



CCBOOTCAMPs CCIE® Voice Technology Lab Workbook Version 3.0

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CCBOOTCAMP's CCIE Voice Lab Technology Workbook

Version 3.0

CCIE Voice 3.0 Blueprint

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A note from the Author:

"I know the price of success: dedication, hard work, and a devotion to the things you want to see happen." -- Frank Lloyd Wright

I want to be the first to congratulate you on the decision to pursue your CCIE. The journey in which you are about to partake has been ventured by many and achieved by few. It is this dedication, hard work, and devotion that separates those who achieve their number and those who do not.

Here at CCBOOTCAMP we believe in helping students achieve one of the greatest accomplishments in our industry: becoming a Cisco Certified Internetwork Expert. All the instructors at CCBOOTCAMP have been down the same path you are about to take and know what hard work and sacrifice you are about to endure. It is the commitment of CCBOOTCAMP to help you in every step of your journey.

As with any test process, you should always prepare in the manner in which you will be taking the test. You should structure your lab time so that tasks can be accomplished within an eight hour timeframe. A good time management strategy is the key to success in the CCIE lab. Also, how you study is critical to your success. Many students tend to shy away from topics in which they are weak or have little knowledge. However, it is crucial that you concentrate on these areas. Most times you will find that the specific topic is quite simple once you understand the basics of that technology.

Last, but certainly not least, have fun in this endeavor. The journey to becoming a CCIE is long and hard for a reason but the moment you get your number, all the hard work will undoubtedly seem worth the effort. Best of luck!

Chris Fortner - CCIE #18065
CCIE Voice Program Manager

General Information:

CCIE Voice Blueprint 3.0:

Listed below is the current published 3.0 blueprint from Cisco Systems. The CCBOOTCAMP remote racks features a hardware, where relevant, and software match based on the published blueprint.

Lab Equipment:

- Cisco MCS-7845 Media Convergence Servers
- Cisco 3825 Series Integrated Services Routers (ISR)
- Cisco 2821 Series Integrated Services Routers (ISR)
- ISR Modules and Interface Cards
 - VWIC2-1MFT-T1/E1
 - PVDM2
 - HWIC-4ESW-POE
 - NME-CUE
- Cisco Catalyst 3750 Series Switches
- IP Phones and Soft Clients

Software Versions:

Any major software release which has been generally available for six months is eligible for testing in the CCIE Voice Lab Exam.

- Cisco Unified Communications Manager 7.0
- Cisco Unified Communications Manager Express 7.0
- Cisco Unified Contact Center Express 7.0
- Cisco Unified Presence 7.0

- Cisco Unity Connection 7.0
- All routers use IOS version 12.4T Train.
- Cisco Catalyst 3750 Series Switches uses 12.2 Main Train
- Network Interfaces
 - Fast Ethernet
 - Frame Relay
- Telephony Interfaces
 - T1
 - E1

Pre Configuration:

The pre configuration files for the voice racks of CCBOOTCAMP can be downloaded from <http://www.ccbootcamp.com/download/Workbook/V3/configs.zip> which will contain the the base information for the start of all labs.

Tips for the initial setup:

- Define under the console (line con 0) the command 'no exec-timeout' in order to avoid inactivity logout.
- Define some useful shortcuts that may save precious time under aliases, samples would be: 'show call active voice brief', 'show gatekeeper call status' and other commands you use often.
- Think ahead and try not to touch any page more than once or twice.

Cisco's Non-Disclosure Agreement:

This book was written in high respect to the CCIE certification and resists any use of it in order to violate Cisco's Non-Disclosure Agreement. We will not answer questions regarding things that relate to actual LAB exam and will not take part in activities that stand against the CCIE NDA.

For complete NDA specification, please use the following URL:

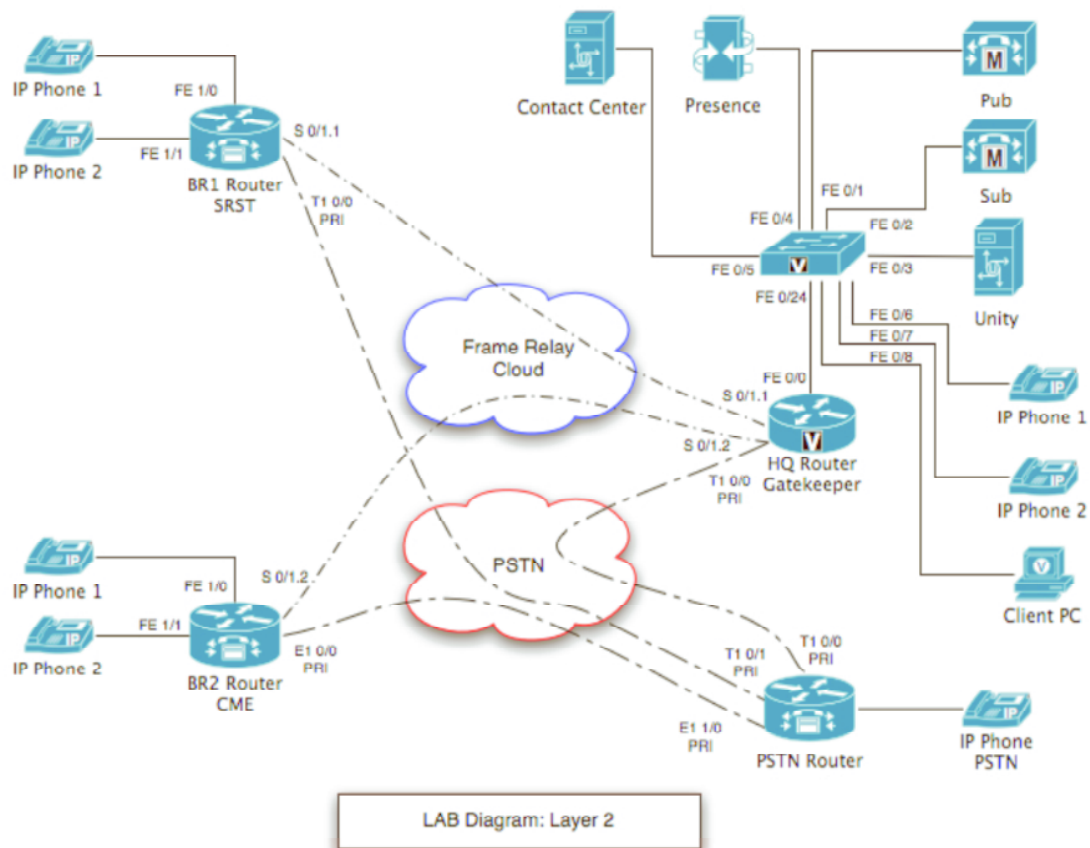
http://www.cisco.com/web/learning/le3/ccie/exam/violation_rules.html

Read Before Start:

Here are some simple rules to follow during you lab which should be taken into consideration before you configure any devices.

1. All devices should register to the subscriber and then the publisher.
2. All usernames and passwords for devices are "admin" and "cisco5796" unless specified in your lab.
3. Where you see "YY" that is your rack number.
4. All devices should pull NTP from the HQ1 router and should be set to the appropriate time zone.
5. Credit will only be give for working solutions.

Lab Topology :



Note: Please note that ports may vary on different racks so please check your connections with “show cdp neighbors”.

Lab Dial Plan and Addressing:

Phone	Number	Protocol	Class of Service
HQ Phone 1	1001	SCCP	International
HQ Phone 2	1002	SIP	Long Distance
BR1 Phone 1	2001	SCCP	International
BR1 Phone 2	2002	SIP	Internal
BR2 Phone 1	3001	SCCP	International
BR2 Phone 2	3002	SCCP	Local

Site	PSTN E.164 Address	PSTN Number
HQ	7029461...	7029465000
BR1	7023332...	7023335000
BR2	442076303...	442076305000
ALL	911	911

Server	IP Address	Login
Publisher	10.1.200.21	admin:cisco5796
Subscriber	10.1.200.25	admin:cisco5796
Unity Connections	10.1.200.22	admin:cisco5796
Presence	10.1.200.23	admin:cisco5796
Contact Center	10.1.200.24	administrator:enableme

Chapter 1 – Basic Campus Design

Topics included in this chapter:

- A. DHCP, TFTP
- B. Catalyst voice and data VLAN configuration
- C. Catalyst VTP configuration

Tasks to accomplish:

1. Configure VLANS and IP networks in all three sites according to the following two tables:

VLAN	HQ	BR1	BR2
Servers	10	N/A	N/A
Data	20	120	220
Voice	30	130	230

Network	HQ	BR1	BR2
Servers	10.1.200.0/24	N/A	N/A
Data	10.YY.20.0/24	10.YY.120.0/24	10.YY.220.0/24
Voice	10.YY.30.0/24	10.YY.130.0/24	10.YY.230.0/24

2. Make sure you set all voice traffic to use the voice VLAN for all sites.
3. Configure phones on HQ site to have IP addresses 120–130, use IOS DHCP on the HQ Catalyst 3750 to accomplish this task.

4. Configure BR1 phones to have IP addresses of 130–140 using the IOS DHCP on the HQ Router.
5. Configure BR2 phones to have IP addresses 210–220 using the IOS DHCP on the BR2 router.
6. Configure HQ router as an NTP master clock with stratum 2 for local time zone in Los Angeles and configure BR1 and BR2 to synchronize their clocks to HQ. BR1 is in New York time zone and BR2 is in India.

Solutions

1. Start with "show vlan" and make sure you have all VLANS defined in all devices. If not create them:

HQ:

```
HQ-3750#config t
Enter configuration commands, one per line. End with CNTL/Z.
HQ-3750(config)#vlan 10
HQ-3750(config-vlan)#name Servers
HQ-3750(config-vlan)#vlan 20
HQ-3750(config-vlan)#name Data
HQ-3750(config-vlan)#vlan 30
HQ-3750(config-vlan)#name Voice
HQ-3750(config-vlan)#^Z
HQ-3750#

HQ-3750#show vlan

VLAN Name                Status    Ports
-----
1    default                active    Gi1/0/8, Gi1/0/9, Gi1/0/10
                                           Gi1/0/11, Gi1/0/12, Gi1/0/13
                                           Gi1/0/14, Gi1/0/15, Gi1/0/16
                                           Gi1/0/17, Gi1/0/18, Gi1/0/19
                                           Gi1/0/20, Gi1/0/21, Gi1/0/22
10   Servers                active    Gi1/0/1, Gi1/0/2, Gi1/0/3
                                           Gi1/0/4, Gi1/0/5
20   Data                  active    Gi1/0/6, Gi1/0/7, Gi1/0/24
30   Voice                 active    Gi1/0/6, Gi1/0/7
1002 fddi-default         act/unsup
1003 token-ring-default   act/unsup
1004 fddinet-default      act/unsup
1005 trnet-default        act/unsup

VLAN Type  SAID      MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
-----
1    enet  100001   1500  -    -    -    -    -    0      0
10   enet  100010   1500  -    -    -    -    -    0      0
20   enet  100020   1500  -    -    -    -    -    0      0
30   enet  100030   1500  -    -    -    -    -    0      0

VLAN Type  SAID      MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
-----
1002 fddi  101002   1500  -    -    -    -    -    0      0
1003 tr   101003   1500  -    -    -    -    -    0      0
1004 fdnet 101004   1500  -    -    -    ieee -    0      0
1005 trnet 101005   1500  -    -    -    ibm  -    0      0

Remote SPAN VLANs
-----

Primary Secondary Type      Ports
-----
```

HQ-3750#

BR1:

```
BR1-Router#vlan database
BR1-Router(vlan)#vlan 120 name Data state active
VLAN 120 added:
  Name: Data
  State ACTIVE
BR1-Router(vlan)#vlan 130 name Voice state active
VLAN 130 added:
  Name: Voice
  State ACTIVE
BR1-Router(vlan)#exit
APPLY completed.
Exiting...
BR1-Router#
```

```

BR1-Router(vlan)#show current
VLAN ISL Id: 1
Name: default
Media Type: Ethernet
VLAN 802.10 Id: 100001
State: Operational
MTU: 1500
Translational Bridged VLAN: 1002
Translational Bridged VLAN: 1003

VLAN ISL Id: 120
Name: Data
Media Type: Ethernet
VLAN 802.10 Id: 100120
State: Operational
MTU: 1500

VLAN ISL Id: 130
Name: Voice
Media Type: Ethernet
VLAN 802.10 Id: 100130
State: Operational
MTU: 1500

BR1-Router(vlan)#

```

BR2:

2. Start by finding what devices are connected to what ports:

3. In order to use dhcp on the HQ-3750 we need to accomplish the following:

```

HQ-3750(config)#interface VLAN 30
HQ-3750(config-if)#ip address 10.10.30.2 255.255.255.0
HQ-3750(config-if)#exit
HQ-3750(config)#ip dhcp excluded-address 10.10.30.0 10.10.30.119
HQ-3750(config)# ip dhcp excluded-address 10.10.30.131 10.10.30.254
HQ-3750(config)# ip dhcp pool HQPhones
HQ-3750(config)# network 10.10.30.0 255.255.255.0
HQ-3750(config)# option 150 ip 10.10.10.20
HQ-3750(config)# default-router 10.10.30.1

```

4. Use the same procedure for BR1 site, as described for HQ site.

```

HQ-Router(config)#ip dhcp excluded-address 10.10.130.0 10.10.130.119
HQ-Router(config)# ip dhcp excluded-address 10.10.130.131 10.10.130.254
HQ-Router(config)#!
HQ-Router(config)# ip dhcp pool BR1Phones
HQ-Router(config)# network 10.10.130.0 255.255.255.0

```

```
HQ-Router(config)# option 150 ip 10.10.10.20
HQ-Router(config)# default-router 10.10.130.1
```

```
BR1-Router(config)#interface VLAN 130
BR1-Router(config-if)#ip address 10.10.130.1 255.255.255.0
BR1-Router(config-if)#ip helper-address 10.10.10.1
```

5. Configure BR2 IOS dhcp services according to the following commands:

```
BR2-Router(config)#ip dhcp excluded-address 10.10.230.0 10.10.230.209
BR2-Router(config)# ip dhcp excluded-address 10.10.230.221 10.10.230.254
BR2-Router(config)#!
BR2-Router(config)# ip dhcp pool BR2Phones
BR2-Router(config)# network 10.10.230.0 255.255.255.0
BR2-Router(config)# option 150 ip 10.10.230.1
BR2-Router(config)# default-router 10.10.230.1
BR2-Router(config)#interface VLAN 230
BR2-Router(config-if)#ip address 10.10.230.1 255.255.255.0
BR2-Router(config-if)#no shut
```

TIP for 2-5: Make sure you first exclude the address and only then declare the pool; otherwise the phones will acquire addresses from the pool and will keep them until you would clear the binding.

6. First set the time zone for HQ router, then configure it as NTP master and finally verify:

```
HQ-Router(config)#clock timezone PST -8
HQ-Router(config)#clock summer-time PDT recurring
HQ-Router(config)#ntp master 2
```

```
HQ-Router#show ntp status
Clock is synchronized, stratum 2, reference is 127.127.1.1
nominal freq is 250.0000 Hz, actual freq is 250.0000 Hz, precision is 2**24
reference time is CD76C354.634CC300 (20:15:32.387 PDT Thu Mar 26 2009)
```

```
clock offset is 0.0000 msec, root delay is 0.00 msec
root dispersion is 0.93 msec, peer dispersion is 0.93 msec
loopfilter state is 'CTRL' (Normal Controlled Loop), drift is 0.000000000 s/s
system poll interval is 16, last update was 4 sec ago.
HQ-Router#
```

Then go into BR1 and point it to HQ, after setting the time zone for New York:

```
BR1-Router(config)#clock timezone EST -5
BR1-Router(config)#clock summer-time EDT recurring
BR1-Router(config)#ntp server 10.10.30.1
```

```
BR1-Router#show ntp status
Clock is synchronized, stratum 3, reference is 10.10.30.1
nominal freq is 119.2092 Hz, actual freq is 119.2092 Hz, precision is 2**18
reference time is CD76C657.0AD43FA0 (22:28:23.042 EST Thu Mar 26 2009)
clock offset is -0.0020 msec, root delay is 1.36 msec
root dispersion is 3875.27 msec, peer dispersion is 3875.03 msec
BR1-Router#
```

Do the same for BR2 router with time zone settings of UTC +5.

```
BR2-Router(config)#clock timezone UTC +5
BR2-Router(config)#ntp server 10.10.30.1
BR2-Router#show ntp status
Clock is synchronized, stratum 3, reference is 10.100.100.1
nominal freq is 119.2092 Hz, actual freq is 119.2093 Hz, precision is 2**18
reference time is CD76C7A3.093DDBF1 (08:33:55.036 utc Fri Mar 27 2009)
clock offset is -0.5402 msec, root delay is 1.39 msec
root dispersion is 1.22 msec, peer dispersion is 0.18 msec
BR2-Router#
```

Troubleshooting Tips:

- Beware of typing errors; they are the number one cause of problems. Work accurate and have things configured correctly from the first attempt.
- IOS DHCP can be verified with the "show ip dhcp binding" command.
- If you suspect the phones are not issuing a dhcp request, debug the dhcp relay by using the 'debug udp forwarding' command

Chapter 2 – CallManager and CallManager Express Configuration

Topics included in this chapter:

- A. CallManager Setup
- B. Phone registration
- C. Phone configuration

Tasks to accomplish:

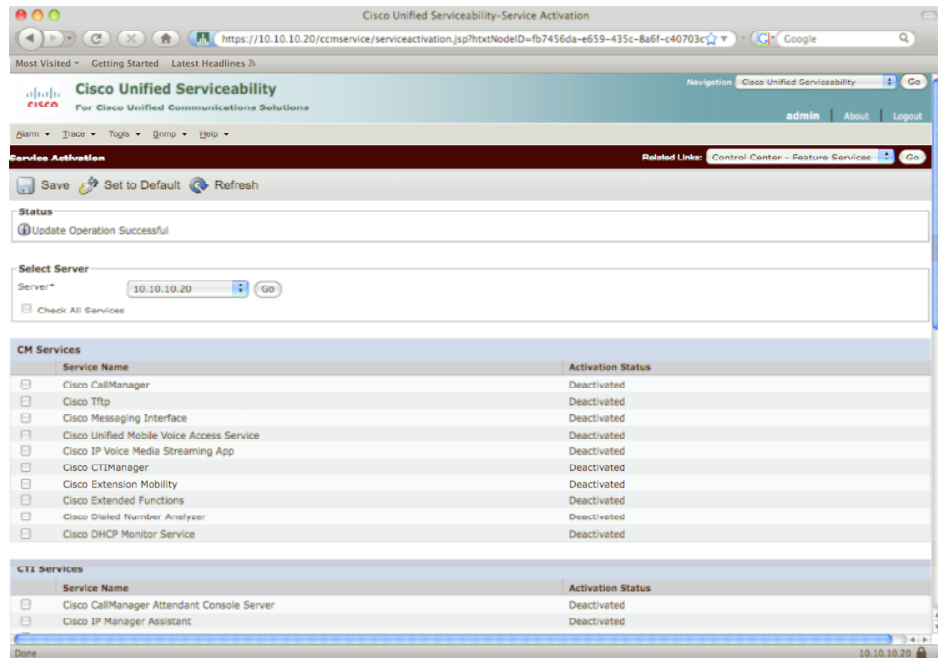
1. Register all HQ, BR1, and BR2 phones according to the dial plan table, make sure the phones will display calling names in every scenario presented (internal and PSTN):
2. Configure Phone number 3003 as a second line on both phones in BR2, when a call comes in to 3003 it should ring on both phones and be answered by the first user to respond and if the line is busy on that phone then the call should be shown with visible indication and with no ring. The second call should ring on the available phone.
3. Make sure you allow dialing from BR2 only by selecting specific line appearance.

4. Make sure all phones display the same general information, aside from the line specific configuration; this refers to HQ, BR1 and BR2.
5. Create another line for BR2 Phone 2, on button 6 of the 7960 and assign to it directory number 3005. Make sure this line will not allow call waiting.
6. Allow phone 1 to pickup calls ringing and on hold on phone 2 and vice versa, this should work for internal and external calls.
7. Both phone 1 and phone 2 are members of VIP sales group and are required to take calls dialed to 442076303111. The calls are expected to ring the phone that was idle the longest. If no one answers the call for 8 seconds, it is assumed that the user is on a break and he should be switched to a DND mode. Calls that passed both phones (busy or no answer) should be forwarded to DN 3000.

Solutions:

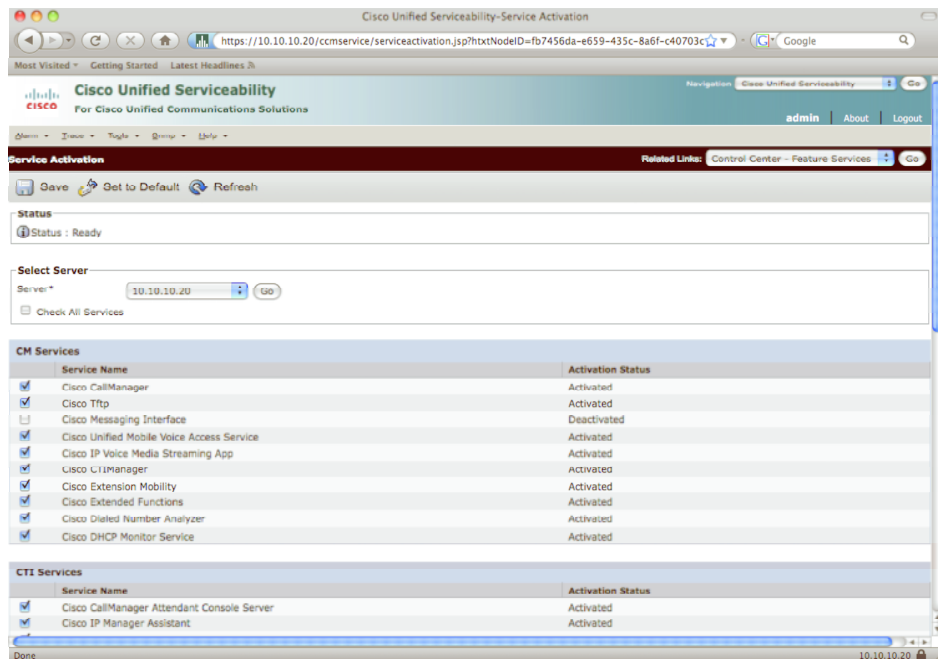
1. First verify and complete (if needed) the basic things in CallManager, this will require:

- **Activating services:**



Chapter 2 – CallManager and CallManager Express Configuration

- Verify that the activated services are running:



Chapter 2 – CallManager and CallManager Express Configuration

- Change the CallManager names to IP address for both Publisher and Subscriber:

The first screenshot shows the 'Server Configuration' page for a 'Publisher' server. The 'Host Name/IP Address' field is set to '10.10.10.20'. The 'Status' section indicates 'Update successful'. The second screenshot shows the 'Server Configuration' page for a 'Subscriber' server. The 'Host Name/IP Address' field is set to '10.10.10.21'. The 'Status' section indicates 'Status: Ready'. Both screenshots show the 'Cisco Unified CM Administration' header with navigation links for System, Call Routing, Media Resources, Voice Mail, Device, Application, User Management, Bulk Administration, and Help. The 'Server Information' section includes fields for Database Replication, Host Name/IP Address, MAC Address, and Description. The 'Status' section shows the current status of the server.

Server Configuration

Most Visited - Getting Started - Latest Headlines 2

Cisco Unified CM Administration
For Cisco Unified Communications Solutions

Navigation: Cisco Unified CM Administration - Go

admin | About | Logout

System - Call Routing - Media Resources - Voice Mail - Device - Application - User Management - Bulk Administration - Help

Server Configuration

Related Links: Back To Find/List - Go

Save Delete Add New

Status

Update successful

Server Information

Database Replication Publisher

Host Name/IP Address* 10.10.10.20

MAC Address

Description

Save Delete Add New

*. indicates required item.

Server Configuration

Most Visited - Getting Started - Latest Headlines 2

Cisco Unified CM Administration
For Cisco Unified Communications Solutions

Navigation: Cisco Unified CM Administration - Go

admin | About | Logout

System - Call Routing - Media Resources - Voice Mail - Device - Application - User Management - Bulk Administration - Help

Server Configuration

Related Links: Back To Find/List - Go

Save Delete Add New

Status

Status: Ready

Server Information

Database Replication Subscriber

Host Name/IP Address* 10.10.10.21

MAC Address

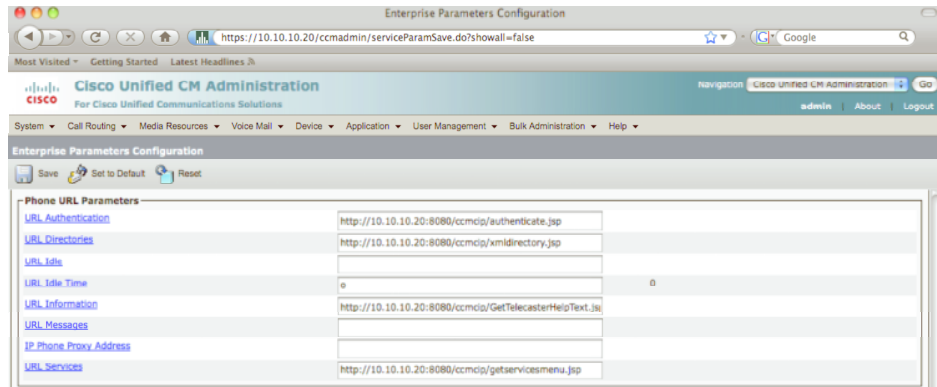
Description

Save Delete Add New

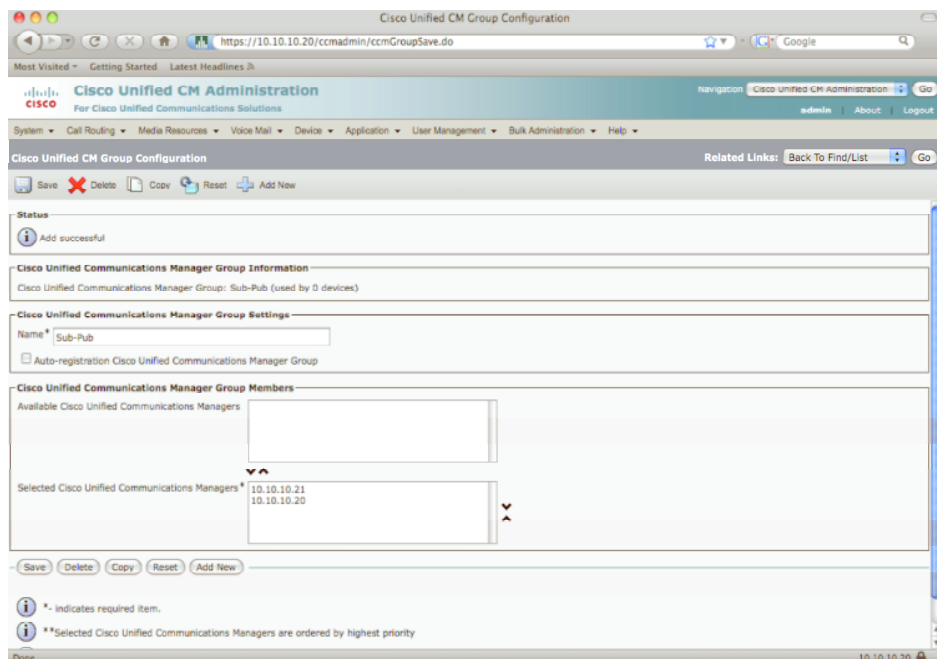
*. indicates required item.

Chapter 2 – CallManager and CallManager Express Configuration

- Modifying enterprise parameters to use IP address of publisher and not host name in all relevant URL settings:

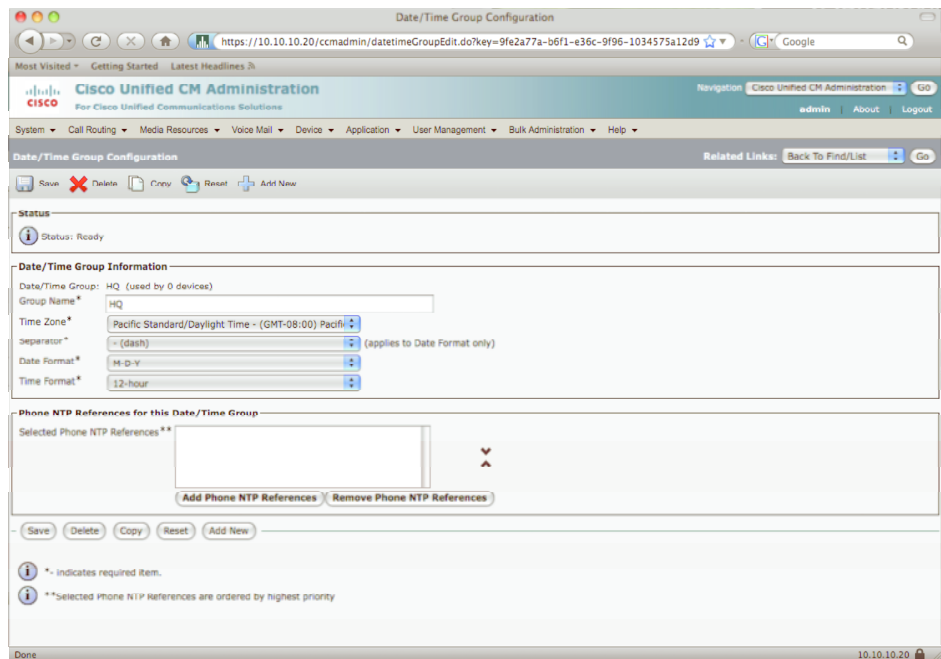


- Configure the CallManager Groups per the requirements from "Read Before Start" section:



Chapter 2 – CallManager and CallManager Express Configuration

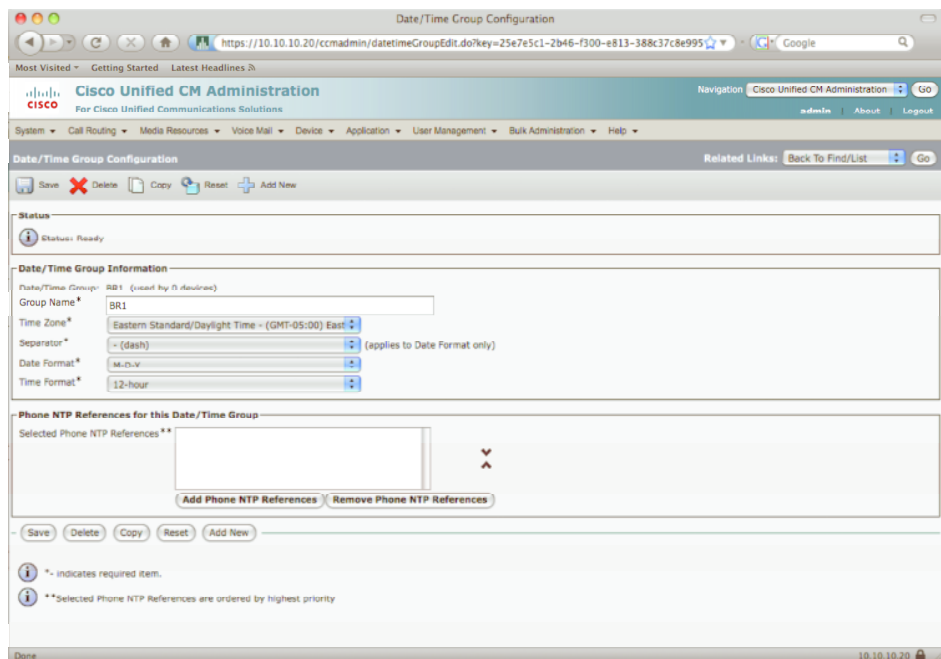
- Configure the date/time groups for HQ and BR1:



The screenshot shows the Cisco Unified CM Administration interface for configuring a Date/Time Group. The browser address bar shows the URL: <https://10.10.10.20/ccmadmin/datetimeGroupEdit.do?key=9fe2a77a-b6f1-e36c-9f96-1034575a12d9>. The page title is "Date/Time Group Configuration". The "Status" section shows "Status: Ready". The "Date/Time Group Information" section contains the following fields:

- Date/Time Group: HQ (used by 0 devices)
- Group Name: HQ
- Time Zone: Pacific Standard/Daylight Time - (GMT-08:00) Pacific
- Separator: - (dash) (applies to Date Format only)
- Date Format: M-D-Y
- Time Format: 12-hour

The "Phone NTP References for this Date/Time Group" section shows a list of "Selected Phone NTP References" with an "Add Phone NTP References" button and a "Remove Phone NTP References" button. At the bottom, there are "Save", "Delete", "Copy", "Reset", and "Add New" buttons. A note indicates that "*" indicates required items and that selected Phone NTP References are ordered by highest priority.



The screenshot shows the Cisco Unified CM Administration interface for configuring a Date/Time Group. The browser address bar shows the URL: <https://10.10.10.20/ccmadmin/datetimeGroupEdit.do?key=25e7e5c1-2b46-f300-e813-388c37c8e995>. The page title is "Date/Time Group Configuration". The "Status" section shows "Status: Ready". The "Date/Time Group Information" section contains the following fields:

- Date/Time Group: BR1 (used by 0 devices)
- Group Name: BR1
- Time Zone: Eastern Standard/Daylight Time - (GMT-05:00) East
- Separator: - (dash) (applies to Date Format only)
- Date Format: M-D-Y
- Time Format: 12-hour

The "Phone NTP References for this Date/Time Group" section shows a list of "Selected Phone NTP References" with an "Add Phone NTP References" button and a "Remove Phone NTP References" button. At the bottom, there are "Save", "Delete", "Copy", "Reset", and "Add New" buttons. A note indicates that "*" indicates required items and that selected Phone NTP References are ordered by highest priority.

Chapter 2 – CallManager and CallManager Express Configuration

- Create the HQ and BR1 locations for later use:

The screenshot shows the Cisco Unified CM Administration interface for the 'Location Configuration' page. The browser address bar shows the URL: `https://10.10.10.20/ccmadmin/locationEdit.do?key=e43c6866-0e19-33e1-d0c3-21791bc8ce15`. The page title is 'Location Configuration'. The navigation bar includes 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. The 'Location Configuration' section has a 'Status' field set to 'Ready'. The 'Location Information' section has a 'Name' field set to 'HQ'. The 'Audio Calls Information' section has 'Audio Bandwidth' set to 'Unlimited'. The 'Video Calls Information' section has 'Video Bandwidth' set to '384 kbps'. The 'Location RSVP Settings' section has a table with one row: 'HQ' with 'No Reservation'. The 'Modify Setting(s) to Other Locations' section has a table with one row: 'BR1' with 'Use System Default'. The 'Done' button is at the bottom right.

Location	RSVP Setting
HQ	No Reservation

Location	RSVP Setting
BR1	Use System Default

The screenshot shows the Cisco Unified CM Administration interface for the 'Location Configuration' page. The browser address bar shows the URL: `https://10.10.10.20/ccmadmin/locationEdit.do?key=a2b0abe2-0f2b-fc14-ec58-3ecd3323222e`. The page title is 'Location Configuration'. The navigation bar includes 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. The 'Location Configuration' section has a 'Status' field set to 'Ready'. The 'Location Information' section has a 'Name' field set to 'BR1'. The 'Audio Calls Information' section has 'Audio Bandwidth' set to 'Unlimited'. The 'Video Calls Information' section has 'Video Bandwidth' set to '384 kbps'. The 'Location RSVP Settings' section has a table with one row: 'BR1' with 'No Reservation'. The 'Modify Setting(s) to Other Locations' section has a table with one row: 'BR1' with 'Use System Default'. The 'Done' button is at the bottom right.

Location	RSVP Setting
BR1	No Reservation

Location	RSVP Setting
BR1	Use System Default

Chapter 2 – CallManager and CallManager Express Configuration

- Create the Regions for HQ and BR1 for later use:

The screenshot shows the Cisco Unified CM Administration interface for Region Configuration. The browser address bar shows the URL: <https://10.10.10.20/ccmadmin/regionEdit.do?key=2c49af1c-608e-2c6a-7ae2-1299ad5ef5ae>. The page title is "Region Configuration". The navigation bar includes links for System, Call Routing, Media Resources, Voice Mail, Device, Application, User Management, Bulk Administration, and Help. The "Region Configuration" section has tabs for Save, Details, Reset, and Add New. The "Region Information" section shows the Name field set to "HQ". The "Region Relationships" section shows a table with columns: Region, Audio Codec, Video Call Bandwidth, and Link Loss Type. The table is currently empty, with a note: "NOTE: Region(s) not displayed". The "Modify Relationship to other Regions" section shows a table with columns: Regions, Audio Codec, Video Call Bandwidth, and Link Loss Type. The "Regions" column lists "BR1", "Default", and "HQ". The "Audio Codec" column has a dropdown menu set to "Keep Current Setting". The "Video Call Bandwidth" column has a dropdown menu set to "Keep Current Setting". The "Link Loss Type" column has a dropdown menu set to "Keep Current Setting". The "Save" button is highlighted. Below the table, there is a note: "i * indicates required item." and a warning: "i **The Audio Codec selection determines bandwidth only. The G.711 and G.722 codecs both result in a maximum bandwidth of 64 Kbps between regions and can be used interchangeably."

The screenshot shows the Cisco Unified CM Administration interface for Region Configuration. The browser address bar shows the URL: <https://10.10.10.20/ccmadmin/regionEdit.do?key=92ff72d-376b-76a0-b69f-27568bde21cd>. The page title is "Region Configuration". The navigation bar includes links for System, Call Routing, Media Resources, Voice Mail, Device, Application, User Management, Bulk Administration, and Help. The "Region Configuration" section has tabs for Save, Details, Reset, and Add New. The "Region Information" section shows the Name field set to "BR1". The "Region Relationships" section shows a table with columns: Region, Audio Codec, Video Call Bandwidth, and Link Loss Type. The table is currently empty, with a note: "NOTE: Region(s) not displayed". The "Modify Relationship to other Regions" section shows a table with columns: Regions, Audio Codec, Video Call Bandwidth, and Link Loss Type. The "Regions" column lists "BR1", "Default", and "HQ". The "Audio Codec" column has a dropdown menu set to "Keep Current Setting". The "Video Call Bandwidth" column has a dropdown menu set to "Keep Current Setting". The "Link Loss Type" column has a dropdown menu set to "Keep Current Setting". The "Save" button is highlighted. Below the table, there is a note: "i * indicates required item." and a warning: "i **The Audio Codec selection determines bandwidth only. The G.711 and G.722 codecs both result in a maximum bandwidth of 64 Kbps between regions and can be used interchangeably."

Chapter 2 – CallManager and CallManager Express Configuration

- Create the Media Resource Groups for later use (always a good idea to set the software resources in their own group):

The screenshot shows the 'Media Resource Group Configuration' page in the Cisco Unified CM Administration interface. The browser address bar shows the URL: `https://10.10.10.20/ccmadmin/mrsrcGroupEdit.do?key=c9ec8ac3-81f7-8bf2-7225-0ac5ca4903de`. The page title is 'Media Resource Group Configuration'. The navigation bar includes 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. The 'Media Resource Group Configuration' section shows the following details:

- Status:** Ready
- Media Resource Group Status:** Media Resource Group: Publisher (used by 0 devices)
- Media Resource Group Information:**
 - Name:** Publisher
 - Description:** Publisher
- Devices for this Group:**
 - Available Media Resources:** ANN_3, CFB_3, MOH_3, RTP_3
 - Selected Media Resources:** ANN_2 (ANN), CFB_2 (CFB), MOH_2 (MOH), RTP_2 (RTP)
 - ☐ Use Multicast for MOH Audio (If at least one multicast MOH resource is available)
- Buttons:** Save, Delete, Copy, Add New
- Footer:** * indicates required item.

The screenshot shows the 'Media Resource Group Configuration' page in the Cisco Unified CM Administration interface for a group named 'Subscriber'. The browser address bar shows the URL: `https://10.10.10.20/ccmadmin/mrsrcGroupEdit.do?key=f215899a-4914-c183-826e-04672e979f1b`. The page title is 'Media Resource Group Configuration'. The navigation bar includes 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. The 'Media Resource Group Configuration' section shows the following details:

- Status:** Ready
- Media Resource Group Status:** Media Resource Group: Subscriber (used by 0 devices)
- Media Resource Group Information:**
 - Name:** Subscriber
 - Description:** Subscriber
- Devices for this Group:**
 - Available Media Resources:** ANN_2, CFB_2, MOH_2, RTP_2
 - Selected Media Resources:** ANN_3 (ANN), CFB_3 (CFB), MOH_3 (MOH), RTP_3 (RTP)
 - ☐ Use Multicast for MOH Audio (If at least one multicast MOH resource is available)
- Buttons:** Save, Delete, Copy, Add New
- Footer:** * indicates required item.

Chapter 2 – CallManager and CallManager Express Configuration

- Create the Media Resource List for HQ and BR1 for later use:

The screenshot shows the 'Media Resource Group List Configuration' page in the Cisco Unified CM Administration interface. The browser address bar shows the URL: <https://10.10.10.20/ccmadmin/mrsrcListEdit.do?key=aa3c0a1d-9404-244e-6538-2781cef72876>. The page title is 'Media Resource Group List Configuration'. The navigation menu includes System, Call Routing, Media Resources, Voice Mail, Device, Application, User Management, Bulk Administration, and Help. The 'Media Resource Group List Configuration' section is active. The 'Status' field shows 'Status: Ready'. The 'Media Resource Group List Status' field shows 'Media Resource Group List: HQ (used by 0 devices)'. The 'Media Resource Group List Information' section has a 'Name' field with the value 'HQ'. The 'Media Resource Groups for this List' section shows 'Available Media Resource Groups' and 'Selected Media Resource Groups' with 'Publisher' and 'Subscriber' listed. The 'Save', 'Delete', 'Copy', and 'Add New' buttons are visible at the bottom. A note indicates that an asterisk (*) indicates a required item.

The screenshot shows the 'Media Resource Group List Configuration' page in the Cisco Unified CM Administration interface. The browser address bar shows the URL: <https://10.10.10.20/ccmadmin/mrsrcListEdit.do?key=f3da6f4-43c9-da5a-c21a-fafd3c204792>. The page title is 'Media Resource Group List Configuration'. The navigation menu includes System, Call Routing, Media Resources, Voice Mail, Device, Application, User Management, Bulk Administration, and Help. The 'Media Resource Group List Configuration' section is active. The 'Status' field shows 'Status: Ready'. The 'Media Resource Group List Status' field shows 'Media Resource Group List: BR1 (used by 0 devices)'. The 'Media Resource Group List Information' section has a 'Name' field with the value 'BR1'. The 'Media Resource Groups for this List' section shows 'Available Media Resource Groups' and 'Selected Media Resource Groups' with 'Publisher' and 'Subscriber' listed. The 'Save', 'Delete', 'Copy', and 'Add New' buttons are visible at the bottom. A note indicates that an asterisk (*) indicates a required item.

Chapter 2 – CallManager and CallManager Express Configuration

- Configure the Device Pools for HQ and BR1 with the appropriate settings:

The screenshot shows the 'Device Pool Configuration' page in the Cisco Unified CM Administration interface. The browser address bar shows the URL: <https://10.10.10.20/ccmadmin/devicePoolEdit.do?key=cc0c82b7-1255-196f-e9c6-afc7e0f4e01d>. The page title is 'Device Pool Configuration'. The 'Device Pool Information' section shows 'Device Pool: HQ (0 members**)'.

Device Pool Settings

Device Pool Name*	HQ
Cisco Unified Communications Manager Group*	Sub-Pub
Calling Search Space for Auto-registration	< None >
Reverted Call Focus Priority	Default
Local Route Group	< None >

Roaming Sensitive Settings

Date/Time Group*	HQ
Region*	HQ
Media Resource Group List	HQ
Location	HQ
Network Locale	< None >
SRST Reference*	Disable
Connection Monitor Duration***	
Single Button Barge*	Default
Join Across Lines*	Default
Physical Location	< None >
Device Mobility Group	< None >

Device Mobility Related Information****

Done 10.10.10.20

The screenshot shows the 'Device Pool Configuration' page in the Cisco Unified CM Administration interface. The browser address bar shows the URL: <https://10.10.10.20/ccmadmin/devicePoolSave.do>. The page title is 'Device Pool Configuration'. The 'Device Pool Information' section shows 'Device Pool: BR1 (0 members**)'.

Device Pool Settings

Device Pool Name*	BR1
Cisco Unified Communications Manager Group*	Sub-Pub
Calling Search Space for Auto-registration	< None >
Reverted Call Focus Priority	Default
Local Route Group	< None >

Roaming Sensitive Settings

Date/Time Group*	BR1
Region*	BR1
Media Resource Group List	BR1
Location	BR1
Network Locale	< None >
SRST Reference*	Use Default Gateway
Connection Monitor Duration***	
Single Button Barge*	Default
Join Across Lines*	Default
Physical Location	< None >
Device Mobility Group	< None >

Device Mobility Related Information****

Done 10.10.10.20

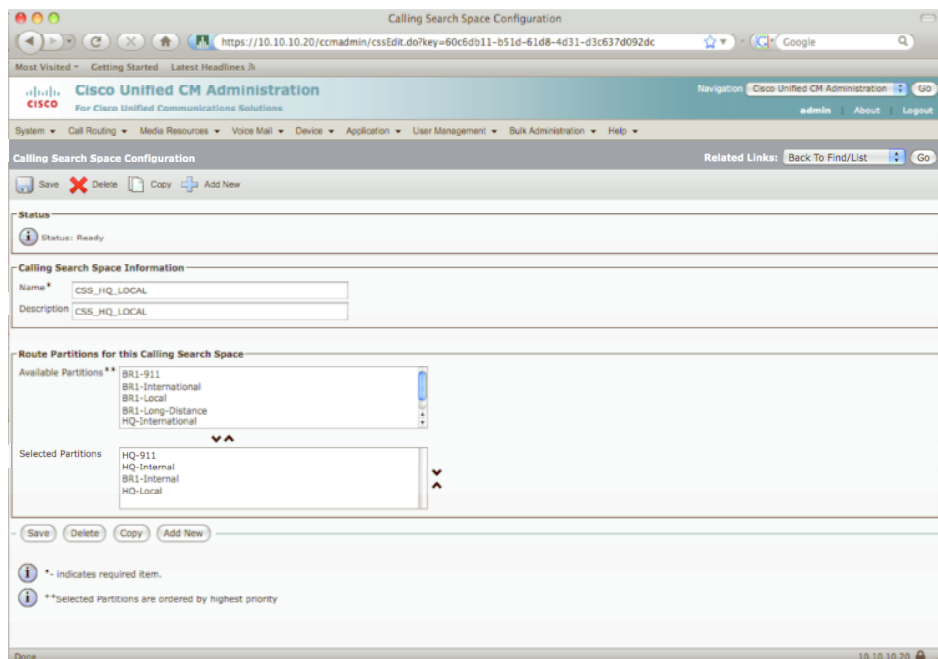
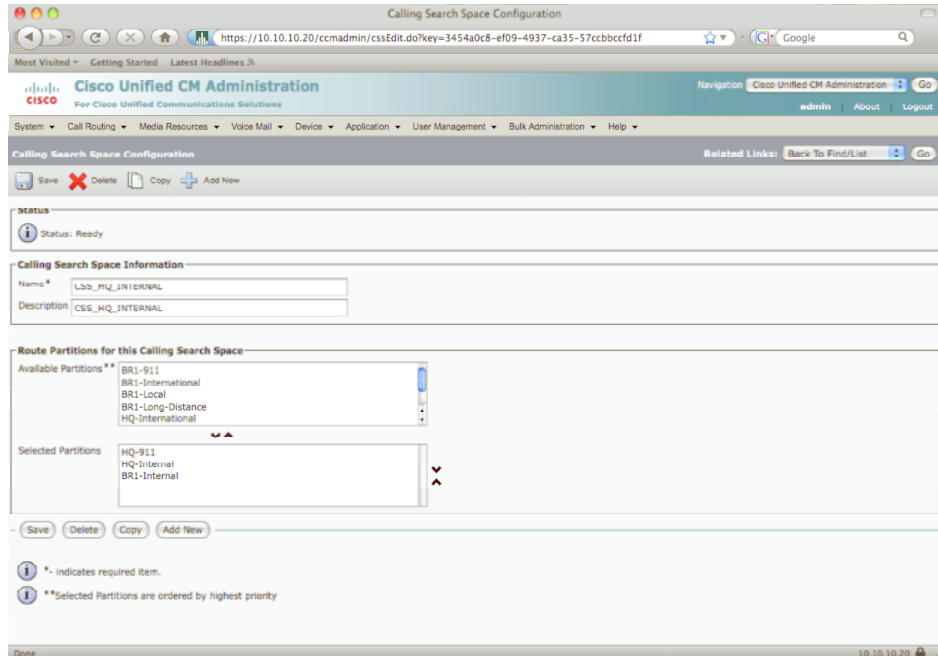
Chapter 2 – CallManager and CallManager Express Configuration

- Create Partitions for HQ and BR1 including Internal, 911, Local, Long Distance, and International:

The screenshot shows the Cisco Unified CM Administration web interface for Partition Configuration. The browser address bar shows `https://10.10.10.20/ccmadmin/partitionEdit.do`. The page has a navigation menu with options like System, Call Routing, Media Resources, Voice Mail, Device, Application, User Management, Bulk Administration, and Help. The main content area is titled "Partition Configuration" and includes a "Save" button. Below this is a "Status" section showing "Status: Ready". The "Partition Information" section contains instructions on how to enter multiple partitions and a list of partition names: HQ-Internal, HQ-911, HQ-Local, HQ-Long-Distance, HQ-International, BR1-Internal, BR1-911, BR1-Local, BR1-Long-Distance, and BR1-International. A "Save" button is located at the bottom of the form. The footer shows the date "10.10.10.20" and a "Done" button.

Chapter 2 – CallManager and CallManager Express Configuration

- Create standard Calling Search Spaces for HQ and BR1 to include Internal, Local, Long Distance, and International(repeat for BR1):



Chapter 2 – CallManager and CallManager Express Configuration

Calling Search Space Configuration

https://10.10.10.20/ccadmin/cssEdit.do?key=13c8629c-7de9-8455-557d-58e785f97da8

Most Visited Getting Started Latest Headlines 3

Cisco Unified CM Administration
For Cisco Unified Communications Solutions

Navigation: Cisco Unified CM Administration Go

System Call Routing Media Resources Voice Mail Device Application User Management Bulk Administration Help

admin About Logout

Calling Search Space Configuration Related Links: Back To Find/List Go

Save Delete Copy Add New

Status
Status: Ready

Calling Search Space Information
Name* CSS_HQ_LONG_DISTANCE
Description CSS HQ LONG DISTANCE

Route Partitions for this Calling Search Space

Available Partitions**
BR1-911
BR1-International
BR1-Local
BR1-Long-Distance
HQ-International

Selected Partitions
HQ-911
HQ-Internal
BR1-Internal
HQ-Local
HQ-Long-Distance

Save Delete Copy Add New

* Indicates required item.
** Selected Partitions are ordered by highest priority

Done 10.10.10.20

Calling Search Space Configuration

https://10.10.10.20/ccadmin/cssEdit.do?key=e03466ec-ebf7-013c-ac33-b03622408221

Most Visited Getting Started Latest Headlines 3

Cisco Unified CM Administration
For Cisco Unified Communications Solutions

Navigation: Cisco Unified CM Administration Go

System Call Routing Media Resources Voice Mail Device Application User Management Bulk Administration Help

admin About Logout

Calling Search Space Configuration Related Links: Back To Find/List Go

Save Delete Copy Add New

Status
Status: Ready

Calling Search Space Information
Name* CSS_HQ_LONG_INTERNATIONAL
Description CSS HQ LONG INTERNATIONAL

Route Partitions for this Calling Search Space

Available Partitions**
BR1-911
BR1-International
BR1-Local
BR1-Long-Distance

Selected Partitions
HQ-911
HQ-Internal
BR1-Internal
HQ-Local
HQ-Long-Distance

Save Delete Copy Add New

* Indicates required item.
** Selected Partitions are ordered by highest priority

Done 10.10.10.20

Chapter 2 – CallManager and CallManager Express Configuration

- Enable the auto registration on a number range that will not be used in the lab (say 8000 to 8099) and wait for phones to start registering:

The screenshot shows the Cisco Unified CM Administration web interface in a browser window. The address bar displays the URL: `https://10.10.10.20/ccmadmin/ccmEdit.do?key=8bbe0acd-a0db-4908-869c-8ea55f8148f0`. The page title is "Cisco Unified CM Configuration". The navigation menu includes: System, Call Routing, Media Resources, Voice Mail, Device, Application, User Management, Bulk Administration, and Help. The main content area is titled "Cisco Unified CM Configuration" and includes a "Related Links" section with a link to "Back To Find/List".

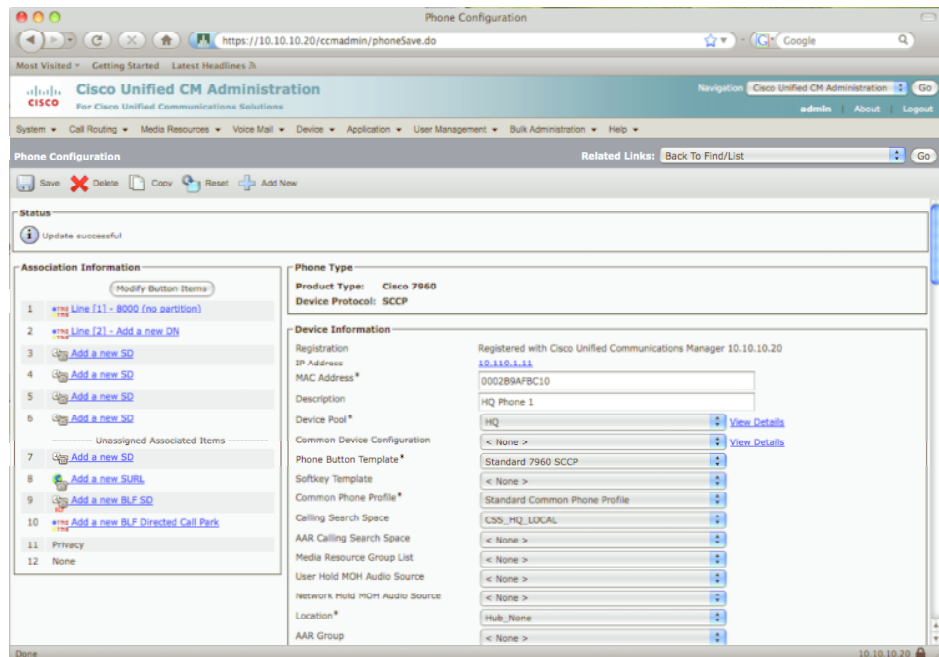
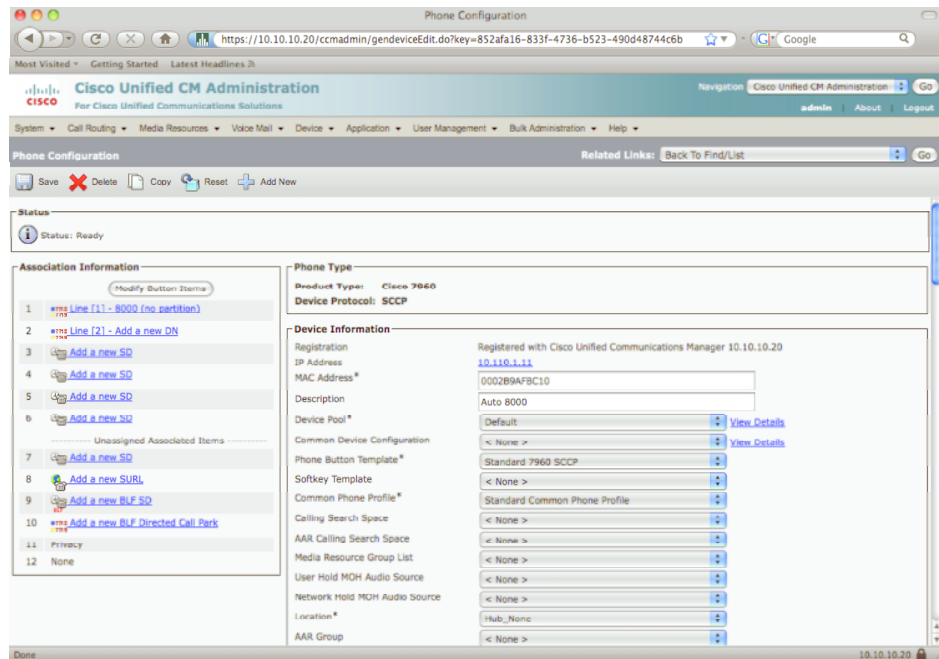
The configuration form is divided into several sections:

- Status:** Status: Ready
- Cisco Unified Communications Manager Information:** Cisco Unified Communications Manager 1.0.1.0.1.0.1.0 (read by 0 devices)
- Server Information:**
 - CTI ID: 1
 - Cisco Unified Communications Manager Server*: 10.10.10.20
 - Cisco Unified Communications Manager Name*: 10.10.10.20
 - Description: UCMPUB1
- Auto-registration Information:**
 - Starting Directory Number*: 8000
 - Ending Directory Number*: 8099
 - Partition: < None >
 - External Phone Number Mask:
 - ☐ Auto-registration Disabled on this Cisco Unified Communications Manager
- Cisco Unified Communications Manager TCP Port Settings for this Server:**
 - Ethernet Phone Port*: 2000
 - MGCP Listen Port*: 2427
 - MGCP Keep-alive Port*: 2428
 - SIP Phone Port*: 5060

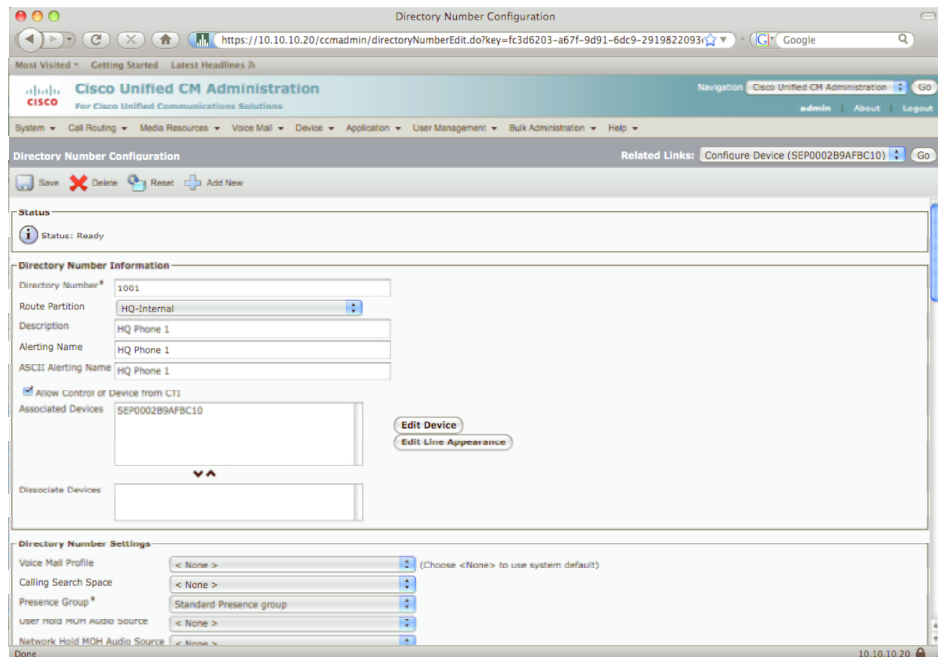
The bottom of the page shows the status "Done" and the IP address "10.10.10.20".

Chapter 2 – CallManager and CallManager Express Configuration

- Once you have registered phones start configuring them with the correct parameters(repeat for all phones in HQ and BR1). To change protocols copy MAC address, disable auto registration, and the add phones manually:



Chapter 2 – CallManager and CallManager Express Configuration



Directory Number Configuration

Navigation: Cisco Unified CM Administration

System > Call Routing > Media Resources > Voice Mail > Device > Application > User Management > Bulk Administration > Help

Related Links: Configure Device (SEP002B9AFBC10)

Save Delete Reset Add New

Status: Ready

Directory Number Information

Directory Number: 1001

Route Partition: HQ-Internal

Description: HQ Phone 1

Alerting Name: HQ Phone 1

ASCII Alerting Name: HQ Phone 1

☒ Allow Control of Device from CTI

Associated Devices: SEP002B9AFBC10

Edit Device Edit Line Appearance

Dissociate Devices

Directory Number Settings

Voice Mail Profile: < None > (Choose <None> to use system default)

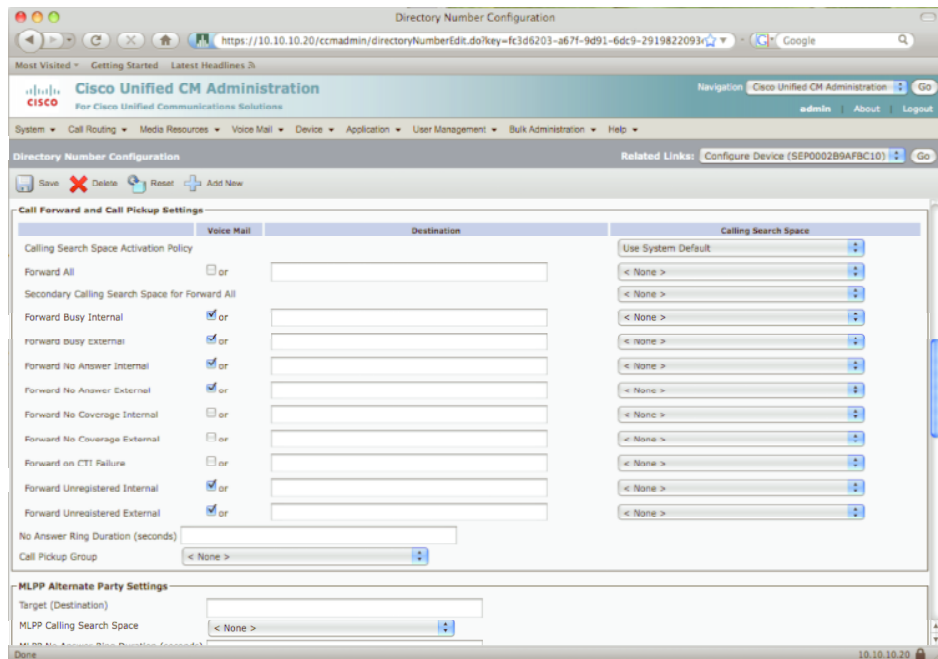
Calling Search Space: < None >

Presence Group: Standard Presence group

User Hold MUM Audio Source: < None >

Network Hold MOH Audio Source: < None >

Done



Directory Number Configuration

Navigation: Cisco Unified CM Administration

System > Call Routing > Media Resources > Voice Mail > Device > Application > User Management > Bulk Administration > Help

Related Links: Configure Device (SEP002B9AFBC10)

Save Delete Reset Add New

Call Forward and Call Pickup Settings

	Voice Mail	Destination	Calling Search Space
Calling Search Space Activation Policy			Use System Default
Forward All	<input type="checkbox"/> or		< None >
Secondary Calling Search Space for Forward All			< None >
Forward Busy Internal	<input checked="" type="checkbox"/> or		< None >
Forward Busy External	<input checked="" type="checkbox"/> or		< None >
Forward No Answer Internal	<input checked="" type="checkbox"/> or		< None >
Forward No Answer External	<input checked="" type="checkbox"/> or		< None >
Forward No Coverage Internal	<input type="checkbox"/> or		< None >
Forward No Coverage External	<input type="checkbox"/> or		< None >
Forward on CTI Failure	<input type="checkbox"/> or		< None >
Forward Unregistered Internal	<input checked="" type="checkbox"/> or		< None >
Forward Unregistered External	<input checked="" type="checkbox"/> or		< None >
No Answer Ring Duration (seconds)			
Call Pickup Group		< None >	

MLPP Alternate Party Settings

Target (Destination):

MLPP Calling Search Space: < None >

Done

Chapter 2 – CallManager and CallManager Express Configuration

The top screenshot displays the 'Directory Number Configuration' page in the Cisco Unified CM Administration interface. The page is for 'Line 1 on Device SEP0002B9AFC10'. It includes fields for 'Display (Internal Caller ID)', 'ASCII Display (Internal Caller ID)', 'Line Text Label', 'ASCII Line Text Label', 'External Phone Number Mask' (7029461XXX), 'Visual Message Waiting Indicator Policy' (Use System Policy), 'Ring Setting (Phone Idle)' (Ring), 'Ring Setting (Phone Active)' (Use System Default), 'Call Pickup Group Audio Alert Setting (Phone Idle)' (Use System Default), 'Call Pickup Group Audio Alert Setting (Phone Active)' (Use System Default), and 'Monitoring Calling Search Space' (< None >). Below these are 'Multiple Call/Call Waiting Settings on Device SEP0002B9AFC10' with 'Maximum Number of Calls' (4) and 'Busy Trigger' (2). The bottom section is 'Forwarded Call Information Display on Device SEP0002B9AFC10'.

The bottom screenshot displays the 'Find and List Phones' page. It shows a status of '4 records found'. Below is a table with 4 rows and 9 columns: Phone, Device Name, Description, Device Pool, Device Protocol, Status, IP Address, Copy, and Super Copy. The table lists four phones, all registered with status 10.10.10.21.

Phone	Device Name	Description	Device Pool	Device Protocol	Status	IP Address	Copy	Super Copy
SEP001FCA34C8E1	HQ Phone 2	HQ	SIP	Registered with 10.10.10.21	10.10.30.123			
SEP001FCA34D7E3	BR1 Phone 1	BR1	SCCP	Registered with 10.10.10.21	10.10.130.132			
SEP001FCA34D85F	BR1 Phone 2	BR1	SIP	Registered with 10.10.10.21	10.10.130.133			
SEP001FCA34D865	HQ Phone 1	HQ	SCCP	Registered with 10.10.10.21	10.10.30.123			

On BR2:

```
telephony-service
max-ephones 5
max-dn 10
ip source-address 10.10.230.1 port 2000
load 7960-7940 P00300000500.bin
max-conferences 8 gain -6
transfer-system full-consult
create cnf-files version-stamp 7960 Mar 31 2009 04:38:40
!
!
ephone-dn 1
number 3001
!
!
ephone-dn 2
number 3002
!
!
ephone 1
description BR2 Phone 1
mac-address 001F.CA34.DB52
type 7960
button 1:1
!
!
!
ephone 2
description BR2 Phone 2
mac-address 001F.CA34.CF32
type 7960
button 1:2
```

2. This task can be accomplished by using the overlay-dn feature, as shown below:

```
ephone-dn 3 dual-line
number 3003
!
!
ephone-dn 4 dual-line
number 1004
!
!
ephone 1
description BR2 Phone 1
mac-address 001F.CA34.DB52
type 7960
button 1:1 2o3,4
!
!
!
ephone 2
description BR2 Phone 2
mac-address 001F.CA34.CF32
type 7960
button 1:2 2o3,4
```

As you can see, button 2 of both phones is defined as overlay-dn and as such it will ring both phone if the lines are available and when one of the lines is used, it will ring the second phone.

3. This task refers to the configuration setting of auto-line, under ephone configuration. Auto-line incoming means that only for incoming calls you can

Chapter 2 – CallManager and CallManager Express Configuration

answer without selecting a line. For outgoing you would need to first select a line and go off hook to dial:

```
ephone 1
description BR2 Phone 1
mac-address 001F.CA34.D852
type 7960
auto-line incoming
button 1:1 2o3,4
!
!
ephone 2
description BR2 Phone 2
mac-address 001F.CA34.CF32
type 7960
auto-line incoming
button 1:2 2o3,4
```

4. The display task is directing to the 'description' ephone-dn setting and the 'system message' under telephony service. The calling name should also be set per the table with the name command under each DN:

```
telephony-service
max-ephones 5
max-dn 10
ip source-address 10.10.230.1 port 2000
system message Your current options
load 7960-7940 P00308000500.bin
max-conferences 8 gain -6
transfer-system full-consult
transfer-pattern .T
create cnf-files version-stamp 7960 Mar 31 2009 05:37:47
!
!
ephone-dn 1
number 3001
description 442076303001
name BR2 Phone 1
!
!
ephone-dn 2
number 3002
description 442076303002
name BR2 Phone 2
```

5. This task will require defining another ephone-dn, without the dual-line keyword, and assigning it to the

sixth button using the button 6:5 command:

```
ephone-dn 5
 number 3005
 !
 !
 ephone 1
  description BR2 Phone 1
  mac-address 081F.CA34.D652
  type 7960
  auto-line incoming
  button 1:1 2o3,4
 !
 !
 ephone 2
  description BR2 Phone 2
  mac-address 081F.CA34.CF32
  type 7960
  auto-line incoming
  button 1:2 2o3,4 6:5
```

6. Pick up is enabled by default, but some times problem might arise when external calls are involved. Since call pickup is actually a transfer you should set the transfer pattern in the telephony-service to .T:

```
telephony-service
 max-ephones 5
 max-dn 10
 ip source-address 10.10.230.1 port 2000
 system message Your current options
 load 7960-7940 P00300000500.bin
 max-conferences 8 gain -6
 transfer-system full-consult
 transfer-pattern .T
 create cnf-files version-stamp 7960 Mar 31 2009 05:37:47
```

7. This is done by creating an ephone hunt and defining the following on it:

```
ephone-hunt 1 longest-idle
 pilot 3111
 list 3001, 3002
 final 3000
 timeout 8, 8
 auto logout 1
```


Troubleshooting Tips:

- Overlay-dn disables call waiting unless defined with call waiting enabled, so don't expect it to work.
- You can verify phone behavior by using "debug ephone status", get familiar with this command.
- Some things can be tested locally by using the "csim start phone_number" hidden command.

Chapter 3 – Voice Gateway and Signaling

Topics included in this chapter:

- A. Digital voice protocols: T1, E1, PRI, CAS, R2
 - B. VoIP protocols: H323, MGCP, SCCP, SIP, RAS
 - C. All gateways use time-slots 1-3 only, clock is always supplied by the PSTN, line code will be B8ZS and framing will be in extended format.
 - D. HQ and BR1 PSTN is sending 10 digits inbound and BR2 is PSTN is sending 12 digits inbound.
 - E. For the E1 interface use CRC4 and HDB3 as framing and line code settings. Tasks to accomplish:
 - 1. Configure the HQ router as a IOS MGCP gateway using T1 PRI and NI as the line parameters. You are not allowed to use the command "ccm-manager config".
 - 2. Configure BR1 as IOS H.323 gateway using T1 PRI and NI as the line parameters.
 - 3. Configure BR2 as E1 PRI and make sure all BR2 numbers are reachable.
 - 4. Configure HQ router as a gatekeeper with the following details:
 - Local zone name: voiceie
 - Domain name: ccbootcamp.com
- Register CallManager and CME to the gatekeeper.

Chapter 3 – Voice Gateway and Signaling

* You are not allowed to use any technology prefix in this task.

Solutions:

1. First we need to add a new gateway following the steps shown below; parameters that are different than the default should be noted:

The first screenshot shows the 'Add a new Gateway' page in the Cisco Unified CM Administration interface. The 'Gateway Type' dropdown menu is open, displaying a list of Cisco gateway models. The second screenshot shows the same page, but the 'Protocol' dropdown menu is open, displaying a list of protocols: MGCP, SCCP, and a 'Not Selected' option.

Gateway Type*

- Not Selected --
- Cisco IAD2400
- Cisco 1751
- Cisco 1760
- Cisco 1861
- Cisco 269X
- Cisco 26XX
- Cisco 2801
- Cisco 2811
- Cisco 2821
- Cisco 2851
- Cisco 362X
- Cisco 364X
- Cisco 366X
- Cisco 3725
- Cisco 3745
- Cisco 3825
- Cisco 3845
- Cisco Catalyst 4000 Access Gateway Module
- Cisco Catalyst 4224 Voice Gateway Switch

Protocol*

- Not Selected --
- MGCP
- SCCP

Chapter 3 – Voice Gateway and Signaling

Once you have selected your gateway type and protocol you will need to fill out the main gateway configuration page with the “Domain Name” and modules. Keep in mind the “Domain Name” is case sensitive and if you have a domain name configured on the gateway then the domain name is router name plus domain name:

The screenshot shows the 'Gateway Configuration' page in the Cisco Unified CM Administration interface. The page is titled 'Gateway Configuration' and includes a 'Save' button at the top left. The 'Status' section shows 'Status: Ready'. The 'Gateway Details' section contains the following fields: Product (Cisco 2801), Protocol (MGCP), Domain Name* (HQ-Router), Description (HQ-Router), and Cisco Unified Communications Manager Group* (SUB-PUB). The 'Configured Slots, VICs and Endpoints' section shows 'Module in Slot 0' as 'NM-4VWIC-MBRD'. The 'Product Specific Configuration Layout' section includes: Global ISDN Switch Type (N12), Switchback Timing* (Graceful), Switchback uptime-delay (min) (10), Switchback schedule (hh:mm) (12:00), Fax mode* (Fax Relay), Modem Passthrough* (Enable), and Type Of DTMF Relay* (Current GW Config). A 'Save' button is at the bottom left. A note at the bottom states: '*. indicates required item.'

Gateway Details	
Product	Cisco 2801
Protocol	MGCP
Domain Name*	HQ-Router
Description	HQ-Router
Cisco Unified Communications Manager Group*	SUB-PUB

Configured Slots, VICs and Endpoints	
Module in Slot 0	NM-4VWIC-MBRD

Product Specific Configuration Layout	
Global ISDN Switch Type	N12
Switchback Timing*	Graceful
Switchback uptime-delay (min)	10
Switchback schedule (hh:mm)	12:00
Fax mode*	Fax Relay
Modem Passthrough*	Enable
Type Of DTMF Relay*	Current GW Config

Chapter 3 – Voice Gateway and Signaling

Then select the VWIC's based on your "show diag" command:

The screenshot shows the 'Gateway Configuration' page in the Cisco Unified CM Administration interface. The page is titled 'Gateway Configuration' and includes a navigation bar with links like 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. The main content area is divided into several sections:

- Status:** Shows 'Status: Ready'.
- Gateway Details:** Includes fields for 'Product' (Cisco 2801), 'Gateway' (HQ-Router), 'Protocol' (MGCP), 'Domain Name' (HQ-Router), 'Description' (HQ-Router), and 'Cisco Unified Communications Manager Group' (SUB-PUB).
- Configured Slots, VICs and Endpoints:** Shows a table with columns for 'Module in Slot', 'Subunit', and 'Endpoints'. The table lists 'NM-4VVIC-MBRD' in Slot 0, with Subunit 0 configured as 'VWIC-1MFT-T1' and Subunits 1, 2, and 3 set to '< None >'. The endpoints are listed as '0/0/0'.
- Product Specific Configuration Layout:** Includes fields for 'Global ISDN Switch Type' (NI2), 'Switchback Timing' (Graceful), 'Switchback uptime-delay (min)' (10), 'Switchback schedule (hh:mm)' (12:00), 'Fax mode' (Fax Relay), 'Modem Passthrough' (Enable), and 'Type Of DTMF Relay' (Current GW Config).

At the bottom of the page, there are buttons for 'Save', 'Delete', 'Reset', and 'Add New', along with a note indicating that '*' indicates required items.

You can then configure the gateway ports based on the requirement of T1 PRI or T1 CAS:

The screenshot shows the 'Find and List Gateway' page in the Cisco Unified CM Administration interface. The page is titled 'Find and List Gateway' and includes a navigation bar with links like 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. The main content area is divided into several sections:

- Select Protocol for this Gateway:** Includes a dropdown menu for 'Device Protocol' with options: '-- Not Selected --', 'Digital Access T1', and 'Digital Access PRI'. The 'Digital Access PRI' option is currently selected.

At the bottom of the page, there are buttons for 'Next' and a note indicating that '*' indicates required items.

Chapter 3 – Voice Gateway and Signaling

From here you can set all the standard options such as Device Pool, Calling Search Space, Significant Digits:

The screenshot shows the 'Gateway Configuration' page in the Cisco Unified CM Administration interface. The page is divided into three main sections: Device Information, Multilevel Precedence and Preemption (MLPP) Information, and Interface Information.

Device Information:

- Product: Cisco MGCP T1 Port
- Gateway: HQ-Router
- Device Protocol: Digital Access PRI
- Registration: Unknown
- IP Address: Unknown
- End-Point Name: S0/SU0/DS1-0@HQ-Router
- Description: S0/SU0/DS1-0@HQ-Router
- Device Pool: HQ
- Common Device Configuration: < None >
- Call Classification: Use System Default
- NetworkLocale: < None >
- Packet Capture Mode: None
- Packet Capture Duration: 0
- Media Resource Group List: < None >
- Location: Hub_None
- AAR Group: < None >
- Load Information: (empty field)
- Use Trusted Relay Point: Default
- ☐ Transmit UTF-8 for Calling Party Name

Multilevel Precedence and Preemption (MLPP) Information:

- MLPP Domain: < None >
- MLPP Indication: Default
- MLPP Preemption: Default

Interface Information:

- PRI Protocol Type: PRI N12
- Protocol Side: User
- Channel Selection Order: Top Down
- Channel IE Type: Use Number when 18
- PCM Type: u-law
- Delay for first restart (1/8 sec ticks): 12
- Delay between restarts (1/8 sec ticks): 4
- ☒ Inhibit restarts at PRI initialization
- ☒ Enable status poll
- ☐ Unattended Port

The bottom of the page shows a 'Done' button and the IP address 10.10.10.20:8443.

You will also need to set the channel selection order to start from channel 1 and downward, since you were instructed to use channels 1-3 only. Also, "Enable Status Poll" is required in order to instruct CallManager to enable only these channels and it is complimentary to the service configuration setting that we will perform in the next step.

Chapter 3 – Voice Gateway and Signaling

The screenshot displays the 'Gateway Configuration' page in the Cisco Unified CM Administration interface. The page is divided into several sections:

- Call Routing Information - Inbound Calls:**
 - Significant Digits*: 4
 - Calling Search Space: CSS_HQ_INTERNAL
 - AAR Calling Search Space: < None >
 - Prefix DN: (empty)
- Call Routing Information - Outbound Calls:**
 - Calling Party Presentation*: Default
 - Calling Party Selection*: Originator
 - Called party IE number type unknown*: Cisco CallManager
 - Calling party IE number type unknown*: Cisco CallManager
 - Called Numbering Plan*: Cisco CallManager
 - Calling Numbering Plan*: Cisco CallManager
 - Number of digits to strip*: 0
 - Caller ID DN: (empty)
 - SMDI Base Port*: 0
 - Called Party Transformation CSS: < None >
 - ☒ Use Device Pool Called Party Transformation CSS
 - Calling Party Transformation CSS: < None >
 - ☒ Use Device Pool Calling Party Transformation CSS
- PRI Protocol Type Specific Information:**
 - ☒ Display IE Delivery
 - ☐ Redirecting Number IE Delivery - Outbound
 - ☐ Redirecting Number IE Delivery - Inbound
 - ☐ Send Extra Leading Character in Display IE***
 - ☐ Setup non-ISDN Progress Indicator IE Enable****
 - ☐ MCDN Channel Number Extension Bit Set to Zero**
 - ☐ Send Calling Name in Facility IE
 - ☐ Interface Identifier Present**
 - Interface Identifier Value**: 0
 - Connected Line ID Presentation (QSIG Inbound Call)*: Default
- UUUE Configuration:**
 - ☐ Passing Precedence Level Through UUUE
 - Security Access Level*: 2

At the bottom of the page, there are buttons for 'Save', 'Delete', and 'Reset'. The status bar at the bottom indicates 'Done' and the IP address '10.10.10.20:8443'.

Now you would need to force using only channels 1-3, this is done in the CallManager service parameters, but before you go there copy the gateway MGCP name as you will need it in the next step:

You can verify the configuration of the MGCP gateway with the following commands (we are looking for “MULTIPLE_FRAME_ESTABLISHED” and Registered):

```
HQ-Router#show isdn status
Global ISDN Switchtype = primary-ni

HQ-931 is backhauled to CCM MANAGER 0x0003 on DSL 0. Layer 3 output may not apply

ISDN Serial0/1/0:23 interface
  dsl 0, interface ISDN Switchtype = primary-ni
  L2 Protocol = Q.921 0x0000 L3 Protocol(s) = CCM MANAGER 0x0003
  Layer 1 Status:
    ACTIVE
  Layer 2 Status:
    TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
  Layer 3 Status:
    0 Active Layer 3 Call(s)
  Active dsl 0 CCBs = 0
  The Free Channel Mask: 0x00000007
  Number of L2 Discards = 0, L2 Session ID = 1
  Total Allocated ISDN CCBs = 0
HQ-Router#

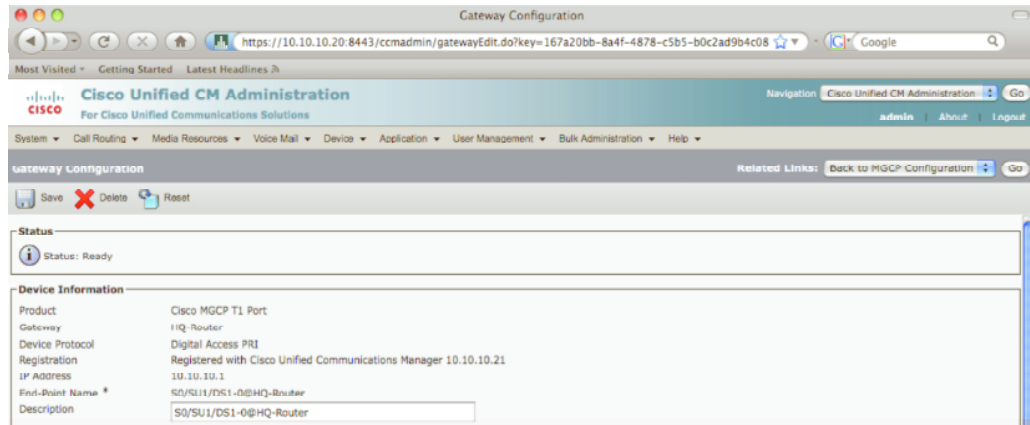
HQ-Router#show ccm-manager
MGCP Domain Name: HQ-Router
Priority      Status      Host
-----
Primary      Registered  10.10.10.21
First Backup  Backup Ready 10.10.10.20
Second Backup None

Current active Call Manager: 10.10.10.21
Backhaul/Redundant Link port: 2428
Failover Interval: 30 seconds
Keepalive Interval: 15 seconds
Last keepalive sent: 14:41:23 PDT Mar 31 2009 (elapsed time: 00:00:00)
Last MGCP traffic time: 14:41:23 PDT Mar 31 2009 (elapsed time: 00:00:00)
Last failover time: 14:27:07 PDT Mar 31 2009 from (0.0.0.0)
Last switchback time: 14:27:22 PDT Mar 31 2009 from (10.10.10.20)
Switchback mode: Graceful
MGCP Fallback mode: Not Selected
Last MGCP Fallback start time: None
Last MGCP Fallback end time: None
MGCP Download Tones: Disabled
TFTP retry count to shut Ports: 2

Backhaul Link info:
  Link Protocol: TCP
  Remote Port Number: 2428
  Remote IP Address: 10.10.10.21
  Current Link State: OPEN
  Statistics:
    Packets recvd: 55
    Recv failures: 54
    Packets xmitted: 1
    Xmit failures: 0
  PRI Ports being backhauled:
    Slot 0, VIC 1, port 0
FAX mode: cisco
Configuration Error History:
HQ-Router#
```

Chapter 3 – Voice Gateway and Signaling

As well as in the CallManager we should see the gateway port registered (You should also be able to make a call from the PSTN phone to your HQ Phone 1):



2. The first thing you got to know is what interface will be used by the gateway to communicate with CallManager. Since this is an H.323 gateway we would normally choose the closet interface to the CallManager excluding any WAN interfaces:

```
interface Vlan130
description Voice Network
ip address 10.10.130.1 255.255.255.0
ip helper-address 10.10.10.1
h323-gateway voip interface
h323-gateway voip bind srcaddr 10.10.130.1
!
```

Now we need to define our T1 PRI in the BR1-Router:

```
BR1-Router(config)#network-clock-participate wic 0
BR1-Router(config)!
BR1-Router(config) isdn switch-type primary-ni
BR1-Router(config)!
BR1-Router(config) controller T1 0/0/0
BR1-Router(config-if) pri-group timeslots 1-3,24
```

We should now be able to verify that the T1 PRI is up with the “show isdn status” command (we are looking for a “MULTIPLE_FRAME_ESTABLISHED”):

```
BR1-Router#show isdn status
Global ISDN Switchtype = primary-ni
ISDN Serial0/0/0:23 interface
  dsl 0, interface ISDN Switchtype = primary-ni
  Layer 1 Status:
    ACTIVE
  Layer 2 Status:
    TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
  Layer 3 Status:
    0 Active Layer 3 Call(s)
  Active dsl 0 CCBs = 0
  The Free Channel Mask: 0x00000007
  Number of L2 Discards = 0, L2 Session ID = 1
  Total Allocated ISDN CCBs = 0
BR1-Router#
```

We also need to strip the incoming called number to 4 digits:

```
voice translation-rule 1
 rule 1 /\(^702333\)\(....\) / \2/
!
!
voice translation-profile STRIP
 translate called 1
!

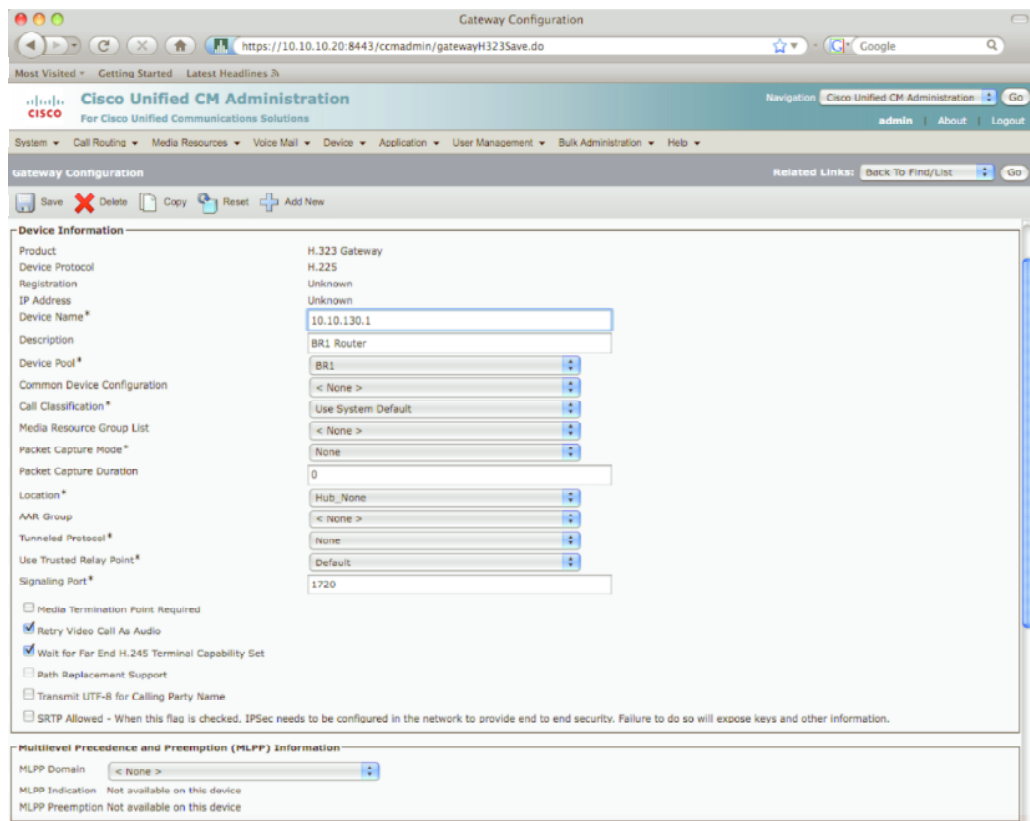
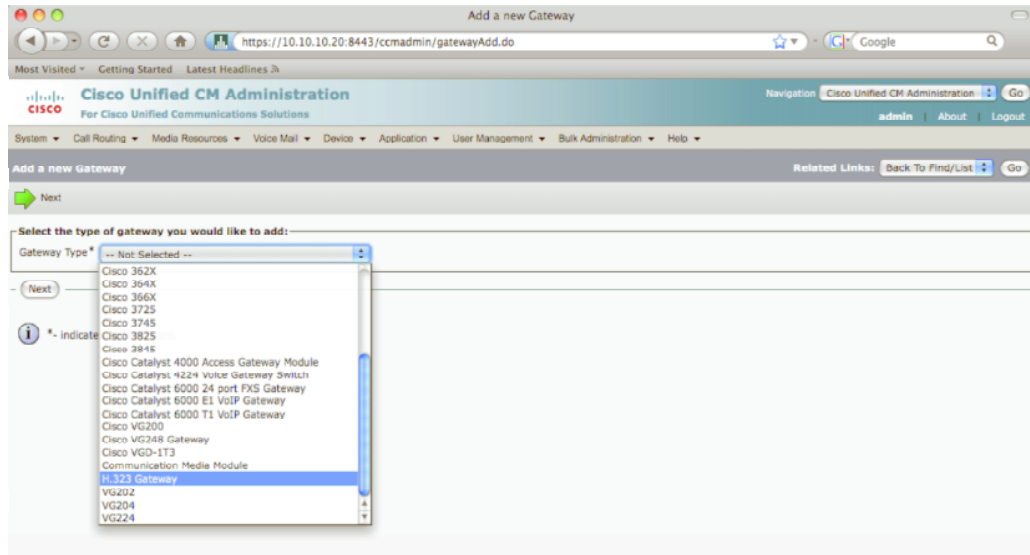
voice-port 0/0/0:23
 translation-profile incoming STRIP
!
```

We now need to send the BR1 extensions to CallManager in the proper order:

```
dial-peer voice 1 pots
 incoming called-number .
 direct-inward-dial
!
dial-peer voice 2 voip
 preference 1
 destination-pattern 2...
 session target ipv4:10.10.10.21
!
dial-peer voice 3 voip
 preference 2
 destination-pattern 2...
 session target ipv4:10.10.10.20
```

Chapter 3 – Voice Gateway and Signaling

Now we can create a gateway on the CallManager, following these steps:



Chapter 3 – Voice Gateway and Signaling

The screenshot shows the 'Gateway Configuration' page in the Cisco Unified CM Administration interface. The page is titled 'Gateway Configuration' and has a URL of 'https://10.10.10.20:8443/ccadmin/gatewayH323Save.do'. The navigation bar includes 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. The 'Gateway Configuration' section has a 'Related Links' button 'Back To Find/List' and a 'Go' button. The 'Call Routing Information - Inbound Calls' section contains the following fields: 'Significant Digits*' (4), 'Calling Search Space' (CSS_BR1_INTERNAL), 'AAR Calling Search Space' (< None >), 'Prefix DN' (empty), 'Redirecting Number IE Delivery - Inbound' (unchecked), and 'Enable Inbound FastStart' (unchecked). The 'Call Routing Information - Outbound Calls' section contains the following fields: 'Calling Party Selection*' (Originator), 'Calling Party Presentation*' (Default), 'Called party IE number type unknown*' (Cisco CallManager), 'Calling party IE number type unknown*' (Cisco CallManager), 'Called Numbering Plan*' (Cisco CallManager), 'Calling Numbering Plan*' (Cisco CallManager), 'Caller ID DN' (empty), 'Display IE Delivery' (checked), 'Redirecting Number IE Delivery - Outbound' (unchecked), 'Enable Outbound FastStart' (unchecked), 'Codec For Outbound FastStart' (G711 u-law 64K), 'Called Party Transformation CSS' (< None >), 'Use Device Pool Called Party Transformation CSS' (checked), 'Calling Party Transformation CSS' (< None >), and 'Use Device Pool Calling Party Transformation CSS' (checked). The 'Incoming Calling Party Settings' section contains a note: 'If the administrator sets the prefix to Default this indicates call processing will use prefix at the next level setting (DevicePool/Service Parameter). Otherwise, the value configured is used as the prefix unless the field is empty in which case there is no prefix assigned.' and four fields: 'Incoming Calling Party National Number Prefix' (Default), 'Incoming Calling Party International Number Prefix' (Default), 'Incoming Calling Party Unknown Number Prefix' (Default), and 'Incoming Calling Party Subscriber Number Prefix' (Default). The page has buttons for 'Save', 'Delete', 'Copy', 'Reset', and 'Add New' at the bottom.

We should now be able to make an inbound call from the PSTN to BR1 Phone 1.

3. This task requires only IOS configuration under BR2 router. You should first set the network clock participation(You may need a "card type e1 slot wic"):

```
BR2-Router(config)#network-clock-participate wic 0
BR2-Router(config)# isdn switch-type primary-net5
BR2-Router(config)# controller E1 0/0/0
BR2-Router(config-if)# pri-group timeslots 1-3,16
```

Chapter 3 – Voice Gateway and Signaling

We can test with the “show isdn status” command (we should see “MULTIPLE_FRAME_ESTABLISHED”):

```
BR2-Router# show isdn status
Global ISDN Switchtype = primary-net5
ISDN Serial8/8/0:15 interface
  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:
    0 Active Layer 3 Call(s)
  Active dsl 0 CCBs = 0
  The Free Channel Mask: 0x80000007
  Number of L2 Discards = 0, L2 Session ID = 1
  Total Allocated ISDN CCBs = 0
BR2-Router#
```

Now we have to allow incoming calls to be answered and strip to 4 digits:

```
voice translation-rule 1
rule 1 /\(^44207630\)(....\) / ^2/
!
!
voice translation-profile STRIP
translate called 1
!

dial-peer voice 1 pots
incoming called-number .
direct-inward-dial
!
```

You should now be able to call from the PSTN to BR2 Phone 1.

4. You should be familiar with gatekeeper issues, for this you are encouraged to read the document in the following link:

http://www.cisco.com/en/US/tech/tk1077/technologies_tech_note09186a00800a8928.shtml

First lets define the gatekeeper on the HQ-Router:

```
gatekeeper
zone local voiceie ccbootcamp.com 10.10.30.1
no shutdown
```

Now let's register CallManager to the gatekeeper, defining gatekeeper and then trunk settings:

Chapter 3 – Voice Gateway and Signaling

The screenshot shows the 'Gatekeeper Configuration' page in the Cisco Unified CM Administration interface. The page title is 'Gatekeeper Configuration'. The navigation bar includes 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. The 'Gatekeeper Configuration' section is active, showing a 'Status' of 'Ready'. Below this, the 'Gatekeeper Information' section contains the following fields:

Host Name/IP Address*	10.10.30.1
Description	10.10.30.1
Registration Request Time to Live*	60
Registration Retry Timeout*	300

There is a checkbox for 'Enable Device' which is checked. At the bottom of the form are buttons for 'Save', 'Delete', 'Reset', and 'Add New'.

TIP: set the registration retry timeout to a value lower than the default to get faster response to changes.

Add the trunk and set values according to the following examples:

The screenshot shows the 'Trunk Configuration' page in the Cisco Unified CM Administration interface. The page title is 'Trunk Configuration'. The navigation bar is the same as the previous screenshot. The 'Trunk Configuration' section is active, showing a 'Status' of 'Ready'. Below this, the 'Trunk Information' section contains the following fields:

Trunk Type*	-- Not Selected --
Device Protocol*	-- Not Selected --

A dropdown menu is open for 'Device Protocol', showing the following options:

- Inter-Cluster Trunk (Gatekeeper Controlled)
- Inter-Cluster Trunk (Gatekeeper Controlled)
- Inter-Cluster Trunk (Non-Gatekeeper Controlled)
- SIP Trunk

At the bottom of the form are buttons for 'Next' and 'Back'. A note at the bottom left states: '* Indicates required item.'

Chapter 3 – Voice Gateway and Signaling

The screenshot shows the Cisco Unified CM Administration web interface for configuring a trunk. The browser address bar shows the URL: `https://10.10.10.20:8443/ccmadmin/trunkEdit.do?key=8c749784-fe58-c949-34ba-58649f39fb6e`. The page title is "Trunk Configuration".

Navigation: System | Call Routing | Media Resources | Voice Mail | Device | Application | User Management | Bulk Administration | Help

Trunk Configuration: Save | Delete | Reset | Add New

Status: Status: Ready

Device Information:

Product:	H.225 Trunk (Gatekeeper Controlled)
Device Protocol:	H.225
Device Name*	Trunk
Description	Trunk to Gatekeeper
Device Pool*	HQ
Common Device Configuration	< None >
Call Classification*	Use System Default
Media Resource Group List	< None >
Location*	Hub_None
AAR Group	< None >
Tunneled Protocol*	None
Packet Capture Mode*	None
Packet Capture Duration	0

☐ Media Termination Point Required
☒ Retry Video Call as Audio
☒ Wait for Far End H.245 Terminal Capability Set
☐ Path Replacement Support
☐ Transmit UTF-8 for Calling Party Name
☐ Unattended Port
☐ SRTP Allowed - When this flag is checked, IPsec needs to be configured in the network to provide end to end security. Failure to do so will expose keys and other information.
Use Trusted Relay Point* Default

Incoming Calling Party Settings

If the administrator sets the prefix to Default this indicates call processing will use prefix at the next level setting (DevicePool/Service Parameter). Otherwise, the value configured is used as the prefix unless the field is empty in which case there is no prefix assigned.

Clear Prefix Settings | Default Prefix Settings

Incoming Calling Party National Number Prefix	Default
Incoming Calling Party International Number Prefix	Default
Incoming Calling Party Unknown Number Prefix	Default
Incoming Calling Party Subscriber Number Prefix	Default

Chapter 3 – Voice Gateway and Signaling

Trunk Configuration

Save Delete Reset Add New

Call Routing Information

Inbound Calls

Significant Digits * All

Calling Search Space CSS_HQ_INTERNAL

AAR Calling Search Space < None >

Prefix DN

☒ Redirecting Number IE Delivery - Inbound

☐ Enable Inbound FastStart

Outbound Calls

Called Party Transformation CSS < None >

☒ Use Device Pool Called Party Transformation CSS

Calling Party Transformation CSS < None >

☒ Use Device Pool Calling Party Transformation CSS

Calling Party Selection * Originator

Calling Line ID Presentation * Default

Called Party IE Number Type Unknown * Cisco CallManager

Calling Party IE Number Type Unknown * Cisco CallManager

Called Numbering Plan * Cisco CallManager

Calling Numbering Plan * Cisco CallManager

Caller ID DN

☒ Display IE Delivery

☒ Redirecting Number IE Delivery - Outbound

☐ Enable Outbound FastStart

Codec For Outbound FastStart G711 u-law 64K

Gatekeeper Information

Gatekeeper Name * 10.10.30.1

Terminal Type * Gateway

Technology Prefix

Zone voiceie

Save Delete Reset Add New

Verify registration to the gatekeeper by issuing the “show gatekeeper endpoint” command:

```

GATEKEEPER ENDPOINT REGISTRATION
=====
CallSignalAddr Port RASSignalAddr Port Zone Name      Type  Flags
-----
10.10.10.20    49500 10.10.10.20    32877 voiceie      VOIP-GW
H323-ID: Trunk_1
Voice Capacity Max.= Avail.= Current.= 0
10.10.10.21    41784 10.10.10.21    32799 voiceie      VOIP-GW
H323-ID: Trunk_2
Voice Capacity Max.= Avail.= Current.= 0
Total number of active registrations = 2

```

Chapter 3 – Voice Gateway and Signaling

Register the CME router to the gatekeeper using the following command:

```
interface FastEthernet0/0.230
 encapsulation dot1Q 230
 ip address 10.10.230.1 255.255.255.0
 h323-gateway voip interface
 h323-gateway voip id voiceie ipaddr 10.10.30.1 1719
 h323-gateway voip h323-id CME
 h323-gateway voip bind srcaddr 10.10.230.1
```

And then enter “gateway” at global configuration mode, in order to start the H.323 gateway operation. If defined correctly. Issue the “show gateway” command to verify that CME is registered to the gatekeeper:

```
BR2-Router#show gateway
H.323 ITU-T Version: 4.0  H323 Stack Version: 0.1

H.323 service is up
Gateway CME is registered to Gatekeeper voiceie

Alias list (CLI configured)
H323-ID: CME
E164-ID: 3001
E164-ID: 3002
E164-ID: 3003
E164-ID: 1004
E164-ID: 3005
E164-ID: 3111
Alias list (last RCF)
H323-ID: CME
E164-ID: 3001
E164-ID: 3002
E164-ID: 3003
E164-ID: 1004
E164-ID: 3005
E164-ID: 3111

H323 resource thresholding is Disabled
BR2-Router#
```

Finally, you should expect the following output from the “show gatekeeper endpoint” command:

```

      GATEKEEPER ENDPOINT REGISTRATION
=====
CallSignalAddr  Port  RASSignalAddr  Port  Zone Name      Type  Flags
-----
10.10.10.20     49500 10.10.10.20     32877 voiceie      VOIP-GW
      H323-ID: Trunk_1
      Voice Capacity Max.= Avail.= Current.= 0
10.10.10.21     41784 10.10.10.21     32799 voiceie      VOIP-GW
      H323-ID: Trunk_2
      Voice Capacity Max.= Avail.= Current.= 0
10.10.230.1     1720  10.10.230.1     62302 voiceie      VOIP-GW
      H323-ID: CME
      E164-ID: 3001
      E164-ID: 3002
      E164-ID: 3003
      E164-ID: 1004
      E164-ID: 3005
      E164-ID: 3111
      Voice Capacity Max.= Avail.= Current.= 0
Total number of active registrations = 3
```

Troubleshooting Tips:

- Reset gateways often under CallManager for settings to take effect.
- Verify gateway operation layer by layer, starting from physical layer that can be verified using the “show controller e1/t1” command, then go to the upper layers that can be verified using: “show isdn status”, “show ccm-manager” and “show mgcp endpoints”.
- Get familiar with gatekeeper troubleshooting commands like: “debug h225 asn1”, “debug ras”, “show gatekeeper endpoint”, and “show gatekeeper zone status”.

Chapter 4 – Call Routing

Topics included in this chapter:

- A. CCM route patterns (No local route groups)
- B. CCM route preference and redundancy
- C. IOS dial peers
- D. Digit manipulation and translation

Tasks to accomplish:

1. In every site, phone one should be allowed to dial international and below numbers, phone two should be allowed to call long distance and below.
2. Configure the following dialing options for users in HQ:

7+4 digits	Calls to BR2
911 and 9911	Emergency
9+7 digits The first is in the range of 2 to 9	Local
9+1+10 digits The first and the forth are in the range of 2 to 9.	Long Distance
9+011+any number of digits Please allow users to dial the hash sign at the end of the number in order to have faster response	International

- Local calls from HQ should use local HQ gateway and BR1 gateway as backup.

- Long distance calls from HQ should use local HQ gateway as first choice and then BR1 gateway.
- Calls to BR1 PSTN numbers should be routed out BR1 gateway (Toll Bypass), with fallback to local HQ gateway.
- International calls to BR2 numbers, using the 7+4 digits pattern, should be routed via the gatekeeper as VoIP and use the local HQ gateway as backup.
- All other International calls should route out the HQ gateway.

3. Configure the following dialing options for users in BR1:

7+4 digits	Calls to BR2
911 and 9911	Emergency
9+7 digits The first is in the range of 2 to 9	Local
9+1+10 digits The first and the forth are in the range of 2 to 9.	Long Distance
9+011+any number of digits Please allow users to dial the hash sign at the end of the number in order to have faster response	International

- Local calls from BR1 should use local BR1 IOS gateway and HQ gateway as backup.
- Long distance calls from BR1 should use BR1 gateway as first choice and then HQ gateway.

Chapter 4 – Call Routing

- Calls to HQ PSTN numbers (Area Code+Prefix) should be routed out HQ gateway (Toll Bypass), with fallback to local BR1 gateway.
- International calls to BR2 numbers, using the 7+4 digits pattern, should be routed via the gatekeeper as VoIP and use BR1 gateway as backup.

4. Configure the following dialing options for users in BR2:

7+4 digits	Calls to HQ and BR1
999	Emergency
9+7 digits	Local
9+0+8 digits	Long Distance
9+00+any number of digits	International
Please allow users to dial the hash sign at the end of the number in order to have faster response	

- International calls to HQ and BR1 should use gatekeeper first and local PRI as backup.

Solutions:

Use the following to accomplish tasks 1-4.

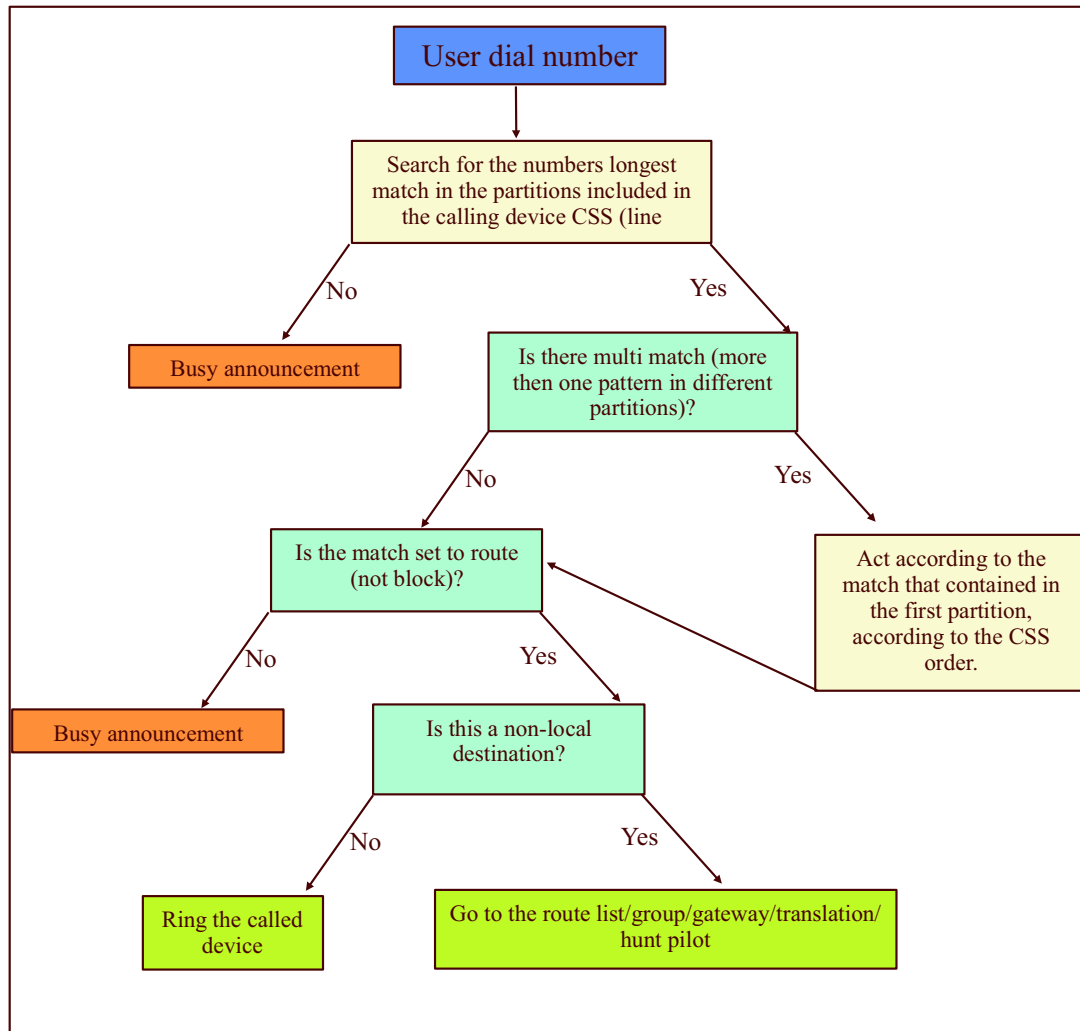
In the lab credit is given for working solutions only. This is a key rule to remember when deciding which dial plan method to use. There are two basic approaches to dial plans, the traditional approach and the line/device approach. It is up to you to choose which approach to use in the actual lab, as long as it will produce the required results.

You should start by writing down the requirements in a way that will allow you to define things later on the CallManager and CME. It is up to you to select the format and detail level in it. Keep in mind that more time you spend developing your plan the less time you have to perform your configuration.

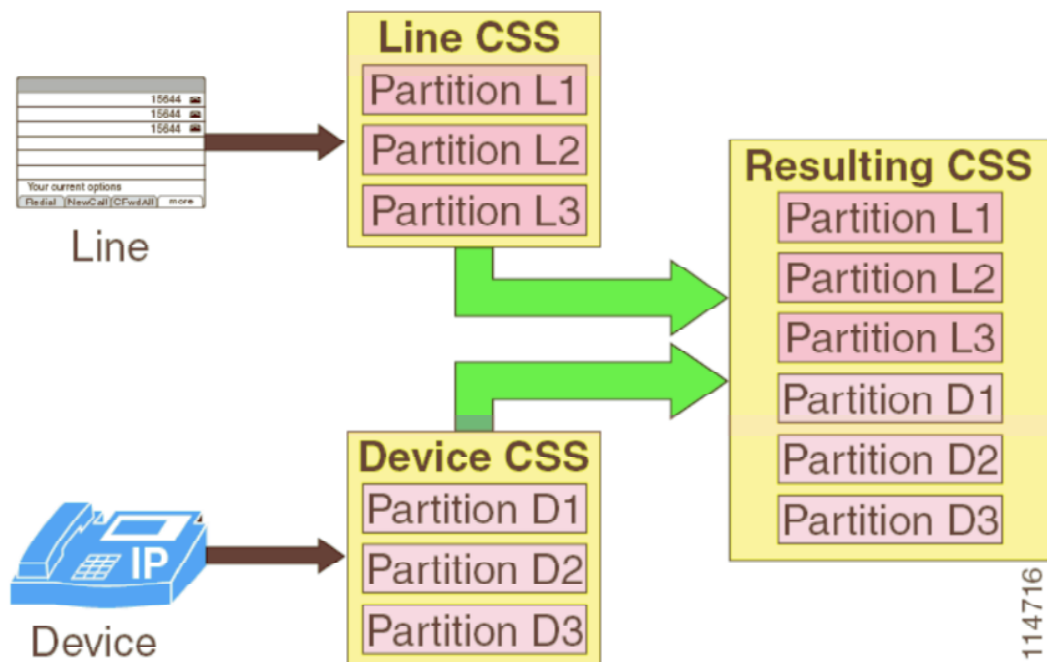
Try and come up with a fast way to outline your dial plan in the shortest amount of time possible. While making sure you have enough information so that you are not constantly looking back into your lab book.

Chapter 4 – Call Routing

The complete logic which combines the entire process is described in the flow chart below:

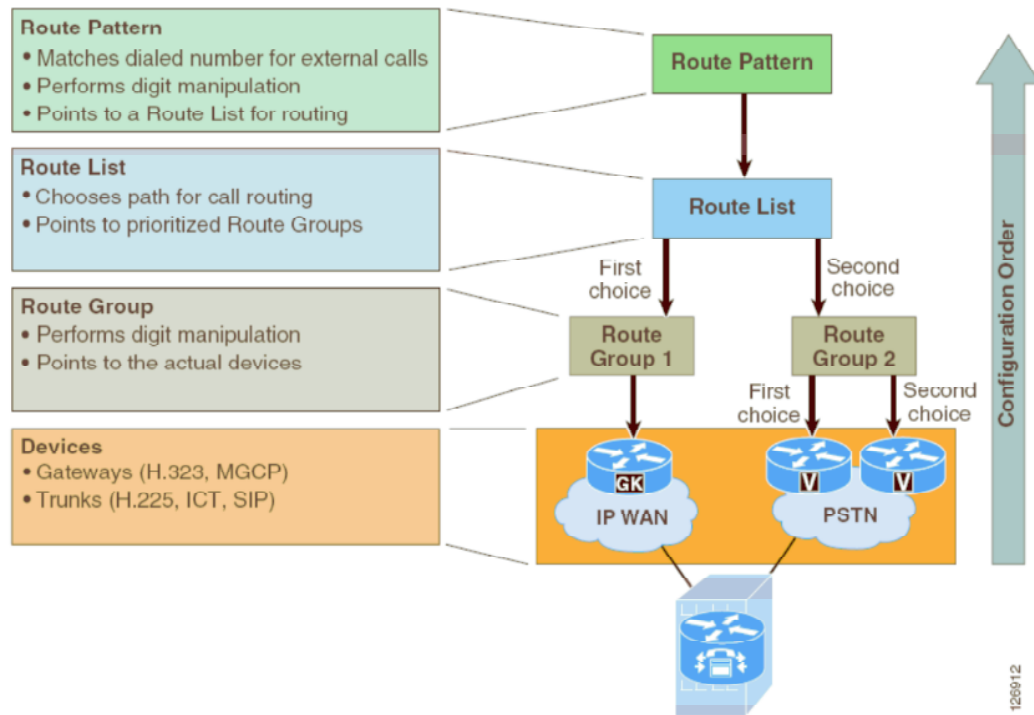


Also refer to the following taken from the SRND for the relation between the line and device CSS:

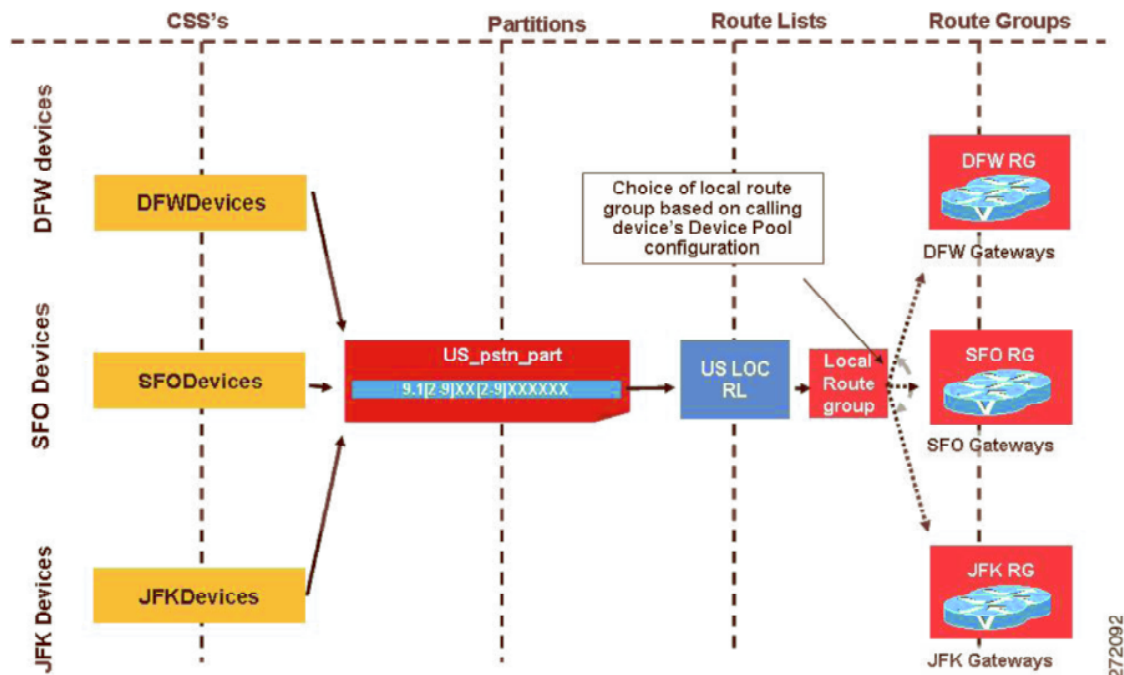


Chapter 4 – Call Routing

As for the traditional gateway selection logic, refer to the following:



With the introduction of Communications Manager 7.0 came the construct of Local Route Groups. Below is an outline, from the 7.0 SRND, of how local route groups work:



Local route groups significantly reduce the number of route patterns need to serve a dial plan with multiple sites. You may be tested on both so the ability to recognize the difference is key.

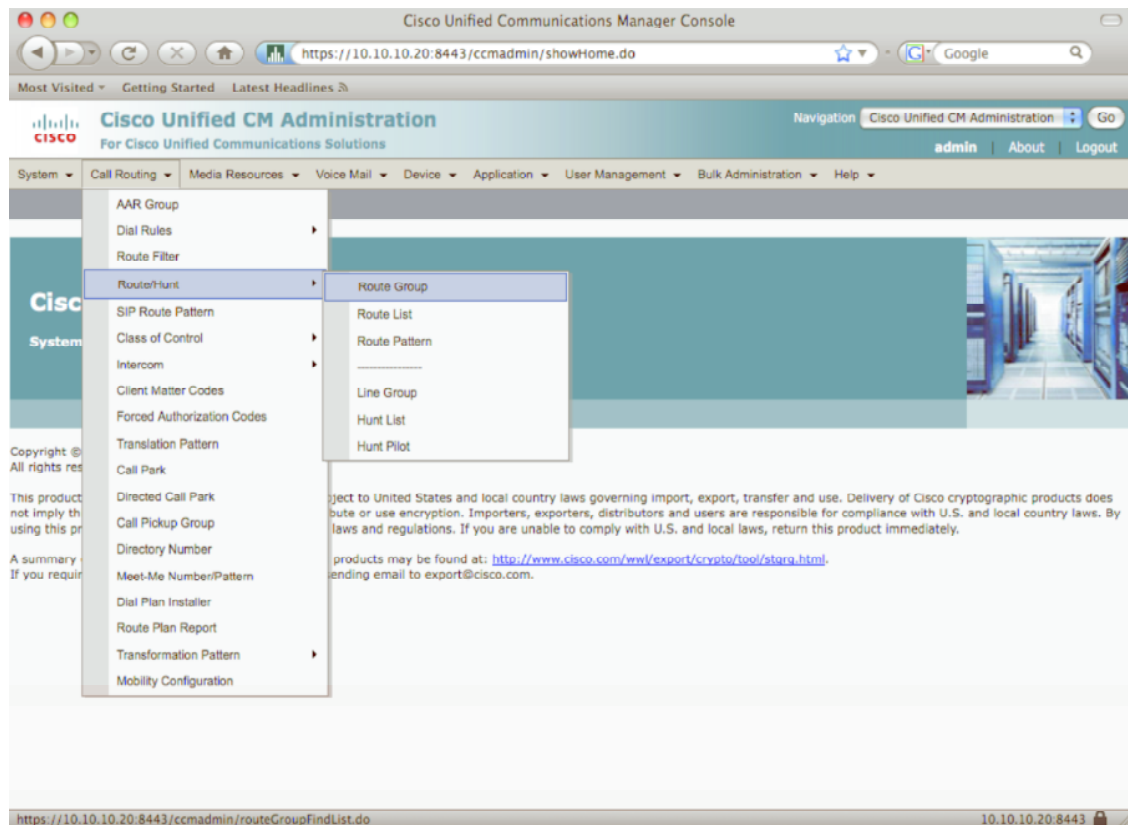
It is strongly recommended that you will refer to the SRND for further review of the call routing issue, at the following URL:

http://www.cisco.com/en/US/docs/voice_ip_comm/cucm/srnd/7x/uc7_0.html

Chapter 4 – Call Routing

The Traditional Approach:

Before we start the dial plan we should define a route group for each gateway and trunk within the system:

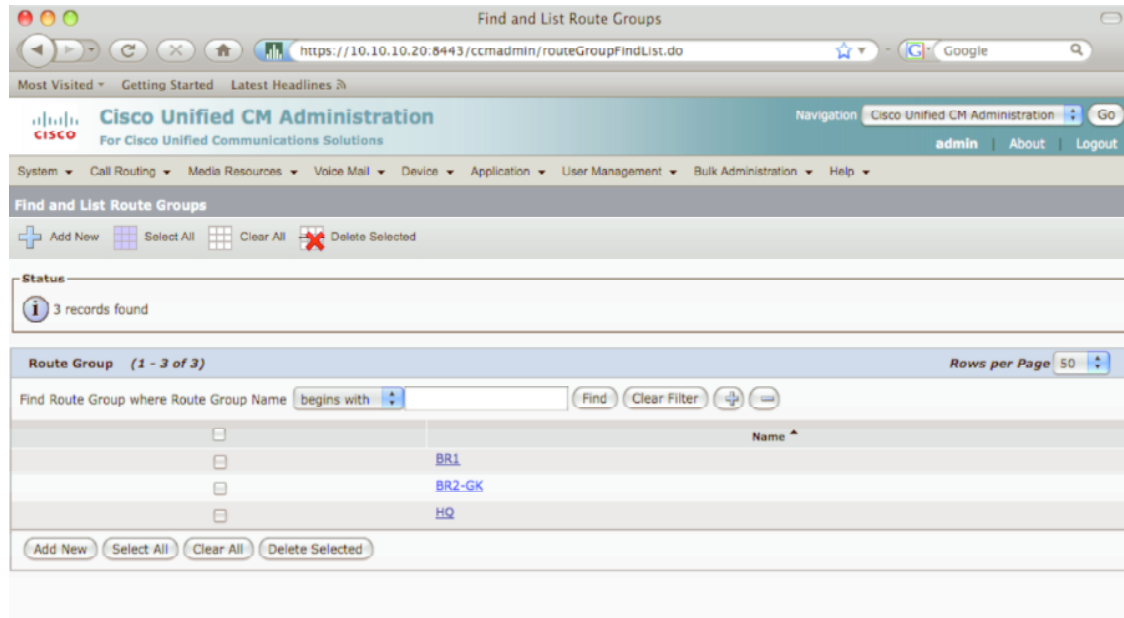


Set the name and other parameters, distribution algorithm is not important since there is only one gateway in the group(repeat for each gateway and trunk):

The screenshot displays the 'Route Group Configuration' interface in the Cisco Unified CM Administration console. The browser address bar shows the URL `https://10.10.10.20:8443/ccmadmin/routeGroupSave.do`. The page title is 'Route Group Configuration'. Below the navigation bar, there are tabs for 'Save', 'Delete', and 'Add New'. The 'Route Group Information' section contains a 'Route Group Name' field with the value 'HQ' and a 'Distribution Algorithm' dropdown set to 'Circular'. The 'Route Group Member Information' section includes a 'Find Devices to Add to Route Group' area with a 'Device Name contains' field and a 'Find' button. Below this, a list of 'Available Devices' shows 'S0/SU1/DS1-0@HQ-Router' and 'Trunk'. The 'Port(s)' dropdown is set to 'None Available'. An 'Add to Route Group' button is present. The 'Current Route Group Members' section shows a list of 'Selected Devices' with 'S0/SU1/DS1-0@HQ-Router (All Ports)' selected. A 'Reverse Order of Selected Devices' button is also visible. The 'Route Group Members' section at the bottom shows the selected device 'S0/SU1/DS1-0@HQ-Router'.

Chapter 4 – Call Routing

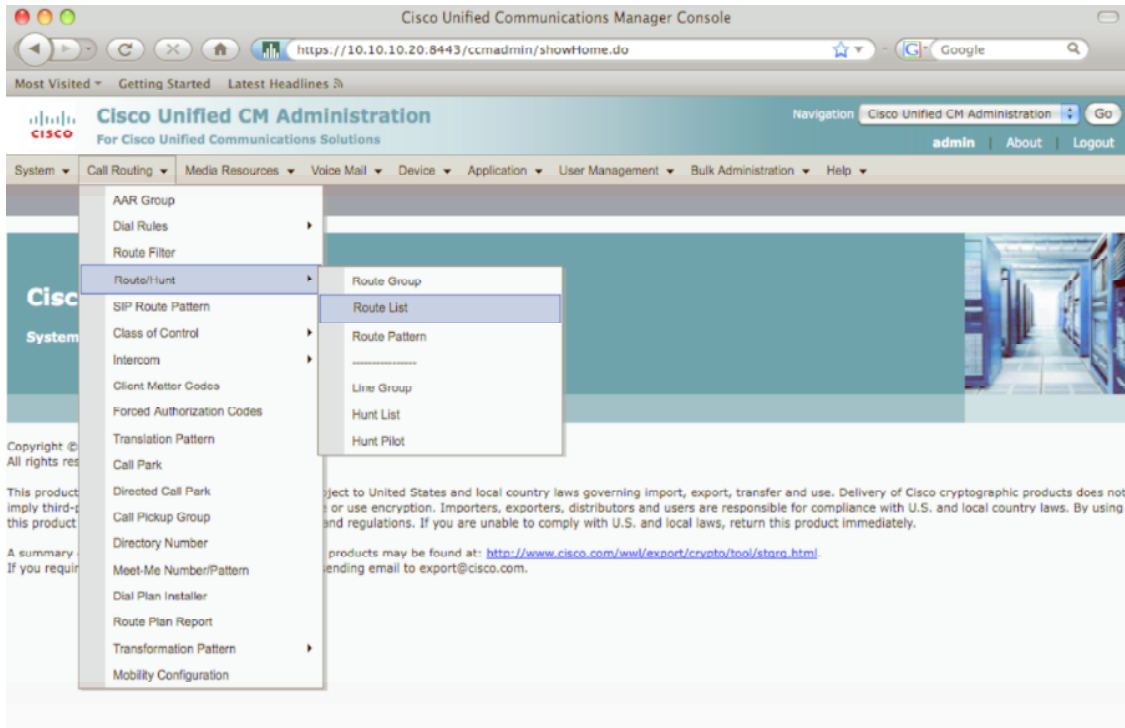
When finished you should show be able to see all three route groups:



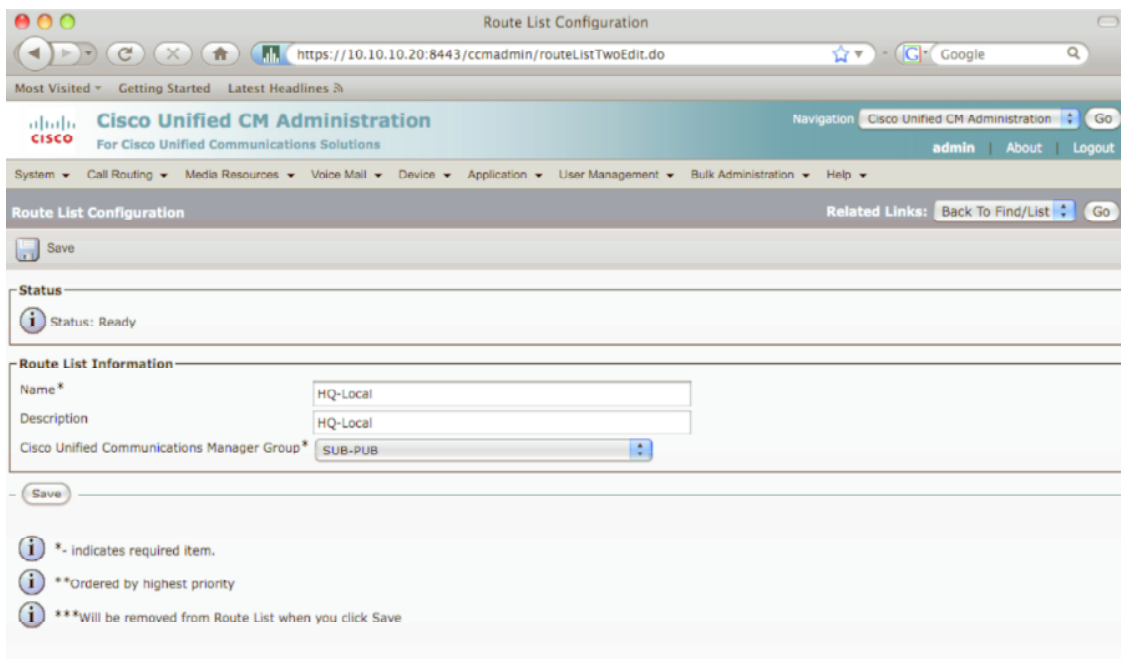
Now it's time for the route lists, which can be a little more complicated. You should have a route list for every unique digit manipulation and redundancy set. So if you are requested to provide redundancy when dialing local calls from HQ, it will take a route list just for that. If you planned it correctly from the beginning, you should have a list of route lists which will define digit manipulation and a prioritized order of gateways.

Lets start with the request to allow local calls from HQ to be processed via the HQ gateway and then the BR1 gateway. This requires a route list that will strip the 9 and then send the pattern [2-9]xxxxxx to the HQ gateway. If it is not working then call should be processed out the BR1 gateway with addition of 1 and the local area prefix of the HQ site which is 702 (1702). The steps to accomplish this are shown below:

First add a route list:



Click the "Save" button:



Chapter 4 – Call Routing

Click the “Add Route Group” button:

Route List Configuration

https://10.10.10.20:8443/ccmadmin/routeListTwoSave.do

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Route List Configuration Related Links: Back To Find/List Go

Save Delete Copy Reset Add New

Status
Add successful

Route List Information

Name* MQ-Local

Description HQ-Local

Cisco Unified Communications Manager Group* SUB-PUB

☒ Enable this Route List (change effective on Save; no reset required)

Route List Member Information

Selected Groups**

Removed Groups***

Add Route Group

Save Delete Copy Reset Add New

Now add route groups to the route list:

The screenshot shows the 'Route List Detail Configuration' page in the Cisco Unified CM Administration interface. The browser address bar shows the URL: `https://10.10.10.20:8443/ccmadmin/routeListTwoDetailEdit.do?devkey=e03784d2-...`. The page title is 'Route List Detail Configuration'. The navigation menu includes 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. The 'Route List Member Information' section shows the 'Route Group' as 'HQ-[NON-QSIG]'. Below this, there are two sections for transformations:

- Calling Party Transformations:**
 - Use Calling Party's External Phone Number Mask*: On
 - Calling Party Transform Mask: (empty text field)
 - Prefix Digits (Outgoing Calls): (empty text field)
 - Calling Party Number Type*: Cisco CallManager
 - Calling Party Numbering Plan*: Cisco CallManager
- Called Party Transformations:**
 - Discard Digits: NANP:PreDot
 - Called Party Transform Mask: (empty text field)
 - Prefix Digits (Outgoing Calls): (empty text field)
 - Called Party Number Type*: Cisco CallManager
 - Called Party Numbering Plan*: Cisco CallManager

At the bottom of the page, there is a 'Save' button.

Chapter 4 – Call Routing

You can see the HQ route group now assigned to the HQ-Local route list once you hit save:

Route List Configuration

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Route List Configuration Related Links: Back To Find/List Go

Save Delete Copy Reset Add New

Status

Status: Ready

Route List Information

Name* HQ-Local

Description HQ-Local

Cisco Unified Communications Manager Group* SUB-PUB

☒ Enable this Route List (change effective on Save; no reset required)

Route List Member Information

Selected Groups** HQ

Add Route Group

Removed Groups***

Route List Details

HQ

Save Delete Copy Reset Add New

You will not need to add the BR1 route group to the HQ-Local route list:

Route List Detail Configuration

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Route List Detail Configuration Related Links: Back To Find/List ▾ Go

Save

Status

Status: Ready

Route List Member Information

Route Group * BR1-[NUN-QSIG] ▾

Calling Party Transformations

Use Calling Party's External Phone Number Mask * On ▾

Calling Party Transform Mask

Prefix Digits (Outgoing Calls)

Calling Party Number Type * Cisco CallManager ▾

Calling Party Numbering Plan * Cisco CallManager ▾

Called Party Transformations

Discard Digits NANP:PreDot ▾

Called Party Transform Mask

Prefix Digits (Outgoing Calls) 1702

Called Party Number Type * Cisco CallManager ▾

Called Party Numbering Plan * Cisco CallManager ▾

Save

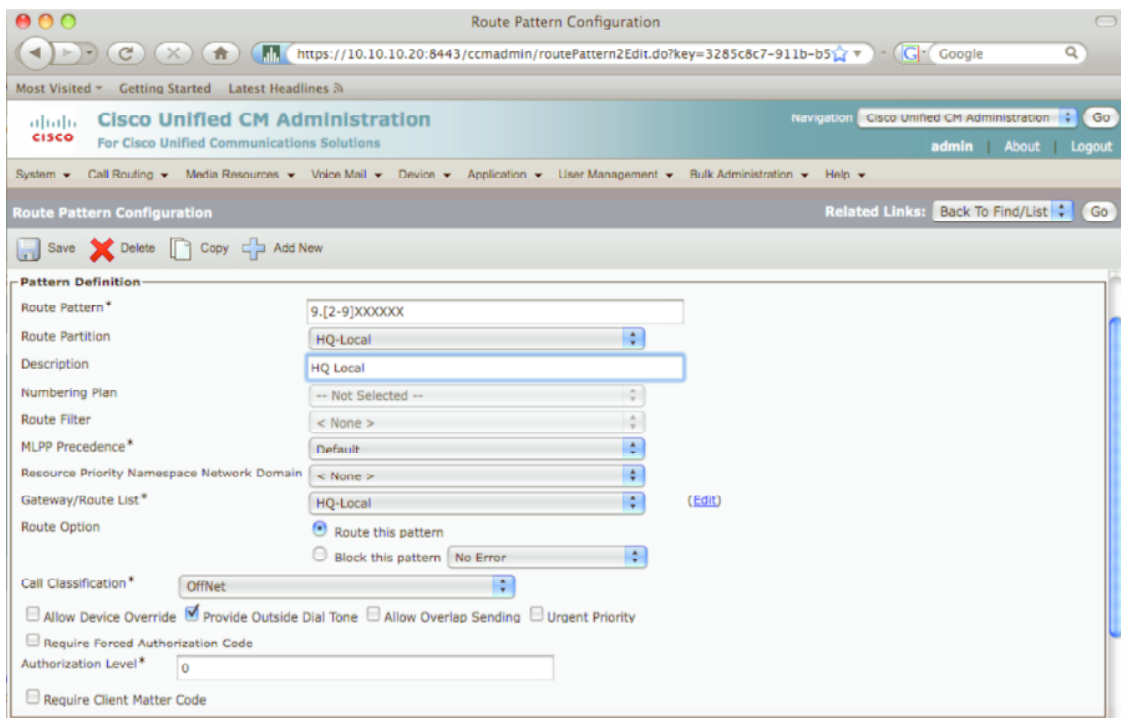
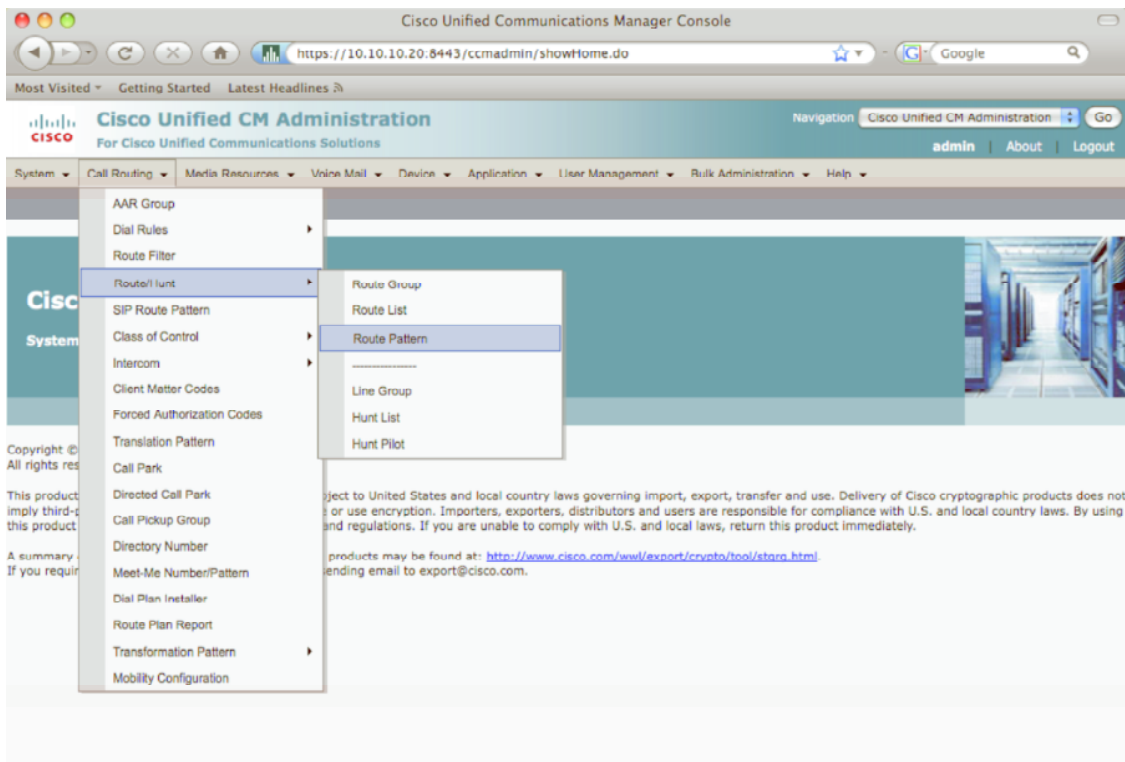
Chapter 4 – Call Routing

You should now be able to see both route groups within the route list(don't forget to select the NANP:PreDot for discard digits and external phone number mask on both route groups):

The screenshot displays the 'Route List Configuration' page in the Cisco Unified CM Administration interface. The page is titled 'Route List Configuration' and shows a successful status message: 'Add successful'. The 'Route List Information' section contains the following fields: Name* (HQ-Local), Description (HQ-Local), and Cisco Unified Communications Manager Group* (SUB-PUB). A checkbox 'Enable this Route List (change effective on Save; no reset required)' is checked. The 'Route List Member Information' section shows 'Selected Groups**' (HQ, BR1) and 'Removed Groups***'. The 'Route List Details' section shows two entries: HQ and BR1, both with a status of 'X'. The page includes navigation links at the top and bottom, and a 'Related Links' section with a 'Back To Find/List' link.

TIP: Reset any route list whenever you make a change as changes will not be applied until you have reset the route list.

Now let's add the relevant route pattern:



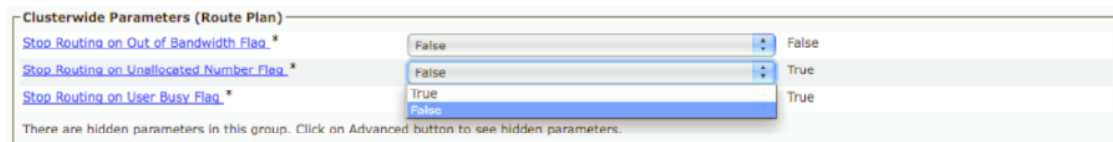
Chapter 4 – Call Routing

Next we could test a call from HQ Phone 1 to 99465000 and we should see the call process through the HQ gateway as expected. If we then shutdown the T1 PRI on the HQ gateway the call should process through the BR1 gateway. However, the BR1 gateways has no dial-peers defined for external calls so the call will fail. We could go ahead at this time and define the dial-peers needed by BR1 gateway:

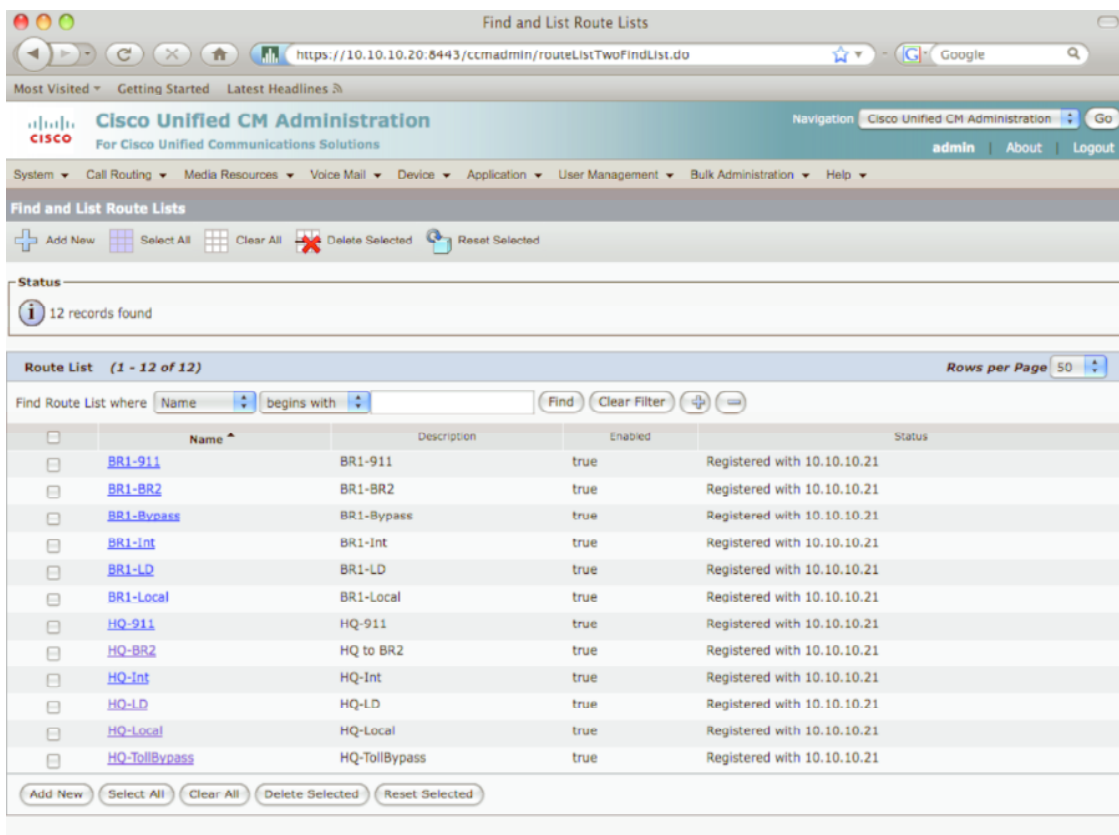
```
dial-peer voice 7 pots
 destination-pattern [2-9].....T
 port 0/0/0:23
 forward-digits all
!
dial-peer voice 10 pots
 destination-pattern [2-9]..[2-9].....T
 port 0/0/0:23
 forward-digits all
!
dial-peer voice 11 pots
 destination-pattern 1[2-9]..[2-9].....T
 port 0/0/0:23
 forward-digits all
!
dial-peer voice 20 pots
 destination-pattern 011T
 port 0/0/0:23
 forward-digits all
!
dial-peer voice 911 pots
 destination-pattern 911
 port 0/0/0:23
 forward-digits all
.
```

Now try your call to 99465000 from HQ Phone 1 and make sure your call succeeds with the HQ gateway T1 PRI down.

TIP: You will need to change the following CallManager service parameter as you continue to test your dial plan as some calls will not follow their redundant path unless this parameters is set correctly(default is true but needs to be false so calls route to next route group in route list on Unallocated number):



Now add the rest of the dial plan, except for calls to BR2, for HQ and BR1 site. Be sure to test your dial plan by shutting down interfaces as needed until you are sure all calls are routing correctly. The final list of route lists, and route patterns should look like the following:



Name	Description	Enabled	Status
BR1-911	BR1-911	true	Registered with 10.10.10.21
BR1-BR2	BR1-BR2	true	Registered with 10.10.10.21
BR1-Bypass	BR1-Bypass	true	Registered with 10.10.10.21
BR1-Int	BR1-Int	true	Registered with 10.10.10.21
BR1-LD	BR1-LD	true	Registered with 10.10.10.21
BR1-Local	BR1-Local	true	Registered with 10.10.10.21
HQ-911	HQ-911	true	Registered with 10.10.10.21
HQ-BR2	HQ to BR2	true	Registered with 10.10.10.21
HQ-Int	HQ-Int	true	Registered with 10.10.10.21
HQ-LD	HQ-LD	true	Registered with 10.10.10.21
HQ-Local	HQ-Local	true	Registered with 10.10.10.21
HQ-TollBypass	HQ-TollBypass	true	Registered with 10.10.10.21

Chapter 4 – Call Routing

Find and List Route Patterns

https://10.10.10.20:8443/ccmadmin/routePattern2FindList.do?%3C%3DreqParams%3C%3D

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Find and List Route Patterns

+ Add New Select All Clear All Delete Selected

Status
14 records found

Route Patterns (1 - 14 of 14)

Rows per Page 50

Find Route Patterns where Pattern begins with Find Clear Filter

<input type="checkbox"/>	Pattern ^	Description	Partition	Route Filter	Associated Device	Copy
<input type="checkbox"/>	9.0111	BR1 International	BR1-International		BR1-Int	
<input type="checkbox"/>	9.0111	HQ International	HQ-International		HQ-Int	
<input type="checkbox"/>	9.0111#	BR1 International w #	BR1-International		BR1-Int	
<input type="checkbox"/>	9.0111#	HQ International with #	HQ-International		HQ-Int	
<input type="checkbox"/>	9.1(2-9)XX(2-9)XXXXXX	HQ Long Distance	HQ-Long-Distance		HQ-LD	
<input type="checkbox"/>	9.1(2-9)XX(2-9)XXXXXX	BR1 Long Distance	BR1-Long-Distance		BR1-LD	
<input type="checkbox"/>	9.911	BR1 911	BR1-911		BR1-911	
<input type="checkbox"/>	9.911	HQ 9.911	HQ-911		HQ-911	
<input type="checkbox"/>	9.(2-9)XXXXXX	HQ Local	HQ-Local		HQ-Local	
<input type="checkbox"/>	9.(2-9)XXXXXX	BR1 Local	BR1-Local		BR1-Local	
<input type="checkbox"/>	911	HQ 911	HQ-911		HQ-911	
<input type="checkbox"/>	911	BR1 911	BR1-911		BR1-911	
<input type="checkbox"/>	91702333.XXXX	HQ TollBypass to BR1	HQ-Long-Distance		HQ-TollBypass	
<input type="checkbox"/>	91702946.XXXX	BR1 TollBypass to HQ	HQ-Long-Distance		BR1-Bypass	

Add New Select All Clear All Delete Selected

The most difficult part of the dial plan, and I say this due to lack of gatekeeper knowledge for most students, is the calls from HQ and BR1 to the BR2 site. In order to make these calls work correctly we need to make sure we create a new route list for calls from HQ and BR1 to BR2(repeat for BR1 site):

The screenshot displays the 'Route List Configuration' interface in Cisco Unified CM Administration. The browser address bar shows the URL: <https://10.10.10.20:8443/ccmadmin/routeList1woedit.do?key=304de502-ad0b-35>. The page title is 'Route List Configuration'. The navigation bar includes 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. The 'Route List Configuration' section has a 'Related Links' bar with 'Back To Find/List' and 'Go'. Below this are buttons for 'Save', 'Delete', 'Copy', 'Reset', and 'Add New'. The 'Route List Information' section contains fields for 'Name*' (HQ-BR2), 'Description' (HQ to BR2), and 'Cisco Unified Communications Manager Group*' (SUB-PUB). There is a checkbox for 'Enable this Route List (change effective on Save; no reset required)'. The 'Route List Member Information' section has 'Selected Groups**' (BR2-GK, HQ) and 'Removed Groups***'. An 'Add Route Group' button is present. The 'Route List Details' section shows a list of route groups: 'BR2-GK' and 'HQ'. At the bottom are buttons for 'Save', 'Delete', 'Copy', 'Reset', and 'Add New'.

You will need to "PreDot" strip on both route groups and then prepend 01144207630 to the HQ route group under your new route list.

Chapter 4 – Call Routing

Now create a route pattern in the internal partition for HQ and BR1 for pattern 7XXXX. Route this to the appropriate route list:

The screenshot shows the 'Find and List Route Patterns' interface in Cisco Unified CM Administration. The search criteria are set to 'Pattern' and 'begins with 7'. The results table shows two entries:

Pattern	Description	Partition	Route Filter	Associated Device	Copy
7XXXX	HQ to BR2	HQ-Internal		HQ-BR2	
7XXXX	BR1 to BR2	BR1-Internal		BR1-BR2	

At the bottom of the table, there are buttons for 'Add New', 'Select All', 'Clear All', and 'Delete Selected'.

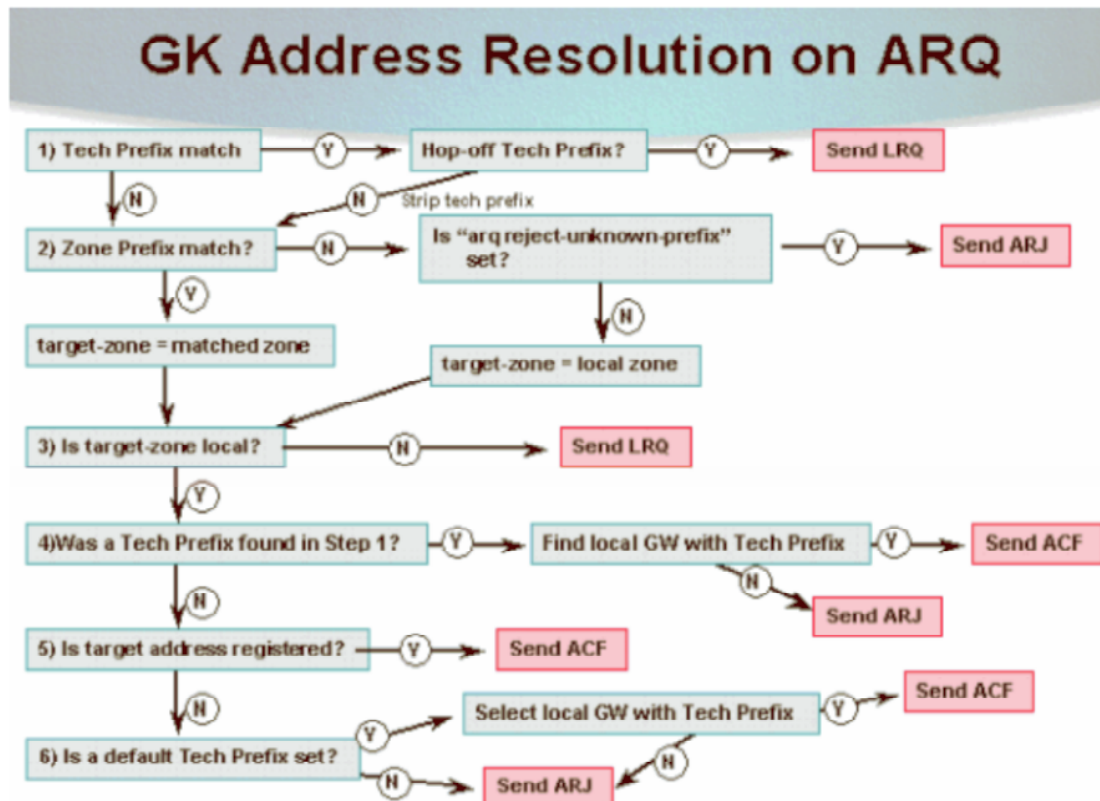
You can check your configuration by calling 73003 from HQ Phone 1 and then issuing the command “show gatekeeper calls” on the HQ-Router and you should see the following:

```
Total number of active calls = 1.
                                GATEKEEPER CALL INFO
                                =====
LocalCallID                     Age(secs)  BW
1-230                           11         120(Kbps)
  Endpt(s): Alias                E.164Addr
    src EP: Trunk_2              7029461001
      CallSignalAddr  Port  RASignalAddr  Port
      10.10.10.21      41784 10.10.10.21    32799
  Endpt(s): Alias                E.164Addr
    dst EP: CME                  3003
      CallSignalAddr  Port  RASignalAddr  Port
      10.10.230.1     1720 10.10.230.1    62302
```

Once you complete a call through gatekeeper then you will want to shutdown gatekeeper on the HQ router and make sure your call completes through the HQ gateway as an international call. You can use the “show voice call summary” on HQ or BR1 gateways to validate calls are routed through the appropriate gateway.

Chapter 4 – Call Routing

As you recall it is forbidden to use a tech prefix in call routing via the gatekeeper, so we need to have every extension registered to the gatekeeper, as can be seen in the following flow chart:



In order to register extension behind the CME in BR2, we don't need to do anything. It is registered for us by the IOS as can be seen from the following "show gatekeeper endpoint" command:

```

GATEKEEPER ENDPOINT REGISTRATION
=====
CallSignalAddr  Port  RASignalAddr  Port  Zone Name      Type  Flags
-----
10.10.10.20     51168 10.10.10.20   32877 voiceie       VOIP-GW
H323-ID: Trunk_1
Voice Capacity Max.= Avail.= Current.= 0
10.10.10.21     52721 10.10.10.21   32799 voiceie       VOIP-GW
H323-ID: Trunk_2
Voice Capacity Max.= Avail.= Current.= 0
10.10.230.1     1720  10.10.230.1   62302 voiceie       VOIP-GW
E164-ID: 3001
E164-ID: 3002
E164-ID: 3003
E164-ID: 3005
E164-ID: 3111
E164-ID: 3004
H323-ID: CME
Voice Capacity Max.= Avail.= Current.= 0
Total number of active registrations = 3

```

You can see that extension 3001 to 3005 and extension 3111 (hunt list previously defined) is registered with an E.164 ID. The CallManager, however, does not register extensions automatically. In order to process calls from BR2 to HQ or BR1 we will need to add alias commands, since we are not allowed to use tech prefixes, to the gatekeeper for HQ and BR1 extensions. We will also have to change the port that CallManager uses to register with gatekeeper for the static alias commands to work:

Device Name of GK-controlled Trunk That Will Use Port 1720 *	Trunk	None
Host Name/IP Address of GK That Will Use RAS UDP Port 1719 *	10.10.30.1	None

Chapter 4 – Call Routing

You will now see the CallManager trunks registered with port 1720 instead of a dynamically assigned port(use the “show gatekeeper endpoints” command):

```

GATEKEEPER ENDPOINT REGISTRATION
=====
CallSignalAddr  Port  RASignalAddr  Port  Zone Name      Type  Flags
-----
10.10.10.20     1720  10.10.10.20   32877 voiceie    VOIP-GW
H323-ID: Trunk_1
Voice Capacity Max.= Avail.= Current.= 0
10.10.10.21     1720  10.10.10.21   32799 voiceie    VOIP-GW
H323-ID: Trunk_2
Voice Capacity Max.= Avail.= Current.= 0
10.10.230.1     1720  10.10.230.1   62302 voiceie    VOIP-GW
E164-ID: 3001
E164-ID: 3002
E164-ID: 3003
E164-ID: 3005
E164-ID: 3111
E164-ID: 3004
H323-ID: CME
Voice Capacity Max.= Avail.= Current.= 0
Total number of active registrations = 3
```

You will need to define each extension for site HQ and BR1 within the gatekeeper using the “alias static” command:

```

gatekeeper
zone local voiceie ccbootcamp.com 10.254.254.2
alias static 10.10.10.21 1720 gkid voiceie gateway voip ras 10.10.10.21 32804 e164 1001 e164 1002 e164 2001 e164 2002
alias static 10.10.10.20 1720 gkid voiceie gateway voip ras 10.10.10.20 32861
no shutdown
```

On BR2 we will first need to define a translation to remove the first digit (the digit 7), because the gatekeeper only knows the 4 digit number of HQ and BR1 phones:

```

translation-rule 1
Rule 1 71 1
Rule 2 72 2
.
```

Next you would need to add the correct dial-peers in the BR2 gateway in order to route calls from BR2 to HQ or BR1:

```
dial-peer voice 1000 voip
  preference 1
  destination-pattern 71...
  translate-outgoing called 1
  session target ras
  codec g711ulaw
!
dial-peer voice 2000 voip
  preference 1
  destination-pattern 72...
  translate-outgoing called 1
  session target ras
  codec g711ulaw
!
dial-peer voice 1001 pots
  preference 2
  destination-pattern 71...
  translate-outgoing called 1
  port 0/0/0:15
  prefix 001702946
!
dial-peer voice 2001 pots
  preference 2
  destination-pattern 72...
  translate-outgoing called 1
  port 0/0/0:15
  prefix 001702333
```

TIP: Don't forget to put in the codec because if not all calls would have to be g729 (the default codec). You could use a voice class codec setup as well. Also remember to preference the dial-peers according to the call flow that is defined.

The second set of dial-peers will route to HQ or BR1 if the gatekeeper is down. Remember to use the correct prefix for the different sites when sending the call out the local E1 PRI.

You should test calls from BR2 Phone 1 to HQ Phone 1 through the gatekeeper and then through the local E1 PRI by shutting down the gatekeeper.

Chapter 4 – Call Routing

Next you will need to complete the dial plan for BR2 as defined in the task:

```
dial-peer voice 999 pots
  destination-pattern 999
  port 0/0/0:15
  forward-digits all
!
dial-peer voice 7 pots
  destination-pattern 9.....T
  port 0/0/0:15
  forward-digits 7
!
dial-peer voice 8 pots
  destination-pattern 90[2-9].....T
  port 0/0/0:15
  forward-digits 9
!
dial-peer voice 11 pots
  destination-pattern 900.T
  port 0/0/0:15
  prefix 00
```

TIP: Make sure you place test calls in order to test your dial plan.

If you were asked to use technology prefix then it would require different consideration regarding the dial plan, you would have to define the **tech-prefix** keyword under VOIP dial peers going to the gatekeeper and you would have to register the CallManager and CME to the gatekeeper using the designated tech-prefix.

Also keep in mind that the tech-prefix is not striped by the gatekeeper so you should have inbound digit manipulation on the receiving end of the call. On CME you can achieve this by using a "num-exp" statement and on CallManager it would be by creating a translation pattern that matches the expected tech prefix.

You should also learn how to configure a multi zone gatekeeper and many other things regarding that product. This document will not cover it all, readers are encouraged to attend our boot camp and practice this issue more thorough.

That's just about it for the dial plan; please remember that the key factors are plan and practice. Focus on them and you should succeed.

Troubleshooting Tips:

- Use “test translation” command to verify the outcome of translation rules.
- Use “csim start 71001” to simulate calls from IOS
- On the gatekeeper you should use the “debug gatekeeper main 10” (hidden command). It will tell you the exact stages that the call is going through.
- In CallManager, you should utilize the “Dialed Number Analyzer” for dial plan tests.

Chapter 5 – Voice CODEC

Topics included in this chapter:

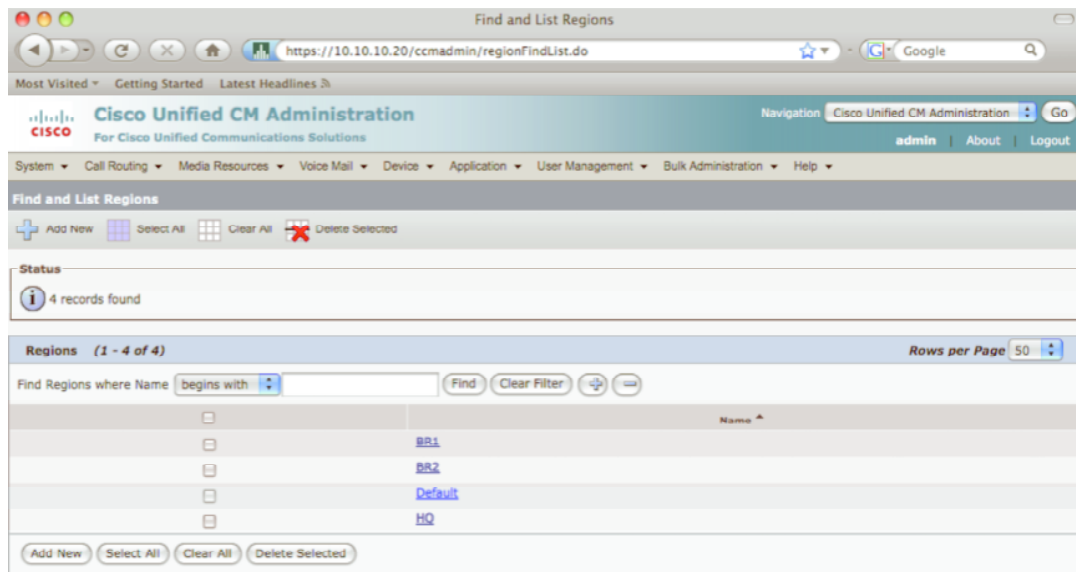
A. G711ulaw, G711alaw, G729, G723

Tasks to accomplish:

1. All calls within a site should use G711 codec.
2. Calls between sites should use G729 codec.

Solutions:

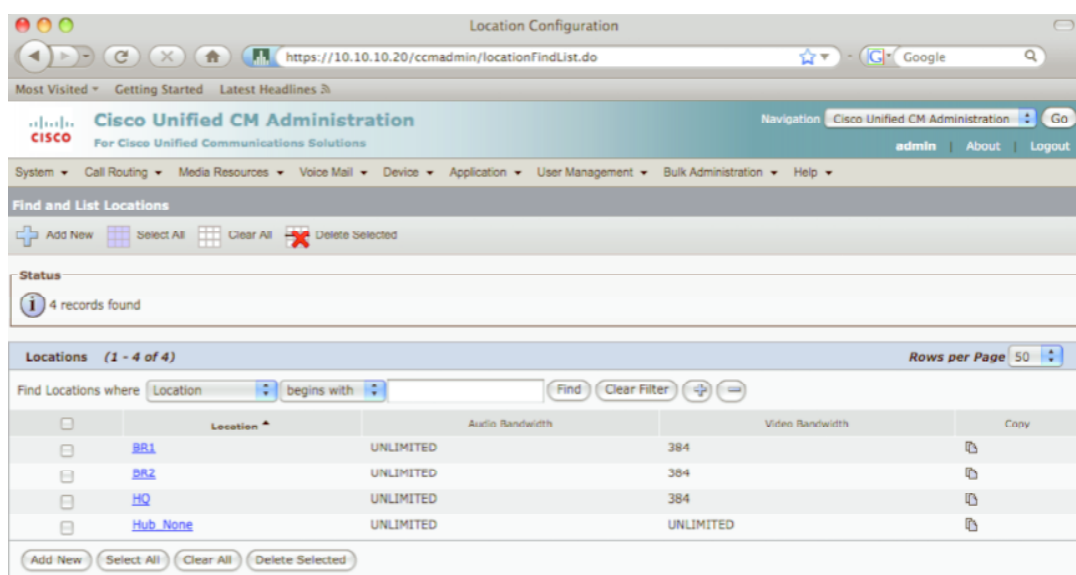
In the previous chapters we defined regions and locations for HQ and BR1. We now need to define a region and location for BR2:



The screenshot shows the 'Find and List Regions' page in Cisco Unified CM Administration. The browser address bar shows `https://10.10.10.20/ccmadmin/regionFindList.do`. The page title is 'Find and List Regions'. Below the navigation bar, there are buttons for 'Add New', 'Select All', 'Clear All', and 'Delete Selected'. A status bar indicates '4 records found'. The main table lists the following regions:

Name
BR1
BR2
Default
HQ

Below the table are buttons for 'Add New', 'Select All', 'Clear All', and 'Delete Selected'.



The screenshot shows the 'Find and List Locations' page in Cisco Unified CM Administration. The browser address bar shows `https://10.10.10.20/ccmadmin/locationFindList.do`. The page title is 'Find and List Locations'. Below the navigation bar, there are buttons for 'Add New', 'Select All', 'Clear All', and 'Delete Selected'. A status bar indicates '4 records found'. The main table lists the following locations:

Location	Audio Bandwidth	Video Bandwidth	Copy
BR1	UNLIMITED	384	
BR2	UNLIMITED	384	
HQ	UNLIMITED	384	
Hub_None	UNLIMITED	UNLIMITED	

Below the table are buttons for 'Add New', 'Select All', 'Clear All', and 'Delete Selected'.

Once we have added BR2 as a location and region we might want to create a device pool for BR2 with the appropriate settings. We create BR2 device pool so that we can assign it to the H.225 trunk we create previously. Be sure to reset the trunk once you can the device pool:

Device Pool Configuration

https://10.10.10.20/ccmadmin/devicePoolEdit.do?key=3ae8f41b-dba2-5362-26d8

Cisco Unified CM Administration

Navigation: Cisco Unified CM Administration Go

admin About Logout

System Call Routing Media Resources Voice Mail Device Application User Management Bulk Administration Help

Device Pool Configuration Related Links: Back To Find/List Go

Save Delete Copy Reset Add New

Device Pool Information

Device Pool: BR2 (1 members**)

Device Pool Settings

Device Pool Name* BR2

Cisco Unified Communications Manager Group* SUB-PUB

Calling Search Space for Auto-registration < None >

Reverted Call Focus Priority Default

Local Route Group < None >

Roaming Sensitive Settings

Date/Time Group* PST

Region* BR2

Media Resource Group List < None >

Location BR2

Network Locale < None >

SRST Reference* Disable

Connection Monitor Duration***

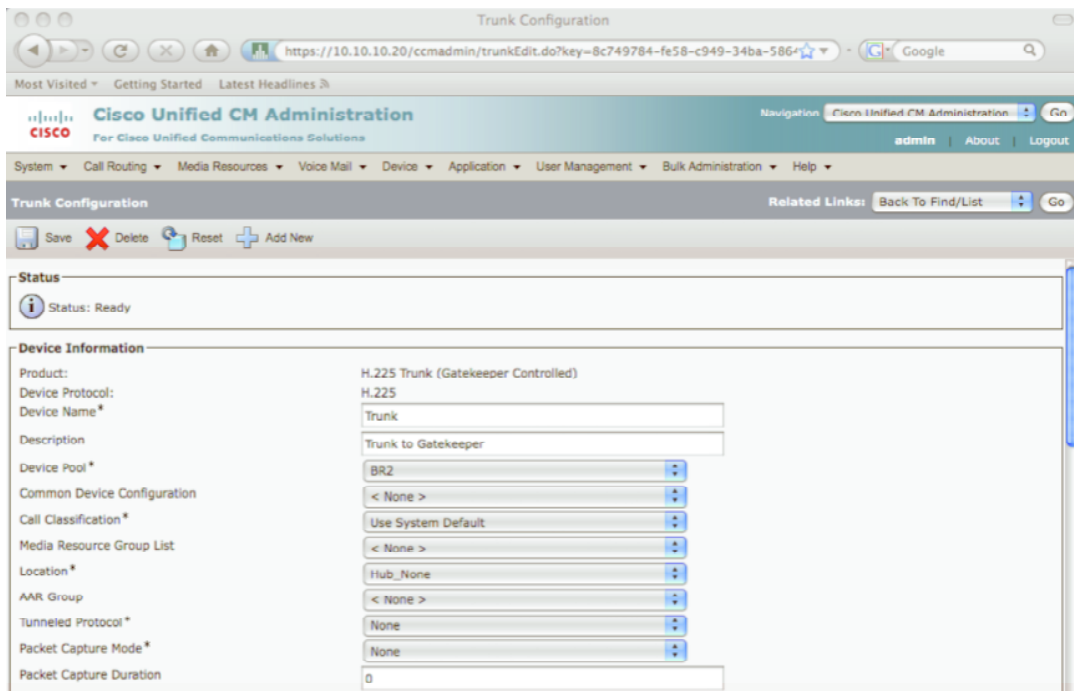
Single Button Barge* Default

Join Across Lines* Default

Physical Location < None >

Device Mobility Group < None >

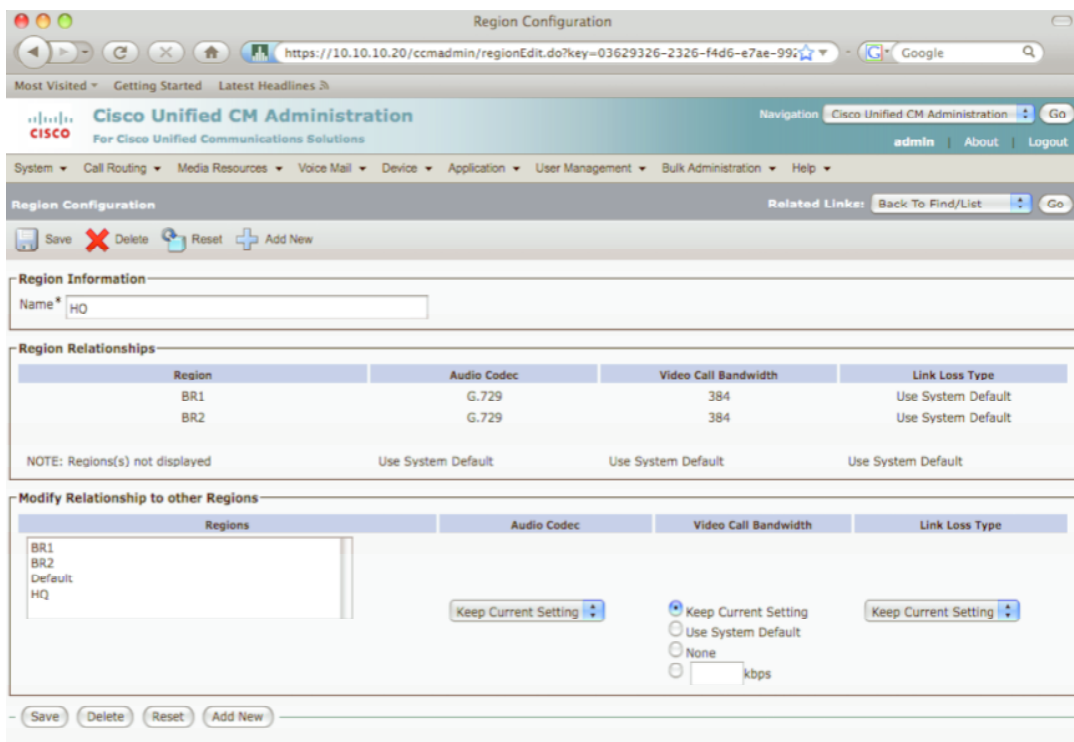
Chapter 5 – Voice CODEC



The screenshot shows the 'Trunk Configuration' page in the Cisco Unified CM Administration interface. The page title is 'Trunk Configuration' and the URL is 'https://10.10.10.20/ccmadmin/trunkEdit.do?key=8c749784-fe58-c949-34ba-5864...'. The page has a navigation bar with links like 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. Below the navigation bar, there are tabs for 'Save', 'Delete', 'Reset', and 'Add New'. The main content area is titled 'Status' and shows 'Status: Ready'. Below this, there is a 'Device Information' section with the following fields:

Field	Value
Product	H.225 Trunk (Gatekeeper Controlled)
Device Protocol	H.225
Device Name*	Trunk
Description	Trunk to Gatekeeper
Device Pool *	BR2
Common Device Configuration	< None >
Call Classification *	Use System Default
Media Resource Group List	< None >
Location *	Hub_None
AAR Group	< None >
Tunneled Protocol *	None
Packet Capture Mode*	None
Packet Capture Duration	0

Once this is completed we can then go into the HQ region and select G.729 between HQ and all other regions(repeat for other regions as well):



The screenshot shows the 'Region Configuration' page in the Cisco Unified CM Administration interface. The page title is 'Region Configuration' and the URL is 'https://10.10.10.20/ccmadmin/regionEdit.do?key=03629326-2326-f4d6-e7ae-99...'. The page has a navigation bar with links like 'System', 'Call Routing', 'Media Resources', 'Voice Mail', 'Device', 'Application', 'User Management', 'Bulk Administration', and 'Help'. Below the navigation bar, there are tabs for 'Save', 'Delete', 'Reset', and 'Add New'. The main content area is titled 'Region Information' and shows 'Name: HQ'. Below this, there is a 'Region Relationships' section with a table showing the relationship between regions and their audio codec, video call bandwidth, and link loss type.

Region	Audio Codec	Video Call Bandwidth	Link Loss Type
BR1	G.729	384	Use System Default
BR2	G.729	384	Use System Default

NOTE: Region(s) not displayed Use System Default Use System Default Use System Default

Below the table, there is a 'Modify Relationship to other Regions' section with a table showing the relationship between regions and their audio codec, video call bandwidth, and link loss type.

Regions	Audio Codec	Video Call Bandwidth	Link Loss Type
BR1 BR2 Default HQ	Keep Current Setting	<input checked="" type="radio"/> Keep Current Setting <input type="radio"/> Use System Default <input type="radio"/> None <input type="text" value=""/> kbps	Keep Current Setting

Region BR1 details:

The screenshot shows the Cisco Unified CM Administration interface for Region Configuration. The browser address bar shows the URL: `https://10.10.10.20/ccadmin/regionEdit.do?key=4833604c-b958-8751-ab0d-97`. The page title is "Region Configuration".

Region Information

Name:

Region Relationships

Region	Audio Codec	Video Call Bandwidth	Link Loss Type
BR2	G.729	384	Use System Default
HQ	G.729	384	Use System Default
NOTE: Region(s) not displayed	Use System Default	Use System Default	Use System Default

Modify Relationship to other Regions

Regions	Audio Codec	Video Call Bandwidth	Link Loss Type
BR1 BR2 Default HQ	<input type="button" value="Keep Current Setting"/>	<input checked="" type="radio"/> Keep Current Setting <input type="radio"/> Use System Default <input type="radio"/> None <input type="text" value=""/> kbps	<input type="button" value="Keep Current Setting"/>

Buttons:

Chapter 5 – Voice CODEC

Region BR2 details:

The screenshot shows the Cisco Unified CM Administration interface for Region Configuration. The browser address bar shows the URL: `https://10.10.10.20/ccmadmin/regionEdit.do?key=9dd250de-72d5-872f-c0f5-4d5`. The page title is "Region Configuration". The navigation bar includes links for "admin", "About", and "Logout". The main menu includes "System", "Call Routing", "Media Resources", "Voice Mail", "Device", "Application", "User Management", "Bulk Administration", and "Help". The "Region Configuration" section is active, showing a "Related Links" button for "Back To Find/List".

Region Information

Name:

Region Relationships

Region	Audio Codec	Video Call Bandwidth	Link Loss Type
BR1	G.729	384	Use System Default
HQ	G.729	384	Use System Default
NOTE: Region(s) not displayed Use System Default Use System Default Use System Default			

Modify Relationship to other Regions


Regions	Audio Codec	Video Call Bandwidth	Link Loss Type
<input type="checkbox"/> BR1 <input type="checkbox"/> BR2 <input type="checkbox"/> Default <input type="checkbox"/> HQ	<input type="button" value="Keep Current Setting"/>	<input checked="" type="radio"/> Keep Current Setting <input type="radio"/> Use System Default <input type="radio"/> None <input type="text" value=""/> kbps	<input type="button" value="Keep Current Setting"/>

Buttons:

Now we must change our CallManager Express dial-peer to match the desired codec as our original setup was for G711ulaw:

```
dial-peer voice 1000 voip
  preference 1
  destination-pattern 71...
  translate-outgoing called 1
  session target ras
!
dial-peer voice 2000 voip
  preference 1
  destination-pattern 72...
  translate-outgoing called 1
  session target ras
```

Troubleshooting tips:

Use the phones question mark button  to verify what codec the call is using, by pressing on it twice during a call.