CHAPTER 11

Configuring Support for PBX Signaling Formats

The Cisco MC3810 multiservice access concentrator supports different PBX signaling formats. Depending on the PBX and the configuration, you can configure the Cisco MC3810 to support Channel Associated Signaling (CAS), Q.SIG PRI, or transparent Common Channel Signaling (CCS).

This chapter is divided into the following sections:

Note The procedures in this chapter assign channel groups, CAS voice groups, time-division multiplexing (TDM) groups and voice groups. All group numbers configured for channel groups, CAS voice groups, TDM groups and voice groups must be unique on the local Cisco MC3810 concentrator. For example, you cannot use the same group number for a channel group and for a TDM group.

Configuring Channel Associated Signaling

Channel Associated Signaling (CAS) extraction and insertion is used for T1/E1 voice ports or the trunk transmitting and receiving digital voice traffic from a PBX. In this case, DS0 channels can be configured to directly connect to the T1/E1 network trunk in TDM mode, or the channels can be connected to the Cisco MC3810's Digital Signaling Processor (DSP) for voice compression. During this process, the CAS bits are extracted from the defined T1/E1 channels and passed to the voice signaling handler.

To configure the T1/E1 line to support CAS for voice traffic, complete the following steps in controller configuration mode:

Step	Command	Purpose
1	`router(config-controller)# mode cas`	Configure the T1/E1 line to support CAS.
2	`router(config-controller-cas)# voice-group` *channel-no* `timeslots` *timeslot-list* `type {e&m-immediate | e&m-delay | e&m-wink | e&m-melcas | fxs-ground-start | fxs-loop-start | fxs-melcas | fxo-ground-start | fxo-loop-start | fxo-melcas)`	Configure a list of timeslots to form a CAS group for the T1/E1 line. The "melcas" options are supported only on E1 and apply to the Mercury Exchange Limited (MEL) standard, used primarily in the United Kingdom. When configuring a CAS group for a T1/E1 line to a PBX, make sure the channel numbers configured match the channels on the PBX. Contact the PBX administrator to determine which channels to use.
3	Repeat step 2 for each CAS group defined.	

For CAS, you can also define the bit pattern for the seize and idle signals in both inbound and outbound directions on a voice port. To configure voice ports for this operation, perform the following tasks in voice-port configuration mode:

Step	Command	Purpose
1	`router(config-voiceport)# define {Tx-bits | Rx-bits} {seize | idle} {0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111}`	Configure the voice port to match the recEive and transMit (E&M) bit patterns with the attached telephony device. E&M interfaces use two-state signaling, in which the interface is in either seize or idle state for both transmit and receive. The **define** command allows the seize and idle patterns to be customized. **Note** Be careful not to define invalid configurations, such as all 0000 on E1, or identical seize and idle states.
2	`router(config-voiceport)# ignore {rx-a-bit | rx-b-bit | rx-c-bit | rx-d-bit}`	Configure the voice port to ignore specific receive bits. The ignore command customizes the receive pattern for determining the seize and idle state.

This completes the CAS configuration.

Configuring Q.SIG PRI Signaling Support

The Q.SIG protocol provides signaling for Private Integrated services Network Exchange (PINX) devices. It is based on the ISDN Q.931 standard. Using Q.SIG PRI signaling, the Cisco MC3810 can route incoming voice calls from a PINX across a WAN to a peer Cisco MC3810, which can then transport the signaling and voice packets to a second PINX.

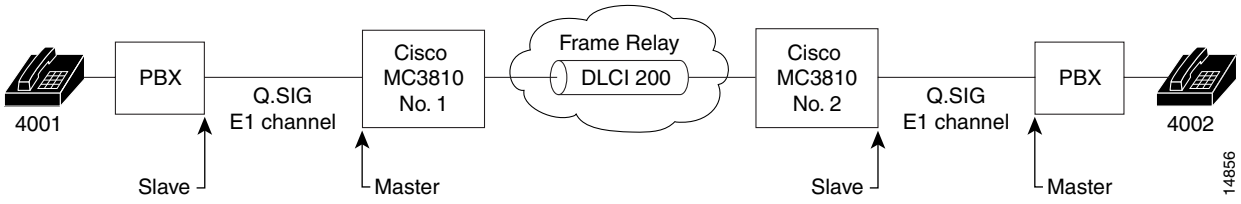
Note In this release, the Cisco MC3810 supports ISDN PRI only when a Q.SIG connection to the PINX is configured on the digital voice module (DVM) T1/E1 controller.

The following restrictions and limitations apply to the Cisco MC3810 Q.SIG PRI implementation:

- Q.SIG data calls are not supported. All calls with bearer capability indicating a non-voice type (such as for video telephony) are rejected.
- Q.SIG is supported only on T1/E1 controller 1. Each Cisco MC3810 supports only one T1/E1 interface with direct connectivity to a PINX.
- The Cisco MC3810 supports a maximum of 24 bearer channels.
- When Q.SIG is configured, serial interface 1 cannot support speeds higher than 192 kbps. This restriction assumes that the MFT is installed in slot 3 on the Cisco MC3810. If the MFT is not installed, then serial interface 1 will not operate at all, but Q.SIG will be supported on other interfaces.

Figure 11-1 shows an example of a Q.SIG signaling configuration. In the example, the Cisco MC3810 either acts as a master to a slave PBX, or as a slave to a master PBX.

Figure 11-1 Q.SIG Signaling Configuration



To configure Q.SIG PRI signaling support, complete the following steps beginning in global configuration mode:

Step	Command	Purpose
1	`router(config)# isdn switch-type [primary-qsig-slave | primary-qsig-master]`	Configure the ISDN switch type to serve either as the primary Q.SIG slave or the primary Q.SIG master. If the PINX is the primary Q.SIG master, configure the Cisco MC3810 to serve as the primary Q.SIG slave. If the PINX is the primary Q.SIG slave, configure the Cisco MC3810 to serve as the primary Q.SIG master. **Note** You can configure the ISDN switch type using either this global command, or this same command in interface configuration mode, depending on your configuration. (See step 3.) If you configure the global **isdn-switch-type** command for Q.SIG support, you do not need to also configure the interface **isdn-switch-type** command for Q.SIG. For more information about the different options available with this command at the global and interface configuration level, see the "ISDN Switch Type Command Options" section on page 11-5.
2	`router(config)# interface serial 1:`*x*	Enter interface configuration mode for the ISDN PRI interface. For T1, enter **serial 1:23**. For E1, enter **serial 1:15**.
3	`router(config-if)# isdn switch-type [primary-qsig-slave | primary-qsig-master]`	If you did not configure the global ISDN switch type for Q.SIG support in step 1, configure the interface ISDN switch type to serve either as the primary Q.SIG slave or the primary Q.SIG master. The same conditions that apply to this command in global configuration mode also apply to this command in interface configuration mode. **Note** This interface command overrides the global **isdn switch-type** command setting for this interface.
4	`router(config-if)# isdn overlap-receiving` *value*	Activate overlap signaling to send to the destination PBX.
5	`router(config-if)# isdn network-failure-cause [1-127]`	Specify the cause code to pass to the PBX when a call cannot be placed or completed because of internal network failures.

Step	Command	Purpose
6	`router(config-if)# isdn bchan-number-order {ascending | descending}`	(Optional) Configure the ISDN Primary Rate Interface (PRI) interface to make the outgoing call selection in ascending or descending order. The default is descending order, in which the first call from the Cisco MC3810 uses channel 23 (T1) or channel 31 (E1). The second call then uses channel 22 (T1) or channel 30 (E1), and so on in descending order. If you select ascending order and the PRI group starts with 1, the first call uses channel 1, the second call uses channel 2, and so on in ascending order. If the PRI group starts with a different timeslot, the ascending order starts with the lowest timeslot.
7	`router(config)# controller {T1 | E1} 1`	Enter controller configuration mode. Q.SIG is only supported on controller 1.
8	`router(config-controller)# pri-group timeslot [1-31]`	Configure the PRI group for either T1 or E1 to carry voice traffic. For T1, available timeslots are 1–23, and for E1 available timeslots are 1–31. You can configure the PRI group to include all the timeslots available, or you can configure a select group of timeslots for the PRI group. For example, if only timeslots 1–10 are in the PRI group, enter **pri-group timeslot 1-10**. If the PRI group includes all channels available for T1, enter **pri-group timeslot 1-24**. If the PRI group includes all channels available for E1, enter **pri-group timeslot 1-31**. **Note** When a PRI group is configured, T1 timeslot 24 or E1 timeslot 16 is automatically assigned to handle D-channel signaling.

ISDN Switch Type Command Options

As shown in the procedure, you have a choice of configuring the **isdn-switch-type** command to support Q.SIG at either the global configuration level or at the interface configuration level. For example, if you have a Q.SIG connection on one line as well as on the BRI port, you can configure the ISDN switch type in one of the following combinations:

- Set the global **isdn-switch-type** command to support Q.SIG, and set the interface **isdn-switch-type** command for **interface bri 0** to a BRI setting such as 5ess.
- Set the global **isdn-switch-type** command to support BRI 5ess, and set the interface **isdn-switch-type** command for **interface serial 1:23** to support Q.SIG.
- Configure the global **isdn-switch-type** command to another setting (such as switch type VN3), and then set the interface **isdn-switch-type** command for **interface bri 0** to a BRI setting, and set the interface **isdn-switch-type** command for **interface serial 1:23** to support Q.SIG.

Note The voice-port **codec** command must be configured before any calls can be placed over the connection to the PINX. The default codec type is G729a. For more information about configuring voice ports, see Chapter 10, "Configuring Voice Ports."

When voice dial peers are configured for use with Q.SIG PRI, voice port 1/1 is used for all bearer channels.

You may need to configure voice dial peers to specify destination patterns for routing calls. For more information, refer to Chapter 5, "Configuring Voice over Frame Relay," Chapter 6, "Configuring Voice over ATM," or Chapter 8, "Configuring Voice over HDLC," depending on your configuration.

Configuring Transparent CCS

The Cisco MC3810 provides support for transparent Common Channel Signaling (CCS), which provides point-to-point PINX connection capability to Cisco MC3810 DVM interfaces when the PINX does not support Q.SIG, or when the PINX has a proprietary solution.

You can configure transparent CCS in one of two ways: CCS cross-connect (or TDM cross-connect, which implies a fractional trunk), or CCS frame-forwarding. These procedures are described in the following sections:

- Configuring CCS Cross-Connect, page 11-6
- Configuring CCS Frame-Forwarding, page 11-9

Note Although not explicitly stated in the procedures, this feature also requires that voice ports and dial peers must also be configured. For more information about configuring voice ports, see Chapter 10, "Configuring Voice Ports." For more information about configuring dial peers, see Chapter 5, "Configuring Voice over Frame Relay," Chapter 6, "Configuring Voice over ATM," or Chapter 8, "Configuring Voice over HDLC."

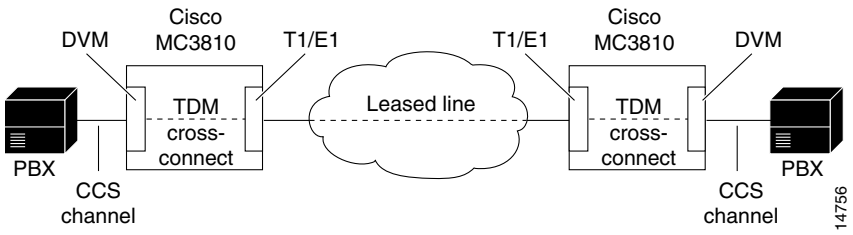
Configuring CCS Cross-Connect

This section is divided into the following procedures:

- Configure CCS Cross-Connect for T1, page 11-7
- Configure CCS Cross-Connect for E1, page 11-7
- Configure T1/E1 Trunk Bearer Channels, page 11-8

Figure 11-2 shows an example of CCS cross-connect. In this example, the CCS channel from the PBX is cross-connected on the Cisco MC3810 to a timeslot on the T1/E1 controller. The channel is then passed through the WAN as a leased line to the second Cisco MC3810, where it is cross-connected to the digital voice module (DVM) signaling timeslot (timeslot 24 for T1, or timeslot 16 for E1). The channel is then passed to the second PBX. The CCS signal byte stream is passed through transparently by the Cisco MC3810.

Figure 11-2 CCS Cross-Connect Configuration



Configure CCS Cross-Connect for T1

When you configure CCS cross-connect for T1, you need to cross-connect from the first T1 controller to the second T1 controller. To configure CCS cross-connect for T1, complete the following steps beginning in global configuration mode:

Step	Command	Purpose
1	`router(config)# controller T1 0`	Enter controller configuration mode for controller T1 0.
2	`router(config-controller)# tdm-group` *tdm-group-no* `timeslot` *timeslot-list*	Configure a TDM channel group for controller T1 0. Do not specify the **type** option in the command.
3	`router(config)# controller T1 1`	Enter controller configuration mode for controller T1 1.
4	`router(config-controller)# mode ccs cross-connect`	Configure CCS cross-connect for controller T1 1.
5	`router(config-controller)# tdm-group` *tdm-group-no* `timeslot` *timeslot-list*	Configure a TDM channel group for controller T1 1. Do not specify the **type** option in the command.
6	`router(config)# cross-connect id` *controller-1 tdm-group-no-1 controller-2 tdm-group-no-2*	Configure cross-connect pass-through between the two controllers.

Configure CCS Cross-Connect for E1

When you configure CCS cross-connect for E1, you need to configure cross-connect from the first E1 controller to the second E1 controller, and then configure the **mode ccs cross-connect** command to allow the cross-connect to timeslot 16. This enables all of the channels to perform similarly to normal CAS mode, but the signaling bit is no longer processed by the Cisco MC3810.

To configure CCS cross-connect for E1, complete the following steps beginning in global configuration mode:

Step	Command	Purpose
1	`router(config)# controller E1 0`	Enter controller configuration mode for controller E1 0.
2	`router(config-controller)# tdm-group` *tdm-group-no* `timeslot` *timeslot-list*	Configure a TDM channel group for E1. Do not specify the **type** option in the command.
3	`router(config)# controller E1 1`	Enter controller configuration mode for controller E1 1.
4	`router(config-controller)# mode ccs cross-connect`	Configure controller E1 1 to support CCS cross-connect by enabling channel 16 to no longer carry the signaling bit.

Step	Command	Purpose
5	router(config-controller-cas)# **voice-group** *channel-no* **timeslots** *timeslot-list* **type** [**ext-sig-master** | **ext-sig-slave**]	Configure the specified channel to support CCS mode, and specify whether the T1/E1 trunk will be the external signaling master or slave. A channel configured as **ext-sig-master** automatically generates the off-hook signal and stays in the off-hook state. A channel configured as **ext-sig-slave** automatically generates the answer signal when a call is terminated to that channel. These **type** options are available only when the **mode ccs** command is enabled.
6	router(config)# **cross-connect id** *controller-1 tdm-group-no-1 controller-2 tdm-group-no-2*	Configure cross-connect pass-through between the two controllers.

Configure T1/E1 Trunk Bearer Channels

If you will use CCS cross-connect for bearer channels of the T1/E1 trunk, you will need to perform some additional configuration. To configure the T1/E1 trunk to support CCS cross-connect for bearer channels, complete the following steps beginning in global configuration mode:

Step	Command	Purpose
1	router(config)# **controller** {**T1** | **E1**} *number*	Enter controller configuration mode for the controller.
2	router(config-controller)# **mode ccs cross-connect**	Specify the controller to support CCS cross-connect.
3	router(config-controller-cas)# **voice-group** *channel-no* **timeslots** *timeslot-list* **type** [**ext-sig-master** | **ext-sig-slave**]	Configure the specified channel to support CCS mode, and specify whether the T1/E1 trunk will be the external signaling master or slave. A channel configured as **ext-sig-master** automatically generates the off-hook signal and stays in the off-hook state. A channel configured as **ext-sig-slave** automatically generates the answer signal when a call is terminated to that channel. These type options are available only when the **mode ccs** command is enabled.
4	router(config)# **voice-port** *slot/port*	Enter voice-port configuration mode. For digital voice ports, the *slot* number is 1 for this configuration. Valid numbers for *port* are 1–24 for T1, and 1–15 and 17–31 for E1. For more detailed information on how to configure voice ports, see Chapter 10, "Configuring Voice Ports."

Step	Command	Purpose
5	`router(config-voiceport)#` **`connection plar`** *`string`*	Configure the voice-port connection to support Private Line Auto Ringdown (PLAR) mode. For the string, enter the number of the voice channel that was configured as the **ext-sig-slave** for the **voice-group** command. **Note** After a transparent CCS connection is configured by entering the **connection plar** command, any change to the configuration will not take place until the connection is shut down with a **shutdown** command and then restarted with a **no shutdown** command. For example, the phone number supplied in the **connection plar** command can be changed while the connection is in **no shutdown** state, but the change will not cause the current connection to be closed and a new connection opened to the new phone number. This will only take effect on the next **no shutdown** command after a **shutdown** command.

The voice channel type configured as the **ext-sig-master** is considered the master side of the permanent virtual circuit (PVC) connection and is responsible for establishing the PVC connection. After the master channel is configured, a fixed timer of 30 seconds starts. The voice signaling driver then generates an off-hook signal on the master voice channel after the timer expires. The call is treated as a regular call, and the master voice channel will not hang up after the connection is made. If the call does not go through, or if the T1/E1 trunk is down, the 30-second timer on the master channel side restarts. A new off-hook signal is then generated at the master channel side after the timer expires.

CCS cross-connect is not supported on analog PVC connections.

Configuring CCS Frame-Forwarding

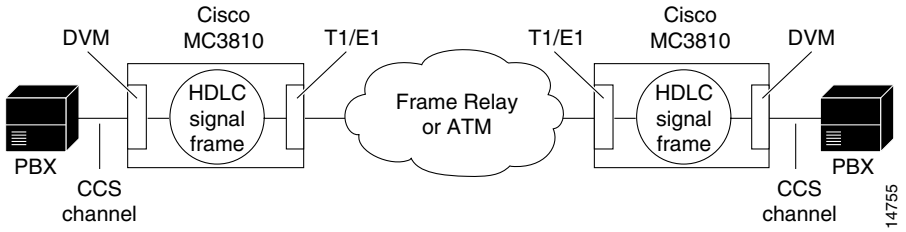
The Cisco MC3810 provides support for CCS frame-forwarding, which allows the Cisco MC3810 DVM to be connected to a Private Telco network Exchange (PTNX) without having to interpret CCS signaling information for call processing. CCS frame-forwarding forwards High-Level Data Link Control (HDLC) frames over a preconfigured interface running HDLC, Frame Relay, or ATM encapsulation.

With CCS frame-forwarding, the connection between PTNXs over the network must be point-to-point and preconfigured. With the CCS frame-forwarding implementation, calls from the PTNXs are not routed, but follow a preconfigured route to the destination.

Note When CCS frame-forwarding is configured, the speed (clock rate) of serial interface 1 on the Cisco MC3810 is limited to a maximum of 192 kbps. This restriction assumes that the MFT is installed in slot 3 on the Cisco MC3810. If the MFT is not installed, then serial interface 1 will not operate at all, but CCS frame-forwarding will be supported on other interfaces.

Figure 11-3 shows an example of CCS frame-forwarding. In the example, the Cisco MC3810 captures the signaling frame from the PBX. The Cisco MC3810 then transports the signaling frame as a data frame through the Frame Relay or ATM network to the second Cisco MC3810. The second Cisco MC3810 then forwards the signaling frame to the PBX signaling channel.

Figure 11-3 CCS Frame-Forwarding



Note Although not explicitly stated in the procedures, this feature also requires that voice ports and dial peers must also be configured. For more information about configuring voice ports, see Chapter 10, "Configuring Voice Ports." For more information about configuring dial peers, see Chapter 5, "Configuring Voice over Frame Relay," Chapter 6, "Configuring Voice over ATM," or Chapter 8, "Configuring Voice over HDLC."

To configure CCS frame-forwarding, complete the following steps beginning in global configuration mode:

Step	Command	Purpose
1	`router(config)# controller {T1 | E1} 1`	Enter controller configuration mode. CCS frame-forwarding is only available on controller T1/E1 1.
2	`router(config-controller)# mode ccs frame-forwarding`	Specify the controller to support CCS transparent signaling.
3	`router(config-controller-cas)# voice-group` *channel-no* `timeslots` *timeslot-list* `type [ext-sig-master | ext-sig-slave]`	Configure the specified channel to support CCS mode, and specify whether the T1/E1 trunk will be the external signaling master or slave. A channel configured as **ext-sig-master** automatically generates the off-hook signal and stays in the off-hook state. A channel configured as **ext-sig-slave** automatically generates the answer signal when a call is terminated to that channel. These **type** options are available only when the **mode ccs** command is enabled.
4	`router(config)# voice-port` *slot/port*	Enter voice-port configuration mode. For digital voice ports, the *slot* number is always 1. Valid numbers for *port* are 1–24 for T1, and 1–15 and 17–31 for E1. For more detailed information on how to configure voice ports, see Chapter 10, "Configuring Voice Ports."

Step	Command	Purpose
5	`router(config-voiceport)# connection plar` *string*	If the voice port in the voice group is configured as the **ext-sig-master**, configure the voice-port connection to support PLAR mode for bearer channels. For the string, enter the number of the voice channel that was configured as the **ext-sig-master** for the **voice-group** command. If the voice port in the voice group is configured as the **ext-sig-slave**, the dial peer should just terminate the PLAR calls. **Note** After a transparent CCS connection is configured by entering the **connection plar** command, any change to the configuration will not take place until the connection is shut down with a **shutdown** command and then restarted with a **no shutdown** command. For example, the phone number supplied in the **connection plar** command can be changed while the connection is in **no shutdown** state, but the change will not cause the current connection to be closed and a new connection opened to the new phone number. This will only take effect on the next **no shutdown** command after a **shutdown** command.
6	`router(config)# interface serial 1:`*x*	Enter interface mode for serial 1:*x* where x represents the channel number. For E1, enter 15. For T1, enter 23. This procedure maps the D channel from the DVM to the specified interface.
7	`router(config-if)# ccs connect {serial |atm} number [dlci dlci| pvc vci | pvc vcd | pvc vpi/vci | pvc string]`	Configure the CCS connection. If the CCS connection is over Frame Relay, specify a serial interface and the DLCI. If the CCS connection is over ATM, specify ATM, interface 0, and the PVC.
8	`router(config-if)# no cdp enable`	Disable Cisco Discovery Protocol (CDP) on the interface.
9	`router(config-if)# no keepalive`	Disable keepalive packets on the interface.