number as **23**. For E1, enter **15**.
		Enters interface configuration mode for the ISDN PRI interface and the specified interface slot and port location and channel number. Enter a *slot* number from 1 to 6 and a *port* number of 1 or 2. For T1, enter the channel number as **23**. For E1, enter **15**.

	Command	Purpose
Step 2	`Router(config-if)# isdn switch-type primary-qsig`	If you did not configure the global PRI ISDN switch type for QSIG support in global configuration mode, configure the interface ISDN switch type to support QSIG signaling. See the section "Switch-Type Configuration Options." The conditions that apply to this command in global configuration mode also apply to this command in interface configuration mode. **Note** For this interface, this interface configuration command overrides the setting of the **isdn switch-type** command entered in global configuration mode.
Step 3	`Router(config-if)# isdn contiguous-bchan`	(E1 only) Specifies contiguous bearer channel handling so that B channels 1 through 30 map to time slots 1 to 31, skipping time slot 16.
Step 4	`Router(config-if)# isdn protocol-emulate {user | network}`	Configures the Layer 2 and Layer 3 port protocol emulation. The keywords are as follows: • **user**—Configures the port as TE; the PINX is the master. This is the default. The term **user** is equivalent to the QSIG term *slave*. • **network**—Configures the port as NT; the PINX is the slave. The term **network** is equivalent to the QSIG term *master.* **Note** On the Cisco MC3810 multiservice concentrator, this command replaces the **isdn switch-type** [**primary-qsig-slave** | **primary-qsig-master**] command.
Step 5	`Router(config-if)# isdn overlap-receiving value`	(Optional) Activates overlap signaling to send to the destination PBX. In this mode, the interface waits for possible additional call-control information from the preceding PINX. **Note** You can leave the default mode of *enbloc*, in which all call establishment information is sent in the setup message without need for additional messages from the preceding PINX.
Step 6	`Router(config-if)# isdn network-failure-cause value`	(Optional) Specifies the cause code to pass to the PBX when a call cannot be placed or completed because of internal network failures. Possible values range from 1 to 127.

Verifying the QSIG Configuration

To confirm the QSIG configuration, perform the following steps. The **show running-config** command displays PRI time slot group configuration and other details.

Step 1 To see information about switch type, memory, status, and Layer 2 and Layer 3 timers, enter the **show isdn** command.

For more information about this command, refer to the *Cisco IOS Dial Technologies Command Reference*.

The following sample output shows the results of the **show isdn status** command for a BRI voice port on a Cisco 3600 series router:

```
Router# show isdn status

Global ISDN Switchtype = primary-qsig
ISDN Serial3/1:15 interface
        dsl 0, interface ISDN Switchtype = primary-qsig
         **** Master side configuration ****
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
    Layer 3 Status:
        29 Active Layer 3 Call(s)
    Activated dsl 0 CCBs = 29
        CCB:callid=89BF, sapi=0, ces=0, B-chan=5, calltype=VOICE
.
.
.
CCB:callid=89C8, sapi=0, ces=0, B-chan=14, calltype=VOICE
.
.
.
        CCB:callid=89D9, sapi=0, ces=0, B-chan=1, calltype=VOICE
        CCB:callid=89DA, sapi=0, ces=0, B-chan=2, calltype=VOICE
        CCB:callid=89DB, sapi=0, ces=0, B-chan=3, calltype=VOICE
    The Free Channel Mask: 0x80000018
ISDN Serial3/0:15 interface
        dsl 1, interface ISDN Switchtype = primary-qsig
         **** Master side configuration ****
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
        TEI = 0, Ces = 9, SAPI = 16, State = TEI_ASSIGNED
    Layer 3 Status:
        28 Active Layer 3 Call(s)
    Activated dsl 1 CCBs = 28
        CCB:callid=BDF, sapi=0, ces=0, B-chan=2, calltype=VOICE
        CCB:callid=BE0, sapi=0, ces=0, B-chan=1, calltype=VOICE
        CCB:callid=BE1, sapi=0, ces=0, B-chan=3, calltype=VOICE
.
.
.
CCB:callid=BFA, sapi=0, ces=0, B-chan=31, calltype=VOICE
    The Free Channel Mask: 0xB0000000
    Total Allocated ISDN CCBs = 54

Total Allocated ISDN CCBs = 0
.
```

```
.
.
CCB:callid=89C8, sapi=0, ces=0, B-chan=14, calltype=VOICE
.
.
.
        CCB:callid=89D9, sapi=0, ces=0, B-chan=1, calltype=VOICE
        CCB:callid=89DA, sapi=0, ces=0, B-chan=2, calltype=VOICE
        CCB:callid=89DB, sapi=0, ces=0, B-chan=3, calltype=VOICE
    The Free Channel Mask: 0x80000018
ISDN Serial3/0:15 interface
        dsl 1, interface ISDN Switchtype = primary-qsig
         **** Master side configuration ****
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
        TEI = 0, Ces = 9, SAPI = 16, State = TEI_ASSIGNED
    Layer 3 Status:
        28 Active Layer 3 Call(s)
    Activated dsl 1 CCBs = 28
        CCB:callid=BDF, sapi=0, ces=0, B-chan=2, calltype=VOICE
        CCB:callid=BE0, sapi=0, ces=0, B-chan=1, calltype=VOICE
        CCB:callid=BE1, sapi=0, ces=0, B-chan=3, calltype=VOICE
.
.
.
CCB:callid=BFA, sapi=0, ces=0, B-chan=31, calltype=VOICE
    The Free Channel Mask: 0xB0000000
    Total Allocated ISDN CCBs = 54
```

The following sample output shows the results of the **show isdn status** command for a BRI voice port and a PRI voice port on a Cisco MC3810 multiservice concentrator:

```
Router# show isdn status

Global ISDN Switchtype = basic-qsig
ISDN BRI1 interface
dsl 1, interface ISDN Switchtype = basic-qsig
**** Slave side configuration ****
    Layer 1 Status:
DEACTIVATED
    Layer 2 Status:
TEI = 0, Ces = 1, SAPI = 0, State = TEI_ASSIGNED
    Layer 3 Status:
NLCB:callid=0x0, callref=0x0, state=31, ces=0 event=0x0
0 Active Layer 3 Call(s)
    Activated dsl 1 CCBs = 0
ISDN BRI2 interface
.
.
.
Router# show isdn status

     Global ISDN Switchtype = primary-qsig
     ISDN Serial1:23 interface
             dsl 0, interface ISDN Switchtype = primary-qsig
              **** Slave side configuration ****
         Layer 1 Status:
             DEACTIVATED
         Layer 2 Status:
             TEI = 0, Ces = 1, SAPI = 0, State = TEI_ASSIGNED
         Layer 3 Status:
             0 Active Layer 3 Call(s)
```

```
         Activated dsl 0 CCBs = 0
         The Free Channel Mask: 0x7FFFFF
```

The following sample output shows the results of the **show isdn status** command for a PRI voice port on a Cisco 7200 series router:

```
Router# show isdn status

Global ISDN Switchtype = primary-qsig
ISDN Serial1/0:15 interface
        dsl 0, interface ISDN Switchtype = primary-qsig
         **** Slave side configuration ****
    Layer 1 Status:
        DEACTIVATED
    Layer 2 Status:
        TEI = 0, Ces = 1, SAPI = 0, State = TEI_ASSIGNED
    Layer 3 Status:
        0 Active Layer 3 Call(s)
    Activated dsl 0 CCBs = 0
    The Free Channel Mask:  0x7FFF7FFF
ISDN Serial1/1:15 interface
        dsl 1, interface ISDN Switchtype = primary-qsig
         **** Slave side configuration ****
    Layer 1 Status:
        DEACTIVATED
    Layer 2 Status:
        TEI = 0, Ces = 1, SAPI = 0, State = TEI_ASSIGNED
    Layer 3 Status:
        0 Active Layer 3 Call(s)
    Activated dsl 1 CCBs = 0
    The Free Channel Mask:  0x7FFF7FFF
    Total Allocated ISDN CCBs = 0
```

Step 2 To display the state and the service status of each ISDN channel, enter the **show isdn service** command in privileged EXEC mode.

The following example shows sample output from the **show isdn service** command when PRI is configured on a T1 controller:

```
Router# show isdn service

PRI Channel Statistics:
ISDN Se0:15, Channel (1-31)
  Activated dsl 8
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

Step 3 To display the Call Distributor Application Programming Interface (CDAPI) information, use the **show cdapi** command.

The following sample output shows the results of the **show cdapi** command for a PRI voice port on a Cisco 3660 series router:

```
Router# show cdapi

Registered CDAPI Applications/Stacks
====================================

Application: TSP CDAPI Application Voice
        Application Type(s) : Voice Facility Signaling
        Application Level   : Tunnel
        Application Mode    : Enbloc
```

```
Signaling Stack: ISDN
        Interface: Se5/0:15

Signaling Stack: ISDN
        Interface: Se5/1:15

Signaling Stack: ISDN
        Interface: Se6/0:15

Signaling Stack: ISDN
        Interface: Se6/1:15

CDAPI Message Buffers
=====================

Used Msg Buffers: 0, Free Msg Buffers: 9600
Used Raw Buffers: 0, Free Raw Buffers: 4800
Used Large-Raw Buffers: 0, Free Large-Raw Buffers: 480
```

The following sample output shows the results of the **show cdapi** command for a PRI voice port on a Cisco MC3810 multiservice concentrator:

```
Router# show cdapi

Registered CDAPI Applications/Stacks
====================================

Application: TSP CDAPI Application Voice
        Application Type(s) : Voice Facility Signaling
        Application Level   : Tunnel
        Application Mode    : Enbloc

Signaling Stack: ISDN
        Interface: Se1:15

CDAPI Message Buffers
=====================

Used Msg Buffers: 2, Free Msg Buffers: 1198
Used Raw Buffers: 2, Free Raw Buffers: 598
Used Large-Raw Buffers: 0, Free Large-Raw Buffers: 60
```

QSIG Support Troubleshooting Tips

Table 49 lists **debug** and **show** commands that can help you analyze problems with your QSIG configuration. The documents listed at the beginning of this chapter include information about these commands.

Table 49 QSIG Troubleshooting Commands

Command	Purpose
`Router# show isdn status`	Displays the status of all ISDN interfaces, including active layers, timer information, and switch type settings.
`Router# show controllers {t1 | e1}`	Displays information about T1 and E1 controllers.

Table 49 QSIG Troubleshooting Commands (continued)

`Router# show voice port summary`	Displays summary information about voice port configuration.
`Router# show dial-peer voice`	Displays how voice dial peers are configured.
`Router# show cdapi`	Displays the Call Distributor Application Programming Interface (CDAPI) information.
`Router# show call history voice record`	Displays information about calls made to and from the router.
`Router# show rawmsg`	Displays information about any memory leaks.
`Router# debug isdn event`	Displays events occurring on the user side (on the router) of the ISDN interface. The ISDN events that can be displayed are Q.931 events (call setup and teardown of ISDN network connections).
`Router# debug tsp`	Displays information about the telephony service provider (TSP).
`Router# debug cdapi {events | detail}`	Displays information about CDAPI application events, registration, messages, and so on.

Configuring ISDN PRI Q.931 Support

To configure ISDN PRI Q.931 support on a Cisco 2600 or Cisco 3600 series router, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# isdn switch-type primary-net5`	(Optional; see note.) Selects a service provider switch type that accommodates PRI. **Note** You can configure the ISDN switch type in either global configuration mode or interface configuration mode. If you configure the ISDN switch type here in this step, specify the switch type for all PRI ports. If you configure the ISDN switch type in interface configuration mode, specify the switch type for a single interface. The switch type specified in interface configuration mode for any individual interface overrides the switch type specified in global configuration mode.
Step 2	`Router(config)# controller {t1 | e1} slot/port`	Enters controller configuration mode for the specified *slot/port*. Valid values for *slot* and *port* are 0 and 1.

	Command	Purpose
Step 3	`Router(config-controller)# pri-group timeslots range`	Configures the T1 or E1 PRI group. The argument is as follows: • *range*—Range of time slots that make up the PRI group. T1 range is 1 to 23. E1, range is 1 to 31. You can configure the PRI group to include all available time slots, or you can configure a select group of time slots for the PRI group.
Step 4	`Router(config-controller)# exit`	Exits controller configuration mode.
Step 5	`Router(config)# interface serial0/0:n`	Enters interface configuration mode and specifies the D-channel interface. For *n*, the D-channel number, use the following values: • **23** on a T1 PRI • **15** on an E1 PRI
Step 6	`Router(config-if)# isdn protocol-emulate {user | network}`	Configures the Layer 2 and Layer 3 port protocol emulation. The keywords are as follows: • **user**—Configures the port as a slave. This is the default. • **network**—Configures the port as a master.
Step 7	`Router(config-if)# [no] line-power`	Turns on or turns off the power supplied from an NT-configured port to a TE device. The default is **no line-power**.
Step 8	`Router(config-if)# isdn incoming-voice voice`	Routes incoming ISDN voice calls to the voice module.

ISDN Voice Interface Configuration Examples

This section provides specific configuration examples for ISDN interfaces in the following sections:

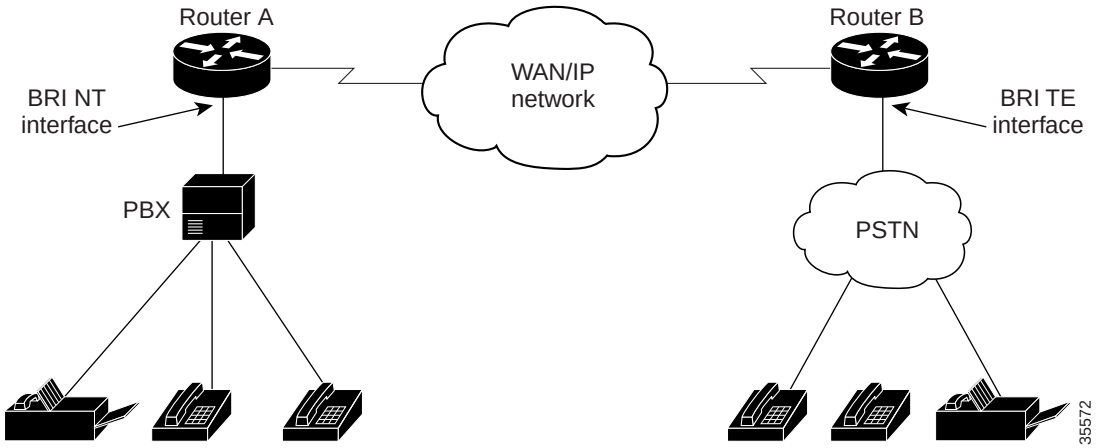
ISDN to PBX and ISDN to PSTN Configuration Examples

This section includes the following configuration examples:

The configuration examples included in this section correspond to the topology shown in Figure 111. The routers each include a BRI VIC and a 2-slot VNM, along with other voice interface cards and modules that are included for completeness. Router A is connected to a PBX through the BRI VIC and is connected to Router B by a serial Ethernet interface. Router B includes a BRI VIC for connection to the PSTN in order to process voice calls from off-premises terminal equipment.

For more information about IP configuration, refer to the *Cisco IOS IP Configuration Guide*. For more information about VoIP, VoFR, and VoATM configuration, see the appropriate configuration information elsewhere in this configuration guide.

Figure 111 Configuration Example Topology



ISDN Connection to a PBX Configuration Example

The following configuration example illustrates the configuration of the BRI interfaces on a Cisco 3640 router (Router A in Figure 111) connected to a PBX:

```
interface BRI1/0
no ip address
isdn switch-type basic-net3
isdn overlap-receiving
isdn protocol-emulate network
isdn layer1-emulate network
isdn T306-30000
isdn sending-complete
isdn skipsend-idverify
isdn incoming-voice voice
!
interface BRI1/1
no ip address
isdn switch-type basic-net3
isdn overlap-receiving
isdn protocol-emulate network
isdn layer1-emulate network
isdn T306-30000
isdn sending-complete
isdn skipsend-idverify
isdn incoming-voice voice
!
ip default-gateway 1.14.0.1
```

```
ip classless
ip route 2.0.0.0 255.0.0.0 Ethernet0/1
ip route 2.0.0.0 255.0.0.0 Serial0/1
ip route 172.22.66.33 255.255.255.255 Ethernet0/0
!
!
line con 0
 exec-timeout 0 0
 transport input none
line aux 0
line vty 0 4
 login
```

ISDN Connection to the PSTN Configuration Example

The following configuration example illustrates the configuration of the BRI interfaces on a Cisco 2600 series router (Router B in Figure 111) connected to the public ISDN telephone network:

```
interface BRI1/0
no ip address
 no ip directed-broadcast
 isdn switch-type basic-ni1
 isdn twait-disable
 isdn spid1 14085552111 5552111
 isdn spid2 14085552112 5552112
 isdn incoming-voice voice

interface BRI1/1
 no ip address
 no ip directed-broadcast
 isdn switch-type basic-ni1
 isdn twait-disable
 isdn spid1 14085552111 5552111
 isdn spid2 14085552112 5552112
 isdn incoming-voice voice
!
ip classless
ip route 3.0.0.0 255.0.0.0 Ethernet0/1
ip route 3.0.0.0 255.0.0.0 Serial0/1
ip route 172.21.66.0 255.255.255.0 Ethernet0/0
!
!
!
line con 0
 exec-timeout 0 0
 transport input none
line aux 0
line vty 0 4
 login
```

QSIG Support Configuration Examples

The following configuration examples shows QSIG configuration on several supported routers:

- QSIG Support on Cisco 3600 Series Routers Example, page 613
- QSIG Support on Cisco 7200 Series Routers Example, page 617
- QSIG Support on Cisco MC3810 Multiservice Concentrators Example, page 622

QSIG Support on Cisco 3600 Series Routers Example

The following configuration example shows how a Cisco 3660 series router can be configured for E1 and PRI with QSIG signaling support using VoIP and VoATM:

```
.
.
.
hostname router3660
!
!
!
!
!
!
memory-size iomem 20
voice-card 5
!
voice-card 6
!
ip subnet-zero
!
isdn switch-type primary-qsig
isdn voice-call-failure 0
!
!
!
!
controller E1 5/0
 pri-group timeslots 1-5,16
!
controller E1 5/1
 pri-group timeslots 1-31
!
controller E1 6/0
 pri-group timeslots 1-31
!
controller E1 6/1
 pri-group timeslots 1-31
!
!
!
interface FastEthernet0/0
 ip address 10.7.72.9 255.255.255.0
 speed auto
 half-duplex
!
interface FastEthernet0/1
 ip address 10.100.100.7 255.255.255.0
 no keepalive
 duplex auto
 speed auto
 hold-queue 1000 in
!
interface Serial2/0
 no ip address
 shutdown
!
interface Serial2/1
 no ip address
 shutdown
!
```

```
interface Serial2/2
 no ip address
 shutdown
!
interface Serial2/3
 no ip address
 shutdown
!
interface ATM3/0
 no ip address
 atm clock INTERNAL
 no atm ilmi-keepalive
 pvc 10/40
  vbr-rt 155000 50000 64000
  encapsulation aal5mux voice
 !
interface Serial5/0:15
 no ip address
 ip mroute-cache
 no logging event link-status
 isdn switch-type primary-qsig
 isdn overlap-receiving
 isdn incoming-voice voice
 no cdp enable
!
interface Serial5/1:15
 no ip address
 ip mroute-cache
 no logging event link-status
 isdn switch-type primary-qsig
 isdn incoming-voice voice
 fair-queue 64 256 0
 no cdp enable
!
interface Serial6/0:15
 no ip address
 ip mroute-cache
 no logging event link-status
 isdn switch-type primary-qsig
 isdn incoming-voice voice
 fair-queue 64 256 0
 no cdp enable
!
interface Serial6/1:15
 no ip address
 ip mroute-cache
 no logging event link-status
 isdn switch-type primary-qsig
 isdn incoming-voice voice
 fair-queue 64 256 0
 no cdp enable
!
ip classless
ip route 192.168.17.125 255.255.255.255 FastEthernet0/0
no ip http server
!
!
map-class frame-relay frs0
 frame-relay voice bandwidth 1260000
 frame-relay fragment 200
 no frame-relay adaptive-shaping
 frame-relay cir 1260000
 frame-relay fair-queue
!
```

```
voice-port 1/0/0
 modem passthrough system
 timing hookflash-in 0
!
voice-port 1/0/1
 modem passthrough system
 timing hookflash-in 0
!
voice-port 5/0:15
 compand-type a-law
!
voice-port 5/1:15
 compand-type a-law
 cptone DE
!
voice-port 6/0:15
 compand-type a-law
 cptone DE
!
voice-port 6/1:15
 no echo-cancel enable
 compand-type a-law
 cptone DE
!
dial-peer voice 1 pots
 shutdown
 destination-pattern 21...
 modem passthrough system
 direct-inward-dial
!
dial-peer voice 51 voip
 shutdown
 destination-pattern 6504007
 modem passthrough system
 session target ipv4:100.100.100.3
!
dial-peer voice 2 pots
 shutdown
 destination-pattern 21...
 modem passthrough system
 direct-inward-dial
 port 5/1:15
!
dial-peer voice 3 voip
 shutdown
 destination-pattern 22...
 modem passthrough system
 session target ipv4:100.100.100.6
!
dial-peer voice 5 pots
 shutdown
 destination-pattern 22...
 modem passthrough system
 direct-inward-dial
 prefix 4006
!
dial-peer voice 13 pots
 shutdown
 destination-pattern 21...
 modem passthrough system
 direct-inward-dial
 port 6/0:15
!
```

```
dial-peer voice 6 pots
 destination-pattern 21...
 modem passthrough system
 direct-inward-dial
 port 6/1:15
!
dial-peer voice 44 voatm
 destination-pattern 22...
 modem passthrough system
 session target ATM3/0 pvc 10/40
!
dial-peer voice 20 pots
 incoming called-number 4...
 destination-pattern 4007
 modem passthrough system
 direct-inward-dial
 port 5/0:15
 prefix 4007
!
dial-peer voice 21 pots
 destination-pattern 4006
 modem passthrough system
 direct-inward-dial
 port 5/0:15
 prefix 4006
!
!
line con 0
 transport input none
line aux 0
line vty 0 4
 login
!
end
```

QSIG Support on Cisco 7200 Series Routers Example

The following configuration examples show how QSIG protocol support is configured with VoFR on Router A, where calls are originated, and Router B, where calls terminate:

Router A: Originating Configuration

```
.
.
.
hostname 7200_RouterA
!
card type e1 3
card type e1 4
!
!
dspint DSPfarm3/0
!
dspint DSPfarm4/0
!
ip subnet-zero
no ip domain-lookup
ip host routerC 192.168.17.125
ip host routerD 10.1.1.2
!
multilink virtual-template 1
frame-relay switching
isdn switch-type primary-qsig
isdn voice-call-failure 0
!
voice class codec 1
 codec preference 1 g711ulaw
 codec preference 3 g729br8
!
controller E1 3/0
 pri-group timeslots 1-31
 description qsig connected to PCG 1
!
controller E1 3/1
 pri-group timeslots 1-31
 description cas connected to PCG 2
!
controller E1 4/0
 pri-group timeslots 1-31
 description qsig group connected PCG slot3
!
controller E1 4/1
 pri-group timeslots 1-31
 description qsig group connected PCG slot4
!
!
!
!
!
```

Router B: Terminating Configuration

```
.
.
.
hostname 7200_RouterB
!
card type e1 3
card type e1 4
!
!
dspint DSPfarm3/0
!
dspint DSPfarm4/0
!
ip subnet-zero
ip cef
no ip domain-lookup
ip host routerC 192.168.17.125
!
multilink virtual-template 1
isdn switch-type primary-qsig
isdn voice-call-failure 0
!
!
!
!
!
!
controller E1 3/0
 pri-group timeslots 1-31
 description qsig connected to PCG 5
!
controller E1 3/1
 pri-group timeslots 1-31
 description cas connected to PCG 6
!
controller E1 4/0
 pri-group timeslots 1-31
 description cas connected to PCG slot7
!
controller E1 4/1
 pri-group timeslots 1-31
 description cas connected to PCG slot8
!
interface Loopback0
 no ip address
 no ip directed-broadcast
!
```

Router A: Originating Configuration	Router B: Terminating Configuration

interface FastEthernet0/0
 no ip address
 no ip directed-broadcast
 shutdown
 half-duplex
!
!
!
!
!
interface Serial1/0
 bandwidth 512
 ip address 10.1.1.104 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip route-cache
 no ip mroute-cache
 load-interval 30
 no keepalive
 shutdown
 no fair-queue
 clockrate 2015232
 ppp multilink
!
interface Serial1/1
 description vofr connection to
7200_RouterB_s1/1
 ip address 10.0.0.2 255.0.0.0
 ip broadcast-address 10.0.0.0
 no ip directed-broadcast
 encapsulation frame-relay
 no ip route-cache
 no ip mroute-cache
 no keepalive
 frame-relay traffic-shaping
 frame-relay map ip 10.0.0.1 100 broadcast
 frame-relay interface-dlci 100
  class vofr_class
  vofr data 4 call-control 5
!
interface Serial1/2
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 shutdown
!
interface Serial1/3
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 shutdown
 clockrate 2015232
!
	interface FastEthernet0/0
	 description VOIP_10.0.0.1_maxstress to
	7200_RouterAgate
	 ip address 10.0.0.1 255.0.0.0
	 no ip directed-broadcast
	 no ip mroute-cache
	 shutdown
	 media-type MII
	 full-duplex
	!
	interface Serial1/0
	 no ip address
	 no ip directed-broadcast
	 no ip mroute-cache
	 shutdown
	!
	!
	!
	!
	!
	!
	!
	!
	!
	interface Serial1/1
	 description vofr connection to
	7200_RouterA
	 ip address 10.0.0.1 255.0.0.0
	 ip broadcast-address 10.0.0.0
	 no ip directed-broadcast
	 encapsulation frame-relay
	 no keepalive
	 clockrate 8060928
	 frame-relay traffic-shaping
	 frame-relay map ip 10.0.0.2 100 broadcast
	 frame-relay interface-dlci 100
	  class vofr_class
	  vofr data 4 call-control 5
	!
	!
	interface Serial1/2
	 no ip address
	 no ip directed-broadcast
	 shutdown
	 clockrate 2015232
	!
	!
	interface Serial1/3
	 no ip address
	 no ip directed-broadcast
	 shutdown
	!
	!
	!
	!

Router A: Originating Configuration	Router B: Terminating Configuration
interface Ethernet2/0 ip address 10.1.50.77 255.255.0.0 ip broadcast-address 10.1.0.0 no ip directed-broadcast no ip route-cache no ip mroute-cache ! interface Ethernet2/1 ip address 10.0.0.2 255.255.0.0 ip broadcast-address 10.0.0.0 no ip directed-broadcast no ip route-cache no ip mroute-cache shutdown ! interface Ethernet2/2 no ip address no ip directed-broadcast no ip route-cache no ip mroute-cache shutdown ! interface Ethernet2/3 no ip address no ip directed-broadcast no ip route-cache no ip mroute-cache shutdown ! interface Serial3/0:15 no ip address no ip directed-broadcast no logging event link-status isdn switch-type primary-qsig isdn overlap-receiving isdn incoming-voice voice isdn bchan-number-order ascending no cdp enable ! ! ! interface Serial3/1:15 no ip address no ip directed-broadcast no logging event link-status isdn switch-type primary-qsig isdn overlap-receiving isdn incoming-voice voice isdn bchan-number-order ascending no cdp enable ! ! !	interface Ethernet2/0 ip address 10.5.192.123 255.255.0.0 ip helper-address 192.168.17.125 no ip directed-broadcast no ip mroute-cache ! ! interface Ethernet2/1 ip address 10.0.0.1 255.255.0.0 no ip directed-broadcast no ip mroute-cache shutdown ! ! ! interface Ethernet2/2 no ip address no ip directed-broadcast shutdown ! ! ! interface Ethernet2/3 no ip address no ip directed-broadcast shutdown ! ! ! interface Serial3/0:15 no ip address no ip directed-broadcast no ip route-cache cef ip mroute-cache no logging event link-status isdn switch-type primary-qsig isdn overlap-receiving isdn incoming-voice voice isdn bchan-number-order ascending no cdp enable ! interface Serial3/1:15 no ip address no ip directed-broadcast no ip route-cache cef ip mroute-cache no logging event link-status isdn switch-type primary-qsig isdn overlap-receiving isdn incoming-voice voice isdn bchan-number-order ascending no cdp enable !

Router A: Originating Configuration	Router B: Terminating Configuration
interface Serial4/0:15 no ip address no ip directed-broadcast no logging event link-status isdn switch-type primary-qsig isdn overlap-receiving isdn incoming-voice voice isdn bchan-number-order ascending no cdp enable ! ! ! interface Serial4/1:15 no ip address no ip directed-broadcast no logging event link-status isdn switch-type primary-qsig isdn overlap-receiving isdn incoming-voice voice isdn bchan-number-order ascending no cdp enable ! ! ! interface ATM5/0 no ip address no ip directed-broadcast no ip route-cache no ip mroute-cache shutdown no atm ilmi-keepalive ! ! ! ! ! interface Virtual-Template1 ip address 10.0.0.2 255.255.255.0 no ip directed-broadcast load-interval 30 fair-queue 64 256 1 ppp multilink ppp multilink fragment-delay 20 ppp multilink interleave ip rtp priority 16384 16383 92 ! router igrp 144 network 10.0.0.0 ! ip default-gateway 10.21.75.10 ip classless no ip http server !	interface Serial4/0:15 no ip address no ip directed-broadcast no ip route-cache cef ip mroute-cache no logging event link-status isdn switch-type primary-qsig isdn overlap-receiving isdn incoming-voice voice isdn bchan-number-order ascending no cdp enable ! interface Serial4/1:15 no ip address no ip directed-broadcast no ip route-cache cef ip mroute-cache no logging event link-status isdn switch-type primary-qsig isdn overlap-receiving isdn incoming-voice voice isdn bchan-number-order ascending no cdp enable ! interface ATM5/0 no ip address no ip directed-broadcast shutdown no atm ilmi-keepalive ! interface FastEthernet6/0 no ip address no ip directed-broadcast shutdown half-duplex ! interface Virtual-Template1 ip unnumbered Loopback0 no ip directed-broadcast no ip route-cache cef ip mroute-cache ppp multilink ppp multilink fragment-delay 20 ppp multilink interleave ! ! router igrp 144 network 10.0.0.0 ! ! ip classless no ip http server !

Router A: Originating Configuration	Router B: Terminating Configuration
map-class frame-relay vofr_class no frame-relay adaptive-shaping frame-relay cir 4400000 frame-relay bc 1000 frame-relay fair-queue frame-relay voice bandwidth 4000000 frame-relay fragment 256 ! voice-port 3/0:15 compand-type a-law cptone DE ! voice-port 3/1:15 compand-type a-law cptone DE ! voice-port 4/0:15 compand-type a-law cptone DE ! voice-port 4/1:15 compand-type a-law cptone DE ! dial-peer voice 5552222 pots destination-pattern +5552... direct-inward-dial port 3/1:15 prefix 5552 ! dial-peer voice 5551111 vofr destination-pattern +6...... sequence-numbers session target Serial1/1 100 codec g729br8 ! dial-peer voice 5554 pots destination-pattern 5554... direct-inward-dial port 4/1:15 prefix 5554 ! dial-peer voice 5553 pots destination-pattern 5553... direct-inward-dial port 4/0:15 prefix 5553 ! dial-peer voice 5551 pots destination-pattern +5551... direct-inward-dial port 3/0:15 prefix 5551 . . .	map-class frame-relay vofr_class no frame-relay adaptive-shaping frame-relay cir 4400000 frame-relay bc 1000 frame-relay fair-queue frame-relay voice bandwidth 4000000 frame-relay fragment 256 ! voice-port 3/0:15 compand-type a-law ! ! voice-port 3/1:15 compand-type a-law ! ! voice-port 4/0:15 compand-type a-law ! ! voice-port 4/1:15 compand-type a-law ! ! dial-peer voice 5552222 pots destination-pattern +6662... direct-inward-dial port 3/1:15 prefix 6662 ! dial-peer voice 5551111 vofr destination-pattern +5...... sequence-numbers session target Serial1/1 100 codec g729br8 ! dial-peer voice 6661 pots destination-pattern +6661... direct-inward-dial port 3/0:15 prefix 6661 ! dial-peer voice 6663 pots destination-pattern +6663... direct-inward-dial port 4/0:15 prefix 6663 ! dial-peer voice 6664 pots destination-pattern +6664... direct-inward-dial port 4/1:15 prefix 6664 . . .

QSIG Support on Cisco MC3810 Multiservice Concentrators Example

The following configuration example shows how a Cisco MC3810 multiservice concentrator can be configured for E1 and PRI with QSIG signaling support and VoIP and VoFR:

```
.
.
.
hostname Router3810
!
!
!
!
network-clock base-rate 56k
ip subnet-zero
!
isdn switch-type primary-qsig
isdn voice-call-failure 0
!
!
!
!
controller T1 0
 mode atm
 framing esf
 clock source internal
 linecode b8zs
!
controller E1 1
 pri-group timeslots 1-7,16
!
!
!
interface Ethernet0
 ip address 100.100.100.6 255.255.255.0
 no ip directed-broadcast
!
interface Serial0
 bandwidth 2000
 ip address 10.168.14.1 255.255.255.0
 no ip directed-broadcast
 encapsulation frame-relay
 no ip mroute-cache
 no keepalive
 clockrate 2000000
 cdp enable
 frame-relay traffic-shaping
 frame-relay interface-dlci 100
  class frs0
  vofr cisco
!
interface Serial1
 no ip address
 no ip directed-broadcast
 shutdown
!
interface Serial1:15
 no ip address
 no ip directed-broadcast
 ip mroute-cache
 no logging event link-status
 isdn switch-type primary-qsig
 isdn overlap-receiving
```

```
 isdn incoming-voice voice
 fair-queue 64 256 0
 no cdp enable
!
interface ATM0
 no ip address
 no ip directed-broadcast
 ip mroute-cache
 no atm ilmi-keepalive
 pvc 10/42
  encapsulation aal5mux voice
 !
!
interface FR-ATM20
 no ip address
 no ip directed-broadcast
 shutdown
!
no ip http server
ip classless
ip route 223.255.254.0 255.255.255.0 Ethernet0
!
!
map-class frame-relay frs0
 frame-relay voice bandwidth 1260000
 frame-relay fragment 200
 no frame-relay adaptive-shaping
 frame-relay cir 1260000
 frame-relay fair-queue
!
map-class frame-relay frsisco
!
voice-port 1:15
 compand-type a-law
!
dial-peer voice 100 voatm
 shutdown
 destination-pattern 4...
 session target ATM0 pvc 10/42
 codec g729ar8
 no vad
!
dial-peer voice 1 pots
 shutdown
 destination-pattern 3001
!
dial-peer voice 42 vofr
 destination-pattern 4006
 session target Serial0 100
 signal-type ext-signal
!
dial-peer voice 21 pots
 destination-pattern 4007
 direct-inward-dial
 port 1:15
 prefix 4007
!
dial-peer voice 12 voip
 shutdown
 destination-pattern 4006
 session target ipv4:100.100.100.7
.
.
.
```

Q.931 Support Configuration Examples

The following configuration example shows how a Cisco 3660 router can be configured for E1 and PRI with network-side support using VoIP:

```
.
.
.
hostname router3660
!
!
memory-size iomem 20
voice-card 5
!
voice-card 6
!
ip subnet-zero
!
isdn switch-type primary-net5
isdn voice-call-failure 0
!
controller E1 3/0
 pri-group timeslots 1-5,16
!
controller E1 3/1
 pri-group timeslots 1-31
!
controller E1 4/0
 pri-group timeslots 1-31
!
controller E1 4/1
 pri-group timeslots 1-31
!
interface FastEthernet0/0
 ip address 10.7.72.9 255.255.255.0
 speed auto
 half-duplex
!
interface FastEthernet0/1
 ip address 10.100.100.7 255.255.255.0
 no keepalive
 duplex auto
 speed auto
 hold-queue 1000 in
!
interface Serial2/0
 no ip address
 shutdown
!
interface Serial2/1
 no ip address
 shutdown
!
interface Serial2/2
 no ip address
 shutdown
!
interface Serial2/3
 no ip address
 shutdown
!
interface Serial5/0:15
 no ip address
```

```
 ip mroute-cache
 no logging event link-status
 isdn switch-type primary-qsig
 isdn overlap-receiving
 isdn incoming-voice voice
 isdn protocol-emulate network
 no cdp enable
!
interface Serial5/1:15
 no ip address
 ip mroute-cache
 no logging event link-status
 isdn switch-type primary-qsig
 isdn incoming-voice voice
 fair-queue 64 256 0
 no cdp enable
!
interface Serial6/0:15
 no ip address
 ip mroute-cache
 no logging event link-status
 isdn switch-type primary-qsig
 isdn incoming-voice voice
 fair-queue 64 256 0
 isdn protocol-emulate network
 no cdp enable
!
interface Serial6/1:15
 no ip address
 ip mroute-cache
 no logging event link-status
 isdn switch-type primary-qsig
 isdn incoming-voice voice
 fair-queue 64 256 0
 no cdp enable
!
ip classless
ip route 223.255.254.254 255.255.255.255 FastEthernet0/0
no ip http server
!
!
voice-port 1/0/0
timing hookflash-in 0
!
voice-port 1/0/1
timing hookflash-in 0
!
voice-port 5/0:15
 compand-type a-law
!
voice-port 5/1:15
 compand-type a-law
 cptone DE
!
voice-port 6/0:15
 compand-type a-law
 cptone DE
!
voice-port 6/1:15
 no echo-cancel enable
 compand-type a-law
 cptone DE
!
```

```
dial-peer voice 1 pots
 shutdown
 destination-pattern 21...
direct-inward-dial
!
dial-peer voice 51 voip
 shutdown
 destination-pattern 6504007
session target ipv4:100.100.100.3
!
dial-peer voice 2 pots
 shutdown
 destination-pattern 21...
direct-inward-dial
 port 5/1:15
!
dial-peer voice 3 voip
 shutdown
 destination-pattern 22...
session target ipv4:100.100.100.6
!
dial-peer voice 5 pots
 shutdown
 destination-pattern 22...
 modem passthrough system
 direct-inward-dial
 prefix 4006
!
dial-peer voice 13 pots
 shutdown
 destination-pattern 21...
direct-inward-dial
 port 6/0:15
!
dial-peer voice 6 pots
 destination-pattern 21...
direct-inward-dial
 port 6/1:15
!
dial-peer voice 20 pots
 incoming called-number 4...
 destination-pattern 4007
direct-inward-dial
 port 5/0:15
 prefix 4007
!
dial-peer voice 21 pots
 destination-pattern 4006
direct-inward-dial
 port 5/0:15
 prefix 4006
!
!
line con 0
 transport input none
line aux 0
line vty 0 4
 login
!
end
```