



Voice Dial Plan Considerations

Depending on your configuration, you may need to consider different strategies for how you organize the dial plan when configuring voice dial peers. This chapter is divided into the following topics regarding dial-peer configuration that you may need to consider:

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Destination Pattern Wildcards

The dial-peer destination pattern can incorporate wildcards using the period (.) character. Using wildcards can reduce dial plan administration, especially when numbering plans allocate contiguous blocks of numbers to different locations.

For example, the following dial-peer configuration shows how the wildcard character can be used in the destination pattern.

```
dial peer voice 1 pots
destination-pattern 22..
port 1/1
```

In this configuration, the Cisco MC3810 will match any four-digit dial string starting with 22 (for example, 2201, 2235, or 2299). Because two wildcard characters are entered in the destination pattern, the dial peer will only match a dial string of four digits or more. If a three-digit number such as 222 is entered, the dial peer would not match the destination pattern. If the Cisco MC3810 could not match any other dial peer for this call request, the call would be aborted after the interdigit timeout duration following the last two digits entered.

Wild cards can only be used in the trailing part of the destination pattern, and cannot be used in between digits. For example, the string 22.. is a valid use of wildcards, but the string 2..2 is not valid.

Number Expansion

In most corporate environments, the telephone network is configured so that you can reach a destination by dialing only a portion (an extension number) of the full E.164 telephone number. Voice over Frame Relay (VoFR) and Voice over ATM (VoATM) can be configured to recognize extension numbers and expand them into their full E.164 dialed number by using two commands in tandem:

destination-pattern and **num-exp**. Before you configure these two commands, it is helpful to map individual telephone extensions with their full E.164 dialed numbers. This can be done easily by creating a number expansion table.

Create a Number Expansion Table

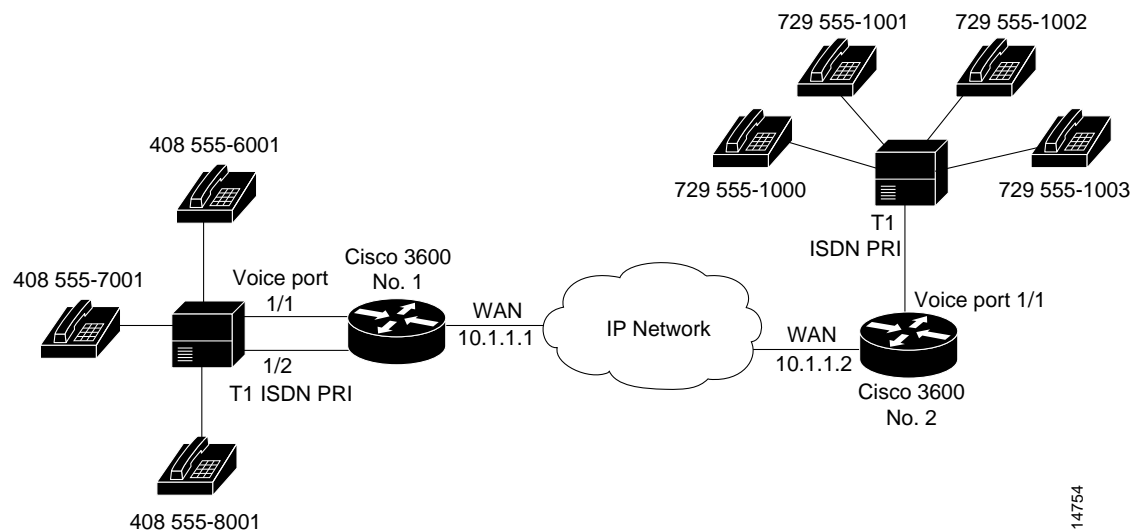
In [Figure 9-1](#), a small company wants to use VoFR to integrate its telephony network with its existing Frame Relay network. The destination pattern (or expanded telephone number) associated with Cisco MC3810 No. 1 (located to the left of the Frame Relay cloud) is (408) 555-6xxx, (408) 555-7xxx or (408) 555-8xxx, where xxx identifies the individual dial peers by extension. The destination pattern (or expanded telephone number) associated with Cisco MC3810 No. 2 (located to the right of the Frame Relay cloud) is (729) 555-1xxx.



Note

Although this example uses VoFR, the concepts of number expansion also apply to VoATM. Also, you can configure the number expansion to handle more than three digits. For example, you can configure a four-digit number expansion for (408) 555-xxxx, or a five-digit number expansion for (408) 55x-xxxx.

Figure 9-1 Number Expansion on Sample VoFR Network



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[Table 9-1](#) shows the number expansion table for this scenario.

Table 9-1 Sample Number Expansion Table

Extension	Destination Pattern	num-exp Command Entry
6...	4085556...	num-exp 6... 408555....
7...	4085557...	num-exp 7... 408555....
8...	4085558...	num-exp 8... 408555....
1...	729555....	num-exp 1... 729555....

**Note**

When configuring number expansion, use the period character (.) to represent variables (such as extension numbers) in a telephone number.

Variable-Length Dial Plans

In most voice configurations, fixed-length dialing plans, in which all the dial peer destination patterns have the same length, are sufficient because the telephone number strings are all the same length. However, in some voice network configurations, variable-length dial plans are required, especially if the network crosses country boundaries and the telephone number strings are of different lengths.

By entering the “T” timer character in the destination pattern, the Cisco MC3810 can be configured to accept a fixed-length dial string, and then wait for additional dialed digits. For example, the following dial-peer configuration shows how the T character can be set to allow variable-length dial strings:

```
dial peer voice 1 pots
destination-pattern 2222T
port 1/1
```

In this example, the Cisco MC3810 accepts the digits 2222, and then waits for an unspecified number of dialed digits. If digits continue to be entered before the inter-digit timeout expires, then the Cisco MC3810 will gather up to 31 additional digits. Once the interdigit timeout expires, the Cisco MC3810 places the call. The interdigit timeout is set by the **timeouts inter-digit** voice-port command.

The interdigit timeout timer can be immediately terminated by entering the “#” character. If the # character is entered while the Cisco MC3810 is waiting for the additional digits, the # character is treated as an end-dial accelerator. The # character is not treated as an actual digit in the destination pattern and is not sent as part of the dialed string across the network.

However, if the # character is entered before the Cisco MC3810 is waiting for the additional digits (meaning before the “T” character is entered in the destination pattern), then the # character is treated as a dialed digit. For example, if a destination pattern is configured with the string 2222...T, then the digits 2222####1234567 can be gathered, but the digits 2222####1234#67 cannot be gathered because the final # character is treated as a terminator.

The default value for the interdigit timeout is 10 seconds. If the duration is not changed, using the “T” timer adds 10 seconds to each call setup time because the call is not attempted until the timer expires (unless the # character is used as a terminator). Because of this dependency, if using variable-length dial plans, the interdigit timeout should be reduced to reduce the call setup time. For more information on configuring the **timeouts inter-digit** command, see the [“General Voice-Port Tuning Options” section on page 10-9](#).

Excess Digits Ployout

Excess digits are defined as received digits that are beyond the length of the destination pattern on a terminating router. A terminating Cisco MC3810 will forward excess digits to the telephony interface. For example, if the digits “123456789” are matched on a terminating Cisco MC3810 with a destination pattern of “1.....,” the “6789” are excess digits and will be forwarded.

A Cisco MC3810 that is originating a call will only collect digits up to the length of a defined destination pattern. When a number is dialed that is longer than the destination pattern, after the last digit in the destination pattern is dialed, the call is immediately placed, and the additional digits are not collected by the Cisco MC3810.

For example, if the digits “123456789” are dialed on an originating Cisco MC3810 with a destination pattern of 1...., then “6789” are not collected. The call is placed immediately after the digit “5” is dialed. The additional digits “6789” are not collected, but are passed through the audio path.

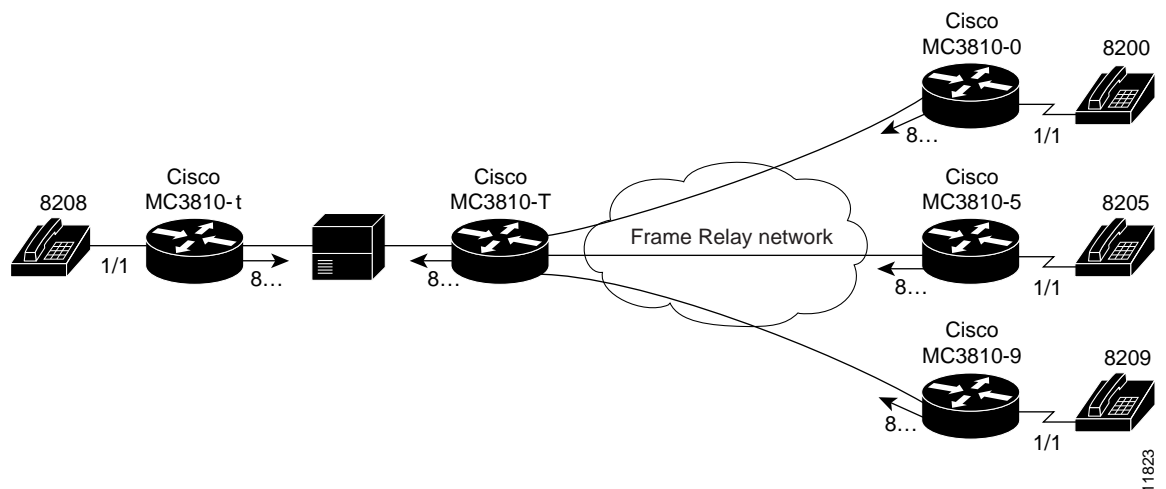
In configurations where a phone on a Foreign Exchange Station (FXS) port on the Cisco MC3810 is connected to the Public Switched Telephone Network (PSTN) through a Foreign Exchange Office (FXO) port on the same Cisco MC3810, additional steps are necessary to enable a call to go through. Because the uncollected excess digits are passed through the audio path, the excess digits might not go through if the audio path isn’t ready when the excess digit is dialed. When dialing a destination pattern in this situation, pause and wait for a second dial tone before dialing the excess digits. This will give the audio path time to accept the excess digits.

Forward Digits and Voice Default Routes

Voice default routing for fixed-length dial plans can be used with larger PBX configurations to forward digits to Cisco MC3810 telephony interfaces.

Figure 9-2 shows an example of routing voice calls through a PBX using forward digits. In the configuration, the Cisco MC3810-t and Cisco MC3810-T are tandem nodes, and are required to support forwarding digits so that calls to extension “8208” can be made from Cisco MC3810 concentrators 0, 5, or 9.

Figure 9-2 Routing Voice Calls among Cisco MC3810s through a PBX



On the two tandem nodes, the **forward-digits** command is required. This command forwards all digits matched with the destination “8...” to the appropriate port. For a call from Cisco MC3810-0 to reach extension 8208, the call must first route through Cisco MC3810-T, which plays out the digits “8208” to the voice port connected to the PBX. The PBX then routes the voice call to Cisco MC3810-t. Although the **forward-digits all** command is used, the **forward-digits 4** command can also be used in this example. The following are the dial-peer configurations on each Cisco MC3810 required for this configuration:

For Cisco MC3810-t:

```
dial-peer voice 8 pots
  destination-pattern 8208
  session-target s0 1
```

```
dial-peer voice 1000 pots
  destination-pattern 8...
  forward-digits all
  port 1/1
```

```
dial-peer voice 9999 pots
  destination-pattern ....
  forward-digits all
  port 1/1
```

For Cisco MC3810-T:

```
dial-peer voice 1 vofr
  destination-pattern 8200
  session-target s0 1
```

```
dial-peer voice 6 vofr
  destination-pattern 8205
  session-target s0 6
```

```
dial-peer voice 10 vofr
  destination-pattern 8209
  session-target s0 10
```

```
dial-peer voice 1 pots
  destination-pattern 8...
  forward-digits all
  port 1/1
```

For Cisco MC3810-0:

```
dial-peer voice 1 pots
  destination-pattern 8200
  port 1/1
```

```
dial-peer voice 1000 vofr
  destination-pattern 8...
  session-target s0 1
```

For Cisco MC3810-5:

```
dial-peer voice 5 pots
  destination-pattern 8205
  port 1/1
```

```
dial-peer voice 1000 vofr
  destination-pattern 8...
  session-target s0-1
```

For Cisco MC3810-9:

```
dial-peer voice 9 pots
  destination-pattern 8209
  port 1/1

dial-peer voice 1000 vofr
  destination-pattern 8...
  session-target s0 1
```

The concept of voice default routes is also shown in [Figure 9-2](#). In the example, the configurations for the destination dial plans “8...” in both the tandem nodes are voice default routes because all voice calls dialed that start with 8 followed by three digits will either match on 8208 or end up with 8...., which is the last resort voice route used by Cisco MC3810-t if no other route is discovered.

Hunt Groups and Preference Configuration

When configuring the destination pattern for voice-telephony dial peers (such as to a PBX), if you configure each dial peer with a different destination pattern, then you may have limitations on the availability of calls getting through. This is because when you configure each dial peer with a different destination pattern, the destination is a single DS0 timeslot on the voice connection to the PBX. If that timeslot gets busy, then a call attempt to the dial peer mapped to that DS0 timeslot will fail.

For example, in the following dial-peer configuration, there are four POTS dial peers configured, all with a different destination pattern on the same PBX:

```
dial-peer voice 1 pots
  destination-pattern 3001
  port 1/1

dial-peer voice 2 pots
  destination-pattern 3002
  port 1/2

dial-peer voice 3 pots
  destination-pattern 3003
  port 1/3

dial-peer voice 4 pots
  destination-pattern 3004
  port 1/4
```

Because each dial peer has a different destination pattern configured, there is no backup available if the DS0 timeslot mapped to the dial peer is busy with another call.

However, the Cisco MC3810 supports the concept of *hunt groups*, in which you configure a group of dial peers on the same PBX with the same destination pattern. With a hunt group, if a call attempt is made to a dial peer on a specific DS0 timeslot, if that timeslot is busy, the Cisco MC3810 hunts for another timeslot on that channel until an available timeslot is found. In this case, each dial peer is configured using the same destination pattern of 3000, forming a dial pool to that destination pattern.

To provide specific dial peers in the pool with a preference over other dial peers, you can configure the preference order for each dial peer using the **preference** command. The following is an example of the dial-peer configuration with all dial peers having the same destination pattern, but different preference orders:

```
dial-peer voice 1 pots
  destination pattern 3000
  port 1/1
  preference 0
```

```

dial-peer voice 2 pots
 destination pattern 3000
 port 1/2
 preference 1

dial-peer voice 3 pots
 destination pattern 3000
 port 1/3
 preference 2

dial-peer voice 4 pots
 destination pattern 3000
 port 1/4
 preference 3

```

**Note**

When setting the preference order, the lower the preference number, the higher the priority. The highest priority is given to the dial peer with preference order 0.

The hunt group feature hunts for dial peers in the following order:

1. Based on the priority set using the **preference** dial-peer command. Using the preference as the criteria is known as a directed hunt group.
2. Using the criteria of the longest number match. For example, if you have one dial peer set for 345.... and a second dial peer set for 3456789, the hunt group would first select the dial peer 3456789 because it has the longest match of the two dial peers.
3. Based on the least-used dial peer. The least-used dial peer is determined by examining the timestamp for when the last successful call was completed via that dial peer.
Using the least-used dial peer as the criteria can be used for a circular or round-robin hunt group, in which all dial peers in the hunt group are given the same destination pattern and preference level.
4. In the order they were defined on the Cisco MC3810.

You can also construct hunt groups across multiple Cisco MC3810 concentrators, in which a number of dial peers on different concentrators are configured with the same destination pattern, with the hunting order determined by the preference number. If the last member in the hunt group is reached and is busy, the call returns to the original matching dial peer to look for an alternate dial-out string (configured with the **alt-dial** command). If there is no alternate dial-out string available, then a busy signal is returned.

