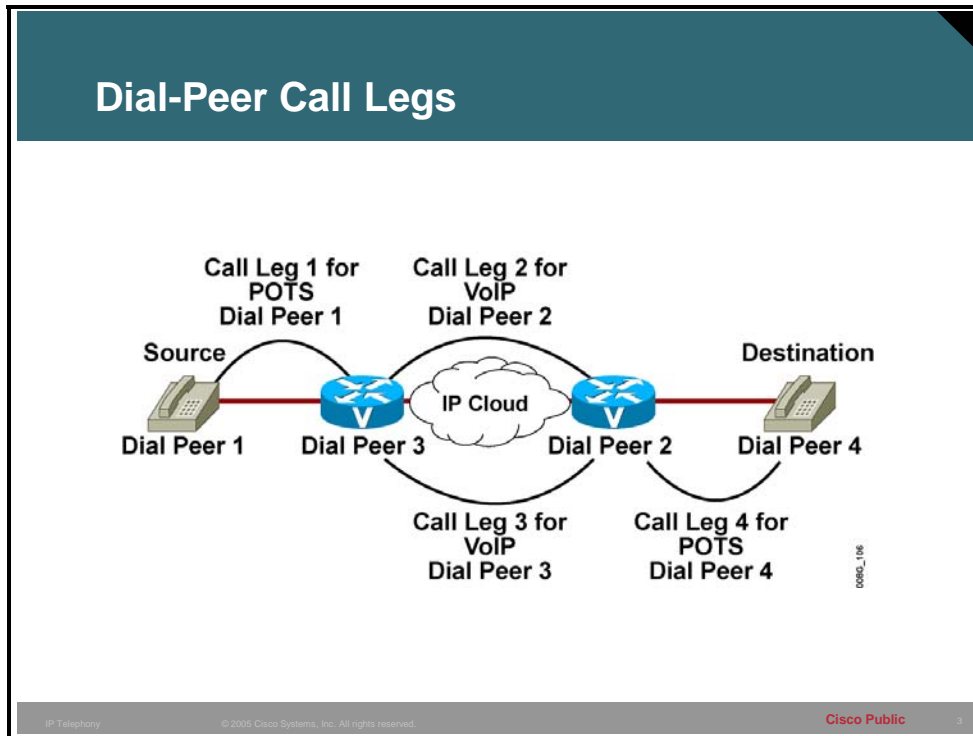


# Call Establishment Principles

## What Are Call Legs?

This topic describes call legs and their relationship to other components.



Call legs are logical connections between any two telephony devices, such as gateways, routers, Cisco CallManagers, or telephony endpoint devices.

Call legs are router-centric. When an inbound call arrives, it is processed separately until the destination is determined. Then a second outbound call leg is established, and the inbound call leg is switched to the outbound voice port.

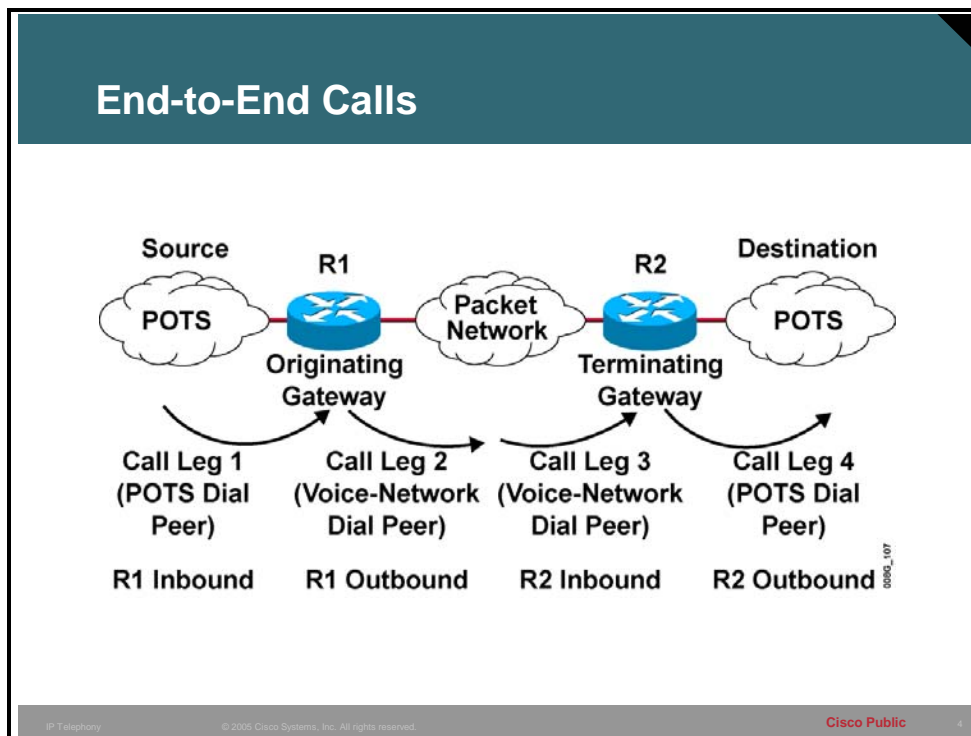
### Example: Call Legs Defined

The connections are made when you configure dial peers on each interface. An end-to-end call consists of four call legs: two from the source router perspective (as shown in the figure), and two from the destination router perspective. To complete an end-to-end call from either side and send voice packets back and forth, you must configure all four dial peers.

Dial peers are used only to set up calls. When the call is established, dial peers are no longer used.

# End-to-End Calls

This topic explains how routers interpret call legs to establish end-to-end calls.



An end-to-end voice call consists of four call legs: two from the originating router (R1) or gateway perspective, and two from the terminating router (R2) or gateway perspective. An inbound call leg originates when an incoming call comes *into* the router or gateway. An outbound call leg originates when a call is placed *from* the router or gateway.

A call is segmented into call legs and a dial peer is associated with each call leg. The process for call setup is listed below:

1. The plain old telephone service (POTS) call arrives at R1 and an inbound POTS dial peer is matched.
2. After associating the incoming call to an inbound POTS dial peer, R1 creates an inbound POTS call leg and assigns it a Call ID (call leg 1).
3. R1 uses the dialed string to match an outbound voice network dial peer.
4. After associating the dialed string to an outbound voice network dial peer, R1 creates an outbound voice network call leg and assigns it a Call ID (call leg 2).
5. The voice network call request arrives at R2 and an inbound voice network dial peer is matched.
6. After R2 associates the incoming call to an inbound voice network dial peer, R2 creates the inbound voice network call leg and assigns it a Call ID (call leg 3). At this point, both R1 and R2 negotiate voice network capabilities and applications, if required.

When the originating router or gateway requests nondefault capabilities or applications, the terminating router or gateway must match an inbound voice network dial peer that is configured for such capabilities or applications.

7. R2 uses the dialed string to match an outbound POTS dial peer.
8. After associating the incoming call setup with an outbound POTS dial peer, R2 creates an outbound POTS call leg, assigns it a Call ID, and completes the call (call leg 4).

# Steps to Configure Class of Restriction

This topic presents the steps to configure Class of Restriction (COR).

## Steps to Configure Class of Restriction

- **Step 1 – Configure the Class of Restriction names**
- **Step 2 – Configure the Class of Restriction lists and members**
- **Step 3 – Assign the COR list to the dial peers**
- **Step 4 - Assign the COR to the ephone-dns**

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## Steps to Configure Class of Restriction

### Step 1 – Configure the Class of Restriction names

```
CMERouter(config)#  
dial-peer cor custom
```

- **Enters COR config mode where classes of restrictions are specified**

```
CMERouter(config-dp-cor)#  
name class-name
```

- **Used to specify a class of restriction**

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## Step 1 Define the name of the COR

Before relating a COR to a dial peer, it needs to be named. This is important because the COR list needs to refer to these names to apply the COR to dial peers or ephone-dns. Multiple names can be added to represent various COR criteria. The 'dial-peer cor custom' and 'name' commands define the COR functionality. Possible names: call1900, call527, call9. Up to 64 COR names can be defined under a dial peer cor custom. This means that a configuration cannot have more than 64 COR names and A COR list would have a limitation of 64 members.

### Example: COR naming and list

```
CMERouter(config)#dial-peer cor custom
```

```
CMERouter(config-dp-cor)#name local_call
```

```
CMERouter(config-dp-cor)#name 911
```

```
CMERouter(config-dp-cor)#name 1800
```

```
CMERouter(config-dp-cor)#name 1900
```

## Steps to Configure Class of Restriction

### Step 2 – Configure the Class of Restriction lists and members

```
CMERouter(config)#
```

`dial-peer cor list list-name`

- Provides a name for a list of restrictions

```
CMERouter(config-dp-corlist)#
```

`member class-name`

- Adds a COR class to this list of restrictions

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- Step 2** Dial peer COR list and member commands set the capabilities of a COR list. COR list is used in dial peers to indicate the restriction that a dial peer has as an outgoing dial peer. The order of entering the members is not important and the list can be appended or made shorter by removing the members.

### Example: Define the COR lists

```
CMERouter(config)#dial-peer list callLocal
```

```
CMERouter(config-dp-corlist)member local_call
```

```
CMERouter(config)#dial-peer list call911
```

```
CMERouter(config-dp-corlist)member 911
```

```
CMERouter(config)#dial-peer list call1800
```

```
CMERouter(config-dp-corlist)member 1800
```

```
CMERouter(config)#dial-peer list call1900
```

```
CMERouter(config-dp-corlist)member 1900
```

This is the third step to configure Class of Restriction (COR).

## Steps to Configure Class of Restriction

### Step 3 – Assign the COR list to the dial peers

```
CMERouter(config)#
```

`dial-peer voice number {pots | voip}`

- Defines a dial-peer and enters dial-peer config mode

```
CMERouter(config-dial-peer)#
```

`corlist {incoming | outgoing} list-name`

- Specifies a COR list to be used when the dial-peer is either the incoming or outgoing dial-peer

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- Step 3** Apply the incoming or outgoing COR list to the dial peer. The incoming COR list specifies the capacity of dial-peer to initiate a certain series or Class of Calls. The outgoing COR list specifies the restriction on dial peers able to place calls to a given number range or port.

### Example: Apply the COR to the dial peer

```
CMERouter(config)#dial-peer voice 1 pots  
  
CMERouter(config-dial-peer)#destination-pattern 1500  
  
CMERouter(config-dial-peer)#port 1/0/0  
  
CMERouter(config-dial-peer)#corlist incoming call911  
  
CMERouter(config)#dial-peer voice 2pots  
  
CMERouter(config-dial-peer)#destination-pattern 1800.....  
  
CMERouter(config-dial-peer)#port 2//1  
  
CMERouter(config-dial-peer)#corlist outgoing call1800
```

## Steps to Configure Class of Restriction

### Step 4 – Assign the COR list to the ephone-dns

```
CMERouter(config)#
```

```
ephone-dn tag
```

- Defines an ephone-dn and enters ephone-dn mode

```
CMERouter(config-ephone-dn)#
```

```
cor {incoming | outgoing} list-name
```

- Specifies a COR list to be used when the ephone-dn is used as either the incoming or outgoing part of a call

- Step 4** Apply the incoming or outgoing COR list to an ephone-dn. The Incoming COR list specifies the capacity of ephone-dn to initiate a certain series or Class of Calls. The outgoing COR list specifies the restriction on the ephone-dn to be able to place calls to a given number range or port.

**Example: Apply the COR to ephone-dns**

```
CMERouter(config)#ephone-dn 1  
  
CMERouter(config-ephone-dn)#number 1000  
  
CMERouter(config-ephone-dn)#description LobbyPhone  
  
CMERouter(config-ephone-dn)#cor incoming call911  
  
CMERouter(config)#ephone-dn 2  
  
CMERouter(config-ephone-dn)#number 1001  
  
CMERouter(config-ephone-dn)#description ConfRoomPhone  
  
CMERouter(config-ephone-dn)#cor incoming callLocal
```



This is an example of Class of Restriction (COR).

## Class of Restriction (COR)

```
dial-peer cor custom
  name 1xxx
  name 2xxx
dial-peer cor list Executive
  member 1xxx
  member 2xxx
dial-peer cor list Employee
  member 1xxx
ephone-dn 1
  number 1000
  cor incoming Employee
ephone-dn 2
  number 2000
  cor outgoing Executives
```

- The executive can call the employee but the employee cannot call the executive
- The incoming COR Employee is not a superset of the Executive, so the call will not succeed

**Ephone-dn 1  
Employee  
Ext 1000**

**Ephone-dn 2  
Executive  
Ext 2000**

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### Example: COR used to restrict access internally within Cisco CME

COR can be used to regulate internal calls and whether they are allowed or not. This example shows two IP phones with an employee and an executive. In this company, the executive should be able to call anyone but employees should not be able to call the executive. Notice that to accomplish the required results, both an incoming COR on the employee must be configured as well as an outgoing COR on the executive. There is no outgoing COR on the employee and as a result anyone can call the employee phone regardless if the phone calling has an incoming COR set or not. The lack of an incoming COR on the executive will allow the executive to call any phone regardless of the outgoing COR setting on the phone called.

This topic describes Class of Restriction case study.

## Class of Restriction – Case Study

### Class of Restriction Case Study – XYZ company






- The XYZ company wishes to prevent toll fraud by restricting the destinations on the PSTN that IP phones and analog phones attached to FXS port can call.
- There should be no restrictions internally; everyone internal should be able to call anyone else internal
- All phones **MUST** be able to call 911
- Within the XYZ company there are Lobby phones, Employee phones, Sales, and Executive phones
- The Lobby phone should be able to call only 911 on the PSTN
- The Employee phones should be able to call 911 and local calls on the PSTN
- The Sales phones should be able to call 911, local calls, and domestic long distance on the PSTN
- The executives should be able to call 911, local call, domestic long distance, and international on the PSTN
- No one should be able to call 900 numbers

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Case Study of the XYZ Company.

## Class of Restriction – Case Study

```
dial-peer cor custom
name 911
name local
name long_distance
name international
name 900
```

	<b>911</b>
	<b>local</b>
	<b>long_distance</b>
	<b>international</b>
	<b>900</b>

- **Step 1 - Define the classes of restriction**

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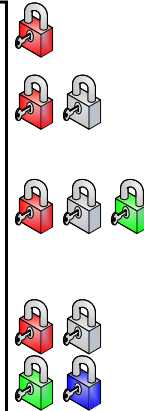
**Step 1** The first step will be to define the COR names.

## Class of Restriction – Case Study

```
dial-peer cor list call911
member 911
dial-peer cor list callLocal
member local
dial-peer cor list callLD
member long_distance
dial-peer cor list callInt
member international
dial-peer cor list call900
member 900
```



```
dial-peer cor list Lobby
member 911
dial-peer cor list Employee
member 911
member local
dial-peer cor list Sales
member 911
member local
member long_distance
dial-peer cor list Executive
member 911
member local
member long_distance
member international
```



### • Step 2 – Define the COR lists and members

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- Step 2** The second step will be to define the COR list and its member or members. Notice that none of the COR lists contain the member 900.

## Class of Restriction – Case Study

### • Step 3 – Assign the COR to the PSTN dial-peers

Dial-peer 1 – COR out call911



Dial-peer 2 – COR out callLD



Dial-peer 3 – COR out callLocal



Dial-peer 4 – COR out callInt



Dial-peer 5 – COR out call900



```
dial-peer voice 1 pots
destination-pattern 911
port 1/0/0
corlist outgoing call911
dial-peer voice 2 pots
destination-pattern 1[2-9]..[2-9].....
port 1/0/0
corlist outgoing callLD
dial-peer voice 3 pots
destination-pattern [2-9].....
port 1/0/0
corlist outgoing callLocal
dial-peer voice 5 pots
destination-pattern 1011T
port 1/0/0
corlist outgoing callInt
dial-peer voice 6 pots
destination-pattern 1900.....
port 1/0/0
corlist outgoing call900
```

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- Step 3** Assign the COR to the dial peers that govern PSTN access. To restrict calls to the PSTN destinations, the outbound COR setting will be defined.

**Note** Although not shown here, the inbound COR can be set to regulate where calls arriving from the PSTN will be allowed to connect internally.

## Class of Restriction – Case Study

- **Step 4 – Assign the COR to the ephone-dns**

	<b>Ephone-dn 1</b> COR in Lobby Ext 1001	
	<b>Ephone-dn 2</b> COR in Employee Ext 1002	 
	<b>Ephone-dn 3</b> COR in Sales Ext 1003	  
	<b>Ephone-dn 4</b> COR in Executive Ext 1004	   

```
ephone-dn 1
number 1001
cor incoming Lobby
ephone-dn 2
number 1002
cor incoming Employee
ephone-dn 3
number 1003
cor incoming Sales
ephone-dn 4
number 1004
cor incoming Executive
```

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**Step 4** Assign the incoming COR to the Lobby, Employee, Sales, and Executive ephone-dns. Notice that no ephone-dn has the ability to call 900 numbers.

## Class of Restriction – Case Study

### Results:

- The Lobby ephone-dn can only call 911 on the PSTN
- The Employee ephone-dn can call 911 and local calls on the PSTN
- The Sales ephone-dn can call 911, local calls, and long distance on the PSTN
- The Executive ephone-dn can call 911, local calls, long distance, and international on the PSTN
- No one can call 900 numbers



Ephone-dn 1  
COR in Lobby  
Ext 1001



Ephone-dn 2  
COR in Employee  
Ext 1002



Ephone-dn 3  
COR in Sales  
Ext 1003



Ephone-dn 4  
COR in Executive  
Ext 1004

The result of the configuration is shown.