



# Avaya 8500 Communications Manager 4.0 to Cisco IOS Voice Gateway using H323 with T1 DMS-100

January 3, 2008

## Table of Contents

Introduction .....	2
Network Topology.....	3
Limitations.....	4
System Components .....	4
Hardware requirements .....	4
Software Requirements .....	4
Features .....	4
Features Supported.....	4
Features Not Supported .....	5
Configuration.....	6
Avaya Configuration .....	6
Cisco IOS configuration.....	18
Acronyms .....	22



## Introduction

- This Application note provides basic call interoperability and documented steps and configurations necessary for H323 integration between Avaya S8500 to Cisco IOS Voice Gateway providing PSTN (T1 ISDN DMS-100) connectivity.
- The H323 protocol is used between Cisco IOS Voice gateway and Avaya S8500. The connection between Cisco IOS gateway and PSTN uses T1-PRI with switch-type DMS-100 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 S8500 users and the PSTN.
- The Cisco IOS Voice Gateway offers the advantage of providing connectivity between Avaya S8500 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 S8500 (10/100baseT) and connected to the PSTN via T1 DMS-100 ISDN.
- This Application Notes uses the Cisco IAD2432 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 IAD2430 Integrated Access Device](#)

[Cisco 2800 Series Integrated Services Routers](#)

[Cisco 3700 Series Multiservice Access Routers](#)

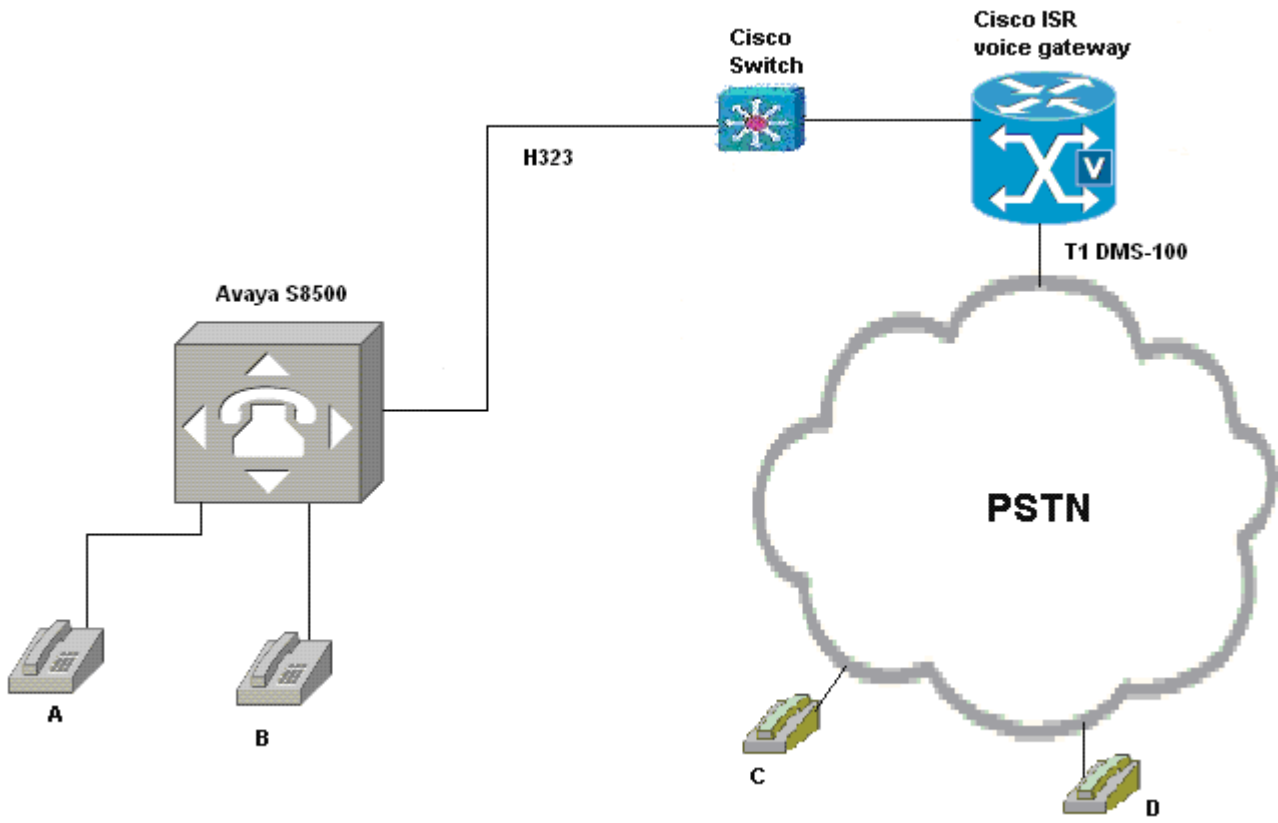
[Cisco 3800 Series Integrated Services Routers](#)

[Cisco AS5350XM Universal Gateway](#)

[Cisco AS5400XM Universal Gateway](#)

## Network Topology

Figure 1. Network Topology





## Limitations

- Called name is not supported. Notify message with called name was mapped correctly, but the display name information was dropped at the IOS voice gateway.
- Basic call using G.726A – 32K and G.722-64K failed. Avaya rejects G.726 and G.722 codec, even when the Avaya is set for G.726 and G.722.

## System Components

### Hardware requirements

#### Cisco equipment

- Cisco 2432 (Cisco 3800 family routers)
- Cisco 3560 powered Ethernet switch

#### Avaya equipment

- Avaya S8500
- TN2312BP IPSI
- TN799DP C-LAN
- TN2302AP IP Media Processor
- TN746B Analog
- TN2224B 2-wire Digital
- 2 - Digital stations 8410D

### Software Requirements

- IOS Gateway: Cisco IOS Release – Cisco IAD2432: c2430-ik9o3s-mz.124-15.T1.bin
- Avaya S8500: Communication Manager 4.0

## Features

### Features Supported

- G.711alaw, G.711ulaw, G.723 (5.3K and 6.3K), G.729(A and B)
- Calling name and Calling number
- Call Transfer Blind and Call Transfer Supervised
- Call Conference
- Caller ID restriction
- Call Forward All
- Call Forward No Reply
- Call Forward Busy
- DTMF (RFC2833)
- Digit Translation
- DTMF in-band



- H245 Alphanumeric or Signal

**Features Not Supported**

- G726 codec
- G.722 codec
- Called name (Gateway dropped display information in Notify message. This is a limitation on the Gateway.)



## Configuration

### Avaya Configuration

#### Signaling group (In band)

change signaling-group 16    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:** 16      **Group Type:** h.323

**Remote Office?**  n      **Max number of NCA TSC:** 10

**SBS?**  n      **Max number of CA TSC:** 10

**IP Video?**  n      **Trunk Group for NCA TSC:** 16

**Trunk Group for Channel Selection:** 16

**TSC Supplementary Service Protocol:** a

**T303 Timer(sec):** 10

**Near-end Node Name:** clan1      **Far-end Node Name:** CecilyGW

**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      **H245 Control Addr On FACility?**  n

**Media Encryption?**  n      **Bypass If IP Threshold Exceeded?**  n

**DTMF over IP:** in-band-q711      **H.235 Annex H Required?**  n

**Link Loss Delay Timer(sec):** 90      **Direct IP-IP Audio Connections?**  n

**Enable Layer 3 Test?**  n      **IP Audio Hairpinning?**  n

**Interworking Message:** PROGRESS

**DCP/Analog Bearer Capability:** 3.1kHz

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

Tasks    Tree

Select an entry from the list



### Signaling group (RFC 2833)

change signaling-group 16    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:** 16      **Group Type:** h.323

**Remote Office?**  n      **Max number of NCA TSC:** 10

**SBS?**  n      **Max number of CA TSC:** 10

**IP Video?**  n      **Trunk Group for NCA TSC:** 16

**Trunk Group for Channel Selection:** 16

**TSC Supplementary Service Protocol:** a

**T303 Timer(sec):** 10

**Near-end Node Name:** clan1      **Far-end Node Name:** CecilyGW

**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      **H245 Control Addr On FACility?**  n

**Media Encryption?**  n      **Bypass If IP Threshold Exceeded?**  n

**DTMF over IP:** rtp-payload      **H.235 Annex H Required?**  n

**Link Loss Delay Timer(sec):** 90      **Direct IP-IP Audio Connections?**  n

**Enable Layer 3 Test?**  n      **IP Audio Hairpinning?**  n

**Interworking Message:** PROGRESS

**DCP/Analog Bearer Capability:** 3.1kHz

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

Tasks    Tree

Right-click in a field to see a list of valid entries or help text



### Signaling group (H245 Alphanumeric)

change signaling-group 16    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:** 16      **Group Type:** h.323

**Remote Office?**  n      **Max number of NCA TSC:** 10

**SBS?**  n      **Max number of CA TSC:** 10

**IP Video?**  n      **Trunk Group for NCA TSC:** 16

**Trunk Group for Channel Selection:** 16

**TSC Supplementary Service Protocol:** a

**T303 Timer(sec):** 10

**Near-end Node Name:** c1an1      **Far-end Node Name:** CecilyGW

**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      **H245 Control Addr On FACility?**  n

**Media Encryption?**  n      **Bypass If IP Threshold Exceeded?**  n

**DTMF over IP:** out-of-band      **H.235 Annex H Required?**  n

**Link Loss Delay Timer(sec):** 90      **Direct IP-IP Audio Connections?**  n

**Enable Layer 3 Test?**  n      **IP Audio Hairpinning?**  n

**Interworking Message:** PROGRESS

**DCP/Analog Bearer Capability:** 3.1kHz

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

Tasks    Tree

Select an entry from the list



Trunk group – p1 of 3

The screenshot displays the Cisco Unified Communications Manager (CUCM) configuration page for a Trunk Group. The interface includes a top toolbar with icons for file operations and a menu dropdown set to 'SIP1'. Below the toolbar is a navigation bar with buttons for 'send (return)', 'help (f5)', 'cancel (esc)', 'enter (f3)', 'schedule (f9)', 'next (f7)', 'previous (f8)', and 'next form (f6)'. A tabbed interface on the left shows the 'General' tab selected, with other tabs for 'Advanced', 'Fault & Performance', 'Tasks', and 'Tree'. The main content area displays the configuration for 'Trunk Group 16' with the following parameters:

TRUNK GROUP			
Group Number:	16	Group Type:	isdn
Group Name:	H.323 trunk to CS1000	CDR Reports:	y
Direction:	two-way	COR:	1
Dial Access?	y	TN:	1
Queue Length:	0	TAC:	816
Service Type:	tie	Outgoing Display?	n
		Carrier Medium:	H.323
		Busy Threshold:	255
		Night Service:	
		Auth Code?	n
		Member Assignment Method:	manual



Trunk group – p2 of 3

display trunk-group 16    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 11 12 13 14 15 16 17 18 19 20 21

**Group Type: isdn**

**TRUNK PARAMETERS**

Codeset to Send Display: 0    Codeset to Send National IEs: 6  
Charge Advice: none  
Supplementary Service Protocol: a    Digit Handling (in/out): enbloc/enbloc

Incoming Calling Number - Delete:    Insert:    Digital Loss Group: 18  
Format: unk-unk

Disconnect Supervision - In? y Out? y  
Answer Supervision Timeout: 0

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

Tasks    Tree



Trunk group – p3 of 3

The screenshot shows a Cisco configuration window titled "Trunk group – p3 of 3". The window has a menu bar with options like "SIP1" and a toolbar with icons for various functions. Below the toolbar is a command line showing "display trunk-group 16". A navigation bar contains buttons for "send (return)", "help (f5)", "cancel (esc)", "enter (f3)", "schedule (f9)", "next (f7)", "previous (f8)", and "next form (f6)".

The main content area displays the configuration for "TRUNK FEATURES" for trunk-group 16. The configuration is as follows:

```
TRUNK FEATURES
  ACA Assignment? n           Measured: none
                               Internal Alert? n       Maintenance Tests? y
                               Data Restriction? n     NCA-TSC Trunk Member: 1
                               Send Name: y           Send Calling Number: y
                               Used for DCS? n         Send EMU Visitor CPN? n
  Suppress # Outpulsing? n   Format: unknown
                               UUI IE Treatment: service-provider

                               Replace Restricted Numbers? y
                               Replace Unavailable Numbers? y
                               Send Connected Number: y
                               Hold/Unhold Notifications? n
                               Modify Tandem Calling Number? n

  Send UUI IE? y
  Send UCID? n
  Send Codeset 6/7 LAI IE? y
```

On the left side of the window, there is a "General" tab selected, with a list of 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 list are tabs for "Advanced" and "Fault & Performance". At the bottom left, there are "Tasks" and "Tree" buttons.



## Node-names IP

Name	IP Address
CCM4.1	172.20.231.254
CCM4.1.2	172.20.236.2
CM-POLARIS	172.20.236.50
CUCMExpress	172.20.228.254
CecilyGW	172.20.174.40
TFTP	172.20.2.181
avayasip1	172.20.212.254
clan1	172.20.212.253
clan1serverb	172.20.213.253
default	0.0.0.0
ipigw	172.20.192.102
medpro1	172.20.212.252
nortelcs1000	172.20.216.100
procr	172.20.212.200

( 14 of 14 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

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 8 9 10 11 12 13 14 15 16 17 18 19

**IP NETWORK REGION**

**Region: 1**  
**Location: 1** Authoritative Domain: lab.com  
**Name: CiscoLAB**

**MEDIA PARAMETERS** Intra-region IP-IP Direct Audio: no  
Codec Set: 1 Inter-region IP-IP Direct Audio: no  
UDP Port Min: 2048 IP Audio Hairpinning? y  
UDP Port Max: 3029

**DIFFSERV/TOS PARAMETERS** RTCP Reporting Enabled? y  
Call Control PHB Value: 34 RTCP MONITOR SERVER PARAMETERS  
Audio PHB Value: 46 Use Default Server Parameters? y  
Video PHB Value: 26

**802.1P/Q PARAMETERS**  
Call Control 802.1p Priority: 7  
Audio 802.1p Priority: 6  
Video 802.1p Priority: 5

**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 Extensions  
Print Button Labels  
Advanced  
Fault & Performance  
Tasks Tree



### IP codec set

change ip-codec-set 1    send (return)    help (F5)    cancel (esc)    enter (F3)    schedule (F9)    next (F7)    previous (F8)    next form (F6)

1 | 2

#### IP Codec Set

Codec Set: 1

Audio Codec	Silence Suppression	Frames Per Pkt	Packet Size(ms)
1: G.711MU	<input type="checkbox"/> n	<input type="text" value="2"/>	20
2: G.711MU	<input type="checkbox"/>	<input type="text"/>	
3: G.722-64K	<input type="checkbox"/>	<input type="text"/>	
4: G.722.1-24K	<input type="checkbox"/>	<input type="text"/>	
5: G.722.1-32K	<input type="checkbox"/>	<input type="text"/>	
6: G.723-5.3K	<input type="checkbox"/>	<input type="text"/>	
7: G.723-6.3K	<input type="checkbox"/>	<input type="text"/>	
G.726A-32K	<input type="checkbox"/>	<input type="text"/>	
G.729	<input type="checkbox"/>		
G.729A	<input type="checkbox"/>		
G.729B	<input type="checkbox"/>		

1: none  
2:   
3:



## Uniform dialing plan

display uniform-dialplan 5

send (return) help (F5) cancel (esc) enter (F3) schedule (F9) next (F7) previous (F8) next form (F6)

1 2

**UNIFORM DIAL PLAN TABLE**

Percent Full: 0

Matching Pattern	Len	Del	Insert Digits	Net Conv	Node Num
5000	4	0	224	aar	n
5001	4	0	224	aar	n
5002	4	0	204	aar	n
5003	4	0	211	aar	n
5004	4	0	211	aar	n
5005	4	0	211	aar	n
5010	4	0	224	aar	n
5012	4	0	211	aar	n
5015	4	0	211	aar	n
5050	4	0	213	aar	n
5051	4	0	226	aar	n
5099	4	0	224	aar	n
5100	4	0	211	aar	n
52	4	0	216	aar	n
53	4	0	207	aar	n
54	4	0	207	aar	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

Tasks Tree



## AAR analysis

display aar analysis 216    send (return)    help (f5)    cancel (esc)    enter (f3)    schedule (f9)    next (f7)    previous (f8)    next form (f6)

1 2

**AAR DIGIT ANALYSIS TABLE**                      Percent Full: 2

Dialed String	Total		Route Pattern	Call Type	Node Num	ANI Reqd
	Min	Max				
216	7	7	16	aar		n
217	7	7	17	aar	3	n
221	7	7	11	aar	4	n
222	7	7	21	aar		n
224	7	7	99	aar		n
225	4	4	13	aar		n
226	7	7	13	aar		n
227	7	7	21	aar		n
228	7	7	44	aar		n
229	7	7	7	aar		n
3	7	7	999	aar		n
5	7	7	999	aar		n
5050	7	7	13	aar		n
5554050	7	7	11	aar		n
7	7	7	999	aar		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

Tasks    Tree



## Route Pattern

display route-pattern 16    send (return)    help (f5)    cancel (esc)    enter (f3)    schedule (f9)    next (f7)    previous (f8)    next form (f6)

1 | 2 | 3

Pattern Number: 16    Pattern Name:  
 SCCAN? n    Secure SIP? n

Grp No	FRL	NPA	Pfx	Hop	Toll	No.	Inserted	DCS/	IXC
			Mrk	Lnt	List	De1	Digits	QSIG	
							Dgts	Intw	
1:	16	0					3	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	PARM	No.	Numbering	LAR
0	1	2	M	4	W	Request		Dgts	Format	Subaddress
1:	y	y	y	y	n	y	as-needed	rest		none
2:	y	y	y	y	n	n		rest		none
3:	y	y	y	y	n	n		rest		none
4:	y	y	y	y	n	n		rest		none
5:	y	y	y	y	n	n		rest		none
6:	y	y	y	y	n	n		rest		none

Advanced  
 Fault & Performance

Tasks    Tree



## Cisco IOS configuration

### Cisco 2432 voice gateway configuration

```
c2432-voice#sh ver
Cisco IOS Software, 2400 Software (C2430-IK9O3S-M), Version 12.4(15)T1, RELEASE
SOFTWARE (fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2007 by Cisco Systems, Inc.
Compiled Wed 18-Jul-07 05:05 by prod_rel_team
```

ROM: System Bootstrap, Version 12.3(7r)T2, RELEASE SOFTWARE (fc1)

```
c2432-voice uptime is 1 week, 23 hours, 17 minutes
System returned to ROM by reload
System image file is "flash:c2430-ik9o3s-mz.124-15.T1.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 IAD2432 (R527x) processor (revision 4.1) with 119808K/11264K bytes of memo
ry.
Processor board ID FHK1013F23V
R527x CPU at 225MHz, Implementation 40, Rev 3.1
1 On-Board Twenty-Four FXS Analog Voice Module V1.3
2 FastEthernet interfaces
42 Serial interfaces
2 Channelized E1/PRI ports
1 Virtual Private Network (VPN) Module
DRAM configuration is 64 bits wide with parity disabled.
63K bytes of non-volatile configuration memory.
System fpga version is 250027
System readonly fpga version is 250025
Option for system fpga is 'system'.
62720K bytes of ATA System CompactFlash (Read/Write)
```

Configuration register is 0x2102

```
=====
c2432-voice#s run
Building configuration...
```

```
Current configuration : 2630 bytes
!
version 12.4
service timestamps debug datetime msec
```



```
service timestamps log datetime msec
no service password-encryption
!
hostname c2432-voice
!
boot-start-marker
boot system flash:c2430-ik9o3s-mz.124-15.T1.bin
boot-end-marker
!
card type t1 1
logging buffered 10000000
!
no aaa new-model
network-clock-participate T1 1/0
network-clock-participate T1 1/1
network-clock-select 1 T1 1/0
!
!
no ip domain lookup
!
!
!
multilink bundle-name authenticated
isdn switch-type primary-dms100
!
voice-card 0
!
!
voice rtp send-recv
!
voice service voip
sip
  asserted-id pai
!
!
voice translation-rule 11
rule 1 /2332/ /5214/
!
!
voice translation-profile rule12
translate called 1
!
!
archive
  log config
  hidekeys
!
!
controller T1 1/0
  framing esf
  linecode b8zs
  pri-group timeslots 1-24
!
controller T1 1/1
  framing esf
```

---

<sup>1</sup> The above translation rule replaces the number “2332” with “5214”

<sup>2</sup> This defines the translation profile rule for the called number. In this particular example, is 2332.



```
linecode b8zs
!
!
interface FastEthernet0/0
no ip address
shutdown
duplex half
speed 100
!
interface FastEthernet0/1
ip address 172.20.174.40 255.255.255.0
duplex auto
speed auto
!
interface Serial1/0:23
no ip address
encapsulation hdlc
isdn switch-type primary-dms100
isdn protocol-emulate network
isdn incoming-voice voice
isdn supp-service name calling3
isdn send-alerting
isdn channel-id invert extend-bit
no cdp enable
!
ip default-gateway 172.20.174.1
ip http server
no ip http secure-server
!
ip route 0.0.0.0 0.0.0.0 172.20.174.1
!
!
control-plane
!
!
voice-port 1/0:23
!
!
dial-peer voice 5000 pots
voice cut-through alert
destination-pattern 52..
direct-inward-dial
port 1/0:23
forward-digits all
!
dial-peer voice 4100 voip
translation-profile incoming rule14
destination-pattern 41..
rtp payload-type nte 1275
session target ipv4:172.20.212.253
incoming called-number 23..6
```

<sup>3</sup> Display calling name parameters sent out an ISDN serial interface.

<sup>4</sup> This defines a call number translation profile for incoming calls. For this example, user dials 2332 will be coming across this dial-peer.

<sup>5</sup> This is to identify the payload type of a RTP packet, using the number value 127.

<sup>6</sup> This is to specify a digit string that can be matched by an incoming call to associate the call with a dial peer. For this example, user dials 2332 will associate to this dial-peer.



```
dtmf-relay h245-alphanumeric h245-signal7
codec g711ulaw
!
!
gateway
timer receive-rtp 1200
!
sip-ua
no remote-party-id
!
!
line con 0
exec-timeout 0 0
password cisco
login
line aux 0
line vty 0 4
exec-timeout 0 0
password cisco
login
!
end
```

---

<sup>7</sup> This is configuring the router so it transmits Dual-Tone Multifrequency (DTMF) tones as out-of-band signals during H.323 voice calls. h245-alphanumeric is to forwards DTMF tones by using the H.245 alphanumeric method; and h245-signal is to forwards DTMF tones by using the H.245 signal UII method.



## Acronyms

Acronym	Definitions
codec	coder/decoder
PBX	Private Branch Exchange
PSTN	Public Switched Telephone Network
IOS	Internetworking Operating System

## Important Information

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