



Avaya S8500 Communications Manager 2.1 to Cisco IOS Voice Gateway using T1 QSIG with SIP

October 30, 2007 Revision 8

Table of Contents

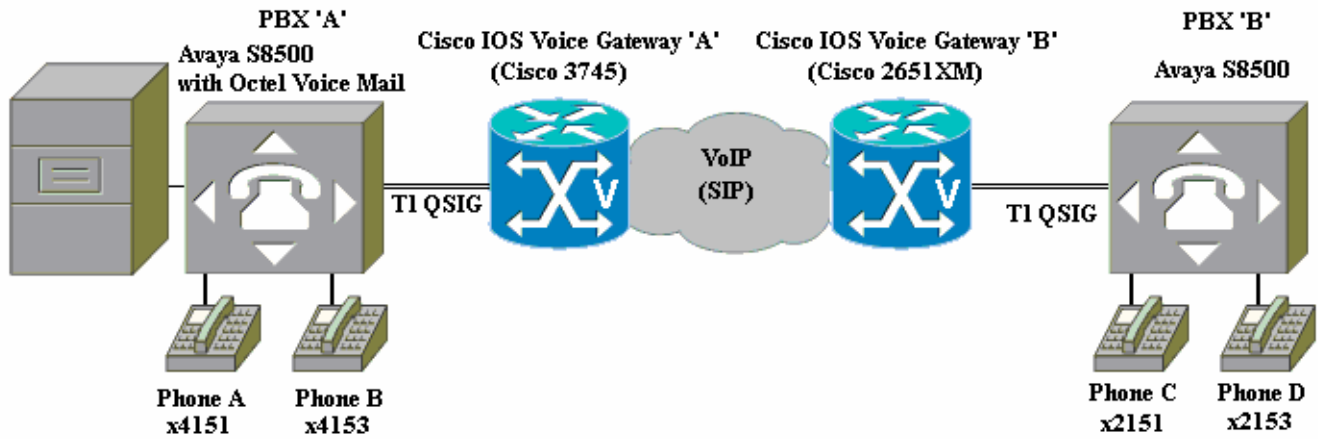
Introduction	1
Network Topology.....	2
Hardware Requirements	2
Software Requirements	2
Features	3
Features Supported.....	3
Features Not Supported	3
Limitations.....	3
Configuration.....	4
Configuring the Avaya S8500 Communications Manager 2.1: Switch 1	4
Configuring the Avaya S8500 Communications Manager 2.1: Switch 2	12
Configuring the IOS Gateway 1 (Cisco 3745).....	20
Configuring the IOS Gateway 2 (Cisco 2651XM)	26
Acronyms	32

Introduction

- Although specific gateway router models were used to validate its content, this application note also applies to all Cisco 1700/2600/3600/3700/2800/3800 series Cisco IOS voice gateways.
- This application note provides configuration guidelines for a toll-bypass network using Cisco IOS voice gateways to connect Avaya S8500 Communications Manager 2.1 PBXs. The PBXs are connected to the Cisco IOS voice gateways by T1 QSIG trunk circuits. The Cisco IOS voice gateways “extend” the T1 QSIG trunk circuits with VoIP, using the SIP protocol.
- Two Avaya S8500 Communications Manager 2.1 PBXs were connected via T1 QSIG trunk to two Cisco IOS voice gateways. The voice gateways were connected via IP over Ethernet, and configured for VoIP using SIP. End-to-end calls were placed between the PBXs to exercise and test basic calls as well as QSIG supplementary services such as MWI, call hold, call transfer, call conference, and call forward.
- Using the Avaya PBX configurations and Cisco IOS voice gateway configurations in this application note, toll bypass integration was achieved. This includes Basic Call, with Calling Name and Calling Number, Call Conference, and Call Hold. Supplementary services, including Call transfer, Call Forward, and Called Name/Number were not supported for the SIP toll bypass implementation. If these Supplementary Services are needed, it is recommended that MGCP or H.323 be used as the connection between the Cisco IOS gateways.

Network Topology

Figure 1. Network Topology or Test Setup



Hardware Requirements

- (2) Cisco IOS voice gateways with T1 VWICs (voice/WAN interface cards)
- (2) Avaya S8500s
- (1) Octel Voice Mail System
- (4) Avaya digital station telephones

Software Requirements

- Avaya PBXs: Communications Manager Release 2.1
- Cisco IOS voice gateways: Cisco IOS Release Version 12.4(1.8)T or later.



Features

Features Supported

- Basic Call (ENBLOC and Overlap)
- Calling Name and Number
- Call Conference
- Call Hold

Features Not Supported

- Called/Connected Name and Number
- Call Transfer
- Call Forward

Limitations

- Caller ID (Calling Name/Number and Called/Connected Name/Number) features were limited in Call Conference scenarios when a conferee or conferencing phone dropped out. A dropping conferee or conferencing phone did not result in a dropped call, however.
- MWI could not be tested due to Call Transfer not working. Calls could not be properly diverted to voice mail.



Figure 3. AAR Analysis screenshot (1 of 1)

```
display aar analysis 0 Page 1 of 2
```

AAR DIGIT ANALYSIS TABLE Percent Full: 1

Dialed String	Total		Route Pattern	Call Type	Node Num	ANI Req'd
	Min	Max				
2	7	7	999	aar		n
222	7	7	21	aar		n
224	7	7	99	aar		n
225	7	7	4	aar		n
226	7	7	13	aar		n
3	7	7	999	aar		n
4	4	4	39	aar		n
5	7	7	999	aar		n
6	7	7	999	aar		n
7	7	7	999	aar		n
8	7	7	999	aar		n
9	7	7	999	aar		n
						n
						n
						n

CANCEL REFRESH HELP GO TO PAGE NEXT PAGE PREV PAGE



Figure 4. Designated Route Pattern (21) screenshot (1 of 1)

display route-pattern 21															Page 1 of 3									
Pattern Number: 21															Pattern Name: ISDN TIE									
															Secure SIP? n									
Grp No	FRL	NPA	Pfx Mrk	Hop Lmt	Toll List	No. Del	Inserted Digits								DCS/ QSIG	IXC								
								Dgts								Intw								
1:	6	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	BAND	No. Dgts	Numbering Format	LAR	
0 1 2 3 4 W																Request								
1:	Y	Y	Y	Y	Y	n	Y	as-needed	bothept						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								

CANCEL REFRESH [] [] HELP GO TO PAGE NEXT PAGE PREV PAGE



Figure 5. Route Patterns screenshot (1 of 1)

```
list route-pattern
```

Route Pat	Name/Trk Pref Grp	FRL	Hop Lmt	IXC	ROUTE PATTERNS					TSC	CA-TSC Request	ITC	Service/Feature
					0	1	2	3	4				
4	1 4		0	user	y	y	y	y	y	n	y	as-needed	both
13	1 13		0	5	user	y	y	y	y	n	n	none	rest
21	ISDN TIE				user	y	y	y	y	n	y	as-needed	both
99	CCS Server A				user	y	y	y	y	n	y	as-needed	both

Command successfully completed

Command:

CANCEL HELP



Figure 7. DS1 Board screenshot (1 of 2)

```
display ds1 1a14                                     Page 1 of 2
DS1 CIRCUIT PACK
Location: 01A14                                     Name: QSIG_TIE
Bit Rate: 1.544                                     Line Coding: b8zs
Line Compensation: 1                               Framing Mode: esf
Signaling Mode: isdn-pri                           Connect: pbx
                                                    Interface: peer-slave
TN-C7 Long Timers? n                               Peer Protocol: Q-SIG
Interworking Message: PROGRESS                     Side: b
Interface Companding: mulaw                        CRC? n
Idle Code: 11111111                               DCP/Analog Bearer Capability: 3.1kHz
                                                    T303 Timer(sec): 4
Slip Detection? n                                  Near-end CSU Type: other
Echo Cancellation? n
```

CANCEL REFRESH HELP GO TO PAGE NEXT PAGE PREV PAGE



Figure 8. DS1 Board screenshot (2 of 2)

```
display ds1 1a14                                     Page 2 of 2
DS1 CIRCUIT PACK

ESF DATA LINK OPTIONS

Network Management Protocol: tabs
Send ANSI-T1.403 One-Second Performance Reports? n
Far-end CSU Address: b
```

CANCEL REFRESH HELP GO TO PAGE NEXT PAGE PREV PAGE



Figure 9. Trunks Status screenshot (1 of 1)

```
status trunk 6
```

TRUNK GROUP STATUS

Member	Port	Service State	Mtce Connected Ports Busy
0006/001	01A1401	in-service/idle	no
0006/002	01A1402	in-service/idle	no
0006/003	01A1403	in-service/idle	no
0006/004	01A1404	in-service/idle	no
0006/005	01A1405	in-service/idle	no
0006/006	01A1406	in-service/idle	no
0006/007	01A1407	in-service/idle	no
0006/008	01A1408	in-service/idle	no
0006/009	01A1409	in-service/idle	no
0006/010	01A1410	in-service/idle	no

Command successfully completed

Command: █

CANCEL █ █ █ HELP █ █ █



Configuring the Avaya S8500 Communications Manager 2.1: Switch 2

Figure 10. Uniform Dial Plan screenshot (1 of 1)

```
display uniform-dialplan 0 Page 1 of 2
```

UNIFORM DIAL PLAN TABLE Percent Full: 0

Matching Pattern	Len	Del	Insert Digits	Net	Conv	Node Num	Matching Pattern	Len	Del	Insert Digits	Net	Conv	Node Num
2	4	0	222	aar	n								n
26	4	0	222	aar	n								n
3	4	0	223	aar	n								n
41	4	0	225	aar	n								n
45	4	0	223	aar	n								n
5003	4	0	213	aar	n								n
5004	4	0	213	aar	n								n
5008	4	0	223	aar	n								n
5050	4	0	225	aar	n								n
					n								n
					n								n
					n								n
					n								n
					n								n
					n								n
					n								n
					n								n

[CANCEL] [REFRESH] [] [] [HELP] [GO TO PAGE] [NEXT PAGE] [PREV PAGE]



Figure 11. AAR Analysis screenshot (1 of 1)

```
display aar analysis 0 Page 1 of 2
```

AAR DIGIT ANALYSIS TABLE Percent Full: 1

Dialled String	Total		Route Pattern	Call Type	Node Num	ANI Reqd
	Min	Max				
2	7	7	999	aar		n
213	7	7	99	aar		n
222	7	7	99	aar		n
223	7	7	14	aar		n
225	7	7	21	aar		n
3	7	7	999	aar		n
4	7	7	999	aar		n
5	7	7	999	aar		n
6	7	7	999	aar		n
7	7	7	999	aar		n
8	7	7	999	aar		n
9	7	7	999	aar		n
						n
						n
						n
						n

[CANCEL] [REFRESH] [] [] [HELP] [GO TO PAGE] [NEXT PAGE] [PREV PAGE]



Figure 12. Designated Route Pattern (21) screenshot (1 of 1)

```

display route-pattern 21                                     Page 1 of 3
                Pattern Number: 21  Pattern Name: ISDN NODE 1
                Secure SIP? n

```

Grp No	FRL	NPA	Pfx Mrk	Hop Lmt	Toll List	No. Del	Inserted Digits	DCS/OSIG	IXC
1:	6	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	BAND	No. Dgts	Numbering Format	LAR		
0	1	2	3	4	W	Request			Subaddress			
1:	y	y	y	y	y	n	y	as-needed	both	pt	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

CANCEL
REFRESH

HELP
GO TO PAGE
NEXT PAGE
PREV PAGE



Figure 13. Route Patterns screenshot (1 of 1)

```
list route-pattern
```

Route Pat	Name/Trk Pref	Trk Grp	FRL	Hop Lmt	IXC	ROUTE PATTERNS					TSC	CA-TSC Request	ITC	Service/Feature
						0	1	2	3	4				
13	1	1	0		user	Y	Y	Y	Y	Y	n	Y	as-needed	rest
14	1	14	0		user	Y	Y	Y	Y	Y	n	Y	as-needed	both
21	ISDN	NODE	1											
	1	6	0		user	Y	Y	Y	Y	Y	n	Y	as-needed	both
99	CCS	Sever	2											
	1	1	0		user	Y	Y	Y	Y	Y	n	Y	as-needed	both
213	1	1	0		user	Y	Y	Y	Y	Y	n	Y	none	rest

Command successfully completed

Command: █

CANCEL █ █ █ HELP █ █ █



Figure 14. Signaling Group (6) screenshot (1 of 1)

```
status signaling-group 6
STATUS SIGNALING GROUP

Group ID: 6                               Active NCA-TSC Count: 0
Group Type: isdn-pri                       Active CA-TSC Count: 0
Signaling Type: facility associated signaling
Group State: in-service

Primary D-Channel

Port: 01A1424                            Level 3 State: in-service

Secondary D-Channel

Port:                                     Level 3 State: no-link

Command: 
```

CANCEL [] [] [] [] HELP [] [] []



Figure 15. DS1 Board screenshot (1 of 2)

```
display ds1 1a14                                     Page 1 of 2
DS1 CIRCUIT PACK
Location: 01A14                                     Name: QSIG_TIE
Bit Rate: 1.544                                     Line Coding: b8zs
Line Compensation: 1                               Framing Mode: esf
Signaling Mode: isdn-pri                          Connect: pbx
                                                    Interface: peer-master
TN-C7 Long Timers? n                               Peer Protocol: Q-SIG
Interworking Message: PROGRESS                     Side: a
Interface Companding: mulaw                        CRC? n
Idle Code: 11111111                               DCP/Analog Bearer Capability: 3.1kHz
                                                    T303 Timer(sec): 4
Slip Detection? n                                 Near-end CSU Type: other
Echo Cancellation? n
```

CANCEL REFRESH [] [] HELP GO TO PAGE NEXT PAGE PREV PAGE



Figure 16. DS1 Board screenshot (2 of 2)

```
display ds1 1a14 Page 2 of 2
DS1 CIRCUIT PACK

ESF DATA LINK OPTIONS

Network Management Protocol: tabs
Send ANSI-T1.403 One-Second Performance Reports? n
Far-end CSU Address: b
```

CANCEL REFRESH HELP GO TO PAGE NEXT PAGE PREV PAGE



Figure 17. Trunks Status screenshot (1 of 1)

```
status trunk 6
```

TRUNK GROUP STATUS

Member	Port	Service State	Mtce Connected Ports Busy
0006/001	01A1401	in-service/idle	no
0006/002	01A1402	in-service/idle	no
0006/003	01A1403	in-service/idle	no
0006/004	01A1404	in-service/idle	no
0006/005	01A1405	in-service/idle	no
0006/006	01A1406	in-service/idle	no
0006/007	01A1407	in-service/idle	no
0006/008	01A1408	in-service/idle	no
0006/009	01A1409	in-service/idle	no
0006/010	01A1410	in-service/idle	no

```
Command successfully completed
```

```
Command: |
```

CANCEL HELP



Configuring the IOS Gateway 1 (Cisco 3745)

3745_East#sho ver

Cisco IOS Software, 3700 Software (C3745-IPVOICE-M), Version 12.4(1.8)T, INTERIM

SOFTWARE

Technical Support: <http://www.cisco.com/techsupport>

Copyright (c) 1986-2005 by Cisco Systems, Inc.

Compiled Thu 05-May-05 02:04 by kellmill

ROM: System Bootstrap, Version 12.2(8r)T2, RELEASE SOFTWARE (fc1)

3745_East uptime is 2 weeks, 6 days, 31 minutes

System returned to ROM by reload

System image file is "flash:c3745-ipvoice-mz.124-1.8.T"

Cisco 3745 (R7000) processor (revision 2.0) with 112640K/18432K bytes of memory.

Processor board ID JMX0813L0ZN

R7000 CPU at 350MHz, Implementation 39, Rev 3.3, 256KB L2, 2048KB L3 Cache

2 FastEthernet interfaces

24 Serial interfaces

2 Channelized T1/PRI ports

DRAM configuration is 64 bits wide with parity disabled.

151K bytes of NVRAM.

31168K bytes of ATA System CompactFlash (Read/Write)

Configuration register is 0x101



```
3745_East#sho run
```

```
Building configuration...
```

```
Current configuration : 2158 bytes
```

```
!
```

```
version 12.4
```

```
service timestamps debug datetime msec
```

```
service timestamps log datetime msec
```

```
no service password-encryption
```

```
!
```

```
hostname 3745_East
```

```
!
```

```
boot-start-marker
```

```
boot system flash
```

```
boot-end-marker
```

```
!
```

```
logging buffered 1000000 debugging
```

```
!
```

```
no aaa new-model
```

```
!
```

```
resource policy
```

```
!
```

```
no network-clock-participate slot 1
```

```
voice-card 1
```

```
dspfarm
```

```
!
```

```
ip subnet-zero
```

```
ip cef
```



```
!  
!  
no ip dhcp use vrf connected  
!  
!  
no ip domain lookup  
ip host CM-PLUTO 172.20.238.254  
ip name-server 172.20.238.254  
isdn switch-type primary-qsig  
!  
!  
no voice call carrier capacity active  
!  
voice service voip  
  signaling forward unconditional  
  sip  
!  
!  
controller T1 1/0  
  framing esf  
  linecode b8zs  
  pri-group timeslots 1-24  
  description ECN-9  
!  
controller T1 1/1  
  framing sf  
  linecode ami  
!  
!
```



```
!  
interface FastEthernet0/0  
ip address 172.20.4.21 255.255.255.0  
duplex auto  
speed auto  
!  
interface FastEthernet0/1  
no ip address  
shutdown  
duplex auto  
speed auto  
!  
interface Serial1/0:23  
description D-channel for ECN-9  
no ip address  
no logging event link-status  
isdn switch-type primary-qsig  
isdn overlap-receiving  
isdn protocol-emulate network  
isdn incoming-voice voice  
isdn supp-service name calling  
isdn sending-complete  
no cdp enable  
!  
ip classless  
ip route 0.0.0.0 0.0.0.0 FastEthernet0/0  
ip route 0.0.0.0 0.0.0.0 172.20.238.1  
!  
ip http server
```



```
!  
control-plane  
!  
voice-port 1/0:23  
description voice port for ECN-9  
!  
!  
no mgcp package-capability res-package  
no mgcp package-capability fxr-package  
no mgcp timer receive-rtcp  
!  
dial-peer cor custom  
!  
dial-peer voice 1023 pots  
destination-pattern 4...  
direct-inward-dial  
port 1/0:23  
forward-digits all  
!  
dial-peer voice 323 voip  
shutdown  
destination-pattern 2...  
session target ipv4:172.20.4.129  
!  
dial-peer voice 5050 pots  
description dial peer for VM  
destination-pattern 5050  
direct-inward-dial  
port 1/0:23
```




```
forward-digits all
!
dial-peer voice 519 voip
destination-pattern 2...
session protocol sipv2
session target ipv4:172.20.4.129
supplementary-service pass-through
!
!
line con 0
line aux 0
line vty 0 4
exec-timeout 0 0
password cisco
login
transport input telnet
!
!
end
```



Configuring the IOS Gateway 2 (Cisco 2651XM)

2651XM_East#sho ver

Cisco IOS Software, C2600 Software (C2600-IPVOICE-M), Version 12.4(1.8)T, INTERI
M SOFTWARE

Technical Support: <http://www.cisco.com/techsupport>

Copyright (c) 1986-2005 by Cisco Systems, Inc.

Compiled Thu 05-May-05 06:32 by kellmill

ROM: System Bootstrap, Version 12.2(8r) [cmong 8r], RELEASE SOFTWARE (fc1)

2651XM_East uptime is 2 weeks, 6 days, 21 minutes

System returned to ROM by reload

System image file is "flash:c2600-ipvoice-mz.124-1.8.T"

Cisco 2651XM (MPC860P) processor (revision 0x300) with 125986K/5086K bytes of me
mory.

Processor board ID JAE0815CCV4 (1027154741)

M860 processor: part number 5, mask 2

2 FastEthernet interfaces

24 Serial interfaces

2 Channelized T1/PRI ports

32K bytes of NVRAM.

49152K bytes of processor board System flash (Read/Write)

Configuration register is 0x2102



```
2651XM_East#sho run
```

```
Building configuration...
```

```
Current configuration : 2181 bytes
```

```
!
```

```
version 12.4
```

```
service timestamps debug datetime msec
```

```
service timestamps log datetime msec
```

```
no service password-encryption
```

```
no service alignment detection
```

```
!
```

```
hostname 2651XM_East
```

```
!
```

```
boot-start-marker
```

```
boot system flash
```

```
boot-end-marker
```

```
!
```

```
!
```

```
no aaa new-model
```

```
!
```

```
resource policy
```

```
!
```

```
no network-clock-participate slot 1
```

```
no network-clock-participate wic 0
```

```
ip subnet-zero
```

```
ip cef
```

```
!
```

```
!
```



```
no ip dhcp use vrf connected
!
!
no ip domain lookup
isdn switch-type primary-qsig
voice-card 1
!
!
voice service voip
signaling forward unconditional
sip
!
!
controller T1 1/0
framing esf
linecode b8zs
pri-group timeslots 1-24
description ECN-3
!
controller T1 1/1
framing sf
linecode ami
!
!
interface FastEthernet0/0
ip address 172.20.4.129 255.255.255.0
duplex auto
speed auto
!
```



```
interface FastEthernet0/1
no ip address
shutdown
duplex auto
speed auto
!
interface Serial1/0:23
description D-channel for ECN-3
no ip address
no logging event link-status
isdn switch-type primary-qsig
isdn overlap-receiving
isdn incoming-voice voice
isdn supp-service name calling
isdn bchan-number-order ascending
isdn sending-complete
no cdp enable
!
ip classless
ip route 0.0.0.0 0.0.0.0 172.20.31.1
ip route 0.0.0.0 0.0.0.0 FastEthernet0/0
ip route 0.0.0.0 0.0.0.0 172.20.33.1
!
ip http server
!
!
!
control-plane
!
```



```
!  
!  
voice-port 1/0:23  
description voice port for ECN-3  
!  
!  
no mgcp package-capability res-package  
no mgcp package-capability fxr-package  
no mgcp timer receive-rtcp  
!  
!  
!  
dial-peer voice 1023 pots  
destination-pattern 2...  
direct-inward-dial  
port 1/0:23  
forward-digits all  
!  
dial-peer voice 323 voip  
shutdown  
destination-pattern 4...  
session target ipv4:172.20.4.21  
!  
dial-peer voice 5050 voip  
description dial peer for VM  
destination-pattern 5050  
session protocol sipv2  
session target ipv4:172.20.4.21  
supplementary-service pass-through
```



```
!  
dial-peer voice 519 voip  
destination-pattern 4...  
session protocol sipv2  
session target ipv4:172.20.4.21  
supplementary-service pass-through  
!  
gateway  
timer receive-rtp 1200  
!  
sip-ua  
!  
!  
line con 0  
line aux 0  
line vty 0 4  
exec-timeout 0 0  
password cisco  
login  
transport input telnet  
!  
!  
end
```



Acronyms

Acronym	Definitions



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.

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