Configuring Network Side ISDN PRI Signaling, Trunking, and Switching

This chapter describes the Network Side ISDN PRI Signaling, Trunking, and Switching feature. The following main sections are provided:

- Network Side ISDN PRI Signaling Overview
- How to Configure Network Side ISDN PRI
- Configuration Examples for Network Side ISDN PRI Signaling, Trunking, and Switching

For hardware technical descriptions and for information about installing the controllers and interfaces, refer to the hardware installation and maintenance publication for your particular product.

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

For a complete description of the ISDN PRI commands in this chapter, refer to the Cisco IOS Dial Technologies Command Reference. To locate documentation of other commands that appear in this chapter, use the command reference master index or search online.

Network Side ISDN PRI Signaling Overview

The Network Side ISDN PRI Signaling, Trunking, and Switching feature enables Cisco IOS software to replicate the public switched network interface to a PBX that is compatible with the National ISDN (NI) switch types and European Telecommunications Standards Institute (ETSI) Net5 switch types.

Routers and PBXs are both traditionally customer premises equipment (CPE) devices with respect to the public switched network interfaces. However, for Voice over IP (VoIP) applications, it is desirable to interface access servers to PBXs with the access server representing the public switched network.

Enterprise organizations use the current VoIP features with Cisco products as a method to reduce costs for long distance phone calls within and outside their organizations. However, there are times that a call cannot go over VoIP and the call needs to be placed using the Public Switched Telephone Network (PSTN). The customer then must have two devices connected to a PBX to allow some calls to be placed
using VoIP and some calls to be placed over the PSTN. In contrast, this feature allows Cisco access servers to connect directly to user-side CPE devices such as PBXs and allows voice calls and data calls to be placed without requiring two different devices to be connected to the PBXs.

The Network Side ISDN PRI Signaling, Trunking, and Switching feature provides the following benefits:

- Allows you to bypass PSTN tariffed services such as trunking and administration, thus extending the cost savings of VoIP.
- Allows your PBXs to be connected directly to a Cisco access server, so PBX station calls can be routed automatically to the IP network without the need for special IP telephones.
- Provides flexibility in network design.
- Enables you to block calls selectively based on the called number or the calling number.

Call Switching Using Dial Peers

Call switching using dial peers enables Cisco VoIP gateways to switch both voice and data calls between different interfaces based on the dial peer matching. An incoming call is matched against configured dial peers, and based on the configured called number, the outgoing interface is selected. Any call that arrives from an ISDN PRI network side on a supported platform is either terminated on the access server, switched to an IP network, or switched to the PSTN, depending on the configuration.

A dial peer is an addressable call endpoint identified, for example, by a phone number or a port number. In VoIP, there are two kinds of dial peers: plain old telephone service (POTS) and VoIP. Dial peers are defined from the perspective of the access server and are used for both inbound and outbound call legs. An inbound call leg originates outside the access server. An outbound call leg originates from the access server.

For inbound call legs, a dial peer might be associated with the calling number or the port designation. Outbound call legs always have a dial peer associated with them. The destination pattern (a defined initial part of a phone number) is used to identify the outbound dial peer. The call is associated with the outbound dial peer at setup time.

POTS dial peers associate a telephone number with a particular voice port so that incoming calls for that telephone number can be received and outgoing calls can be placed.

Additional information about dial peers can be found in the chapter “Configuring Dial Plans, Dial Peers, and Digit Manipulation” in the Cisco IOS Voice, Video, and Fax Configuration Guide, Release 12.2.

Trunk Group Resource Manager

The Trunk Group Resource Manager (TGRM) supports the logical grouping, configuration, and joint management of one or more PRI interfaces. The TGRM is used to store configuration information and to accept or select an interface from a trunk group when requested. A trunk group is provisioned as the target of a dial peer, and the TGRM transparently selects the specific PRI interface and channels to use for incoming or outgoing calls. Trunks are selected based on usage: The trunk that is least used is selected.

Using trunk groups simplifies the task of configuring dial peers and PRI interfaces, and also enables the dynamic selection of PRI interfaces as needed in the access server.
A trunk group can include any number of PRI interfaces, but all the interfaces in a trunk group must use the same type of signaling.

**Class of Restrictions**

The class of restrictions (COR) functionality provides the ability to deny certain call attempts based on the incoming and outgoing class of restrictions provisioned on the dial peers. This functionality provides flexibility in network design, allows users to block calls (for example, to 900 numbers), and applies different restrictions to call attempts from different originators.

COR is used to specify which incoming dial peer can use which outgoing dial peer to make a call. Each dial peer can be provisioned with an incoming and an outgoing COR list. The incoming COR list indicates the capability of the dial peer to initiate certain classes of calls. The outgoing COR list indicates the capability required for an incoming dial peer to deliver a call via this outgoing dial peer. If the capabilities of the incoming dial peer are not the same or a superset of the capabilities required by the outgoing dial peer, the call cannot be completed using this outgoing dial peer.

**ISDN Disconnect Timers**

A new disconnect timer, T306, has been added as part of the Internetworking Signaling Enhancements for H.323 and SIP VoIP feature. This timer allows in-band announcements and tones to be played before a call is disconnected. It is designed for routers that are configured as an ISDN network-side switch. The T306 timer starts when a router sends out a disconnect message with a progress indicator of 8. The voice path is cut-through in the backward direction, and the announcement or error tone is played until the timer expires. When the timer expires, the voice application disconnects the call. You can configure this timer by using the `isdn t306` command. The T306 timer is supported only on routers that are configured for network-side ISDN. The following switches support network-side ISDN:

- National ISDN
- NET3 BRI
- NET5
- QSIG

The T310 timer sets a limit for a call in the Call Proceeding state. The timer starts when the router receives a Call Proceeding message and stops when the call moves to another phase, typically Alerting, Connect, or Progress. If the timer expires while the call is in the Call Proceeding state, the router releases the call. You can configure this timer by using the `isdn t310` command.

**How to Configure Network Side ISDN PRI**

See the following sections for configuration tasks for the Network Side ISDN PRI Signaling, Trunking, and Switching feature. Each task is identified as required or optional.

- Configuring ISDN Network Side (Required)
- Configuring Global or Interface Trunk Groups (Optional)
- Configuring Classes of Restrictions (Optional)
- Configuring ISDN T306 and T310 Timers (Optional)
Verifying Network Side ISDN PRI Signaling, Trunking, and Switching (Optional)

The sections “Monitoring Network Side ISDN PRI” and “Monitoring TGRM” list commands that you can use to monitor network side ISDN PRI signaling.

**Configuring ISDN Network Side**

Before you begin to configure the Network Side ISDN PRI Signaling, Trunking, and Switching feature, ensure that the selected access server is in the following condition:

- The T1 or E1 controllers are operational and configured for ISDN PRI.
- The D-channel interfaces are operational and configured for ISDN PRI.
- Each D-channel interface is configured with the `isdn incoming-voice modem` command.

For example, the selected PRI interfaces might have a configuration similar to the following:

```plaintext
interface Serial1/0/0:23
no ip address
no ip directed-broadcast
isdn switch-type primary-ni
isdn protocol-emulate network
isdn incoming-voice modem
no cdp enable
```

Also keep the following restrictions in mind as you configure network side ISDN PRI signaling, trunking, and switching:

- You can configure Cisco access server and access routers for either Network Side ISDN PRI for NI or Net5 switches.
- The trunking and COR parts of the Network Side ISDN PRI Signaling, Trunking, and Switching feature are available only on the Cisco AS5800 access server. In addition, call hairpinning without the need of a Voice Feature Card (and its digital signal processor) is available only on the Cisco AS5800 and Cisco AS5400. The remainder of the feature is platform-independent.
- The Cisco AS5800 and Cisco AS5400 switch both voice and data calls. The Cisco AS5300 switches only data calls.
- On the Cisco AS5800, direct-inward-dial (DID) switched calls can work without a Voice Feature Card, if the appropriate modem is present. Refer to the AS5800 hardware and software installation manuals for more information.
- On the Cisco AS5400, direct-inward-dial (DID) switched calls can work with only Trunk Feature Cards present. No Voice Feature Card or Modem Feature card are required.
- An interface that is a member of a Non-Facility Associated Signaling (NFAS) group cannot belong to a trunk group.
- The Cisco AS5400 supports Network Side ISDN PRI Signaling and Calling Switching Using Dial Peers. It does not support Trunk Group Resource Manager and Class of Restrictions.
- The Network Side ISDN PRI part of this feature runs on any ISDN-capable platform with PRI interfaces. The trunking and class of restrictions parts of this feature require the Cisco AS5800.

**Note**

To identify the hardware platform or software image information associated with a feature, use the Feature Navigator on Cisco.com to search for information about the feature. For more information, see the “Identifying Supported Platforms” section in the “Using Cisco IOS Software” chapter.
Configuring ISDN Network Side for the National ISDN Switch Type

To configure Network Side ISDN 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>&lt;br&gt;Router(config)# <code>isdn switch-type type</code>&lt;br&gt;or&lt;br&gt;Router(config-if)# <code>interface serial0/0/n</code>&lt;br&gt;and&lt;br&gt;Router(config-if)# <code>switch-type primary-ni</code></td>
<td>Sets the global ISDN switch type. Two types are supported:&lt;br&gt;- <code>primary-ni</code> for NI on a T1 line&lt;br&gt;- <code>primary-net5</code> for ETSI Net5 on an E1 line&lt;br&gt;Specifies the D-channel interface. For <code>n</code>, the D-channel number, use:&lt;br&gt;0:23 on a T1 PRI&lt;br&gt;0:15 on an E1 PRI&lt;br&gt;Sets the switch type on the interface.</td>
</tr>
<tr>
<td><strong>Step 2</strong>&lt;br&gt;Router(config-if)# <code>isdn protocol-emulate network</code></td>
<td>Enables network-side support on the PRI interface.</td>
</tr>
</tbody>
</table>

If you choose to configure Network Side ISDN PRI on individual interfaces in Step 1, repeat the configuration on the additional PRI interfaces.

Configuring ISDN Network Side for ETSI Net5 PRI

To configure a Cisco access router for ISDN Network Side for ETSI Net5 PRI, you can configure the `primary-net5` switch type globally or you can configure the `primary-net5` switch type on selected PRI interfaces. To configure ISDN Network Side for Net5, 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>&lt;br&gt;Router(config)# <code>isdn switch-type primary-net5</code>&lt;br&gt;or&lt;br&gt;Router(config-if)# <code>interface serial0/0/0:15</code>&lt;br&gt;Router(config-if)# <code>switch-type primary-net5</code></td>
<td>Sets the <code>primary-net5</code> global ISDN switch type. or&lt;br&gt;Specifies a D-channel interface to configure for ISDN Network Side for ETSI Net5 PRI.&lt;br&gt;Sets the <code>primary-net5</code> switch type on the interface.</td>
</tr>
<tr>
<td><strong>Step 2</strong>&lt;br&gt;Router(config-if)# <code>isdn protocol-emulate network</code></td>
<td>Enables network side support on the interface.</td>
</tr>
</tbody>
</table>

Repeat the configuration steps on all the additional PRI D-channel interfaces you want to configure for ISDN Network Side for ETSI Net5 PRI.
Configuring Global or Interface Trunk Groups

You can create trunk groups globally (using the one-command version of Step 1) or on each interface (using the two-command version of Step 1). To configure trunk groups, use the following commands beginning in global configuration mode:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1**  
Router(config)# trunk group group-number  
or  
Router(config-if)# interface serial0/0/n  
and  
Router(config-if)# trunk-group group-number | Defines the trunk group globally.  
Specifies the PRI D-channel. For n, the D-channel number, use:  
- 0:23 on a T1 PRI  
- 0:15 on an E1 PRI  
Adds the interface to a trunk group. If the trunk group has not been defined globally, it will be created now. |
| **Step 2**  
Router(config-if)# max-calls {voice | data | any} number | Applies a maximum number of calls restriction to the trunk group.  
This command can be repeated to apply a maximum number to different types of calls and, optionally, to specify whether the maximum applies to incoming or outgoing calls.  
**Note** Repeat Step 1 and Step 2 to create additional trunk groups and specify their restrictions, as needed for your traffic. |
| **Step 3**  
Router(config)# dial-peer voice tag pots | Enters dial-peer configuration mode and defines a remote dial peer. |
| **Step 4**  
Router(config-dial-peer)# trunkgroup group-number | Specifies the trunk group to be used for outgoing calls to the destination phone number. |

Configuring Classes of Restrictions

To configure COR for dial peers, use the following commands beginning in global configuration mode:
### Command Purpose

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Router(config)# dial-peer cor custom</th>
<th>Specifies that named classes of restrictions apply to dial peers and changes the command mode to COR configuration.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2</td>
<td>Router(config-cor)# name class-name</td>
<td>Provides a name for a custom class of restrictions. Note: Repeat this step for additional class names, as needed. These class names are used in various combinations to define the lists in Step 3 and Step 4.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Router(config)# dial-peer cor list list-name</td>
<td>Provides a name for a list of restrictions.</td>
</tr>
<tr>
<td>Step 4</td>
<td>Router(config-cor)# member class-name</td>
<td>Adds a COR class to this list of restrictions. The member is a class named in Step 2. Note: Repeat Step 3 and Step 4 to define another list and its membership, as needed.</td>
</tr>
<tr>
<td>Step 5</td>
<td>Router(config)# dial-peer voice tag pots</td>
<td>Enters dial-peer configuration mode and defines a remote dial peer.</td>
</tr>
<tr>
<td>Step 6</td>
<td>Router(config-dial-peer)# corlist incoming cor-list-name</td>
<td>Specifies the COR list to be used when this is the incoming dial peer.</td>
</tr>
<tr>
<td>Step 7</td>
<td>Router(config-dial-peer)# corlist outgoing cor-list-name</td>
<td>Specifies the COR list to be used when this is the outgoing dial peer. Note: Repeat Step 5 through Step 7 for additional dial peers, as needed.</td>
</tr>
</tbody>
</table>
Configuring ISDN T306 and T310 Timers

To configure the T306 and T310 timers, use the following commands beginning in global configuration mode:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Router(config)# interface serial controller:timeslot</td>
</tr>
<tr>
<td></td>
<td>Enters interface configuration mode for a D-channel serial interface.</td>
</tr>
<tr>
<td>Step 2</td>
<td>Router(config-if)# isdn t306 milliseconds</td>
</tr>
<tr>
<td></td>
<td>Sets the number of milliseconds that the gateway waits before clearing a call after the router sends out a disconnect message with a progress indicator of 8.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Router(config-if)# isdn t310 milliseconds</td>
</tr>
<tr>
<td></td>
<td>Sets the number of milliseconds that the gateway waits before clearing a call after it receives a Call Proceeding message.</td>
</tr>
</tbody>
</table>

To verify that the T306 timer is configured and operating correctly, perform the following steps:

| Step 1 | Display the running configuration file with the show running-config privileged EXEC command. Verify that the configuration is accurate for the T306 timer. See the “T306/T310 Timer Configuration Example” section for a sample configuration. |
| Step 2 | Enable the debug isdn q931 privileged EXEC command to trace the ISDN messages. |
| Step 3 | Place a call to the gateway. Disconnect the call and allow the far end to play its error message until the T306 timer expires. When the timer expires, the gateway should disconnect the call. |

Verifying Network Side ISDN PRI Signaling, Trunking, and Switching

To learn whether the Network Side ISDN PRI Signaling, Trunking, and Switching feature is configured successfully, perform the following steps:

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Enter the show isdn status command to learn whether an appropriate switch type is specified either globally or on the D-channel interface:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Router# show isdn status serial 0:15</td>
</tr>
<tr>
<td></td>
<td>Global ISDN Switchtype = primary-net5</td>
</tr>
<tr>
<td></td>
<td>ISDN Serial0:15 interface</td>
</tr>
<tr>
<td></td>
<td>******* Network side configuration *******</td>
</tr>
<tr>
<td></td>
<td>dsl 0, interface ISDN Switchtype = primary-net5</td>
</tr>
</tbody>
</table>
Step 2 Enter the `show dial-peer voice` command to learn whether the trunk group COR list and permission fields are set as desired on a dial peer:

```
Router# show dial-peer voice
```

```
VoiceEncapPeer210
  information type = voice,
  tag = 210, destination-pattern = '221',
  answer-address = '', preference=0,
  numbering Type = 'unknown'
  group = 210, Admin state is up, Operation state is up,
  incoming called-number = '221', connections/maximum = 4/unlimited,
  DTMF Relay = disabled,
  Modem = system passthrough,
  huntstop = disabled,
  application associated:
    permission :both
  incoming COR list: listA
  outgoing COR list: minimum requirement
  type = pots, prefix = '221',
  forward-digits default
  session-target = '', voice-port = '1/0/8:D',
  direct-inward-dial = enabled,
  digit_strip = enabled,
```

**Note** The above output is for a dial peer configured with incoming COR list “listA” and without an outgoing COR list configured. When no outgoing COR list is configured, the `show dial-peer voice` command displays “minimum requirement” in the outgoing COR list output. When no incoming COR list is configured, the `show dial-peer voice` command displays “maximum capability” in the incoming COR list output.

Step 3 Enter the `show dial-peer cor` command to display the COR names and lists you defined. For example, if you configured COR as shown in the following sample display, the `show dial-peer cor` command output reflects that configuration.

**Sample Configuration**

```
dial-peer cor custom
  name 900block
  name 800_call
  name Catchall

! dial-peer cor list list1
  member 900block
  member 800_call

! dial-peer cor list list2
  member 900block

! dial-peer cor list list3
  member 900block
  member 800_call
  member Catchall
```
Verification

**Step 4** Enter the `show tgrm` command to verify the trunk group configuration. For example, if you configured trunk groups as shown in the following sample display, the `show tgrm` command output reflects that configuration.

**Sample Configuration**

```plaintext
interface Serial1/0/8:15
   no ip address
   ip mroutecache
   no keepalive
   isdn switch-type primary-net5
   isdn protocol-emulate network
   isdn incoming-voice modem
   trunk-group 2
   no cdp enable
```

**Verification**

```
Router# show tgrm

<table>
<thead>
<tr>
<th>Trunk</th>
<th>Any in</th>
<th>Vce in</th>
<th>Data in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Any out</td>
<td>Vce out</td>
<td>Data out</td>
</tr>
</tbody>
</table>

| 2     | 65535 | 65535 | 65535  |
| 65535 | 65535 | 65535 |
| 0 Retries |

Interface Se1/0/1:15  Data = 0, Voice = 0, Free = 30
Interface Se1/0/8:15  Data = 2, Voice = 0, Free = 28
```

Total calls for trunk group: Data = 2, Voice = 0, Free = 58
Selected Voice Interface :Se1/0/1:15
Selected Data Interface  :Se1/0/1:15
Step 5  Enter the **show isdn status** command to display the status of both Network Side ISDN PRI and call switching:

```
Router# show isdn status
```

```
Global ISDN Switchtype = primary-net5
ISDN Serial1/0/0:15 interface
    ****** Network side configuration ******
    dsl 0, interface ISDN Switchtype = primary-net5
Layer 1 Status:
    ACTIVE
Layer 2 Status:
    TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
Layer 3 Status:
    2 Active Layer 3 Call(s)
Activated dsl 0 CCBs = 2
    CCB:callid=3C71, sapi=0, ces=0, B-chan=31, calltype=data
    CCB:callid=3C72, sapi=0, ces=0, B-chan=30, calltype=data
The Free Channel Mask: 0x9FFF7FFF

ISDN Serial1/0/1:15 interface
/1/0/8
filtering...
ISDN Serial1/0/8:15 interface
    ****** Network side configuration ******
    dsl 8, interface ISDN Switchtype = primary-net5
Layer 1 Status:
    ACTIVE
Layer 2 Status:
    TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
Layer 3 Status:
    2 Active Layer 3 Call(s)
Activated dsl 8 CCBs = 2
    CCB:callid=BB40, sapi=0, ces=0, B-chan=1, calltype=DATA
    CCB:callid=BB41, sapi=0, ces=0, B-chan=2, calltype=DATA
The Free Channel Mask: 0xFFFF7FFC
```

---

**Monitoring Network Side ISDN PRI**

To monitor Network Side ISDN PRI, use the following commands in EXEC mode as needed:

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router# <strong>show controllers e1 slot/port</strong></td>
<td>Checks Layer 1 (physical layer) of the PRI over E1.</td>
</tr>
<tr>
<td>Router# <strong>show controllers e1 number call-counters</strong></td>
<td>Displays the number of calls and call durations on an E1 controller.</td>
</tr>
<tr>
<td>Router# <strong>show interfaces serial slot/port bchannel channel-number</strong></td>
<td>Displays information about the physical attributes of the ISDN PRI over channelized E1 B and D channels.</td>
</tr>
<tr>
<td>Router# **show isdn {active</td>
<td>history</td>
</tr>
</tbody>
</table>
Monitoring TGRM

To monitor and maintain the Trunk Group Resource Manager, use the following command in EXEC mode:

```
Router# show tgrm
```

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Router# show tgrm</td>
<td>Displays TGRM information for debugging purposes.</td>
</tr>
</tbody>
</table>

Configuration Examples for Network Side ISDN PRI Signaling, Trunking, and Switching

This section provides the following configuration examples:

- Call Switching and Dial Peers Configuration on T1/T3 Example
- Trunk Group Configuration Example
- COR for Dial Peer Configuration Example
- COR Based on Outgoing Dial Peers Example
- Dial Peers and Trunk Groups for Special Numbers Examples
- ISDN Network Side for ETSI Net5 PRI Configuration on E1 Example
- T306/T310 Timer Configuration Example

Call Switching and Dial Peers Configuration on T1/T3 Example

The following example enables Network Side ISDN PRI, call switching, and dial peers:

```
isdn switch-type primary-ni
!
controller T1 1/0/0
framing esf
linecode b8zs
pri-group timeslots 1-24
!
interface Serial1/0/0:23
no ip address
no ip directed-broadcast
isdn switch-type primary-ni
isdn protocol-emulate network
isdn incoming-voice modem
no cdp enable
!
dial-peer voice 11 pots
incoming called-number 222
destination-pattern 222
direct-inward-dial
port 1/0/0:D
prefix 555
```
Trunk Group Configuration Example

The following trunk group allows only voice calls:

```
trunk group 1
max-calls data 0
```

The following trunk group allows a maximum of 20 outgoing voice calls:

```
trunk group 2
max-calls voice 20 direction out
```

The following trunk group allows a maximum of 50 incoming calls:

```
trunk group 3
max-calls any 50 direction in
```

The following trunk group allows a maximum of 100 calls, 30 of which can be voice (incoming or outgoing), and 60 of which can be incoming data (the remaining 10 will be unused):

```
trunk group 4
max-calls any 100
max-calls voice 30
max-calls data 60 direction in
```

COR for Dial Peer Configuration Example

The following example defines trunk group 101, establishes Network Side ISDN PRI on two PRI interfaces, and assigns both interfaces to trunk group 101. In addition, it establishes three COR lists, and specifies which incoming dial peers can make calls to 800 and which can make calls to 900 area codes. This example adopts a useful mnemonic pattern: the `dial-peer voice` tags for incoming calls correspond to the answer address (the phone number being called) and the `dial-peer voice` tags for outgoing calls correspond to the destination pattern.

```
trunk group 101
!
interface Serial1/0/0:23
   no ip address
   no ip directed-broadcast
   isdn switch-type primary-ni
   isdn protocol-emulate network
   isdn incoming-voice modem
   no cdp enable
   trunk-group 101
!
interface Serial1/0/1:23
   no ip address
   no ip directed-broadcast
   isdn switch-type primary-ni
   isdn protocol-emulate network
   isdn incoming-voice modem
   no cdp enable
   trunk-group 101
!
dial-peer cor custom
   name 900_call
   name 800_call
!
dial-peer cor list list1
   member 900_call
```
dial-peer cor list list2
  member 800_call
!
dial-peer cor list list3
  member 900_csll
  member 800_call
!
dial-peer voice 525 pots
  answer-address 408525....
  corlist incoming list3
  direct-inward-dial
!
dial-peer voice 526 pots
  answer-address 408526....
  corlist incoming list2
  direct-inward-dial
!
dial-peer voice 900 pots
  destination-pattern 1900........
  direct-inward-dial
  trunkgroup 101
  prefix 333
  corlist outgoing list1
!
dial-peer voice 12345 pots
  destination-pattern .T
  direct-inward-dial
  trunkgroup 202
!

**COR Based on Outgoing Dial Peers Example**

A typical application of COR is to define a COR name for the number that an outgoing dial peer serves, then define a list that contains only that COR name, and assign that list as **corlist outgoing** for this outgoing dial peer. For example, dial peer with destination pattern 5x can have a **corlist outgoing** that contains COR 5x.

The next step, in the typical application, is to determine how many call permission groups are needed, and define a COR list for each group. For example, group A is allowed to call 5x and 6x, and group B is allowed to call 5x, 6x, and 1900x. Then, for each incoming dial peer, we can assign a group for it, which defines what number an incoming dial peer can call. Assigning a group means assigning a **corlist incoming** to this incoming dial peer.

```bash
config terminal
dial-peer cor custom
  name 5x
  name 6x
  name 1900x
!
dial-peer cor list listA
  member 5x
  member 6x
!
dial-peer cor list listB
  member 5x
  member 6x
  member 1900x
!
dial-peer cor list list5x
  member 5x
!
```
dial-peer cor list list6x
  member 6x
!
dial-peer cor list list1900x
  member 1900x

! outgoing dialpeer 100, 200, 300
dial-peer voice 100 pots
  destination-pattern 5T
corlist outgoing list5x
dial-peer voice 200 pots
  destination-pattern 6T
corlist outgoing list6x
dial-peer voice 300 pots
  destination-pattern 1900T
corlist outgoing list1900x
!
! incoming dialpeer 400, 500
dial-peer voice 400 pots
  answer-address 525....
corlist incoming listA
dial-peer voice 500 pots
  answer-address 526
corlist incoming listB

In this example, calls from 525xxxx are not able to use dial peer 300, which means they will not be able to make 1900 calls (long distance calls to the 900 area code). But calls from 526xxxx can make 1900 calls.

**Dial Peers and Trunk Groups for Special Numbers Examples**

The following partial examples show setups for handling special numbers such as the 911 emergency number, the 0 local operator number, the 00 long-distance operator number, and so forth. “T” in these examples stands for the “interdigital timeout.” Calls to emergency numbers should not wait for this timeout, so 911 is used as the destination pattern, not 911T.

This partial example sets up a trunk group to handle calls going to the operator (0):

dial-peer voice 100 pots
  destination-pattern 0T
  trunkgroup 203
!

The following partial example sets up a trunk group to handle calls to the long distance operator (00):

dial-peer voice 200 pots
  destination-pattern 00T
  trunkgroup 205
!

The following partial example sets up a trunk group to handle calls to the international direct dial (011):

dial-peer voice 300 pots
  destination-pattern 011T
  trunkgroup 207
!

The following partial example sets up a trunk group to handle street line calls (calls that get a dial tone for an outside line):

dial-peer voice 400 pots
  destination-pattern 9T
  trunkgroup 209
!
The following partial example sets up a trunk group to handle calls for directory assistance:

```
dial-peer voice 500 pots
destination-pattern 411
trunkgroup 211
```

The following partial example sets up a trunk group to handle calls to the 911 emergency number. Emergency calls will not require a wait for the interdigital timeout to expire. They will be completed immediately.

```
dial-peer voice 600 pots
destination pattern 911
trunkgroup 333
```

### ISDN Network Side for ETSI Net5 PRI Configuration on E1 Example

The following example enables the ISDN Network Side for ETSI Net5 PRI feature on an access server on which ISDN PRI is already configured and operational. In this example, the Net5 PRI switch type is set on the D-channel interface, and the global interface type is not shown.

```
controller e1 0
pri-group timeslots 1-31
exit

interface serial0:15
  no ip address
  no ip directed-broadcast
  ip mroute-cache
  isdn switch-type primary-net5
  isdn protocol-emulate network
```

### T306/T310 Timer Configuration Example

The following example configures the T306 and T310 disconnect timers:

```
interface Serial0:23
  no ip address
  no ip directed-broadcast
  encapsulation ppp
dialer rotary-group 0
  isdn switch-type primary-5ess
  isdn incoming-voice modem
  isdn t306 60000
  isdn t310 40000
```