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:

- ISDN Voice Interface Overview, page 584
- ISDN Voice Interface Prerequisite Tasks, page 590
- ISDN Voice Interface Configuration Task List, page 590
- ISDN Voice Interface Configuration Examples, page 610

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
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.
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

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

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

### 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:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Router(config)# <code>isdn switch-type switch-type</code> Configures the telephone company ISDN switch type. For a list of switch types, see Table 48. <strong>Note</strong> The only switch types currently supported for an NT interface are basic-net3 and basic-qsig.</td>
</tr>
</tbody>
</table>
| **Step 2** | Cisco MC3810 Multiservice Concentrators Router(config)# `interface bri number` 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). |
### ISDN Voice Interface Configuration Task List

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

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>
<thead>
<tr>
<th>ISDN Switch Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic-QSIG</td>
<td>PINX (PBX) switches with QSIG signaling in compliance with Q.931</td>
</tr>
<tr>
<td>Basic-TS013</td>
<td>Australian TS013 switches</td>
</tr>
<tr>
<td>Basic-1TR6</td>
<td>German 1TR6 ISDN switches</td>
</tr>
<tr>
<td>Basic-NWnet3</td>
<td>Norwegian NET3 ISDN switches (phase 1)</td>
</tr>
<tr>
<td>Basic-Net3</td>
<td>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.)</td>
</tr>
<tr>
<td>VN2</td>
<td>French VN2 ISDN switches</td>
</tr>
<tr>
<td>VN3</td>
<td>French VN3 ISDN switches</td>
</tr>
<tr>
<td>NTT</td>
<td>Japanese NTT ISDN switches</td>
</tr>
<tr>
<td>Basic-NZnet3</td>
<td>New Zealand NET3 switches</td>
</tr>
<tr>
<td>Basic-5ESS</td>
<td>Lucent Technologies basic rate switches</td>
</tr>
</tbody>
</table>
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:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cisco MC3810 Multiservice Concentrators</strong></td>
<td></td>
</tr>
<tr>
<td>Router# <code>show controllers bri number</code></td>
<td>Displays information about the ISDN BRI interface.</td>
</tr>
<tr>
<td><strong>Other Supported Routers</strong></td>
<td></td>
</tr>
<tr>
<td>Router# <code>show controllers bri slot/port</code></td>
<td></td>
</tr>
<tr>
<td><strong>Cisco MC3810 Multiservice Concentrators</strong></td>
<td></td>
</tr>
<tr>
<td>Router# `show voice port [slot/port</td>
<td>summary]`</td>
</tr>
<tr>
<td><strong>Other Supported Routers</strong></td>
<td></td>
</tr>
<tr>
<td>Router# <code>show voice port summary</code></td>
<td></td>
</tr>
<tr>
<td>Router# `show isdn {memory</td>
<td>status</td>
</tr>
<tr>
<td>Router# <code>debug isdn q921</code></td>
<td>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 <code>no</code> form of this command disables debugging output.</td>
</tr>
<tr>
<td>Router# <code>debug isdn q931</code></td>
<td>Displays information about call setup and teardown of ISDN network connections (Layer 3) between the local router (user side) and the network. The <code>no</code> form of this command disables debugging output.</td>
</tr>
</tbody>
</table>
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:

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

ISDN Voice Interface Configuration Task List

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.*

### Command Purpose

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

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
</tr>
<tr>
<td><strong>BRI Only on Cisco M C3810, 2600, and 3600 Series Routers</strong></td>
<td>(Optional) Configures the global ISDN switch type.</td>
</tr>
<tr>
<td><code>Router(config)# isdn switch-type basic-qsig</code></td>
<td></td>
</tr>
<tr>
<td><strong>PRI Only on Any Supported Router</strong></td>
<td>(Optional) Configures the ISDN switch-type to support QSIG signaling.</td>
</tr>
<tr>
<td><code>Router(config)# isdn switch-type primary-qsig</code></td>
<td><strong>Note</strong> 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 <code>isdn switch-type</code> command for QSIG support, you do not need to configure the interface <code>isdn switch-type</code> command for QSIG.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>(Cisco 7200 series routers only) Configures the digital signal processor (DSP) farm interface.</td>
</tr>
<tr>
<td><code>Router(config)# dspinterface dspfarm slot/port</code></td>
<td>For more information, see “Switch-Type Configuration Options” on page 588. For a list of CO switch types, see Table 47.</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>(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.</td>
</tr>
<tr>
<td>`Router(config)# card type {t1</td>
<td>e1} slot`</td>
</tr>
</tbody>
</table>
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:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Router(config)# controller {t1</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong> On the Cisco MC3810 multiservice concentrator, QSIG is supported only on controller 1.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Router(config-controller)# pri-group timeslots range</td>
</tr>
<tr>
<td></td>
<td>Configures the PRI group for either T1 or E1.</td>
</tr>
<tr>
<td></td>
<td>The argument is as follows:</td>
</tr>
<tr>
<td></td>
<td>• range—Range of time slots that make up the PRI group. T1 range is 1 to 23. E1 range is 1 to 31.</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
</tbody>
</table>

Configuring BRI Interfaces for QSIG

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

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Cisco MC3810 Multiservice Concentrators</td>
</tr>
<tr>
<td></td>
<td>Router(config)# interface bri number</td>
</tr>
<tr>
<td></td>
<td>Enters interface configuration mode for the specified interface.</td>
</tr>
<tr>
<td></td>
<td>The arguments are as follows:</td>
</tr>
<tr>
<td></td>
<td>• number—Voice module (1 to 4).</td>
</tr>
<tr>
<td></td>
<td>• slot—Location of the voice network module in the router (1 to 6).</td>
</tr>
<tr>
<td></td>
<td>• port—Location of the BRI VIC in the voice network module. Valid values are 1 and 2.</td>
</tr>
<tr>
<td>Cisco 2600, and 3600 Series Routers</td>
<td>Router(config)# interface bri slot/port</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Cisco MC3810, 2600, and 3600 Series Routers Only</td>
</tr>
<tr>
<td></td>
<td>Router(config-if)# isdn static-tei 0</td>
</tr>
<tr>
<td></td>
<td>This command is required. (In previous releases, it was set automatically when the isdn switch-type basic-qsig command was issued.)</td>
</tr>
<tr>
<td>Command</td>
<td>Purpose</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------</td>
</tr>
</tbody>
</table>
| **Step 3** Cisco M C3810 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 M C3810 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 M C3810, 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.” |
## Configuring PRI Interfaces for QSIG

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

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>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 <code>23</code>. For E1, enter <code>15</code>.</td>
</tr>
<tr>
<td><strong>Step 1</strong> Cisco MC3810 Multiservice Concentrators</td>
<td><strong>Step 1</strong> Cisco MC3810 Multiservice Concentrators</td>
</tr>
<tr>
<td>Router(config)# interface serial 1:channelnumber</td>
<td>Entries interface configuration mode for the ISDN PRI interface and the specified interface slot location and channel number. Enter a slot number from 1 to 6 and a <code>port</code> number of 1 or 2. For T1, enter the channel number as <code>23</code>. For E1, enter <code>15</code>.</td>
</tr>
<tr>
<td>Or</td>
<td><strong>Step 2</strong> Other Supported Routers</td>
</tr>
<tr>
<td>Router(config)# interface serial slot/port:channel-number</td>
<td>Entries 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 <code>port</code> number of 1 or 2. For T1, enter the channel number as <code>23</code>. For E1, enter <code>15</code>.</td>
</tr>
</tbody>
</table>

### 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.
### ISDN Voice Interface Configuration Task List

<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| 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. |
| 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. |
| 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. |
| 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. |
| 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 Serial1/1:15 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 Serial1/0:15 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=BD0, sapi=0, ces=0, B-chan=1, calltype=VOICE
    CCB:callid=BE1, sapi=0, ces=0, B-chan=3, calltype=VOICE
    The Free Channel Mask: 0xB0000000
    Total Allocated ISDN CCBs = 54
```

Total Allocated ISDN CCBs = 0

---
Configuring ISDN Interfaces for Voice

ISDN Voice Interface Configuration Task List

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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

Layer 3 Status:
28 Active Layer 3 Call(s)
Activated dsl 1 CCBs = 28

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:
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)

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:
Activated dsl 0 CCBs = 0
The Free Channel Mask: 0x7FFFFFFF

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: 0x7FFFFFFF
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: 0x7FFFFFFF
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 0 0 3 0 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 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 cdpi` command.

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

```
Router# show cdpi

Registered CDAPI Applications/Stacks
====================================
Application: TSP CDAPI Application Voice
    Application Type(s) : Voice Facility Signaling
    Application Level   : Tunnel
    Application Mode    : Enbloc
```
Configuring ISDN Interfaces for Voice

ISDN Voice Interface Configuration Task List

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>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router# <code>show isdn status</code></td>
<td>Displays the status of all ISDN interfaces, including active layers, timer information, and switch type settings.</td>
</tr>
<tr>
<td>Router# `show controllers {t1</td>
<td>e1}`</td>
</tr>
</tbody>
</table>
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:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| 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. |
| 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. |
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, page 610
- QSIG Support Configuration Examples, page 612
- Q.931 Support Configuration Examples, page 624

ISDN to PBX and ISDN to PSTN Configuration Examples

This section includes the following configuration examples:

- ISDN Connection to a PBX Configuration Example, page 611
- ISDN Connection to the PSTN Configuration Example, page 612
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**

![Configuration Example Topology](image)

**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:

```plaintext
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
```
Configuring ISDN Interfaces for Voice

ISDN Voice Interface Configuration Examples

```
! 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-nl1
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-nl1
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 ionem 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
!
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**

```bash
hostname 7200_RouterA
!
card type e1 3
card type e1 4
!
dsp int DSPfarm3/0
dsp int DSPfarm4/0
!
ip subnet-zero
no ip domain-lookup
ip host routerC 192.168.17.125
!
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**

```bash
hostname 7200_RouterB
!
card type e1 3
card type e1 4
!
dsp int DSPfarm3/0
dsp int DSPfarm4/0
!
ip subnet-zero
no ip domain-lookup
!
multilink virtual-template 1
isdn switch-type primary-qsig
isdn voice-call-failure 0
!
voice class codec 1
!
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
!```
### ISDN Voice Interface Configuration Examples

**Router A: Originating Configuration**

<table>
<thead>
<tr>
<th>Configuration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>interface FastEthernet0/0</td>
<td></td>
</tr>
<tr>
<td>no ip address</td>
<td></td>
</tr>
<tr>
<td>no ip directed-broadcast</td>
<td></td>
</tr>
<tr>
<td>shutdown</td>
<td></td>
</tr>
<tr>
<td>half-duplex</td>
<td></td>
</tr>
<tr>
<td>clockrate 2015232</td>
<td></td>
</tr>
<tr>
<td>interface Serial1/0</td>
<td></td>
</tr>
<tr>
<td>bandwidth 512</td>
<td></td>
</tr>
<tr>
<td>ip address 10.1.1.104 255.255.255.0</td>
<td></td>
</tr>
<tr>
<td>no ip directed-broadcast</td>
<td></td>
</tr>
<tr>
<td>encapsulation ppp</td>
<td></td>
</tr>
<tr>
<td>no ip route-cache</td>
<td></td>
</tr>
<tr>
<td>no ip mroute-cache</td>
<td></td>
</tr>
<tr>
<td>load-interval 30</td>
<td></td>
</tr>
<tr>
<td>no keepalive</td>
<td></td>
</tr>
<tr>
<td>shutdown</td>
<td></td>
</tr>
<tr>
<td>no fair-queue</td>
<td></td>
</tr>
<tr>
<td>clockrate 2015232</td>
<td></td>
</tr>
<tr>
<td>ppp multilink</td>
<td></td>
</tr>
<tr>
<td>interface Serial1/1</td>
<td></td>
</tr>
<tr>
<td>description vofr connection to 7200 RouterB s1/1</td>
<td></td>
</tr>
<tr>
<td>ip address 10.0.0.2 255.0.0.0</td>
<td></td>
</tr>
<tr>
<td>no ip directed-broadcast</td>
<td></td>
</tr>
<tr>
<td>encapsulation frame-relay</td>
<td></td>
</tr>
<tr>
<td>no ip route-cache</td>
<td></td>
</tr>
<tr>
<td>no ip mroute-cache</td>
<td></td>
</tr>
<tr>
<td>no keepalive</td>
<td></td>
</tr>
<tr>
<td>frame-relay traffic-shaping</td>
<td></td>
</tr>
<tr>
<td>frame-relay map ip 10.0.0.1 100 broadcast</td>
<td></td>
</tr>
<tr>
<td>vofr interface-dlci 100</td>
<td></td>
</tr>
<tr>
<td>vofr data 4 call-control 5</td>
<td></td>
</tr>
<tr>
<td>interface Serial1/2</td>
<td></td>
</tr>
<tr>
<td>no ip address</td>
<td></td>
</tr>
<tr>
<td>no ip directed-broadcast</td>
<td></td>
</tr>
<tr>
<td>no ip route-cache</td>
<td></td>
</tr>
<tr>
<td>no ip mroute-cache</td>
<td></td>
</tr>
<tr>
<td>shutdown</td>
<td></td>
</tr>
<tr>
<td>interface Serial1/3</td>
<td></td>
</tr>
<tr>
<td>no ip address</td>
<td></td>
</tr>
<tr>
<td>no ip directed-broadcast</td>
<td></td>
</tr>
<tr>
<td>no ip route-cache</td>
<td></td>
</tr>
<tr>
<td>no ip mroute-cache</td>
<td></td>
</tr>
<tr>
<td>shutdown</td>
<td></td>
</tr>
<tr>
<td>clockrate 2015232</td>
<td></td>
</tr>
</tbody>
</table>

**Router B: Terminating Configuration**

<table>
<thead>
<tr>
<th>Configuration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>interface FastEthernet0/0</td>
<td></td>
</tr>
<tr>
<td>description VOIP 10.0.0.1 maxstress to 7200 RouterAgate</td>
<td></td>
</tr>
<tr>
<td>ip address 10.0.0.1 255.0.0.0</td>
<td></td>
</tr>
<tr>
<td>no ip directed-broadcast</td>
<td></td>
</tr>
<tr>
<td>no ip mroute-cache</td>
<td></td>
</tr>
<tr>
<td>shutdown</td>
<td></td>
</tr>
<tr>
<td>media-type MII</td>
<td></td>
</tr>
<tr>
<td>full-duplex</td>
<td></td>
</tr>
<tr>
<td>interface Serial1/0</td>
<td></td>
</tr>
<tr>
<td>no ip address</td>
<td></td>
</tr>
<tr>
<td>no ip directed-broadcast</td>
<td></td>
</tr>
<tr>
<td>no ip mroute-cache</td>
<td></td>
</tr>
<tr>
<td>shutdown</td>
<td></td>
</tr>
<tr>
<td>interface Serial1/1</td>
<td></td>
</tr>
<tr>
<td>description vofr connection to 7200 RouterA</td>
<td></td>
</tr>
<tr>
<td>ip address 10.0.0.1 255.0.0.0</td>
<td></td>
</tr>
<tr>
<td>ip broadcast-address 10.0.0.0</td>
<td></td>
</tr>
<tr>
<td>no ip directed-broadcast</td>
<td></td>
</tr>
<tr>
<td>encapsulation frame-relay</td>
<td></td>
</tr>
<tr>
<td>no keepalive</td>
<td></td>
</tr>
<tr>
<td>clockrate 8060928</td>
<td></td>
</tr>
<tr>
<td>frame-relay traffic-shaping</td>
<td></td>
</tr>
<tr>
<td>frame-relay map ip 10.0.0.2 100 broadcast</td>
<td></td>
</tr>
<tr>
<td>frame-relay interface-dlci 100</td>
<td></td>
</tr>
<tr>
<td>class vofr_class</td>
<td></td>
</tr>
<tr>
<td>vofr data 4 call-control 5</td>
<td></td>
</tr>
<tr>
<td>interface Serial1/2</td>
<td></td>
</tr>
<tr>
<td>no ip address</td>
<td></td>
</tr>
<tr>
<td>no ip directed-broadcast</td>
<td></td>
</tr>
<tr>
<td>shutdown</td>
<td></td>
</tr>
<tr>
<td>clockrate 2015232</td>
<td></td>
</tr>
<tr>
<td>interface Serial1/3</td>
<td></td>
</tr>
<tr>
<td>no ip address</td>
<td></td>
</tr>
<tr>
<td>no ip directed-broadcast</td>
<td></td>
</tr>
<tr>
<td>shutdown</td>
<td></td>
</tr>
</tbody>
</table>
### Router A: Originating Configuration

```plaintext
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
!
!
```

### Router B: Terminating Configuration

```plaintext
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
!
!`
### ISDN Voice Interface Configuration Examples

**Router A: Originating Configuration**

```plaintext
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
c shut down
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
!
```

**Router B: Terminating Configuration**

```plaintext
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
### Router A: Originating Configuration

```plaintext
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
```

### Router B: Terminating Configuration

```plaintext
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 +5552...
direct-inward-dial
port 3/1:15
prefix 5552

! 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 frisco
!
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
do 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
do logging event link-status
isdn switch-type primary-qsig
isdn incoming-voice voice
fair-queue 64 256 0
no cdp enable
!
interface Serial6/0:1:15
no ip address
ip mroute-cache
do 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
do 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
!
ISDN Voice Interface Configuration Examples

```
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
```