



# Avaya Definity G3 Version CM2.0 to Cisco IOS Voice Gateway using H.323 with E1 NET5

January 09, 2008

## Table of Contents

Introduction .....	2
Network Topology.....	3
Limitations.....	3
System Components .....	4
Hardware requirements .....	4
Software Requirements .....	4
Features .....	4
Features Supported.....	4
Features Not Supported.....	4
Configuration.....	5
Configuring Avaya Definity G3 Version CM 2.0 .....	5
Cisco 3825 configuration .....	13
Acronyms .....	17



## Introduction

- This Application note provides basic call interoperability and documented steps and configurations necessary for H323 integration between Avaya Definity G3 Version CM 2.0 to Cisco IOS Voice Gateway providing E1 NET5 PSTN connectivity.
- The H323 protocol is used between Cisco IOS Voice gateway and Avaya Definity G3 Version CM 2.0 The connection between Cisco IOS gateway and PSTN uses E1 with switch-type NET5 protocol.
- Features tested include Basic call, Call Transfer supervised, Call Transfer blind, Call Forward (All, Busy and No Answer), Three-way Conference, DTMF tones, Caller ID functionality between Avaya Definity G3 Version CM 2.0 users and PSTN users.
- The Cisco IOS Voice Gateway offers the advantage of providing connectivity between Avaya Definity G3 Version CM 2.0 and PSTN by offering H323 to ISDN inter-working functionality.
- The network topology diagram (Figure 1) shows the test setup for end-to-end interoperability with the Cisco IOS Voice Gateway connected to the Avaya Definity G3 Version CM 2.0 and connected to the PSTN via E1 NET5 ISDN.
- This Application Notes uses the C3825 IOS-voice-gateway, however other Cisco voice gateways are also an option to use since the voice gateway implementation does not depend on the platform. Below is a list of Cisco platforms capable of voice gateway functionality: Care must be taken when selecting a voice gateway platform depending on the capacity and capability required for the intended deployment.

[Cisco 1861 Integrated Services Router](#)

[Cisco IAD2400 Series Integrated Access Device](#)

[Cisco 2800 Series Integrated Services Routers](#)

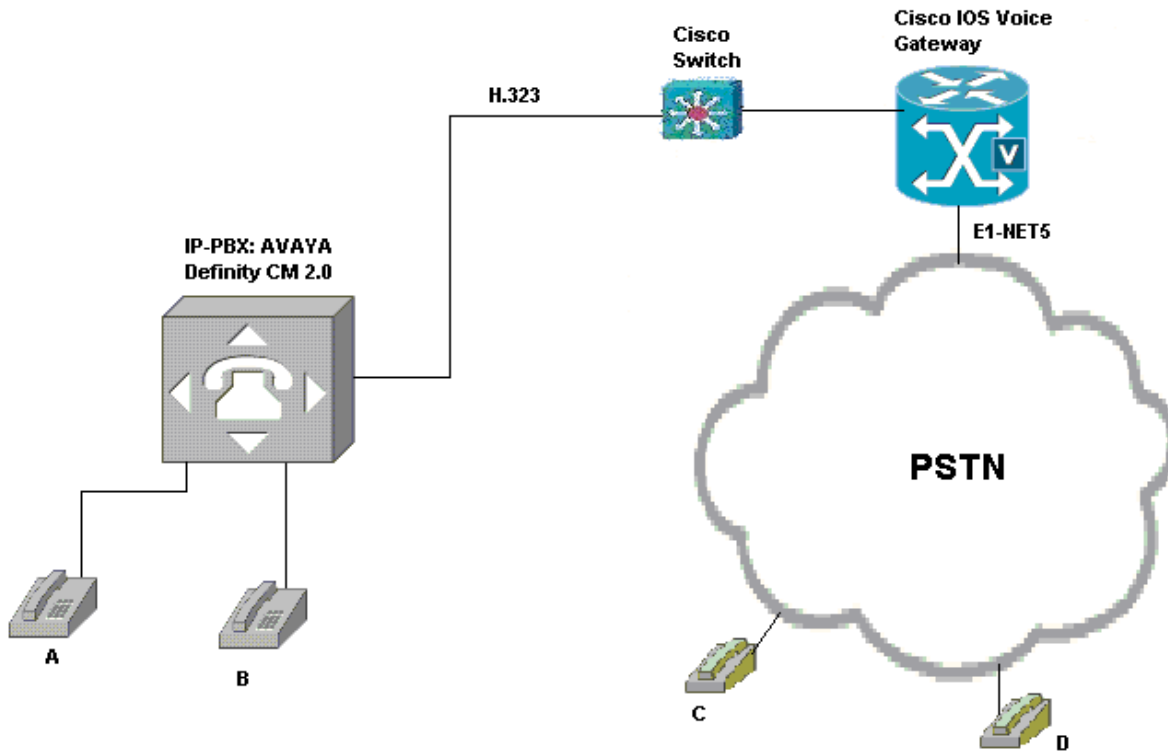
[Cisco 3700 Series Multiservice Access Routers](#)

[Cisco 3800 Series Integrated Services Routers](#)

[Cisco AS5350XM Universal Gateway](#)

[Cisco AS5400XM Universal Gateway](#)

## Network Topology



**Figure 1.** Network Topology

### Limitations

- DTMF tones using RFC2833 feature does not interoperate due to signaling inconsistencies between the Avaya Definity CM2.0 PBX and the Cisco IOS Voice Gateway.



## System Components

### Hardware requirements

- Cisco Hardware
  - Cisco 3825 Gateway
  - DSP Mod. NM-HDV2-2T1/E1<sup>1</sup>
  - Cisco Cat 3550 Power Ethernet switch
- Avaya Definity CM Hardware
  - Avaya Definity G3 Version CM 2.0.

### Software Requirements

- IOS Software releases: c3825-ipvoiceek9-mz.124-11.xj.bin
- PBX Software: Avaya Definity G3 Version CM 2.0

## Features

### Features Supported

- Calling Name Identification Restriction
- Calling Number Identification Restriction
- Codec G.711 Ulaw
- Codec G.729
- Codec G723
- Calling name
- Calling number
- Call Transfer blind
- Call Transfer Supervised
- Call Conference
- Call on-hold
- Call Forward No Reply
- Call Forward all
- Call Forward Busy
- DTMF tones using In-Band and Out-Of-Band (DTMF with H245 signaling) signaling
- Digit translation – The voice gateway can modify the digits of the called 4-digit number sent by Avaya Definity G3 Version CM 2.0 and PSTN

### Features Not Supported

- DTMF tones using RFC2833

---

<sup>1</sup> G.723 Codec does not work with DSP module NM-HDV and work with NM-HDV2-2T1/E1.



## Configuration

### Configuring Avaya Definity G3 Version CM 2.0

#### Trunk Group

The screenshot displays the Avaya V7 configuration interface for a Trunk Group. The window title is "Avaya\_V7" and the active command is "display trunk-group 91". The interface includes a toolbar with various icons and a menu bar with options like "send (return)", "help (F5)", "cancel (esc)", "enter (F3)", "schedule (F9)", "next (F7)", "previous (F8)", and "next form (F6)".

The main configuration area shows the following settings for Trunk Group 91:

```
1 2 3 4 5 6 7 8 9 10
TRUNK GROUP
Group Number: 91          Group Type: isdn          CDR Reports: y
Group Name:  OUTSIDE CALL   COR: 1          TN: 1          TAC: 691
Direction: two-way        Outgoing Display? n    Carrier Medium: IP
Dial Access? y           Busy Threshold: 99     Night Service:
Queue Length: 0
Service Type: tie        Auth Code? n          TestCall ITC: rest
                          Far End Test Line No:

TestCall BCC: 4
TRUNK PARAMETERS
  Codeset to Send Display: 0    Codeset to Send National IEs: 6
  Max Message Size to Send: 260 Charge Advice: none
  Supplementary Service Protocol: a  Digit Handling (in/out): enbloc/enbloc

  Trunk Hunt: ascend          QSIG Value-Added? n
                              Digital Loss Group: 18
  Calling Number - Delete:      Insert:              Numbering Format: unk-unk
  Bit Rate: 1200                Synchronization: async Duplex: full
  Disconnect Supervision - In? y Out? n
  Answer Supervision Timeout: 0
```

The left sidebar contains a "General" section with the following options: Start GEDI, Add User, Change User Name, Remove User, Add Bridged Appearance, Browse Dial Ranges, Browse Stations, Browse Unused Ports, Find Unused Extension, and Print Button Labels. Below this are "Advanced" and "Fault & Performance" sections, and at the bottom are "Tasks" and "Tree" buttons.





## Trunk Group Cont'd

display trunk-group 91    send (return)    help (f5)    cancel (esc)    enter (f3)    schedule (f9)    next (f7)    previous (f8)    next form (f6)

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10

**TRUNK GROUP**  
 Administered Members (min/max): 1/4  
 Total Administered Members: 4

**GROUP MEMBER ASSIGNMENTS**

Port	Code Sfx	Name	Night	Sig Grp
1:	T00025			91
2:	T00027			91
3:	T00038			91
4:	T00039			91
5:				
6:				
7:				
8:				
9:				
10:				
11:				
12:				
13:				
14:				
15:				

General  
 Start GEDI  
 Add User  
 Change User Name  
 Remove User  
 Add Bridged Appearance  
 Browse Dial Ranges  
 Browse Stations  
 Browse Unused Ports  
 Find Unused Extension  
 Print Button Labels  
 Advanced  
 Fault & Performance

## Signaling Group

display signaling-group 91    send (return)    help (f5)    cancel (esc)    enter (f3)    schedule (f9)    next (f7)    previous (f8)    next form (f6)

1 | 2 | 3 | 4 | 5

**SIGNALING GROUP**

**Group Number: 91**      **Group Type: h.323**  
 Remote Office? n      Max number of NCA TSC: 2  
 SBS? n      Max number of CA TSC: 2  
 Trunk Group for NCA TSC: 91

**Trunk Group for Channel Selection: 91**  
 Supplementary Service Protocol: a

**Near-end Node Name: clan**      **Far-end Node Name: Ri-GW**  
 Near-end Listen Port: 1720      Far-end Listen Port: 1720  
 Far-end Network Region: 1

LRQ Required? n      Calls Share IP Signaling Connection? n  
 RRQ Required? n      Bypass If IP Threshold Exceeded? n

DTMF over IP: in-band      Direct IP-IP Audio Connections? n  
 IP Audio Hairpinning? n  
 Interworking Message: PROGRESS

General  
 Start GEDI  
 Add User  
 Change User Name  
 Remove User  
 Add Bridged Appearance  
 Browse Dial Ranges  
 Browse Stations  
 Browse Unused Ports  
 Find Unused Extension  
 Print Button Labels  
 Advanced  
 Fault & Performance



Node Name IP

send (return) help (f5) cancel (esc) enter (f3) schedule (f9) next (f7) previous (f8) next form (f6)

**General**

- Start GEDI
- Add User
- Change User Name
- Remove User
- Add Bridged Appearance
- Browse Dial Ranges
- Browse Stations
- Browse Unused Ports
- Find Unused Extension
- Print Button Labels

Advanced  
Fault & Performance

**IP NODE NAMES**

Name	IP Address
CCM	172.20 .245.254
MultiVantage	172.20 .7 .252
Ri-GW	172.20 .192.102
Tony-GW	172.20 .228.31
U.10	172.20 .233.254
Webswitch	172.20 .3 .245
ccm4-1	172.20 .231.254
clan	172.20 .232.254
default	0 .0 .0 .0
gateway	172.20 .232.1
medpro	172.20 .232.253

( 11 of 11 administered node-names were displayed )  
 Use 'list node-names' command to see all the administered node-names  
 Use 'change node-names ip xxx' to change a node-name 'xxx' or add a node-name

IP Network Region 1

display ip-network-region 1 send (return) help (f5) cancel (esc) enter (f3) schedule (f9) next (f7) previous (f8) next form (f6)

1 | 2 | 3 | 4 | 5 | 6 | 7 |

**IP NETWORK REGION**

Region: 1  
 Location: 1  
 Name: Default IP Stuff

Intra-region IP-IP Direct Audio: no  
 Inter-region IP-IP Direct Audio: no  
 IP Audio Hairpinning? y

**AUDIO PARAMETERS**  
 Codec Set: 1  
 UDP Port Min: 2048  
 UDP Port Max: 3028  
 RTCP Reporting Enabled? y

**DIFFSERV/TOS PARAMETERS**  
 Call Control PHB Value: 34  
 Audio PHB Value: 46

**RTCP MONITOR SERVER PARAMETERS**  
 Use Default Server Parameters? y

**802.1P/Q PARAMETERS**  
 Call Control 802.1p Priority: 7  
 Audio 802.1p Priority: 6

**AUDIO RESOURCE RESERVATION PARAMETERS**  
 RSUP Enabled? n

**H.323 IP ENDPOINTS**  
 H.323 Link Bounce Recovery? y  
 Idle Traffic Interval (sec): 20  
 Keep-Alive Interval (sec): 5  
 Keep-Alive Count: 5

**General**

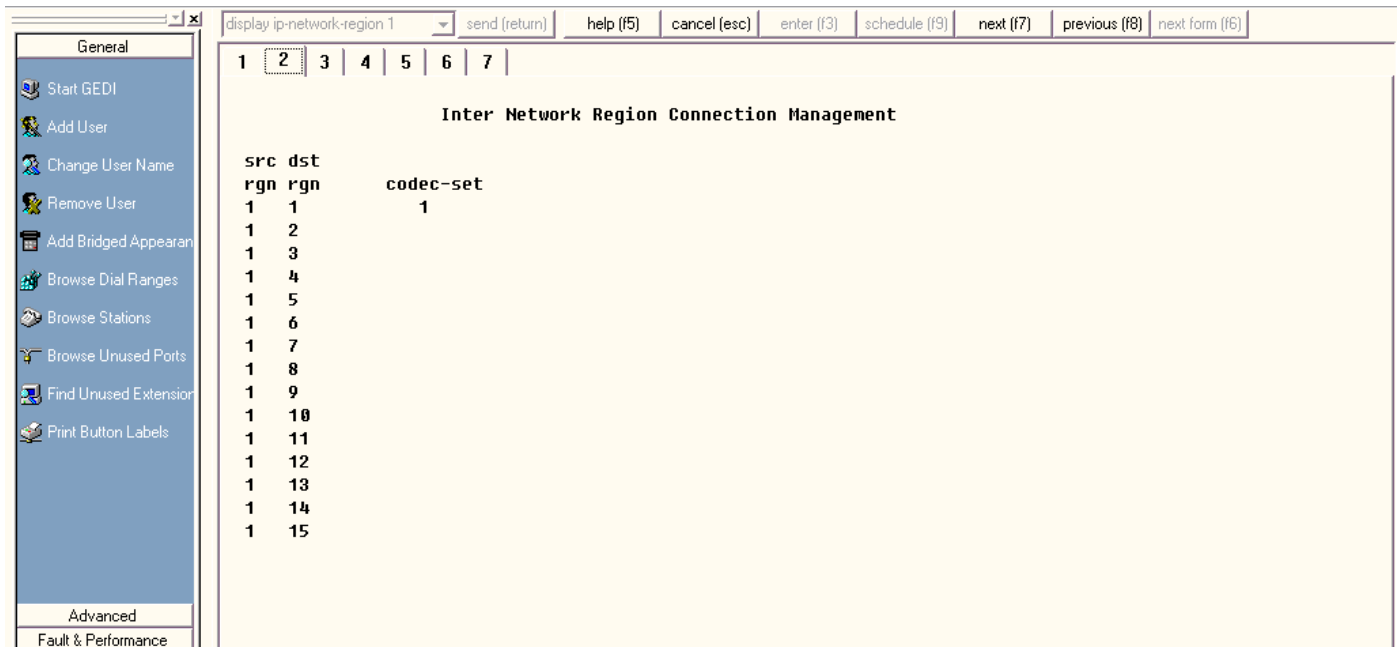
- Start GEDI
- Add User
- Change User Name
- Remove User
- Add Bridged Appearance
- Browse Dial Ranges
- Browse Stations
- Browse Unused Ports
- Find Unused Extension
- Print Button Labels

Advanced  
Fault & Performance





## IP Network Region cont'd



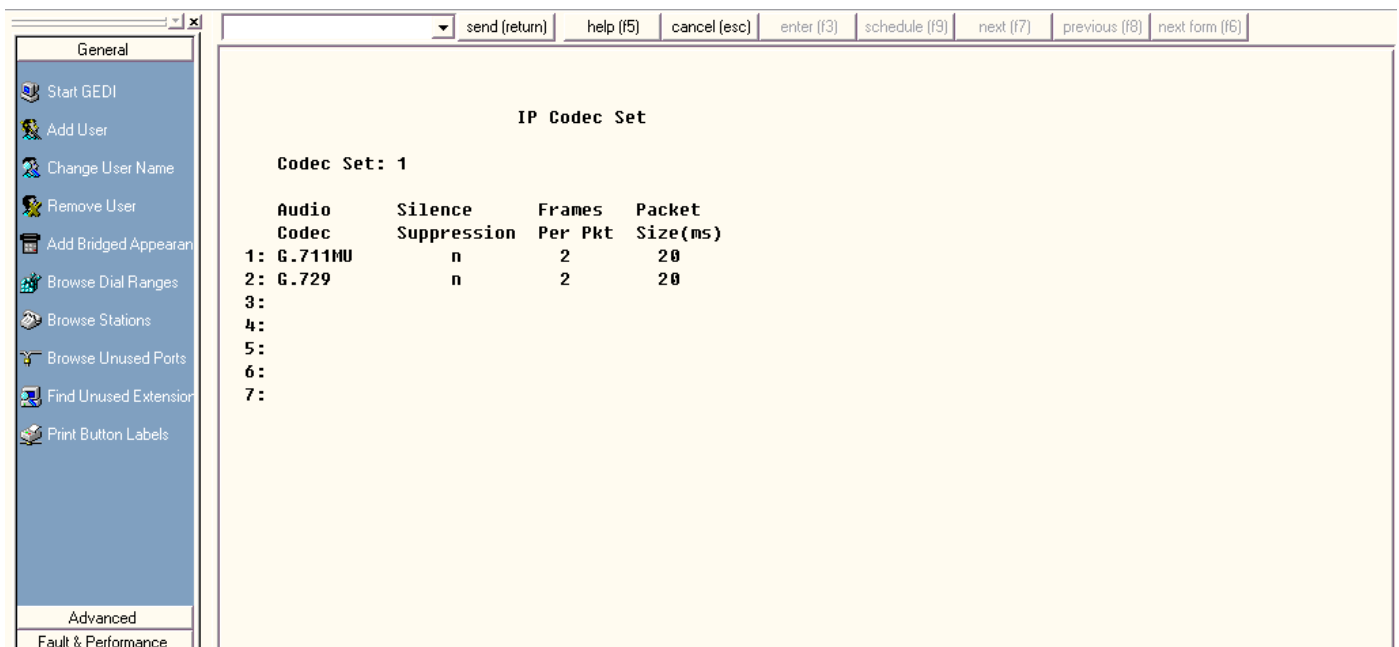
display ip-network-region 1

1 2 3 4 5 6 7

**Inter Network Region Connection Management**

src rgn	dst rgn	codec-set
1 1	1	1
1 2		
1 3		
1 4		
1 5		
1 6		
1 7		
1 8		
1 9		
1 10		
1 11		
1 12		
1 13		
1 14		
1 15		

## IP Codec Set 1<sup>2</sup>



IP Codec Set

**Codec Set: 1**

Audio Codec	Silence Suppression	Frames Per Pkt	Packet Size(ms)
1: G.711MU	n	2	20
2: G.729	n	2	20
3:			
4:			
5:			
6:			
7:			

<sup>2</sup> Change Audio Codec to match with the IOS Media Gateway when testing Codecs.



## Station 2010 Configuration

display station 2010    send (return)    help (f5)    cancel (esc)    enter (f3)    schedule (f9)    next (f7)    previous (f8)    next form (f6)

1 | 2 | 3 | 4 |

**STATION**

<b>Extension:</b> 2010	<b>Lock Messages?</b> n	<b>BCC:</b> 0
<b>Type:</b> 8410D	<b>Security Code:</b>	<b>TN:</b> 1
<b>Port:</b> 01A0603	<b>Coverage Path 1:</b>	<b>COR:</b> 1
<b>Name:</b> PBX-Sean1	<b>Coverage Path 2:</b>	<b>COS:</b> 1
	<b>Hunt-to Station:</b>	

**STATION OPTIONS**

<b>Loss Group:</b> 2	<b>Personalized Ringing Pattern:</b> 1
<b>Data Module?</b> n	<b>Message Lamp Ext:</b> 2010
<b>Speakerphone:</b> 2-way	<b>Mute Button Enabled?</b> y
<b>Display Language:</b> english	
	<b>Media Complex Ext:</b>
	<b>IP SoftPhone?</b> n

General

- Start GEDI
- Add User
- Change User Name
- Remove User
- Add Bridged Appearance
- Browse Dial Ranges
- Browse Stations
- Browse Unused Ports
- Find Unused Extension
- Print Button Labels

Advanced

Fault & Performance

## Station Configuration cont'd

display station 2010    send (return)    help (f5)    cancel (esc)    enter (f3)    schedule (f9)    next (f7)    previous (f8)    next form (f6)

1 | 2 | 3 | 4 |

**STATION**

**FEATURE OPTIONS**

<b>LWC Reception:</b> spe	<b>Auto Select Any Idle Appearance?</b> n
<b>LWC Activation?</b> y	<b>Coverage Msg Retrieval?</b> y
<b>LWC Log External Calls?</b> n	<b>Auto Answer:</b> none
<b>CDR Privacy?</b> n	<b>Data Restriction?</b> n
<b>Redirect Notification?</b> y	<b>Idle Appearance Preference?</b> n
<b>Per Button Ring Control?</b> n	<b>Restrict Last Appearance?</b> y
<b>Bridged Call Alerting?</b> n	
<b>Active Station Ringing:</b> single	
<b>H.320 Conversion?</b> n	<b>Per Station CPN - Send Calling Number?</b>
<b>Service Link Mode:</b> as-needed	<b>Audible Message Waiting?</b> y
<b>Multimedia Mode:</b> basic	<b>Display Client Redirection?</b> y
<b>MWI Served User Type:</b>	<b>Select Last Used Appearance?</b> n
	<b>Coverage After Forwarding?</b> s
	<b>Multimedia Early Answer?</b> n
	<b>Direct IP-IP Audio Connections?</b> y
<b>Emergency Location Ext:</b> 2010	<b>IP Audio Hairpinning?</b> y

General

- Start GEDI
- Add User
- Change User Name
- Remove User
- Add Bridged Appearance
- Browse Dial Ranges
- Browse Stations
- Browse Unused Ports
- Find Unused Extension
- Print Button Labels

Advanced

Fault & Performance



### Station Configuration cont'd

display station 2010    send (return)    help (f5)    cancel (esc)    enter (f3)    schedule (f9)    next (f7)    previous (f8)    next form (f6)

1 | 2 | 3 | 4 |

**STATION**

**SITE DATA**

Room:	Headset? n
Jack:	Speaker? n
Cable:	Mounting: d
Floor:	Cord Length: 0
Building:	Set Color:

**ABBREVIATED DIALING**

List1:	List2:	List3:
--------	--------	--------

**BUTTON ASSIGNMENTS**

1: call-appr	6:
2: call-appr	7:
3: cfw-d-bsd Ext:	8:
4:	9:
5:	10: last-numb

General

- Start GEDI
- Add User
- Change User Name
- Remove User
- Add Bridged Appearance
- Browse Dial Ranges
- Browse Stations
- Browse Unused Ports
- Find Unused Extension
- Print Button Labels

Advanced

Fault & Performance

### Station Configuration cont'd

display station 2010    send (return)    help (f5)    cancel (esc)    enter (f3)    schedule (f9)    next (f7)    previous (f8)    next form (f6)

1 | 2 | 3 | 4 |

**STATION**

**SOFTKEY BUTTON ASSIGNMENTS**

1: lwc-store
2: lwc-cancel
3: auto-cback
4: timer
5: call-fwd Ext:
6: call-park
7: date-time
8: priority
9: abr-prog
10: abr-spchar Char: ~p
11: abr-spchar Char: ~m
12: abr-spchar Char: ~w

General

- Start GEDI
- Add User
- Change User Name
- Remove User
- Add Bridged Appearance
- Browse Dial Ranges
- Browse Stations
- Browse Unused Ports
- Find Unused Extension
- Print Button Labels

Advanced

Fault & Performance



## ARS Analysis 4

ARS DIGIT ANALYSIS TABLE							
Location: all							
Percent Full: 9							
Dialed String	Total Min	Total Max	Route Pattern	Call Type	Node Num	ANI	Reqd
4	4	4	12	loc1		n	
40	4	4	91	lput		n	
408	10	10	16	lput		n	
410	5	5	16	lput		n	
411	3	3	deny	svcl		n	
469	10	10	34	fnpa		n	
5	4	4	16	nat1		n	
555	7	7	deny	hnpa		n	
6	7	7	2	hnpa		n	
603	7	7	3	hnpa		n	
606	7	7	11	hnpa		n	
608	3	3	8	svcl		n	
611	3	3	1	svcl		n	
7	7	7	2	hnpa		n	
70	4	4	91	loc1		n	

## Route Pattern 91

Pattern Number: 91 Pattern Name: H323													
Grp No	FRL	NPA	Pfx	Hop	Toll	No.	Inserted	DCS/ IXC		QSIG			
	Mrk	Lmt	List	Del	Digits			Intw					
1:	91	0				0		n	user				
2:								n	user				
3:								n	user				
4:								n	user				
5:								n	user				
6:								n	user				
	BCC	VALUE	TSC	CA-TSC	ITC	BCIE	Service/Feature	BAND	No.	Numbering	LAR		
	0	1	2	3	4	W	Request		Dgts	Format	Subaddress		
1:	y	y	y	y	y	n	y	as-needed	rest		unk-unk	none	
2:	y	y	y	y	y	n	n		rest			none	
3:	y	y	y	y	y	n	n		rest			none	
4:	y	y	y	y	y	n	n		rest			none	
5:	y	y	y	y	y	n	n		rest			none	
6:	y	y	y	y	y	n	n		rest			none	



## Cisco 3825 configuration

```
Router#sh ver
Cisco IOS Software, 3800 Software (C3825-IPVOICEK9-M), Version 12.4(11)XJ, RELEA
SE SOFTWARE (fc1)
Synched to technology version 12.4(11)T
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Fri 22-Dec-06 04:46 by prod_rel_team
```

ROM: System Bootstrap, Version 12.3(11r)T2, RELEASE SOFTWARE (fc1)

```
Router uptime is 5 days, 4 hours, 20 minutes
System returned to ROM by power-on
System image file is "flash:c3825-ipvoicek9-mz.124-11.XJ.bin"
```

This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at: <http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to [export@cisco.com](mailto:export@cisco.com).

```
Cisco 3825 (revision 1.0) with 222208K/39936K bytes of memory.
Processor board ID FTX0946A1BV
2 Gigabit Ethernet interfaces
22 Serial interfaces
4 Channelized E1/PRI ports
2 Voice FXO interfaces
2 Voice FXS interfaces
DRAM configuration is 64 bits wide with parity enabled.
479K bytes of NVRAM.
62720K bytes of ATA System CompactFlash (Read/Write)
```

Configuration register is 0x2102

```
Router#sh run
Building configuration...
```

```
Current configuration : 2462 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router
!
boot-start-marker
boot-end-marker
```



```
!  
card type e1 2 1  
logging buffered 10000000  
!  
no aaa new-model  
no network-clock-participate slot 1  
no network-clock-participate slot 2  
voice-card 0  
no dspfarm  
!  
voice-card 1  
dspfarm  
!  
voice-card 2  
no dspfarm  
!  
ip cef  
!  
!  
!  
multilink bundle-name authenticated  
!  
isdn switch-type primary-net5  
isdn gateway-max-interworking  
!  
!  
voice service voip  
h323  
!  
!  
!  
voice translation-rule 13  
rule 1 /41/ /20\1/  
!  
!  
voice translation-profile pots  
translate called 1  
!  
!  
archive  
log config  
hidekeys  
!  
!  
controller E1 1/0/0  
pri-group timeslots 1-10,16  
!  
controller E1 1/0/1  
!  
controller E1 2/0
```

---

<sup>3</sup> The voice gateway manipulates the called and calling digits to match configured dial-peers and to route calls appropriately. For example: Digit manipulation rule 1 of voice translation rule 1 instructs IOS gateway that when it receives 41xx, IOS gateway is to strip 41, and add digit 20 as leading number to the remaining digits xx (xx in this case are either 10 or 12) and send them to the appropriate dial-peer.



```
pri-group timeslots 1-10,16
!
controller E1 2/1
vlan internal allocation policy ascending
!
!
!
interface GigabitEthernet0/0
ip address 172.20.192.102 255.255.255.0
duplex auto
speed auto
media-type rj45
no keepalive
!
interface GigabitEthernet0/1
no ip address
shutdown
duplex auto
speed auto
media-type rj45
no keepalive
!
interface Serial1/0/0:15
no ip address
encapsulation hdlc
isdn switch-type primary-net5
isdn incoming-voice voice
isdn supp-service name calling
isdn bchan-number-order ascending
no cdp enable
!
interface Serial2/0:15
no ip address
encapsulation hdlc
isdn switch-type primary-net54
isdn incoming-voice voice
isdn supp-service name calling
isdn bchan-number-order ascending
no cdp enable
!
ip default-gateway 172.20.192.1
ip route 0.0.0.0 0.0.0.0 172.20.192.1
!
!
ip http server
no ip http secure-server
!
!
control-plane
!
!
!
voice-port 0/0/0
!
voice-port 0/0/1
```

---

<sup>4</sup> Specify E1-NET5 interface.



```
!  
voice-port 0/2/0  
!  
voice-port 0/2/1  
!  
voice-port 1/0/0:15  
!  
voice-port 2/0:15  
!  
!  
!  
dial-peer voice 2210 pots  
shutdown  
destination-pattern 22..  
incoming called-number 41..  
direct-inward-dial  
port 1/0/0:15  
forward-digits all  
!  
dial-peer voice 4100 voip5  
description call in H323 voip  
translation-profile incoming voip  
destination-pattern 20..  
rtp payload-type nte 127  
session target ipv4:172.20.232.254  
session transport tcp  
incoming called-number 40..  
dtmf-relay h245-alphanumeric h245-signal6  
codec g711ulaw7  
!  
dial-peer voice 4000 pots8  
translation-profile incoming pots  
destination-pattern 40..  
incoming called-number ....  
direct-inward-dial  
port 2/0:15  
forward-digits all  
!  
!  
!  
line con 0  
stopbits 1  
line aux 0  
stopbits 1  
line vty 0 4  
login  
!  
scheduler allocate 20000 1000  
!  
end  
Router#
```

---

<sup>5</sup> Dial-peer voice toward IP PBX

<sup>6</sup> Insert this command for DTMF using Out-Of-Band (DTMF with H245 signaling) signaling. This command specified the IOS gateway to transports DTMF tones generated after call establishment out of band using a standard H.245 out-of-band method.

<sup>7</sup> Specify CODEC here when testing CODEC. Also change CODEC settings at the PBX end to match the specified codec at the IOS Media Gateway

<sup>8</sup> Dial-peer voice toward PSTN





## Acronyms

Acronym	Definitions
Cisco IOS	Cisco Internetwork Operating System
PSTN	Public switched Telephone Network

## Important Information

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.



**Corporate  
Headquarters**

Cisco Systems, Inc.  
170 West Tasman Drive  
San Jose, CA 95134-1706  
USA  
www.cisco.com  
Tel: 408 526-4000  
800 553-NETS (6387)  
Fax: 408 526-4100

**European  
Headquarters**

Cisco Systems International  
BV  
Haarlerberg park  
Haarlerbergweg 13-19  
1101 CH Amsterdam  
The Netherlands  
www-europe.cisco.com  
Tel: 31 0 20 357 1000  
Fax: 31 0 20 357 1100

**Americas  
Headquarters**

Cisco Systems, Inc.  
170 West Tasman Drive  
San Jose, CA 95134-1706  
USA  
www.cisco.com  
Tel: 408 526-7660  
Fax: 408 527-0883

**Asia Pacific  
Headquarters**

Cisco Systems, Inc.  
Capital Tower  
168 Robinson Road  
#22-01 to #29-01  
Singapore 068912  
www.cisco.com  
Tel: +65 317 7777  
Fax: +65 317 7799

Cisco Systems has more than 200 offices in the following countries and regions. Addresses, phone numbers, and fax numbers are listed on the Cisco Web site at [www.cisco.com/go/offices](http://www.cisco.com/go/offices).

Argentina • Australia • Austria • Belgium • Brazil • Bulgaria • Canada • Chile • China PRC • Colombia • Costa Rica • Croatia • Czech Republic • Denmark • Dubai, UAE • Finland • France • Germany • Greece • Hong Kong SAR • Hungary • India • Indonesia • Ireland • Israel • Italy • Japan • Korea • Luxembourg • Malaysia • Mexico • The Netherlands • New Zealand • Norway • Peru • Philippines • Poland • Portugal • Puerto Rico • Romania • Russia • Saudi Arabia • Scotland • Singapore • Slovakia • Slovenia • South Africa • Spain • Sweden • Switzerland • Taiwan • Thailand • Turkey • Ukraine • United Kingdom • United States • Venezuela • Vietnam • Zimbabwe

© 2008 Cisco Systems, Inc. All rights reserved.

CCDE, CCENT, Cisco Eos, Cisco Lumin, Cisco StadiumVision, the Cisco logo, DCE, and Welcome to the Human Network are trademarks; Changing the Way We Work, Live, Play, and Learn is a service mark; and Access Registrar, Aironet, AsyncOS, Bringing the Meeting To You, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, CCSP, CCVP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Collaboration Without Limitation, EtherFast, EtherSwitch, Event Center, Fast Step, Follow Me Browsing, FormShare, GigaDrive, HomeLink, Internet Quotient, IOS, iPhone, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, iQuick Study, IronPort, the IronPort logo, LightStream, Linksys, MediaTone, MeetingPlace, MGX, Networkers, Networking Academy, Network Registrar, PCNow, PIX, PowerPanels, ProConnect, ScriptShare, SenderBase, SMARTnet, Spectrum Expert, StackWise, The Fastest Way to Increase Your Internet Quotient, TransPath, WebEx, and the WebEx logo are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0804R)

Printed in the USA