CHAPTER 5

Configuring Voice over Frame Relay

Caution This chapter describes the Cisco MC3810 Voice over Frame Relay implementation for versions prior to Cisco IOS Release 12.0(4)T. The configuration procedures were updated in that release; for more information, see the 12.0(4)T online document *Voice over Frame Relay Using FRF.11 and FRF.12*, or the *Cisco IOS 12.1 Multiservice Applications Configuration Guide*. Additional configuration changes were made in Cisco IOS Release 12.1(2)T; for more information, see the 12.1(2)T online document *Voice over Frame Relay Using FRF.11 and FRF.12 Configuration Updates*.

This chapter describes how to configure Voice over Frame Relay (VoFR) on the Cisco MC3810 multiservice access concentrator and includes the following sections:

VoFR enables a Cisco MC3810 concentrator to carry voice traffic (for example, telephone calls and faxes) over a Frame Relay network. VoFR on the Cisco MC3810 is supported on serial ports 0 and 1, as well as on the T1/E1 trunk.

Note The Cisco MC3810 does not support Frame Relay switched virtual circuits (SVCs).

This chapter describes the commands to specifically configure VoFR on the Cisco MC3810. It is assumed you have already configured your Frame Relay backbone network. As part of your Frame Relay configuration, you need to configure the map class, and the Local Management Interface (LMI) among other Frame Relay functionality. For more information about Frame Relay configuration, see the *Wide Area Networking Configuration Guide*.

Preliminary Frame Relay Configuration for Voice

This section describes the preliminary Frame Relay configuration tasks necessary to support VoFR. This section is divided into three procedures:

You can perform any of these procedures, depending on your application.

Configuring a Frame Relay Map Class for a Group of DLCIs (Optional)

Before configuring a Frame Relay data-link connection identifier (DLCI) for voice traffic, you can configure a Frame Relay map class to assign traffic shaping properties to a group of DLCIs. If you have a large number of permanent virtual circuits (PVCs) to configure, you can assign the PVCs the same traffic shaping properties without statically defining the values for each PVC.

Configuring a Frame Relay map class is optional. You can create multiple map classes, with different variables for each map class. If you want to skip this task, proceed to the next section.

Note When configuring the outgoing burst size, the committed burst size, and the committed information rate (CIR) values, obtain the appropriate values from your carrier. The values configured on the Cisco MC3810 must match those of the carrier. Traffic shaping is necessary to prevent your carrier from discarding discard eligible (DE) bits on ingress.

To configure a Frame Relay map class for a group of DLCIs, complete the following steps from configuration mode:

Step	Command	Purpose
1	`router(config)# map-class frame-relay` *map-class-name*	Create a map-class name you will assign to a group of PVCs. The map-class name must be unique.
2	`router(config-map-class)# frame-relay bc out` *bits*	Configure the outgoing committed burst size for this group of PVCs. Configure the *bits* value to a minimum of 1000 for voice traffic. Configure the committed burst size to match your carrier to prevent the carrier from discarding discard eligible (DE) bits on ingress. This command is required.
3	`router(config-map-class)# frame-relay be out` *bits*	Configure the outgoing excess burst size for this group of PVCs. Configure the outgoing excess burst size to match your carrier to prevent the carrier from discarding discard eligible (DE) bits on ingress. This command is required.
4	`router(config-map-class)# frame-relay cir out` *bits*	Configure the outgoing excess CIR for this group of PVCs. Configure the CIR size to match your carrier to prevent the carrier from discarding discard eligible (DE) bits on ingress. This command is required.

Step	Command	Purpose
5	router(config-map-class)# **frame-relay bc in** *bits*	(Optional) Configure the incoming committed burst size for this group of PVCs. **Note** This command and the **frame-relay be in** and **frame-relay cir in** commands are not required because the Cisco MC3810 normally does not police incoming traffic. However, you can set these values to aggregate incoming traffic as needed.
6	router(config-map-class)# **frame-relay be in** *bits*	(Optional) Configure the incoming excess burst size for this group of PVCs.
7	router(config-map-class)# **frame-relay cir in** *bits*	(Optional) Configure the incoming CIR size for this group of PVCs.
8	router(config-map-class)# **frame-relay adaptive-shaping becn**	Configure the adaptive traffic rate adjustment to support backward explicit congestion notification (BECN) on this group of PVCs.
9	router(config)# **exit**	Exit map-class configuration mode.

Proceed to the next section.

Configuring a Frame Relay DLCI for Voice Traffic

When configuring a Frame Relay PVC to support voice traffic, you must ensure that the carrier can accommodate the traffic rate or profile transmitted on the PVC. If too much traffic is sent at once, the carrier may discard frames, which causes disruptions to real-time voice traffic. Or, the carrier may deal with traffic bursts by queuing up the bursts and delivering them at a metered rate. Excessive queuing also causes disruption to real-time voice traffic.

To compensate for this, it is recommended that you configure Frame Relay traffic shaping, and that you configure the traffic profile parameters specified with the map class. For more information on configuring the map class, see the previous section.

To configure a Frame Relay DLCI to support voice traffic, complete the following steps from configuration mode:

Step	Command	Purpose
1	router(config)# **controller** {**t1** | **e1**} *number*	If you will configure VoFR over the T1/E1 trunk (T1/E1 0), enter the controller configuration mode. If you will configure VoFR over serial port 0 or 1, proceed to step 5. The *number* should be 1 if the controller is for the interface to the local phone device or PBX (through the DVM). The *number* should be 0 for the interface to the WAN (through the MFT).

Step	Command	Purpose
2	`router(config-controller)#` **`channel-group`** *`channel-no`* **`timeslots`** *`timeslot-list`* **`speed`** {**`56`** | **`64`**}	Configure the channel group number and the timeslot list for the controller. The channel group is a number from 0 to 23. The timeslot-list is a number from 1 to 24. The channel group number must be unique, and cannot be the same as a configured Channel Associated Signaling (CAS) group or voice group.
3	`router(config-controller)#` **`exit`**	Exit controller configuration mode.
4	`router(config)#` **`interface serial 0:`***`x`*	If configuring VoFR over the T1/E1 trunk, enter interface configuration mode by specifying **serial 0:***x*, where *x* is the channel group number you configured in the previous step. **Note** In Cisco IOS Release 11.3(1) MA, serial port 2 was a valid port number. Beginning with Release 12.0, **serial 2** is not a valid designation on the Cisco MC3810. You must enter the channel group number. Proceed to step 6.
5	`router(config)#` **`interface serial`** *`number`*	If configuring VoFR over serial port 0 or 1, enter interface configuration mode and configure the serial interface. You can specify serial port 0 or 1 for traffic over the universal input/output (UIO) serial ports.
6	`router(config-if)#` **`encapsulation frame-relay`**	Set the encapsulation type to Frame Relay on the serial port.
7	`router(config-if)#` **`clock rate network`** *`rate`*	If configuring back-to-back Frame Relay, set the network clock rate in kbps for the data communications equipment (DCE) side on serial ports 0 and 1 only. The valid range is from 56–2048 kbps, and the value must be a multiple of the value set using the **network-clock base-rate** command.
8	`router(config-if)#` **`dce terminal-timing enable`**	If configuring back-to-back Frame Relay, configure the DCE port to use its own clock signal to prevent phase shifting of the data with respect to the clock.
9	`router(config-if)#` **`frame-relay traffic-shaping`**	If a Frame Relay map class was not configured and assigned to this DLCI, enable Frame Relay traffic shaping on the interface. Make sure to use Frame Relay traffic shaping only; do not use generic traffic shaping. **Note** Frame Relay traffic shaping should be enabled on the interface if sending voice and data traffic over a single Frame Relay PVC over a public Frame Relay network. If sending voice and data traffic over a back-to-back Frame Relay configuration, or on a private Frame Relay network, traffic shaping is not required.

Step	Command	Purpose
10	`router(config-if)# frame-relay interface-dlci dlci voice-encap size voice-cir CIR`	Configure the Frame Relay DLCI to support data segmentation for voice encapsulation. The size denotes the data segmentation size. The valid range is from 80–1600 bytes. You must configure the voice encapsulation option to support voice traffic. Set the data segmentation size to match the line rate, or the port access rate. Configure the same data segmentation size value on both Cisco MC3810 concentrators on the voice connection. For more information about recommended data segmentation sizes, see Table 5-1. The **voice-cir** option is used to configure the voice CIR for the DLCI. The default is the CIR configured for the Frame Relay map class. Do not configure this option to be higher than the physical link speed. If Frame Relay traffic shaping is enabled for a PVC sharing voice and data, do not configure the **voice-cir** option to be higher than the value set with the **frame-relay mincir** command. When the **voice-encap** option is configured, all priority queuing, custom queuing, and weighted fair queuing is disabled on the interface. **Note** The voice encapsulation option applies only to the transmit DLCI side. This option sends the Frame Relay stream through a segmentation engine that is similar to FRF.12.
11	`router(config-dlci)# class name`	Associate the DLCI with a map class that you configured in the previous section. The traffic shaping properties associated with the map class will be assigned to the DLCI.
12	`router(config-dlci)# exit`	Exit DLCI configuration mode.
13	If the serial interface was configured for multipoint operation, repeat steps 10 through 12 for each subinterface.	

Table 5-1 Recommended Data Segmentation Sizes

Access Rate	Recommended Data Segmentation Size[1]
64 kbps	80 bytes
128 kbps	160 bytes
256 kbps	320 bytes
512 kbps	640 bytes
1536 kbps (full T1)	1600 bytes
2048 kbps (full E1)	1600 bytes

1. The data segmentation size is based on back-to-back Frame Relay. If sending traffic through an IGX with standard Frame Relay, subtract 6 bytes from the recommended data segmentation size.

Note When configuring the voice encapsulation data segmentation size, use the slower access rate of either the local or remote device to calculate which data segmentation size to use. If you configure a data segmentation size too high for either the local or remote device, the access rate will become throttled because the slower device cannot handle the larger data segmentation size. For example, if the access rate at the local device is 512 kbps and the access rate of the remote device is 256 kbps, configure the data segmentation size based on the slower 256 kbps access rate.

When configuring VoFR in back-to-back hard-wired configurations, make sure one side of the voice connection is configured as data communications equipment (DCE) and the other side is configured as data terminal equipment (DTE). The VoFR configuration must be performed on the Cisco MC3810 concentrators on both sides of the voice connection.

This completes the preliminary Frame Relay configuration to prepare for voice traffic. Proceed to the "Configuring Dial Peers" section on page 5-8. If you have questions or need assistance, see "Additional Documentation" on page ix.

Configuring Switched Frame Relay for Voice Traffic

To configure switched Frame Relay to support voice traffic, complete the following steps in configuration mode:

Step	Command	Purpose
1	`router(config)# frame-relay switching`	Enable PVC switching on the Cisco MC3810.
2	`router(config-if)# frame-relay route` *in-dlci* `out-interface` *out-dlci* `[voice-encap` *size*`]`	Configure the Frame Relay static route for PVC switching. If the Frame Relay DLCI will be used for voice traffic, specify the voice-encapsulation option and specify the data segmentation size. The range for the data segmentation size is from 8–1600. For recommended data segmentation sizes, see Table 5-1.

Note The voice-encapsulation option applies only to the transmit DLCI side.

This completes the preliminary Frame Relay switch configuration to support voice traffic. Proceed to the "Configuring Dial Peers" section on page 5-8. If you have questions or need assistance, see "Additional Documentation" on page ix.

Preparing to Configure Voice Dial Peers

After you have analyzed your dial plan and decided how to integrate it into your existing network, you are ready to configure your network devices to support VoFR. The actual configuration procedure depends entirely upon the topology of your voice network, but, in general, you need to complete the following steps:

1. Organizing Voice Network Information
2. Creating a Peer Configuration Table

Timesaver

If possible, you might want to configure the Frame Relay dial peers in a back-to-back configuration before separating them across the Frame Relay network. Using a back-to-back configuration, you can test your VoFR and dial-peer configuration to see if you can successfully make a voice connection. Then, when you place both peers on the network, if you cannot make a voice connection, you can isolate the cause as a network problem. For an example of a back-to-back VoFR configuration, see the "Voice over Frame Relay Configuration Examples" section on page 5-15.

Organizing Voice Network Information

After you have configured your Frame Relay network, you should collect all of the data directly related to each dial peer by creating a peer configuration table to prepare for configuring VoFR.

Creating a Peer Configuration Table

There is specific information relative to each dial peer that needs to be identified before you can configure VoFR. One way to do this is to create a peer configuration table.

Figure 5-1 shows a diagram of a small voice network in which Cisco MC3810 No. 1 connects a small sales branch office to the main office through Cisco MC3810 No. 2. There are only two devices in the sales branch office that need to be established as dial peers: a telephone and a fax machine. Cisco MC3810 No. 2 is the primary gateway to the main office; as such, it needs to be connected to the company's private branch exchange (PBX). There are two telephones and one fax machine connected to the PBX that need to be established as dial peers in the main office.

Table 5-2 shows the peer configuration table for the example illustrated in Figure 5-1.

Figure 5-1 Sample VoFR Network

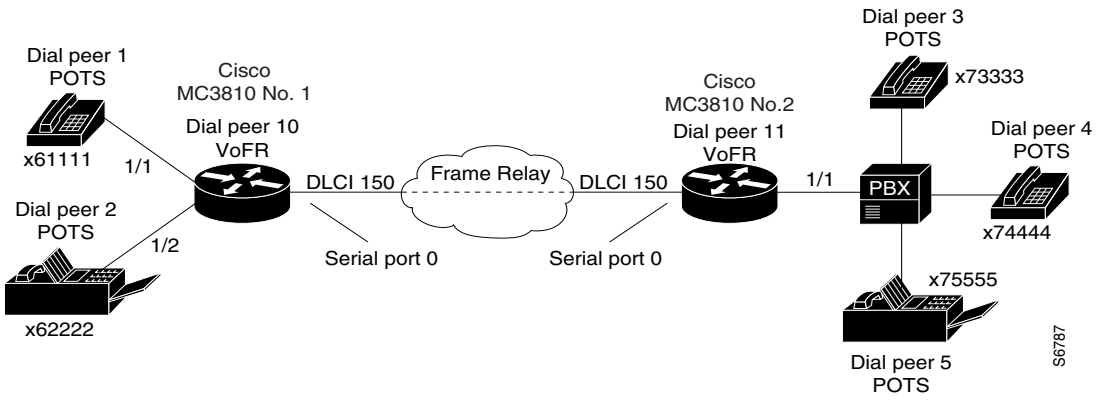


Table 5-2 Dial Peer Configuration Table for Sample VoFR Network

Dial Peer	Extension	Prefix	Destination Pattern	Type	Voice Port	Session Target
Cisco MC3810 No. 1						
1	61111		13107661111	POTS	1/1	
2	62222		13107662222	POTS	1/2	
10			1310767....	VOFR		S0 150

Table 5-2 Dial Peer Configuration Table for Sample VoFR Network

Dial Peer	Extension	Prefix	Destination Pattern	Type	Voice Port	Session Target
Cisco MC3810 No. 2						
11			1310766....	VOFR		S0 150
3	73333	7	1310767....	POTS	1/1	
4	74444	7	1310767....	POTS	1/1	
5	75555	7	1310767....	POTS	1/1	

The dial plan shown in Table 5-1 lists a simple dial-peer configuration table, with no special configuration for how you forward or playout excess digits. For more information on other options for designing your dial plan and configuring your dial peers to connect with PBXs, see Chapter 9, "Voice Dial Plan Considerations."

Configuring Dial Peers

Dial peers describe the entities to and/or from which a call is established. Dial-peer configuration tasks define the address or set of addresses serviced by that dial peer and the call parameters required to establish a call to and/or from that dial peer.

There are two different kinds of dial peers:

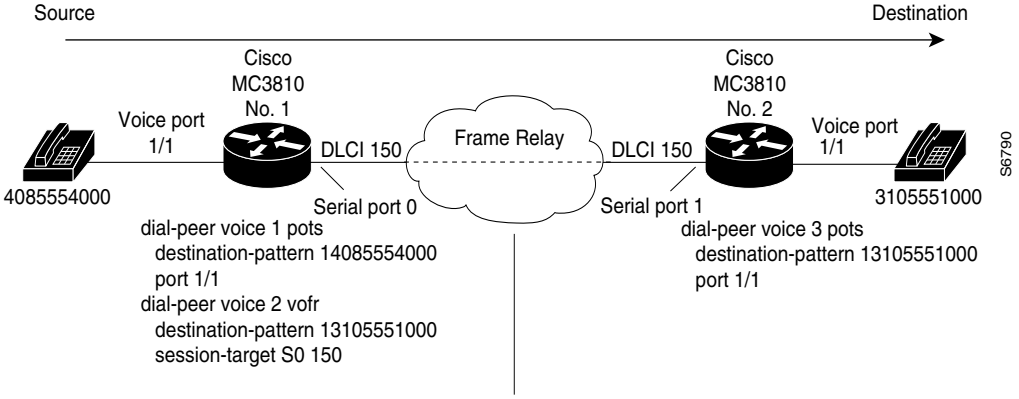
- Plain old telephone service (POTS)—Dial peer connected via a traditional telephony network. Voice-telephony peers point to a particular voice port on a voice-network device.
- Voice over Frame Relay (VoFR)—Dial peer connected via a Frame Relay WAN backbone. VoFR dial peers point to specific voice-network devices.

POTS peers associate a telephone number with a particular voice port so that incoming calls for that port can be received. VoFR peers point to specific voice-network devices (by associating destination telephone numbers with a specific Frame Relay DLCI) so that outgoing calls can be placed. Both POTS and VoFR dial peers are needed to establish VoFR connections if you want to both send and receive calls.

For tandem voice nodes, POTS dial peers are not required.

Establishing two-way communication using VoFR requires establishing a specific voice connection between two defined endpoints. As shown in Figure 5-2, for outgoing calls (from the perspective of the voice-telephony dial peer 1), the voice-telephony dial peer establishes the source (the originating telephone number and voice port) of the call. The voice-network dial peer establishes the destination by associating the destination phone number with a specific Frame Relay DLCI.

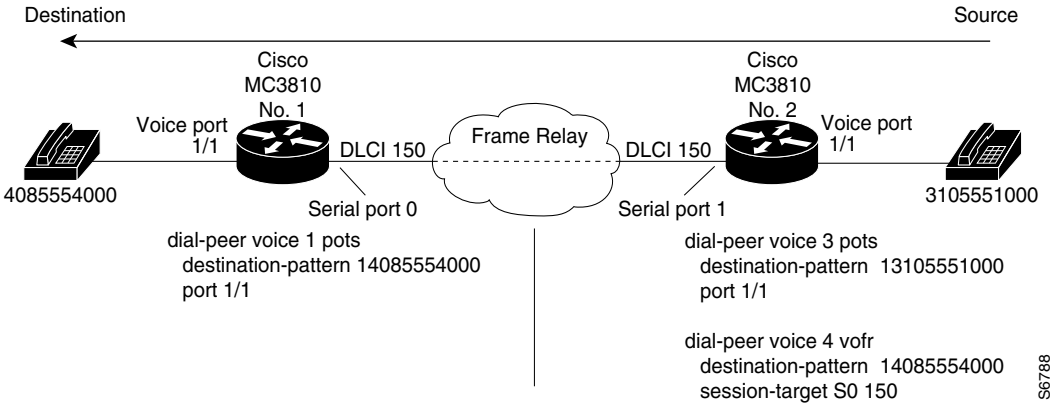
Figure 5-2 Calls from the Perspective of Cisco MC3810 No.1



In the example, the destination pattern 14085554000 string maps to a U.S. phone number 555-4000, with the digit 1 plus the area code (408) preceding the number. When configuring the destination pattern, set the dial string to match the local dial conventions.

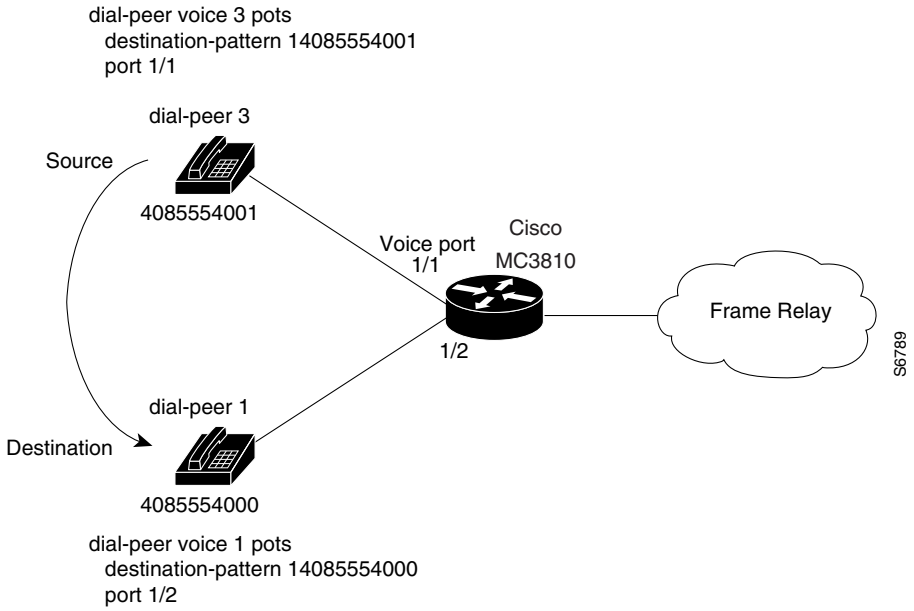
To complete the two-way communications loop, you need to configure VoFR dial peer 4 as shown in Figure 5-3.

Figure 5-3 Calls from the Perspective of Cisco MC3810 No. 2



The only exception to this is when both POTS dial peers are connected to the same concentrator, as shown in Figure 5-4. In this circumstance, you would not need to configure a VoFR dial peer.

Figure 5-4 Communication Between Dial-Peers Sharing the Same Concentrator



When configuring dial peers, you need to understand the relationship between the destination pattern and the session target. The destination pattern is the telephone number of the voice device attached to the voice port. The session target represents the route to a serial port on the peer Cisco MC3810 at the other end of the Frame Relay connection. Figure 5-5 and Figure 5-6 show the relationship between the destination pattern and the session target, as seen from the perspective of both Cisco MC3810 concentrators in a VoFR configuration.

Figure 5-5 Relationship Between Destination Pattern and Session Target from the Perspective of Cisco MC3810 No. 1

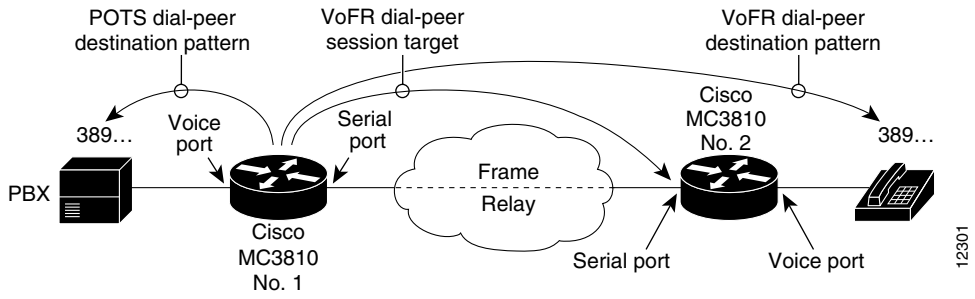
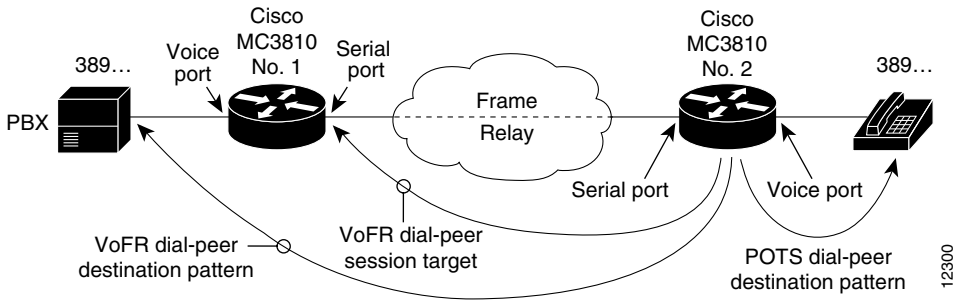


Figure 5-6 Relationship Between Destination Pattern and Session Target from the Perspective of Cisco MC3810 No. 2



The following sections describe how to configure POTS dial peers and VoFR dial peers.

Configuring POTS Dial Peers

To configure a POTS dial peer, you need to uniquely identify thedial peer (by assigning it a unique tag number), define its telephone number, and associate it with a voice port through which calls will be established. Under most circumstances, the default values for the remaining dial-peer configuration commands are sufficient to establish connections.

Depending on your dial plan configuration, you may need to consider how to configure voice networks with variable-length dial plans, number expansion, excess digit playout, forward digits and default voice routes, or use hunt groups with dial-peer preferences. For more information on these topics, see Chapter 9, "Voice Dial Plan Considerations."

To configure POTS dial peers, complete the following steps from configuration mode:

Step	Command	Purpose
1	`router(config)# dial-peer voice` *tag* `pots`	Define a POTS dial peer and enter dial-peer configuration mode. All subsequent commands that you enter in dial-peer voice mode before you exit will apply to this dial peer. The *tag* value identifies the dial peer and must be unique on the Cisco MC3810. Do not duplicate a specific *tag* number.
2	`router(config-dialpeer)#` `destination-pattern` *string*	Configure the dial peer's destination pattern. The *string* is a series of digits that specify the E.164 or private dialing plan telephone number. Valid entries are the digits 0–9 and the letters A–D. The following special characters can be entered in the string: • The star character (*) and the pound sign (#) that appear on standard touch-tone dial pads can be used in any dial string. However, these characters cannot be used as leading characters in a string (for example, *650). • The period (.) can be entered any time, and is used as a wildcard character. For more information see the "Destination Pattern Wildcards" section on page 9-1. • The comma (,) can be used only in prefixes, and is used to insert a one-second pause or a delay. • The timer (T) character can be used to configure variable length dial plans. For more information, see the "Variable-Length Dial Plans" section on page 9-3. The plus symbol (+) is not a valid character in the string.
3	`router(config-dialpeer)# port` *slot/port*	Associate this voice-telephony dial peer with a specific logical dial interface. Enter the *slot/port* number of the voice port connected to the POTS dial peer.

Configuring Dial Plan Options for the POTS Dial Peer

When you configure the dial plan, you have different options for how the dial plan is designed. For more information about dial plan strategies, see Chapter 9, "Voice Dial Plan Considerations."

To configure dial plan options, complete one or more of the following steps from dial-peer configuration mode:

Step	Command	Purpose
1	`router(config-dialpeer)# num-exp` *extension-number extension-string*	(Optional) If using the number expansion feature, define how to expand an extension number into a particular destination pattern.
2	`router(config-dialpeer)# forward-digits` {*num-digit* | **all** | **implicit**}	(Optional) If using the forward-digits feature, configure the digit-forwarding method that will be used on the dial peer. The valid range for the number of digits forwarded (*num-digit*) is from 0–32. The default value is **implicit**, in which the exactly matched digits are not forwarded. Only digits matched by the wildcard pattern are forwarded. For more information about the forward-digits feature, see the "Forward Digits and Voice Default Routes" section on page 9-4.
3	`router(config-dialpeer)# prefix` *string*	(Optional) If the forward-digits feature was not configured in the last step, assign the dialed digits prefix for the dial peer.
4	`router(config-dialpeer)# preference` *value*	(Optional) Configure a preference for the POTS dial peer. The value is a number from 0–10 where the lower the number, the higher the preference. If POTS and voice-network (VoFR) peers are mixed in the same hunt group, POTS dial peers will be searched first, even if a voice-network peer has a higher preference number. For more information about hunt groups and preferences, see the "Hunt Groups and Preference Configuration" section on page 9-6.

To configure the next POTS dial peer, exit dial-peer configuration mode by entering **exit**, and repeat the previous steps. To configure VoFR dial peers, see the next section "Configuring Voice over Frame Relay Dial Peers."

Configuring Voice over Frame Relay Dial Peers

To configure a VoFR dial peer, you need to uniquely identify the peer (by assigning it a unique tag number), define the outgoing serial port number and the virtual circuit number.

Depending on your dial plan configuration, you may need to consider how to configure voice networks with variable-length dial plans, number expansion, excess digit playout, forward digits and default voice routes, or use hunt groups with dial peer preferences. For more information on these topics, see Chapter 9, "Voice Dial Plan Considerations."

To configure VoFR dial peers, complete the following steps from configuration mode:

Step	Command	Purpose
1	`router(config)# dial-peer voice` *tag* `vofr`	Define a VoFR dial peer and enter dial-peer configuration mode. All subsequent commands that you enter in dial-peer voice mode before you exit will apply to this dial peer. The *tag* value identifies the dial peer and must be unique on the Cisco MC3810. Do not duplicate a specific *tag* number.
2	`router(config-dialpeer)#` `destination-pattern` *string*	Configure the dial peer's destination pattern. The same restrictions for the string listed in the POTS dial-peer configuration also apply to the VoFR destination pattern.
3	`router(config-dialpeer)#` `session target` *interface* `serial` *interface dlci*	Configure the Frame Relay session target for the dial peer.
4	`router(config-dialpeer)#` `preference` *value*	(Optional) Configure a preference for the VoFR dial peer. The value is a number from 0 to 10 where the lower the number, the higher the preference. For more information about hunt groups and preferences, see the "Hunt Groups and Preference Configuration" section on page 9-6.
5	`router(config-dialpeer)#` `alt-dial` *string*	(Optional) Configure the alternate dial-out string when configuring on-net-to-off-net alternative dialing.

To configure the next VoFR dial peer, exit dial-peer configuration mode by entering **exit**, and repeat the previous steps.

Note When configuring VoFR, the dial-peer configuration must be performed on the Cisco MC3810 concentrators on both sides of the voice connection.

Verify Your Voice Connection

Verify that the voice connection is working by doing the following:

- Pick up the handset on a telephone connected to the configuration and verify that you can get a dial tone.
- Make a call from the local telephone to a configured dial peer and verify that the call attempt is successful.

You can check the validity of your dial-peer and voice-port configuration by performing the following tasks:

- If you have relatively few dial peers configured, you can use the **show dial-peer voice summary** command to verify that the data configured is correct.
- To show the status of the voice ports, use the **show voice port** command.
- To show the call status for all voice ports, use the **show voice call** command.
- To show the current status of all DSP voice channels, use the **show voice dsp** command.

Troubleshooting Tips

If you are having trouble connecting a call, you can try to resolve the problem by performing the following tasks:

- If you suspect the problem is in the Frame Relay configuration, make sure that Frame Relay traffic shaping is turned on.
- If you suspect the problem is associated with the dial-peer configuration, use the **show dial-peer voice** command on the local and remote concentrators to verify that the data is configured correctly on both.
- Make sure the voice port, serial port and/or the T1/E1 controller are set to **no shutdown**.

Voice over Frame Relay Configuration Examples

This section provides the following VoFR configuration examples:

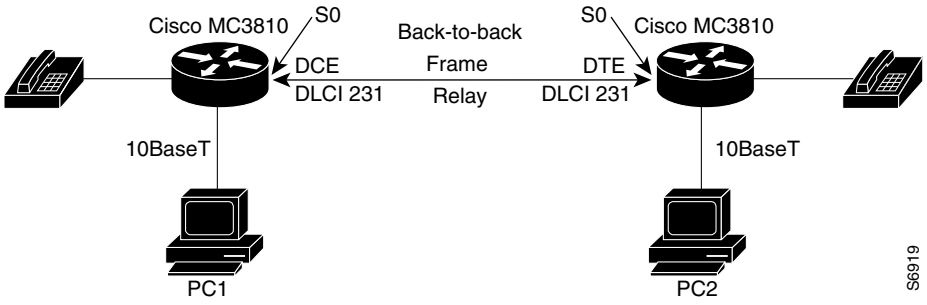
- Example 1—Back-to-Back Voice over Frame Relay Configuration, page 5-15
- Example 2—Voice over Frame Relay Network Configuration, page 5-17

Example 1—Back-to-Back Voice over Frame Relay Configuration

Figure 5-7 shows a configuration example for two Cisco MC3810 concentrators configured back-to-back, with VoFR configured for both concentrators. This setup is useful to test your VoFR configuration locally to make sure voice connections can be made locally before configuring VoFR across a larger network. Following the figure are the commands required to configure the Cisco MC3810 concentrators in this example.

Note There are special considerations required when configuring two Cisco MC3810 concentrators for back-to-back Frame Relay. For example, you must make sure one side is DCE and the other is configured to DTE. On the DCE side, you must configure the **clock rate network-clock** and **dce terminal timing enable** commands. On both sides, make sure to configure the serial ports for point-to-point operation.

Figure 5-7 Back-to-Back VoFR Configuration



Configuration for First Cisco MC3810

```
no service pad
no service udp-small-servers
no service tcp-small-servers
hostname Frame-top
```

```
frame-relay switching
interface Ethernet0
 ip address 10.1.10.1 255.0.0.0

interface Serial0 point-to-point
 ip address 12.0.0.3 255.0.0.0
 encapsulation frame-relay
 no fair-queue
 clock rate network-clock 2000000
 dce terminal-timing enable
 frame-relay class fr1
 frame-relay map ip 12.0.0.1 231 broadcast
 frame-relay interface-dlci 231 voice-encap 1600
 frame-relay intf-type dce

map-class frame-relay fr1
 frame-relay adaptive-shaping becn
 frame-relay cir 64000
 frame-relay bc 1000


router rip
 redistribute connected
 network 12.0.0.0

voice-port 1/1

dial-peer voice 1 pots
 destination-pattern 10
 port 1/1

dial-peer voice 101 vofr
 destination-pattern 2.
 session target Serial0 231
end
```

Configuration for Second Cisco MC3810

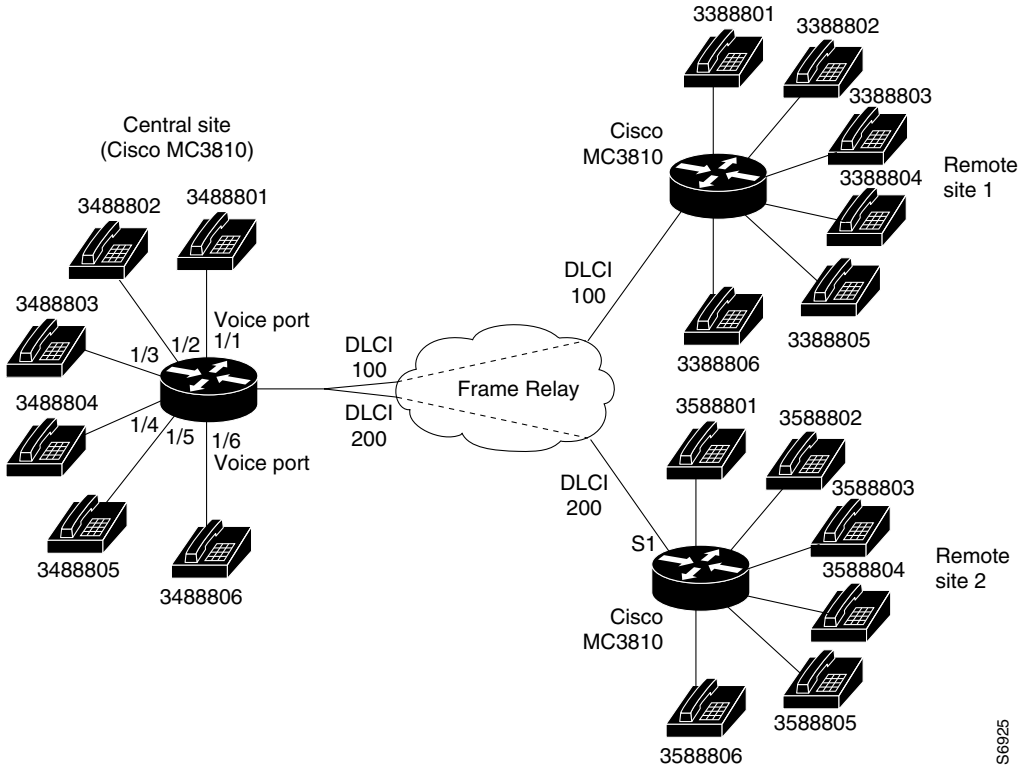
```
interface Ethernet0
 ip address 10.1.20.1 255.0.0.0

router rip
 redistribute connected
 network 12.0.0.0


interface Serial0 point-to-point
 ip address 12.0.0.1 255.0.0.0
 encapsulation frame-relay
 bandwidth 2000000
 frame-relay class fr1
 frame-relay map ip 12.0.0.3 231 broadcast
 frame-relay interface-dlci 231 voice-encap 1600

map-class frame-relay fr1
 frame-relay adaptive-shaping becn
 frame-relay cir 64000
 frame-relay bc 1000

voice-port 1/1

dial-peer voice 1 pots
 destination-pattern 20
 port 1/1
```

```
dial-peer voice 101 vofr
 destination-pattern 1.
 session target Serial0 231
end
```

Example 2—Voice over Frame Relay Network Configuration

The following is a configuration example for a VoFR network, including configuration for voice ports and dial peers. Figure 5-8 shows the configuration for one Cisco MC3810 at a central site connected to two Cisco MC3810 concentrators at different remote sites across a Frame Relay network. Following the figure are the commands required to configure the Cisco MC3810 concentrators in this example.

Figure 5-8 VoFR Network Configuration



Central Site Cisco MC3810 Configuration

The following is the configuration for the central site Cisco MC3810 concentrator:

```
hostname central
controller T1 0
 framing esf
 linecode b8zs
 channel-group 1 timeslots 1-24 speed 64

interface Ethernet0
 ip address 172.22.124.66 255.255.255.0

interface Serial 0:1 multipoint
 ip address 223.223.224.229 255.255.255.0
```

```
 encapsulation frame-relay
 no fair-queue
 frame-relay traffic-shaping
 frame-relay interface-dlci 100 voice-encap 80
 class fr1
 frame-relay interface-dlci 200 voice-encap 160
 class fr2

router igrp 1
 network 172.22.0.0
 network 223.223.224.0

no ip classless

map-class frame-relay fr1
 frame-relay adaptive-shaping becn
 frame-relay cir 64000
 frame-relay bc 1000
map-class frame-relay fr2
 frame-relay adaptive-shaping becn
 frame-relay cir 128000
 frame-relay bc 1000

line con 0
 exec-timeout 0 0
line aux 0
line vty 0

voice-port 1/1
voice-port 1/2
voice-port 1/3
voice-port 1/4
voice-port 1/5
voice-port 1/6

dial-peer voice 1 pots
 destination-pattern 3488801
 port 1/1

dial-peer voice 2 pots
 destination-pattern 3488802
 port 1/2

dial-peer voice 3 pots
 destination-pattern 3488803
 port 1/3

dial-peer voice 4 pots
 destination-pattern 3488804
 port 1/4

dial-peer voice 5 pots
 destination-pattern 3488805
 port 1/5

dial-peer voice 6 pots
 destination-pattern 3488806
 port 1/6

dial-peer voice 338 vofr
 destination-pattern 338....
 session target Serial0:1 100
dial-peer voice 358 vofr
 destination-pattern 358....
```

```
 session target Serial0:1 200


end
```

Remote Site 1 Cisco MC3810 Configuration

The following is the configuration for the Cisco MC3810 concentrator at remote site 1:

```
hostname remote1
controller T1 0
 framing esf
 linecode b8zs
 channel-group 2 timeslots 1 speed 64



interface Ethernet0
 ip address 172.22.125.66 255.255.255.0

interface Serial 0:2 multipoint
 ip address 223.223.224.227 255.255.255.0
 encapsulation frame-relay
no fair-queue
 frame-relay traffic-shaping
 frame-relay interface-dlci 100 voice-encap 80
  class fr1

router igrp 1
 network 172.22.0.0
 network 223.223.224.0

no ip classless

map-class frame-relay fr1
 frame-relay cir 64000
 frame-relay bc 1000
 frame-relay adaptive-shaping becn
line con 0
 exec-timeout 0 0
line aux 0
line vty 0


voice-port 1/1
voice-port 1/2
voice-port 1/3
voice-port 1/4
voice-port 1/5
voice-port 1/6

dial-peer voice 1 pots
 destination-pattern 3388801
 port 1/1

dial-peer voice 2 pots
 destination-pattern 3388802
 port 1/2

dial-peer voice 3 pots
 destination-pattern 3388803
 port 1/3
```

```
dial-peer voice 4 pots
 destination-pattern 3388804
 port 1/4

dial-peer voice 5 pots
 destination-pattern 3388805
 port 1/5

dial-peer voice 6 pots
 destination-pattern 3388806
 port 1/6

dial-peer voice 2000 vofr
 destination-pattern 358....
 session target Serial0:2 100

dial-peer voice 2001 vofr
 destination-pattern 348....
 session target Serial0:2 100
```

Remote Site 2 Cisco MC3810 Configuration

The following is the configuration for the Cisco MC3810 concentrator at remote site 2:

```
hostname remote2

interface Ethernet0
 ip address 172.22.126.66 255.255.255.0

interface Serial1 multipoint
 ip address 223.223.224.226 255.255.255.0
 encapsulation frame-relay
 no fair-queue
 frame-relay traffic-shaping
 frame-relay interface-dlci 200 voice-encap 160
  class fr1
 clock rate 128000


router igrp 1
 network 172.22.0.0
 network 223.223.224.0

no ip classless

map-class frame-relay fr1
 frame-relay cir 128000
 frame-relay bc 1000
 frame-relay adaptive-shaping becn

line con 0
 exec-timeout 0 0
line aux 0
line vty 0

voice-port 1/1
voice-port 1/2
voice-port 1/3
voice-port 1/4
voice-port 1/5
voice-port 1/6

dial-peer voice 1 pots
 destination-pattern 3588801
```

```
 port 1/1

dial-peer voice 2 pots
 destination-pattern 3588802
 port 1/2

dial-peer voice 3 pots
 destination-pattern 3588803
 port 1/3

dial-peer voice 4 pots
 destination-pattern 3588804
 port 1/4

dial-peer voice 5 pots
 destination-pattern 3588805
 port 1/5

dial-peer voice 6 pots
 destination-pattern 3588806
 port 1/6

dial-peer voice 2000 vofr
 destination-pattern 348....
 session target Serial1 200

dial-peer voice 2001 vofr
 destination-pattern 338....
 session target Serial1 200

end
```