



Avaya Solution & Interoperability Test Lab

Application Notes for Windstream (Broadsoft Platform) SIP Trunking Service with Avaya Aura® Communication Manager Release 7.0, Avaya Aura® Session Manager Release 7.0 and Avaya Session Border Controller for Enterprise Release 7.0 – Issue 1.0

Abstract

These Application Notes describe the steps to configure a Session Initiation Protocol (SIP) trunk between Windstream (Broadsoft Platform) SIP Trunking Service and an Avaya SIP-enabled enterprise solution. The Avaya solution consists of Avaya Aura® Communication Manager Evolution Server 7.0, Avaya Aura® Session Manager 7.0, Avaya Session Border Controller for Enterprise 7.0 and various Avaya endpoints. This documented solution does not extend to configurations without Avaya Session Border Controller for Enterprise.

Readers should pay attention to **Section 2**, in particular the scope of testing as outlined in **Section 2.1** as well as the observations noted in **Section 2.2**, to ensure that their own use cases are adequately covered by this scope and results.

Windstream Communications is a member of the Avaya DevConnect Service Provider Program. Information in these Application Notes has been obtained through DevConnect compliance testing and additional technical discussions. Testing is conducted via the DevConnect Program at the Avaya Solution and Interoperability Test Lab.

Table of Contents

1.	Introduction.....	4
2.	General Test Approach and Test Results.....	4
2.1.	Interoperability Compliance Testing	4
2.2.	Test Results	5
2.3.	Support.....	6
3.	Reference Configuration	7
4.	Equipment and Software Validated	9
5.	Configure Avaya Aura® Communication Manager	10
5.1.	Licensing and Capacity	10
5.2.	System Features	11
5.3.	IP Node Names	12
5.4.	Codecs.....	12
5.5.	IP Network Region	13
5.6.	Signaling Group	15
5.7.	Trunk Group.....	17
5.8.	Calling Party Information	20
5.9.	Incoming Call Handling Treatment	20
5.10.	Outbound Routing.....	21
5.11.	Saving Communication Manager Configuration Changes	23
6.	Configure Avaya Aura® Session Manager	24
6.1.	System Manager Login and Navigation	24
6.2.	Specify SIP Domain.....	25
6.3.	Add Location	26
6.4.	Add SIP Entities.....	27
6.5.	Add Entity Links.....	29
6.6.	Add Routing Policies	31
6.7.	Add Dial Patterns.....	32
6.8.	Add/View Session Manager	34
7.	Configure Avaya Session Border Controller for Enterprise	36
7.1.	Avaya Session Border Controller for Enterprise Login.....	36
7.2.	Global Profiles	37
7.2.1.	Uniform Resource Identifier (URI) Groups.....	37
7.2.2.	Server Interworking Profile	37
7.2.3.	Configure Signaling Manipulation	42
7.2.4.	Server Configuration.....	42
7.2.5.	Routing Profiles	45
7.2.6.	Topology Hiding.....	47
7.3.	Domain Policies	49
7.3.1.	Signaling Rules	49
7.3.2.	Endpoint Policy Groups.....	50
7.4.	Device Specific Settings	52
7.4.1.	Network Management.....	52
7.4.2.	Media Interface	53
7.4.3.	Signaling Interface	54

7.4.4.	End Point Flows - Server Flow	55
8.	Windstream Service Configuration.....	57
9.	Verification and Troubleshooting	57
9.1.	Verification Steps.....	57
9.2.	Protocol Traces	57
9.3.	Troubleshooting:	58
9.3.1.	The Avaya SBCE.....	58
9.3.2.	Communication Manager.....	58
10.	Conclusion	59
11.	References	60

1. Introduction

These Application Notes describe the steps to configure a SIP trunk between Windstream SIP Trunking Service and an Avaya SIP-enabled enterprise solution. Avaya Aura® release 7.0 is being deployed in virtualized environment that includes Avaya Aura® Communication Manager 7.0 (Communication Manager), Avaya Aura® Session Manager 7.0 (Session Manager), Avaya Aura® Media Server and Avaya Session Border Controller for Enterprise 7.0 (Avaya SBCE). Various Avaya endpoints are also used in test configuration.

Customers using this Avaya SIP-enabled enterprise solution with Windstream are able to place and receive PSTN calls via a broadband Internet connection. This converged network solution is an alternative to a traditional PSTN trunk such as analog and/or ISDN-PRI.

2. General Test Approach and Test Results

DevConnect Compliance Testing is conducted jointly by Avaya and DevConnect members. The jointly-defined test plan focuses on exercising APIs and/or standards-based interfaces pertinent to the interoperability of the tested products and their functionalities. DevConnect Compliance Testing is not intended to substitute full product performance or feature testing performed by DevConnect members, nor is it to be construed as an endorsement by Avaya of the suitability or completeness of a DevConnect member's solution.

Windstream is a member of the Avaya DevConnect Service Provider Program. The general test approach is to connect a simulated enterprise to Windstream via the Internet and exercise the features and functionalities listed in **Section 2.1**.

2.1. Interoperability Compliance Testing

To verify Windstream interoperability, the following features and functionalities are covered in the compliance testing:

- Inbound PSTN calls to various phone types including H.323, SIP, digital and analog telephone at the enterprise. All inbound calls from PSTN are routed to the enterprise across the SIP trunk from the service provider.
- Outbound PSTN calls from various phone types including H.323, SIP, digital and analog telephone at the enterprise. All outbound calls to PSTN are routed from the enterprise across the SIP trunk to the service provider.
- Inbound and outbound PSTN calls to/from Avaya one-X® Communicator (1XC) soft phone. Both the 1XC Computer Mode (where 1XC is used for call control as well as audio path) and the 1XC Telecommuter Mode (where 1XC is used for call control and a separate telephone is used for audio path) are tested.
- Dialing plans including local, long distance, international, outbound toll-free, calls etc.
- Calling Party Name presentation and Calling Party Name restriction.
- Codec G.711MU and G.729.
- Media and Early Media transmissions.
- Incoming and outgoing fax using G.711MU.
- DTMF tone transmissions as out-of-band RTP events as per RFC2833.

- Voicemail navigation for inbound and outbound calls.
- User features such as hold and resume, transfer, forward and conference.
- Off-net call forward with Diversion method.
- EC500 mobility (extension to cellular) with Diversion method.
- Routing inbound vector call to call center agent queues.
- Response to OPTIONS heartbeat and Registration.
- Response to incomplete call attempts and trunk errors.
- Session Timers implementation.
- Remote Worker which allows Avaya SIP endpoints to connect directly to the public Internet as enterprise phones

Item that is supported but not tested includes the following:

- Inbound toll-free.

Items, that are not supported, include the following:

- Fax T.38 is not supported.
- 0 + 10 digits.

2.2. Test Results

Interoperability testing of Windstream with the Avaya SIP-enabled enterprise solution was completed with successful results for all test cases with the exception of the observations and limitations described below:.

- **OPTIONS** – Windstream sends OPTIONS message sip:ping@10.10.98.119:5060. Avaya Session Manager does not recognize the “ping” parameter in the message. Using manipulation script to convert it to sip:10.10.98.119:5060.
- **Outbound Calls with “+”**– Windstream does not accept “+” in front of 10 digit in the From, Contact, Diversion and P-Asserted-Identity headers. Signaling Manipulation script was used to remove the “+” sign.
- **UPDATE** – Windstream SIP Trunking does not support UPDATE messages (the Allow header in messages from Windstream does not list UPDATE). In consequence, Communication Manager uses re-INVITE messages to update information in an active call or to refresh an active call session.
- **Extra SIP Signaling** – After a call with PSTN was effectively transferred off-net to another PSTN party using REFER, some signaling messages from either side for media shuffling (re-INVITE) or terminating pre-transfer calls between the PSTN and enterprise were observed. These non-recurring messages would receive 200/500/481 responses and had no negative impact on the transferred call.
- **Fax Support:** T.38 fax is not supported on the Windstream SIP trunking service. G.711 fax pass-through was successfully tested during the compliance test. Due to the unpredictability of pass-through techniques, which only work well on networks with very few hops and with limited end-to-end delay, G.711 fax pass-through is delivered in Communication Manager on a “best effort” basis; its success is not guaranteed, and it should be used at the customer’s discretion.

2.3. Support

For technical support on Windstream SIP Trunking, contact Windstream at:
<http://www.windstreambusiness.com/support/customer-support>

3. Reference Configuration

Figure 1 illustrates the sample Avaya SIP-enabled enterprise solution connected to the Windstream (Vendor Validation circuit) through a public Internet connection.

For security purposes, the real public IP addresses and PSTN routable phone numbers used in the compliance test are not shown in these Application Notes.

The Avaya components used to create the simulated customer site included:

- Avaya Aura® Communication Manager running in VMware environment.
- Avaya Aura® System Manager running in VMware environment.
- Avaya Aura® Session Manager running in VMware environment.
- Avaya Aura® Messaging running in VMware environment.
- Avaya Aura® Media Server running in VMware environment
- Avaya G450 Media Gateway.
- Avaya Session Border Controller for Enterprise.
- Avaya 9600Series IP Deskphones (H.323, SIP).
- Avaya one-X® Communicator soft phones (H.323, SIP).
- Avaya digital and analog telephones.

Located at the edge of the enterprise network is the Avaya SBCE. It has a public side that connects to Windstream via Internet and a private side that connects to the enterprise network. All SIP and RTP traffic entering or leaving the enterprise network flows through the Avaya SBCE which can protect the enterprise against any outside SIP-based attacks. The Avaya SBCE provides network address translation at both the IP and SIP layers. The transport protocol between the Avaya SBCE and Windstream across the public network is UDP. The transport protocol between the Avaya SBCE, Session Manager and Communication Manager is TCP.

In the compliance testing, the Avaya Customer-Premises Equipment (CPE) environment was configured with SIP domain “avayalab.com” for the enterprise. The Avaya SBCE is used to adapt the enterprise SIP domain to the IP address based URI-Host known to Windstream. **Figure 1** below illustrates the network diagram for the enterprise. All voice application elements are connected to internal trusted LAN.

In this configuration, Avaya SIP trunking on enterprise side is configured to periodically perform OPTIONS ping to Windstream system. Also a registration message from Avaya SBCE is sent to Windstream for authentication process.

Additionally, the reference configuration included remote worker functionality, introduced with Avaya Communication Manager with Avaya SBCE. A remote worker is a SIP endpoint that resides in the un-trusted network, registered to Session Manager via the Avaya SBCE. Remote workers feature the same functionality as any other endpoint within the enterprise. This functionality was successfully tested during the compliance test, using the Avaya one-x Communicator for Windows using TLS and SRTP. The configuration tasks required to support remote workers are referenced in **Section 11**.

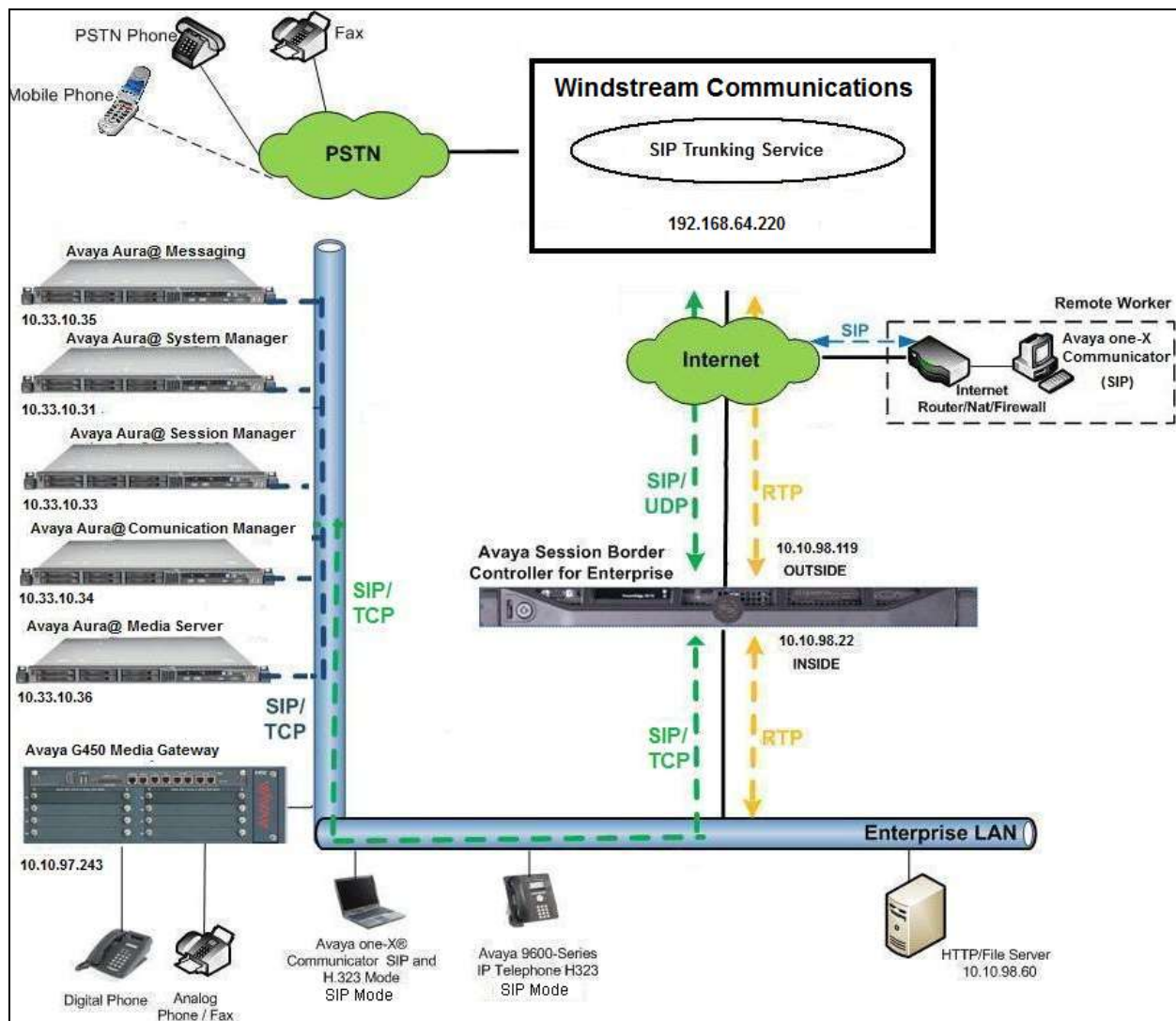


Figure 1: Avaya IP Telephony Network connecting to Windstream Networks

4. Equipment and Software Validated

The following equipment and software are used for the sample configuration provided:

Avaya IP Telephony Solution Components	
Component	Release
Avaya Aura® Communication Manager running in Virtualized Environment	7.0 (R017x.00.0.441.0 Patch 22477)
Avaya G450 Media Gateway	37.19.0
Avaya Aura® System Manager running in Virtualized Environment	7.0 (7.0.0.0.3929)
Avaya Aura® Session Manager running in Virtualized Environment	7.0 (7.0.0.0.700007)
Avaya Aura® Messaging running in Virtualized Environment	6.3.124.335-1.253373
Avaya Aura® Media Server running on Virtualized Environment	7.7.0.226
Avaya Session Border Controller for Enterprise	7.0.0-21-6602
Avaya 9621G IP Deskphone (H.323)	6.6.029
Avaya 9641G IP Deskphone (SIP)	7.0.0.39
Avaya one-X Communicator (H.323/SIP)	6.2.7.03-SP7
Avaya 1408 Digital Telephone	1408D02A-003
Avaya Analog Telephone	n/a
Windstream SIP Trunking Service Components	
Component	Release
Broadsoft	R17SP4
ACME Net-Net 4250	Firmware SC6.2.0 Patch 3 Build 497(Build Date=02/12/10)

Table 1: Equipment and Software Tested

Note: This solution will be compatible with other Avaya Server and Media Gateway platforms running similar version of Communication Manager.

5. Configure Avaya Aura® Communication Manager

This section describes the procedure for configuring Communication Manager for Windstream. It is assumed the general installation of Communication Manager, Avaya G450 Media Gateway and Media Server has been previously completed and is not discussed here.

The configuration of Communication Manager was performed using the System Access Terminal (SAT). Some screens in this section have been abridged and highlighted for brevity and clarity in presentation.

5.1. Licensing and Capacity

Use the **display system-parameters customer-options** command to verify that the **Maximum Administered SIP Trunks** value on **Page 2** is sufficient to support the desired number of simultaneous SIP calls across all SIP trunks at the enterprise including any trunks to and from the service provider. The license file installed on the system controls the maximum values for these attributes. If a required feature is not enabled or there is insufficient capacity, contact an authorized Avaya sale representative to add the additional capacity or feature.

display system-parameters customer-options		Page 2 of 12
OPTIONAL FEATURES		
IP PORT CAPACITIES		USED
Maximum Administered H.323 Trunks:	4000	0
Maximum Concurrently Registered IP Stations:	2400	1
Maximum Administered Remote Office Trunks:	4000	0
Maximum Concurrently Registered Remote Office Stations:	2400	0
Maximum Concurrently Registered IP eCons:	68	0
Max Concur Registered Unauthenticated H.323 Stations:	100	0
Maximum Video Capable Stations:	2400	0
Maximum Video Capable IP Softphones:	2400	3
Maximum Administered SIP Trunks:	4000	12
Maximum Administered Ad-hoc Video Conferencing Ports:	4000	0
Maximum Number of DS1 Boards with Echo Cancellation:	80	0
(NOTE: You must logoff & login to effect the permission changes.)		

5.2. System Features

Use the **change system-parameters features** command to set the **Trunk-to-Trunk Transfer** field to **all** to allow an incoming call from the PSTN to be transferred to another PSTN endpoint. If for security reasons, incoming calls should not be allowed to transfer back to the PSTN then leave the field set to **none**.

<pre>change system-parameters features FEATURE-RELATED SYSTEM PARAMETERS Self Station Display Enabled? y Trunk-to-Trunk Transfer: all Automatic Callback with Called Party Queuing? n Automatic Callback - No Answer Timeout Interval (rings): 3 Call Park Timeout Interval (minutes): 10 Off-Premises Tone Detect Timeout Interval (seconds): 20 AAR/ARS Dial Tone Required? y</pre>	Page 1 of 19
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On **Page 9** verify that a text string has been defined to replace the Calling Party Number (CPN) for restricted or unavailable calls. The compliance test used the value of **Restricted** for restricted calls and **Unavailable** for unavailable calls.

<pre>change system-parameters features FEATURE-RELATED SYSTEM PARAMETERS CPN/ANI/ICLID PARAMETERS CPN/ANI/ICLID Replacement for Restricted Calls: Restricted CPN/ANI/ICLID Replacement for Unavailable Calls: Unavailable DISPLAY TEXT Identity When Bridging: principal User Guidance Display? n Extension only label for Team button on 96xx H.323 terminals? n INTERNATIONAL CALL ROUTING PARAMETERS Local Country Code: 1 International Access Code: 001 SCCAN PARAMETERS Enable Enbloc Dialing without ARS FAC? n CALLER ID ON CALL WAITING PARAMETERS Caller ID on Call Waiting Delay Timer (msec): 200</pre>	Page 9 of 19
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5.3. IP Node Names

Use the **change node-names ip** command to verify that node names have been previously defined for the IP addresses of Communication Manager (**procr**), Session Manager (**SM**) and Media Server (**AMS**). These node names will be needed for defining the service provider signaling groups in **Section 5.6**.

change node-names ip		Page 1 of 2
		IP NODE NAMES
Name	IP Address	
SM	10.33.10.33	
AMS	10.33.10.36	
default	0.0.0.0	
procr	10.33.10.34	
procr6	::	

5.4. Codecs

Use the **change ip-codec-set** command to define a list of codecs to be used for calls between the enterprise and the service provider. This compliance test used ip-codec-set 1. Windstream supports G.711MU and G729. To use this codec, enter **G.711MU** and **G.729** in the **Audio Codec** column of the table in the order of preference.

The following screen shows the configuration for ip-codec-set 1. During testing, the codec set specifications are varied to test for individual codec support as well as codec negotiation between the enterprise and the network at call setup time.

change ip-codec-set 1

Page1 of 2

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:			

On **Page 2**, set the **Fax Mode** to **pass-through** faxing which Windstream supported G.711 fax.

change ip-codec-set 1		Page	2 of	2
IP CODEC SET				
Allow Direct-IP Multimedia? n				
	Mode	Redundancy	Packet	
			Size (ms)	
FAX	pass-through	1		
Modem	off	0		
TDD/TTY	US	3		
H.323 Clear-channel	n	0		
SIP 64K Data	n	0	20	

5.5. IP Network Region

A separate IP network region for the service provider trunk group is created. This allows separate codec or quality of service setting to be used (if necessary) for a call between the enterprise and the service provider versus a call within the enterprise or elsewhere. For the compliance testing, ip-network-region 1 was created by the **change ip-network-region 1** command with the following parameters:

- Set the **Authoritative Domain** field to match the SIP domain of the enterprise. In the compliance testing, the domain name is *avayalab.com*. This domain name appears in the “From” header of SIP message originating from this IP region.
- Enter a descriptive name in the **Name** field.
- Enable **IP-IP Direct Audio** (shuffling) to allow audio traffic to be sent directly between IP endpoints without using media resources in the Media Gateway. By default, both **Intra-region** and **Inter-region IP-IP Direct Audio** are set to *yes*. Shuffling can be further restricted at the trunk level under the Signaling Group form.
- Set the **Codec Set** field to the IP codec set defined in **Section 5.4**.
- Default values can be used for all other fields.

change ip-network-region 1		Page 1 of 20
IP NETWORK REGION		
Region: 1		
Location: 1	Authoritative Domain: avayalab.com	
Name: ToSM		
MEDIA PARAMETERS		Intra-region IP-IP Direct Audio: yes
Codec Set: 1	Inter-region IP-IP Direct Audio: yes	
UDP Port Min: 2048	IP Audio Hairpinning? n	
UDP Port Max: 3329		
DIFFSERV/TOS PARAMETERS		
Call Control PHB Value: 46		
Audio PHB Value: 46		
Video PHB Value: 26		
...		

On **Page 4**, define the IP codec set to be used for traffic between region 1 and other regions. In the compliance testing, Communication Manager, the Avaya G450 Media Gateway, IP/SIP phones, Session Manager and the Avaya SBCE were assigned to the same region 1. To configure the IP codec set between regions, enter the desired IP codec set in the **codec set** column of the table with appropriate destination region (**dst rgn**). Default values may be used for all other fields. The example below shows codec set 1 will be used for a call between region 1 and other regions.

change ip-network-region 1										Page		4 of		20			
Source Region: 1		Inter Network Region Connection Management								I		M					
										G		A		t			
dst codec direct		WAN-BW-limits		Video		Intervening		Dyn		A		G		c			
rgn set		WAN Units		Total Norm		Prio Shr Regions		CAC		R		L		e			
1		1												all			
2												n		t			
3												n		t			

Non-IP telephones (e.g., analog, digital) derive network region from IP interface of the Avaya G450 Media Gateway to which the device is connected. IP telephones can be assigned a network region based on an IP address mapping.

To define network region 1 for IP interface **procr**, use **change ip-interface procr** command as shown in the following screen.

change ip-interface procr	Page 1 of 2
IP INTERFACES	
Type: PROCR	Target socket load: 4800
Enable Interface? y	Allow H.323 Endpoints? y
Network Region: 1	Allow H.248 Gateways? y
...	Gatekeeper Priority: 5

To define network region 1 for the Avaya G450 Media Gateway, use **change media-gateway** command as shown in the following screen.

change media-gateway 1	Page 1 of 2
MEDIA GATEWAY 1	
Type: g450	
Name: g450	
Serial No: 11N526797797	
Link Encryption Type: any-ptls/tls	Enable CF? n
Network Region: 1	Location: 1
	Site Data:
Recovery Rule: none	
...	

If Avaya Aura® Media Server is used in parallel with Avaya Media Gateway G450 then it is needed to define network region 1 for the Avaya Aura® Media Server, use **change media-server** command as shown in the following screen.

change media-server 1	Page 1 of 1
MEDIA SERVER	
Media Server ID: 1	
Signaling Group: 3	
Voip Channel License Limit: 30	
Dedicated Voip Channel Licenses: 30	
Node Name: AMS	
Network Region: 1	
Location: 1	
Announcement Storage Area:	
...	

5.6. Signaling Group

Use the **add signaling-group** command to create a signaling group between Communication Manager and Session Manager for use by the service provider trunk. This signaling group is used for inbound and outbound calls between the service provider and the enterprise. For the compliance test, signaling group 2 was used for this purpose and was configured using the parameters highlighted below.

- Set the **Group Type** field to *sip*.
- Set the **IMS Enabled** field to *n*.
- Set the **Transport Method** to *tcp*. The transport method specified here is used between Communication Manager and Session Manager.
- Set the **Near-end Listen Port** and **Far-end Listen Port** to *5060*.
- Set the **Near-end Node Name** to *procr*. This node name maps to the IP interface of *procr* defined in Section 5.3.
- Set the **Far-end Node Name** to *SM*. This node name maps to the IP address of Avaya SBCE as defined in Section 5.3.
- Set the **Far-end Network Region** to the IP network region *1* defined for the service provider in Section 5.5.
- Set the **Far-end Domain** to *avayalab.com*.
- Set the **DTMF over IP** to *rtp-payload*. This setting enables Communication Manager to send or receive the DTMF transmissions using RFC2833.
- Set **Enable Layer 3 Test?** to *y*. This setting allows Communication Manager to send OPTIONS heartbeat to Session Manager on the SIP trunk.
- Set **Direct IP-IP Audio Connections** to *y*. This field will enable media shuffling on the SIP trunk allowing Communication Manager to redirect media traffic directly between the SIP trunk and the enterprise endpoint. If this value is set to *n*, then the Avaya G450 Media Gateway will remain in the media path between the SIP trunk and the endpoint for the duration of the call. Depending on the number of media resources available in the Avaya G450 Media Gateway, these resources may be depleted during high call volume preventing additional calls from completing.
- Set the **Direct IP-IP Early Media** is set to *n*.
- Set the **Alternate Route Timer** to *30*. This defines the number of seconds Communication Manager will wait for a response (other than 100 Trying) to an outbound INVITE before canceling the call.
- Default values may be used for all other fields.

Signaling Group 2.

add signaling-group 2		Page 1 of 2
SIGNALING GROUP		
Group Number: 2	Group Type: sip	
IMS Enabled? n	Transport Method: tcp	
Q-SIP? n		
IP Video? n	Enforce SIPS URI for SRTP? y	
Peer Detection Enabled? y Peer Server: SM		
Prepend '+' to Outgoing Calling/Alerting/Diverting/Connected Public Numbers? y		
Remove '+' from Incoming Called/Calling/Alerting/Diverting/Connected Numbers? n		
Alert Incoming SIP Crisis Calls? n		
Near-end Node Name: procr	Far-end Node Name: SM	
Near-end Listen Port: 5060	Far-end Listen Port: 5060	
	Far-end Network Region: 1	
Far-end Domain: avayalab.com		
Incoming Dialog Loopbacks: eliminate	Bypass If IP Threshold Exceeded? n	
DTMF over IP: rtp-payload	RFC 3389 Comfort Noise? n	
Session Establishment Timer(min): 3	Direct IP-IP Audio Connections? y	
Enable Layer 3 Test? y	IP Audio Hairpinning? n	
H.323 Station Outgoing Direct Media? n	Initial IP-IP Direct Media? n	
	Alternate Route Timer(sec): 30	

Another signaling group is created between Communication Manager and Media Server to provide media resource for IP telephony in parallel of media gateway G450. For the compliance test, signaling group 3 was used for this purpose and was configured in capture below.

Signaling Group 3.

add signaling-group 3		Page 1 of 2
SIGNALING GROUP		
Group Number: 3	Group Type: sip	
	Transport Method: tcp	
Peer Detection Enabled? n Peer Server: AMS		
Near-end Node Name: procr	Far-end Node Name: AMS	
Near-end Listen Port: 5060	Far-end Listen Port: 5060	
	Far-end Network Region: 1	
Far-end Domain: 10.33.10.36		

5.7. Trunk Group

Use the **add trunk-group** command to create trunk group for the signaling group created in **Section 0**. For the compliance testing, trunk group **2** was configured using the parameters highlighted below.

- Set the **Group Type** field to *sip*.
- Enter a descriptive name for the **Group Name**.
- Enter an available Trunk Access Code (TAC) that is consistent with the existing dial plan in the **TAC** field.
- Set the **Outgoing Display** to *y* to enable name display on the trunk.
- Set the **Service Type** field to *public-ntwrk*.
- Set the **Signaling Group** to the signaling group shown in **Section 0**.
- Set the **Number of Members** field to **32**. It is the number of trunk members in the SIP trunk group. This value determines how many simultaneous SIP calls can be supported by this trunk group.
- Default values are used for all other fields.

```
add trunk-group 2                                     Page 1 of 21
                                     TRUNK GROUP
Group Number: 2                      Group Type: sip      CDR Reports: y
  Group Name: SIP-Carrier             COR: 1             TN: 1       TAC: #02
  Direction: two-way                 Outgoing Display? y
Dial Access? n                       Night Service:
Queue Length: 0
Service Type: public-ntwrk           Auth Code? n
                                     Member Assignment Method: auto
                                     Signaling Group: 2
                                     Number of Members: 32
```

On **Page 2**, verify that the **Preferred Minimum Session Refresh Interval (sec)** is set to a value acceptable to service provider. This value defines the interval a re-INVITES must be sent to refresh the Session Timer. For the compliance testing, a default value of **600** seconds was used.

```
add trunk-group 2                                     Page 2 of 21
  Group Type: sip
TRUNK PARAMETERS
  Unicode Name: auto
                                     Redirect On OPTIM Failure: 5000
                                     SCCAN? n               Digital Loss Group: 18
                                     Preferred Minimum Session Refresh Interval(sec): 600
Disconnect Supervision - In? y Out? y
  XOIP Treatment: auto             Delay Call Setup When Accessed Via IGAR? N
Caller ID for Service Link Call to H.323 1xC: station-extension
```

On **Page 3**, set the **Numbering Format** field to *public*. This field specifies the format of the CPN sent to the far-end. The public numbers are automatically preceded with a + sign when passed in the “From”, “Contact” and “P-Asserted Identity” headers. The addition of the + sign impacted interoperability with the service provider. Thus, the **Numbering Format** is set to *public* and the **Numbering Format** in the route pattern is set to *pub-unk* (see **Section 5.98**).

Set the **Replace Restricted Numbers** and **Replace Unavailable Numbers** fields to *y*. This will allow the CPN displayed on the local endpoint to be replaced with the value set in **Section 5.2**, if the inbound call enabled CPN block. Default values are used for all other fields.

add trunk-group 2	Page 3 of 21
TRUNK FEATURES	
ACA Assignment? n	Measured: none
	Maintenance Tests? y
Numbering Format: public	UI Treatment: service-provider
	Replace Restricted Numbers? y
	Replace Unavailable Numbers? Y
	Hold/Unhold Notifications? y
	Modify Tandem Calling Number: no
Show ANSWERED BY on Display? y	

On **Page 4**, Windstream supports SIP REFER method for call redirection.

- Set of **Network Call Redirection** flag to **y** to enable the use of SIP REFER message to transfer calls back to the PSTN.
- Set the **Send Diversion Header** field to **y**. This field provides additional information to the network if the call has been re-directed. This is needed to support call forwarding of inbound call back to PSTN and Extension to Cellular (EC500) call scenarios.
- Set the **Support Request History** field to **n**. This parameter determines if History-Info header will be excluded in the call-redirection INVITE from the enterprise.
- Set the **Telephone Event Payload Type** to **101**.

add trunk-group 2

Page 4 of 21

PROTOCOL VARIATIONS

```

                                Mark Users as Phone? n
Prepend '+' to Calling/Alerting/Diverting/Connected Number? n
                                Send Transferring Party Information? n
                                Network Call Redirection? Y
Build Refer-To URI of REFER From Contact For NCR? n
                                Send Diversion Header? y
                                Support Request History? n
                                Telephone Event Payload Type: 101

                                Convert 180 to 183 for Early Media? n
                                Always Use re-INVITE for Display Updates? n
                                Identity for Calling Party Display: P-Asserted-Identity
Block Sending Calling Party Location in INVITE? n
                                Accept Redirect to Blank User Destination? n
                                Enable Q-SIP? n

Interworking of ISDN Clearing with In-Band Tones: keep-channel-active
                                Request URI Contents: may-have-extra-digits
```

5.8. Calling Party Information

The calling party number is sent in the SIP “From”, “Contact” and “PAI” headers. Since public numbering is selected to define the format of this number (**Section 0**), use the **change public-unknown-numbering** command to create an entry for each extension which has a DID assigned. DID numbers are provided by the service provider. They are used to authenticate the caller.

The screen below shows a subset of the 10 digits DID numbers assigned for testing. These 3 numbers were mapped to the 3 enterprise extensions 60396, 60397 and 60379. These same 10-digit numbers were used in the outbound calling party information on the service provider trunk when calls were originated from these extensions.

change public-unknown-numbering 0					Page	1 of	2
NUMBERING - PUBLIC/UNKNOWN FORMAT							
Ext	Ext	Trk	CPN	Total			
Len	Code	Grp(s)	Prefix	Len			
5	60396	2	2814022045	10	Total Administered: 3		
5	60397	2	2814022046	10	Maximum Entries: 240		
5	60379	2	2814022036	10			

5.9. Incoming Call Handling Treatment

In general, the incoming call handling treatment for a trunk group can be used to manipulate the digits received for an incoming call if necessary. DID number sent by Windstream can be mapped to an extension using the incoming call handling treatment of the receiving trunk-group. Use the **change inc-call-handling-trmt trunk-group** command to create an entry for each DID.

change inc-call-handling-trmt trunk-group 50					Page	1 of	30
INCOMING CALL HANDLING TREATMENT							
Service/ Feature	Number Len	Number Digits	Del	Insert			
public-ntwrk	10	2814022045	10	60396			
public-ntwrk	10	2814022046	10	60397			
public-ntwrk	10	2814022036	10	60379			
.....							

5.10. Outbound Routing

In these Application Notes, the **Automatic Route Selection (ARS)** feature is used to route an outbound call via the SIP trunk to the service provider. In the compliance testing, a single digit 9 was used as the ARS access code. An enterprise caller will dial 9 to reach an outside line. To define feature access code (**fac**) **9**, use the **change dialplan analysis** command as shown below.

change dialplan analysis			DIAL PLAN ANALYSIS TABLE						Page 1 of 12
			Location: all			Percent Full: 2			
Dialed String	Total Length	Call Type	Dialed String	Total Length	Call Type	Dialed String	Total Length	Call Type	
1	4	ext							
30	4	ext							
39	5	udp							
60	5	ext							
9	1	fac							
*	3	dac							
#	3	dac							

Use the **change feature-access-codes** command to define **9** as the **Auto Route Selection (ARS)** – **Access Code 1**.

change feature-access-codes		Page 1 of 10
FEATURE ACCESS CODE (FAC)		
Abbreviated Dialing List1 Access Code:		
Abbreviated Dialing List2 Access Code:		
Abbreviated Dialing List3 Access Code:		
Abbreviated Dial - Prgm Group List Access Code:		
Announcement Access Code: *05		
Answer Back Access Code:		
Attendant Access Code:		
Auto Alternate Routing (AAR) Access Code:		
Auto Route Selection (ARS) - Access Code 1: 9		Access Code 2:

Use the **change ars analysis** command to configure the routing of dialed digits following the first digit 9. The example below shows a subset of the dialed strings tested as part of the compliance testing. See **Section 2.1** for the complete list of call types tested. All dialed strings are mapped to route pattern **2** for an outbound call which contains the SIP trunk to the service provider (as defined next).

change ars analysis 0						Page 1 of 2	
ARS DIGIT ANALYSIS TABLE							
Location: all					Percent Full: 0		
	Dialed	Total		Route	Call	Node	ANI
	String	Min	Max	Pattern	Type	Num	Reqd
0		1	11	2	op		n
011		10	18	2	intl		n
1		11	11	2	pubu		n
300		10	10	2	pubu		n
411		3	3	2	svcl		n
613		10	10	2	pubu		n
866		10	10	2	pubu		n
911		3	3	2	svcl		n

As mentioned above, the route pattern defines which trunk group will be used for the outbound calls and performs necessary digit manipulation. Use the **change route-pattern** command to configure the parameters for route pattern **2** in the following manner.

- **Pattern Name:** Enter a descriptive name.
- **Grp No:** Enter the outbound trunk group for the SIP service provider. For the compliance testing, trunk group **2** was used.
- **FRL:** Set the Facility Restriction Level (**FRL**) field to a level that allows access to this trunk for all users that require it. The value of **0** is the least restrictive level.
- **Numbering Format: pub-unk** All calls using this route pattern will use the public numbering table. See setting of the **Numbering Format** in the trunk group form for full details in **Section 5.8**.

```

change route-pattern 2
Pattern Number: 2      Pattern Name: SP Route
                        SCCAN? n      Secure SIP? n
Grp FRL NPA Pfx Hop Toll No.   Inserted      DCS/  IXC
No   No      Mrk Lmt List Del  Digits      QSIG
                        Dgts
1: 2      0      1
2:
....
      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 y n  n      rest      pub-unk  none
...

```

5.11. Saving Communication Manager Configuration Changes

The command “**save translation all**” can be used to save the configuration changes made on Communication Manager.

6. Configure Avaya Aura® Session Manager

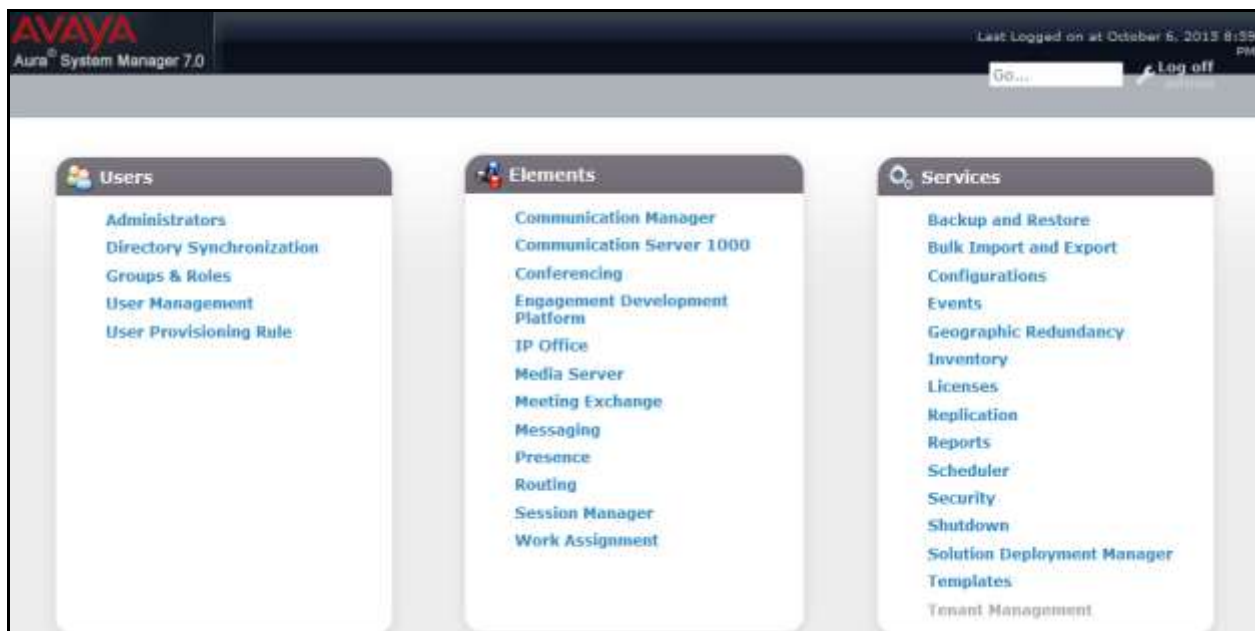
This section provides the procedures for configuring Session Manager. The procedures include adding the following items:

- SIP domain
- Logical/physical Location that can be used by SIP Entities
- SIP Entities corresponding to Communication Manager, Session Manager and the Avaya SBCE
- Entity Links, which define the SIP trunk parameters used by Session Manager when routing calls to/from SIP Entities
- Routing Policies, which control call routing between the SIP Entities
- Dial Patterns, which govern to which SIP Entity a call is routed
- Session Manager, corresponding to the Session Manager server to be managed by System Manager

It may not be necessary to configure all the items above when creating a connection to the service provider since some of these items would have already been defined as part of the initial Session Manager installation. This includes items such as certain SIP domains, locations, SIP entities, and Session Manager itself. However, each item should be reviewed to verify the configuration.

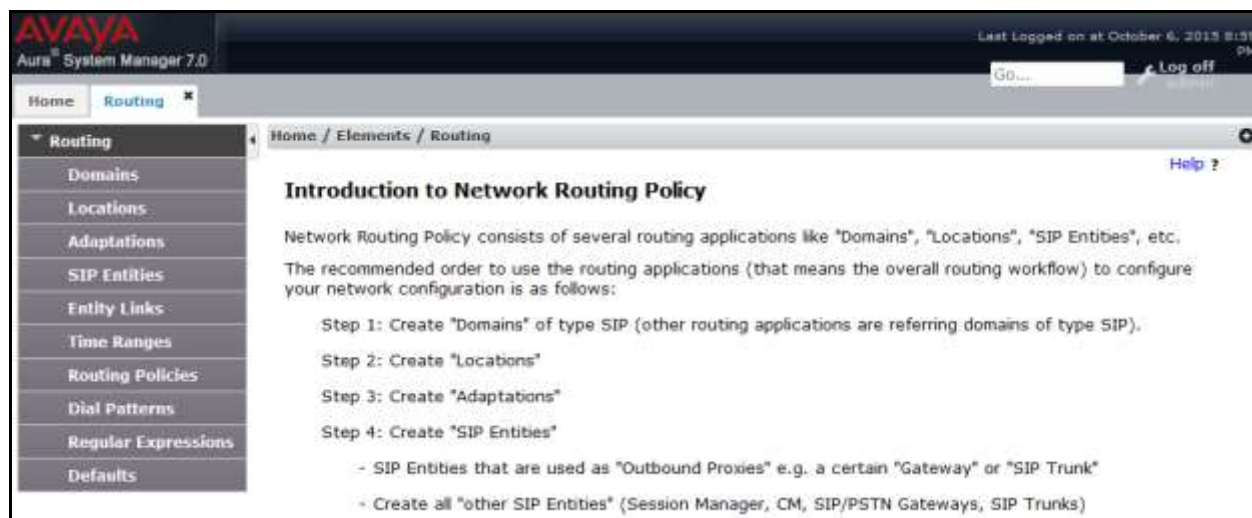
6.1. System Manager Login and Navigation

Session Manager configuration is accomplished by accessing the Web GUI of System Manager, using the URL “https://<ip-address>/SMGR”, where “<ip-address>” is the IP address of System Manager. At the **System Manager Log On** screen, provide the appropriate credentials and click on **Login** (not shown). The initial screen shown below is then displayed.



Most of the configuration items are performed in the Routing element. Click on **Routing** in the **Elements** column to bring up the **Introduction to Network Routing Policy** screen.

The navigation tree displayed in the left pane will be referenced in subsequent sections to navigate to items requiring configuration.



6.2. Specify SIP Domain

To view or to change SIP domains, select **Routing** → **Domains**. Click on the checkbox next to the name of the SIP domain and **Edit** to edit an existing domain, or the **New** button to add a domain. Click the **Commit** button (not shown) after changes are completed.

The following screen shows the list of configured SIP domains. The domain "avayalab.com" was already created for communication between Session Manager and Communication Manager. The domain "avayalab.com" is not known to Windstream. It will be adapted by the Avaya SBCE to IP address based URI-Host to meet the SIP specification of Windstream system.



6.3. Add Location

Locations can be used to identify logical and/or physical locations where SIP Entities reside for bandwidth management and call admission control purposes. To add a location, navigate to **Routing → Locations** in the left-hand navigation pane and click **New** button in the right pane (not shown).

In **General** section, enter the following values:

- **Name:** Enter a descriptive name for the location.
- **Notes:** Add a brief description (optional).

In the **Location Pattern** section (see the screen below), click **Add** and enter following values:

- **IP Address Pattern:** An IP address pattern used to identify the location.
- **Notes:** Add a brief description (optional).

Displayed below are the screenshots for location **Belleville**, which includes all equipment on the **10.33.x**, **10.10.98.x** and **10.10.97.x** subnet including Communication Manager, Session Manager and Avaya SBCE. Click **Commit** to save.

The screenshot displays the Avaya Aura System Manager 7.0 web interface. The left-hand navigation pane shows the 'Routing' menu expanded, with 'Locations' selected. The main content area is titled 'Location Details' and contains several sections:

- General:** Includes fields for 'Name' (set to 'Belleville') and 'Notes' (set to 'GSSCP Belleville').
- Dial Plan Transparency in Survivable Mode:** Includes a checkbox for 'Enabled' (checked), and fields for 'Listed Directory Number' and 'Associated CM SIP Entity'.
- Overall Managed Bandwidth:** Includes a dropdown for 'Managed Bandwidth Units' (set to 'Kbit/sec'), and fields for 'Total Bandwidth' and 'Multimedia Bandwidth' (both set to '10000000').
- Location Pattern:** Includes a checkbox for 'Audio Calls Can Take Multimedia Bandwidth' (checked), and a table for 'IP Address Pattern'.

The 'Location Pattern' table has a header with 'IP Address Pattern' and 'Notes'. It contains three rows of data:

IP Address Pattern	Notes
10.33.	
135.10.97.	
135.10.98.	

At the bottom of the 'Location Pattern' section, there is a 'Select: All, None' link.

6.4. Add SIP Entities

A SIP Entity must be added for Session Manager and for each SIP telephony system connected to it which includes Communication Manager and Avaya SBCE.

To add a new SIP Entity, navigate to **Routing** → **SIP Entities** in the left navigation pane and click **New** button in the right pane (not shown).

In **General** section, enter following values. Use default values for all remaining fields:

- **Name:** Enter a descriptive name.
- **FQDN or IP Address:** Enter the FQDN or IP address of the SIP Entity that is used for SIP signaling.
- **Type:** Select *Session Manager* for Session Manager, *CM* for Communication Manager and *Other* for the Avaya SBCE.
- **Location:** Select one of the locations defined in **Section** Error! Reference source not found..
- **Time Zone:** Select the time zone for the location above.

The following screen shows the addition of Session Manager SIP Entity. The IP address of the Session Manager signaling interface is entered for **FQDN or IP Address**.

The screenshot displays the Avaya Aura System Manager 7.0 web interface. The top navigation bar includes the Avaya logo, the text 'Aura System Manager 7.0', and a user session summary showing 'Last Logged on at October 6, 2015 8:59 PM' and a 'Log off' button. The left-hand navigation pane lists various system components: Routing, Domains, Locations, Adaptations, SIP Entities (which is currently selected and highlighted), Entity Links, Time Ranges, Routing Policies, Dial Patterns, Regular Expressions, and Defaults. The main content area is titled 'SIP Entity Details' and features a 'General' tab. The form contains several fields: 'Name' with the value 'SM7', 'FQDN or IP Address' with the value '10.33.10.33', 'Type' set to 'Session Manager' via a dropdown menu, and an empty 'Notes' field. Below these are 'Location' (set to 'Belleville'), 'Outbound Proxy' (empty), 'Time Zone' (set to 'America/Toronto'), and 'Credential name' (empty). At the bottom, there is a 'SIP Link Monitoring' section with a dropdown menu currently set to 'Use Session Manager Configuration'. 'Commit' and 'Cancel' buttons are located in the top right corner of the form area.

To define the ports used by Session Manager, scroll down to the **Port** section of the **SIP Entity Details** screen. This section is only present for the **Session Manager** SIP Entity.

In the **Port** section, click **Add** and enter following values. Use default values for all remaining fields:

- **Port:** Port number on which the Session Manager can listen for SIP requests.
- **Protocol:** Transport protocol to be used to send SIP requests.
- **Default Domain:** The domain used for the enterprise.

Defaults can be used for the remaining fields. Click **Commit** to save (not shown).

The compliance test used **Port** entry **5060** with **TCP** for connecting to Communication Manager and **Port** entry **5060** with **TCP** for connecting to the Avaya SBCE.

The screenshot shows the 'Listen Ports' configuration window. At the top, there are fields for 'TCP Failover port:' and 'TLS Failover port:'. Below these are 'Add' and 'Remove' buttons. A table lists 4 items with columns: Listen Ports, Protocol, Default Domain, and Notes. The table contains two entries: one for port 5060 using TCP protocol with default domain avaya.com, and another for port 5060 using UDP protocol with default domain avaya.com.

Listen Ports	Protocol	Default Domain	Notes
5060	TCP	avaya.com	
5060	UDP	avaya.com	

The following screen shows the addition of Communication Manager SIP Entities. In order for Session Manager to send SIP traffic on an entity link to Communication Manager, it is necessary to create a SIP Entity for Communication Manager. The **FQDN or IP Address** field is set to IP address of Communication Manager and **Type** to **CM**. Then set Location and Time Zone parameters as shown in capture below.

The screenshot shows the 'SIP Entity Details' screen in the 'Routing' section. The 'General' tab is active. Fields include: Name (CM7), FQDN or IP Address (10.33.10.34), Type (CM), Notes, Adaptation, Location (Belleville), Time Zone (America/Toronto), and SIP Timer B/F (in seconds) (4). There are 'Commit' and 'Cancel' buttons at the top right.

SIP Entity Details

General

Name: CM7

FQDN or IP Address: 10.33.10.34

Type: CM

Notes:

Adaptation:

Location: Belleville

Time Zone: America/Toronto

SIP Timer B/F (in seconds): 4

The following screen shows the addition of the SIP Entity for Avaya SBCE. The **FQDN or IP Address** field is set to the IP address of its private network interface (see **Figure 1**). Select **Type** as *Other*. Select **SIP Link Monitoring** as **Link Monitoring Enabled** with the interval of **120** seconds. This setting allows Session Manager to send outbound OPTIONS heartbeat in every **120** seconds to service provider (which is forwarded by the Avaya SBCE) to query for the status of the SIP trunk connecting to service provider.

AVAYA
Aura® System Manager 7.0

Last Logged on at October 6, 2015 8:39 PM

Home Routing

Home / Elements / Routing / SIP Entities

SIP Entity Details

Commit Cancel

General

* Name: SBCE22

* FQDN or IP Address: 10.10.98.22

Type: Other

Notes: Avaya Aura SBC-E using IP 98.22

Adaptation: [dropdown]

Location: Belleville

Time Zone: America/Toronto

* SIP Timer B/F (in seconds): 4

Credential name: [text field]

Securable: [checkbox]

Call Detail Recording: none

CommProfile Type Preference: [dropdown]

Loop Detection

Loop Detection Mode: Off

SIP Link Monitoring

SIP Link Monitoring: Link Monitoring Enabled

* Proactive Monitoring Interval (in seconds): 120

* Reactive Monitoring Interval (in seconds): 120

* Number of Retries: 5

6.5. Add Entity Links

A SIP trunk between Session Manager and a telephony system is described by an Entity Link. During compliance testing, two Entity Links were created, one for Communication Manager and other for Avaya SBCE. To add an Entity Link, navigate to **Routing → Entity Links** in the left navigation pane and click **New** button in the right pane (not shown). Fill in the following fields in the new row that is displayed:

- **Name:** Enter a descriptive name.
- **SIP Entity 1:** Select the Session Manager defined in **Section 6.4**.
- **Protocol:** Select the transport protocol used for this link, **TCP** for the Entity Link to Communication Manager and **TCP** for the Entity Link to the Avaya SBCE.

- **Port:** Port number on which Session Manager will receive SIP requests from the far-end. For Communication Manager, this must match the **Far-end Listen Port** defined on the Communication Manager in **Section 5.6**.
- **SIP Entity 2:** Select the name of the other systems. For Communication Manager, select the Communication Manager SIP Entity defined in **Section Error! Reference source not found..** For Avaya SBCE, select Avaya SBCE SIP Entity defined in **Section Error! Reference source not found..**
- **Port:** Port number on which the other system receives SIP requests from Session Manager. For Communication Manager, this must match the **Near-end Listen Port** defined on the Communication Manager in **Section 5.6**.
- **Connection Policy:** Select **Trusted**. **Note:** If this is not selected, calls from the associated SIP Entity specified in **Section Error! Reference source not found.** will be denied.
- Click **Commit** to save.

The following screens illustrate the Entity Links to Communication Manager and to Avaya SBCE.

Entity Link to Communication Manager

The screenshot shows the Avaya Aura System Manager 7.0 interface. The left sidebar contains a navigation menu with options: Home, Routing, Domains, Locations, Adaptations, SIP Entities, Entity Links (selected), Time Ranges, Routing Policies, and Dial Patterns. The main content area is titled 'Entity Links' and shows a table with 1 item. The table has columns: Name, SIP Entity 1, Protocol, Port, and SIP Entity 2. The row shows: SM7_CM7_S060_TCP, SM7, TCP, S060, and CM7. There are 'Commit' and 'Cancel' buttons at the top right of the table area.

Name	SIP Entity 1	Protocol	Port	SIP Entity 2
SM7_CM7_S060_TCP	SM7	TCP	S060	CM7

Entity Link to Avaya SBCE

The screenshot shows the Avaya Aura System Manager 7.0 interface. The left sidebar contains a navigation menu with options: Home, Routing, Domains, Locations, Adaptations, SIP Entities, Entity Links (selected), Time Ranges, Routing Policies, and Dial Patterns. The main content area is titled 'Entity Links' and shows a table with 1 item. The table has columns: Name, SIP Entity 1, Protocol, Port, and SIP Entity 2. The row shows: SM7_SBCE22_S060_T, SM7, TCP, S060, and SBCE22. There are 'Commit' and 'Cancel' buttons at the top right of the table area.

Name	SIP Entity 1	Protocol	Port	SIP Entity 2
SM7_SBCE22_S060_T	SM7	TCP	S060	SBCE22

6.6. Add Routing Policies

Routing Policies describe the conditions under which calls will be routed to the SIP Entities specified in **Section** Error! Reference source not found.. Two routing policies were added, one for Communication Manager and other for Avaya SBCE. To add a routing policy, navigate to **Routing → Routing Policies** in the left navigation pane and click **New** button in the right pane (not shown). The following screen is displayed.

In the **General** section, enter the following values:

- **Name:** Enter a descriptive name.
- **Notes:** Add a brief description (optional).

In **SIP Entity as Destination** section, click **Select**. The **SIP Entity List** page opens (not shown). Select appropriate SIP entity to which this routing policy applies and click **Select**. The selected SIP Entity is displayed in the **Routing Policy Details** page as shown below. Use default values for remaining fields. Click **Commit** to save.

The following screens show the Routing Policies for Communication Manager.

AVAYA
Aura® System Manager 7.0

Last Logged on at October 6, 2015 8:59 PM

Home / Elements / Routing / Routing Policies

Routing Policy Details

Commit Cancel Help ?

General

* Name: To-CM7

Disabled: ☐

* Retries: 0

Notes: Route to CM

SIP Entity as Destination

Select

Name	FQDN or IP Address	Type	Notes
CM7	10.33.10.34	CM	

The following screens show the Routing Policies for the Avaya SBCE.

AVAYA
Aura® System Manager 7.0

Last Logged on at October 6, 2015 8:59 PM

Home / Elements / Routing / Routing Policies

Routing Policy Details

Commit Cancel

Help ?

General

* Name: To-SBCE22

Disabled: ☐

* Retries: 0

Notes:

SIP Entity as Destination

Select

Name	FQDN or IP Address	Type	Notes
SBCE22	10.10.98.22	Other	Avaya Aura SBC-E using IP 98.22

6.7. Add Dial Patterns

Dial Patterns are needed to route specific calls through Session Manager. For the compliance testing, dial patterns were needed to route calls from Communication Manager to Windstream and vice versa. Dial Patterns define which routing policy will be selected for a particular call based on the dialed digits, destination domain and originating location. To add a dial pattern, navigate to **Routing → Dial Patterns** in the left navigation pane and click **New** button in the right pane (not shown).

In the **General** section, enter the following values:

- **Pattern:** Enter a dial string that will be matched against the “Request-URI” of the call.
- **Min:** Enter a minimum length used in the match criteria.
- **Max:** Enter a maximum length used in the match criteria.
- **SIP Domain:** Enter the destination domain used in the match criteria.
- **Notes:** Add a brief description (optional).

In the **Originating Locations and Routing Policies** section, click **Add**. From the **Originating Locations and Routing Policy List** that appears (not shown), select the appropriate originating location for use in the match criteria. Lastly, select the routing policy from the list that will be used to route all calls that match the specified criteria. Click **Select**.

Default values can be used for the remaining fields. Click **Commit** to save.

Two examples of the dial patterns used for the compliance testing were shown below, one for outbound calls from the enterprise to the PSTN and one for inbound calls from the PSTN to the enterprise.

The first example shows that 10-digit dialed numbers that has a destination domain of “avayalab.com” uses route policy to Avaya SBCE as defined in **Section** Error! Reference source not found..

The screenshot displays the Avaya Aura System Manager 7.0 interface. The left sidebar shows the 'Routing' menu with sub-items: Domains, Locations, Adaptations, SIP Entities, Entity Links, Time Ranges, Routing Policies, **Dial Patterns**, Regular Expressions, and Defaults. The main content area is titled 'Dial Pattern Details' and includes a 'General' tab. The form fields are as follows:

- Pattern:** 613
- Min:** 10
- Max:** 10
- Emergency Call:** ☐
- Emergency Priority:** 1
- Emergency Type:**
- SIP Domain:** avayalab.com
- Notes:** Outbound from CM to SBCE to Service Provide

Below the form is a section titled 'Originating Locations and Routing Policies' with an 'Add' button and a 'Remove' button. It contains a table with 1 item, filtered by 'Enable'.

Originating Location Name	Originating Location Notes	Routing Policy Name	Rank	Routing Policy Disabled	Routing Policy Destination	Routing Policy Notes
<input type="checkbox"/> Belleville	GSSCP Belleville	To-SBCE22	0	<input type="checkbox"/>	SBCE22	

At the bottom of the table, it says 'Select : All, None'.

The second example shows that inbound 10-digit numbers with domain “avayalab.com” to use route policy to Communication Manager as defined in **Section Error! Reference source not found.** These are the DID numbers assigned to the enterprise by Windstream.

AVAYA
Aura System Manager 7.0

Last Logged on at October 23, 2015 3:35 PM

Home / Elements / Routing / Dial Patterns

Dial Pattern Details

General

* Pattern: 281

* Min: 8

* Max: 36

Emergency Call: ☐

Emergency Priority: 1

Emergency Type:

SIP Domain: avayalab.com

Notes: Incoming to CM

Originating Locations and Routing Policies

Add Remove

1 Item

<input type="checkbox"/>	Originating Location Name	Originating Location Notes	Routing Policy Name	Rank	Routing Policy Disabled	Routing Policy Destination	Routing Policy Notes
<input type="checkbox"/>	Belleville	GSSCP Belleville	To-CM7	0	<input type="checkbox"/>	CM7	Route to CM

Select : All, None

6.8. Add/View Session Manager

The creation of a Session Manager element provides the linkage between System Manager and Session Manager. This is most likely done as part of the initial Session Manager installation. To add a Session Manager, navigate to **Home → Elements → Session Manager → Session Manager Administration** in the left navigation pane and click **New** button in the right pane (not shown). If the Session Manager Instances already exists, click **View** (not shown) to view the configuration. Enter/verify the data as described below and shown in the following screen:

In the **General** section, enter the following values:

- **SIP Entity Name:** Select the SIP Entity created for Session Manager.
- **Description:** Add a brief description (optional).
- **Management Access Point Host Name/IP:** Enter the IP address of the Session Manager management interface.
- **Directs Routing to Endpoints:** Enabled, to enable call routing on the Session Manager.

In the **Security Module** section, enter the following values:

- **SIP Entity IP Address:** Should be filled in automatically based on the SIP Entity Name.

- **Network Mask:** Enter the network mask corresponding to the IP address of Session Manager.
- **Default Gateway:** Enter the IP address of the default gateway for Session Manager.
- Use default values for the remaining fields. Click **Commit** to save (not shown).

The screen below shows the Session Manager values used for the compliance testing.

The screenshot shows the Avaya Aura System Manager 7.0 web interface. The top navigation bar includes the Avaya logo, the text 'Aura System Manager 7.0', and a 'Log off' button. The left sidebar contains a menu with options: Session Manager, Dashboard, Session Manager Administration (selected), Communication Profile Editor, Network Configuration, Device and Location Configuration, Application Configuration, System Status, System Tools, and Performance. The main content area is titled 'View Session Manager' and shows the 'Session Manager Administration' page. The page has a breadcrumb trail: Home / Elements / Session Manager / Session Manager Administration. Below the title, there are tabs for General, Security Module, Monitoring, CDR, Personal Profile Manager (PPM), Connection Settings, and Event Server. The 'General' tab is active, showing fields for SIP Entity Name (SM7), Description, Management Access Point Host Name/IP (10.33.10.32), Direct Routing to Endpoints (Enable), and Maintenance Mode (unchecked). The 'Security Module' tab is also visible, showing fields for SIP Entity IP Address (10.33.10.33), Network Mask (255.255.255.0), Default Gateway (10.33.10.1), Call Control PHB (46), and SIP Firewall Configuration (SM 6.3.8.0).

7. Configure Avaya Session Border Controller for Enterprise

In the sample configuration, an Avaya SBCE is used as the edge device between the Avaya CPE and Windstream SIP Trunking Service.

These Application Notes assume that the installation of the Avaya SBCE and the assignment of a management IP Address have already been completed.

In this session, the naming convention for Windstream is Service Provider (SP) which is connecting to external interface of Avaya SBCE. And for Avaya side is Enterprise (EN) which is connected to internal interface of Avaya SBCE.

7.1. Avaya Session Border Controller for Enterprise Login

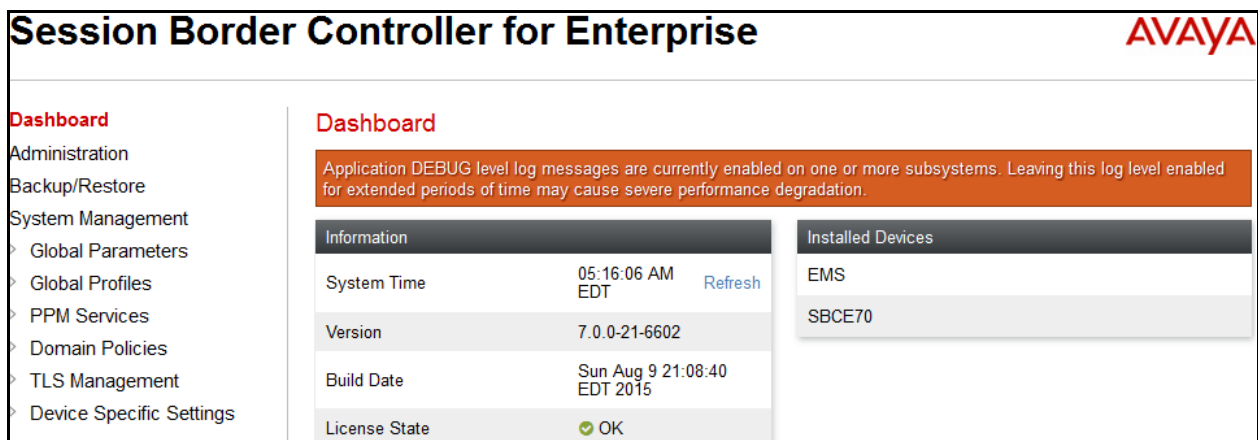
Use a Web browser to access the Avaya SBCE web interface, enter `https://<ip-addr>/ucsec` in the address field of the web browser (not shown), where `<ip-addr>` is the management LAN IP address of Avaya SBCE.

Enter appropriate credentials and click **Log In**.



The login page features the Avaya logo on the left and a 'Log In' section on the right. The 'Log In' section includes a 'Username:' label, a text input field, and a 'Continue' button. Below the input field, there is a disclaimer: 'This system is restricted solely to authorized users for legitimate business purposes only. The actual or attempted unauthorized access, use or modifications of this system is strictly prohibited. Unauthorized users are subject to company disciplinary procedures and or criminal and civil penalties under state, federal or other applicable domestic and foreign laws.' Another paragraph states: 'The use of this system may be monitored and recorded for administrative and security reasons. Anyone accessing this system expressly consents to such monitoring and recording, and is advised that if it reveals possible evidence of criminal activity, the evidence of such activity may be provided to law enforcement officials.' A final line reads: 'All users must comply with all corporate instructions regarding the protection of information assets.' At the bottom right, it says '© 2011 - 2015 Avaya Inc. All rights reserved.'

The main page of the Avaya SBCE will appear as shown below.



The dashboard has a left sidebar with a 'Dashboard' header and a list of navigation items: Administration, Backup/Restore, System Management, Global Parameters, Global Profiles, PPM Services, Domain Policies, TLS Management, and Device Specific Settings. The main content area has a 'Dashboard' header and a warning banner: 'Application DEBUG level log messages are currently enabled on one or more subsystems. Leaving this log level enabled for extended periods of time may cause severe performance degradation.' Below the banner are two panels. The 'Information' panel contains a table with system details, and the 'Installed Devices' panel lists the connected devices.

Information	
System Time	05:16:06 AM EDT Refresh
Version	7.0.0-21-6602
Build Date	Sun Aug 9 21:08:40 EDT 2015
License State	OK

Installed Devices
EMS
SBCE70

7.2. Global Profiles

Global Profiles allows for configuration of parameters across all Avaya SBCE appliances.

7.2.1. Uniform Resource Identifier (URI) Groups

URI Group feature allows a user to create any number of logical URI Groups that are comprised of individual SIP subscribers located in that particular domain or group. These groups are used by the various domain policies to determine which actions (Allow, Block, or Apply Policy) should be used for a given call flow.

For this configuration testing, “*” is used for all incoming and outgoing traffic.

7.2.2. Server Interworking Profile

Interworking Profile features are configured differently for Call Server and Trunk Server.

To create a Server Interworking profile, select **Global Profiles → Server Interworking**. Click on the **Add** button.

In the compliance testing, two Server Interworking profiles were created for SP and EN respectively.

Server Interworking profile for SP

Profile **SP-SI** was defined to match the specification of SP. The **General** and **Advanced** tabs are configured with the following parameters while the other tabs for **Timers**, **Header Manipulations** and **URI Manipulation** are kept as default.

General tab:

- **Hold Support** = *NONE*. The Avaya SBCE will not modify the hold/ resume signaling from EN to SP.
- **18X Handling** = *None*. The Avaya SBCE will not handle 18X, it will keep the 18X messages unchanged from EN to SP.
- **Refer Handling** = *No*. The Avaya SBCE will not handle REFER. It will keep the REFER message unchanged from EN to SP.
- **T.38 Support** = *No*. SP does not support T.38 fax in the compliance testing.
- Others are left as default values.

The screenshots below illustrate the Server Interworking profile **SP-SI, General**.

The screenshot displays the Avaya Session Border Controller for Enterprise web interface. The left sidebar contains a navigation menu with categories like Dashboard, Administration, Backup/Restore, System Management, Global Parameters, Global Profiles, PPM Services, Domain Policies, TLS Management, and Device Specific Settings. Under Global Profiles, 'Server Interworking' is highlighted. The main content area is titled 'Interworking Profiles: SP-SI' and includes an 'Add' button and action buttons (Rename, Clone, Delete). A list of profiles is shown, with 'SP-SI' selected. The 'General' tab is active, displaying a table of configuration parameters.

General	
Hold Support	NONE
180 Handling	None
181 Handling	None
182 Handling	None
183 Handling	None
Refer Handling	No
URI Group	None
Send Hold	No
Delayed Offer	No
3xx Handling	No
Diversion Header Support	No
Delayed SDP Handling	No
Re-Invite Handling	No
Prack Handling	No
Allow 18X SDP	No
T.38 Support	No
URI Scheme	SIP
Via Header Format	RFC3261

Advanced tab:

- **Record Routes** = *None*. The Avaya SBCE will send “Record-Route” header to both call and trunk servers.
- **Include End Point IP for Context Lookup** = *No*.
- **Extensions** = *None*.
- **Has Remote SBC** = *Yes*. SP has a SBC which interfaces its Central Office (CO) to the enterprise SIP trunk. This setting allows the Avaya SBCE to always use the SDP received from SP for the media.
- **DTMF Support** = *None*. The Avaya SBCE will send original DTMF method from EN to SP.
- Others are left as default values.

The screenshots below illustrate the Server Interworking profile **SP-SI, Advanced**.

The screenshot displays the Avaya Session Border Controller for Enterprise web interface. The left sidebar contains a navigation menu with categories: Dashboard, Administration, Backup/Restore, System Management, Global Profiles (expanded), and PPM Services. Under Global Profiles, 'Server Interworking' is highlighted. The main content area is titled 'Interworking Profiles: SP-SI' and includes an 'Add' button and 'Rename', 'Clone', and 'Delete' buttons. A list of profiles shows 'EN-SI' and 'SP-SI' (selected). The 'Advanced' tab is active, showing settings for 'Record Routes' (None), 'Include End Point IP for Context Lookup' (No), 'Extensions' (None), 'Diversion Manipulation' (No), 'Has Remote SBC' (Yes), 'Route Response on Via Port' (No), and 'DTMF Support' (None). An 'Edit' button is at the bottom right.

Setting	Value
Record Routes	None
Include End Point IP for Context Lookup	No
Extensions	None
Diversion Manipulation	No
Has Remote SBC	Yes
Route Response on Via Port	No
DTMF Support	None

Server Interworking profile for EN

Profile **EN-SI** was defined to match the specification of EN. The **General** and **Advanced** tabs are configured with the following parameters while the other settings for **Timers**, **URI Manipulation** and **Header Manipulation** are kept as default.

General tab:

- **Hold Support** = *None*.
- **18X Handling** = *None*. The Avaya SBCE will not handle 18X, it will keep the 18X messages unchanged from SP to EN.
- **Refer Handling** = *No*. The Avaya SBCE will not handle REFER, it will keep the REFER messages unchanged from SP to EN.
- **T.38 Support** = *No*. EN does support T.38 fax, but SP doesn't in the compliance testing.
- Others are left as default values.

The screenshots below illustrate the Server Interworking profile **EN-SI**, **General**.

The screenshot displays the Avaya Session Border Controller for Enterprise (SBCE) web interface. The left sidebar shows the navigation menu with 'Server Interworking' highlighted. The main content area is titled 'Interworking Profiles: EN-SI' and includes an 'Add' button and 'Rename', 'Clone', and 'Delete' buttons. Below this, there's a list of profiles: 'EN-SI' (selected) and 'SP-SI'. The 'General' tab is active, showing a table of configuration parameters. The table lists various settings and their values, such as 'Hold Support' set to 'NONE', '180 Handling' set to 'None', 'Refer Handling' set to 'No', and 'T.38 Support' set to 'No'. An 'Edit' button is located at the bottom right of the table.

General	
Hold Support	NONE
180 Handling	None
181 Handling	None
182 Handling	None
183 Handling	None
Refer Handling	No
URI Group	None
Send Hold	No
Delayed Offer	No
3xx Handling	No
Diversion Header Support	No
Delayed SDP Handling	No
Re-Invite Handling	No
Prack Handling	No
Allow 18X SDP	No
T.38 Support	No
URI Scheme	SIP
Via Header Format	RFC3261

Advanced tab:

- **Record Routes** = *Both Sides*. The Avaya SBCE will send Record-Route header to both call and trunk servers.
- **Include End Point IP for Context Lookup** = *Yes*.
- **Extensions** = *Avaya*.
- **Has Remote SBC** = *Yes*. This setting allows the Avaya SBCE to always use the SDP received from EN for the media.
- **DTMF Support** = *None*. The Avaya SBCE will send original DTMF method from SP to EN.
- Others are left as default values.

The screenshots below illustrate the Server Interworking profile **EN-SI**, **Advanced**.

The screenshot displays the Avaya Session Border Controller for Enterprise web interface. The left sidebar contains a navigation menu with options like Dashboard, Administration, Backup/Restore, System Management, Global Parameters, Global Profiles, Domain DoS, **Server Interworking**, Media Forking, Routing, Server Configuration, Topology Hiding, Signaling Manipulation, URI Groups, SNMP Traps, Time of Day Rules, and PPM Services. The main content area is titled "Interworking Profiles: EN-SI" and includes an "Add" button and "Rename", "Clone", and "Delete" buttons. A list of profiles shows "EN-SI" selected and "SP-SI" below it. The "Advanced" tab is active, showing settings for "Record Routes" (Both Sides), "Include End Point IP for Context Lookup" (Yes), "Extensions" (Avaya), "Diversion Manipulation" (No), "Has Remote SBC" (Yes), "Route Response on Via Port" (No), and "DTMF Support" (None). An "Edit" button is at the bottom right of the settings table.

Record Routes	Both Sides
Include End Point IP for Context Lookup	Yes
Extensions	Avaya
Diversion Manipulation	No
Has Remote SBC	Yes
Route Response on Via Port	No

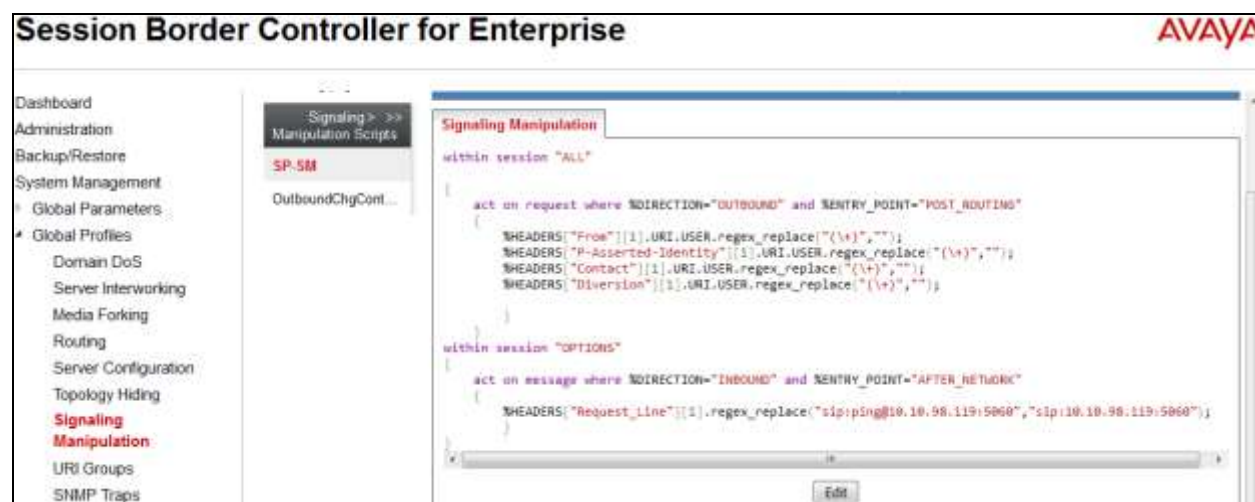
DTMF	
DTMF Support	None

7.2.3. Configure Signaling Manipulation

Signaling Manipulation feature allows the ability to add, change and delete any of the headers in a SIP message. This feature adds the ability to configure such manipulation in a highly flexible manner using a proprietary scripting language called **SigMa**.

To create a Signaling Manipulation script, select **Global Profiles → Signaling Manipulation**. Click **Add Script** (not shown).

In the compliance testing, a SigMa **SP-SM** script is created for Server Configuration for SP and its details are captured below.



7.2.4. Server Configuration

Server Configuration screen contains four tabs: **General**, **Heartbeat**, and **Advanced**. These tabs are used to configure and manage various SIP Call Server specific parameters such as TCP and UDP port assignments, heartbeat signaling parameters, DoS security statistics and trusted domains. No configuration of **Authentication** is required.

To create a Server Configuration entry, select **Global Profiles → Server Configuration**. Click on the **Add** button.

In the compliance testing, two separate Server Configurations were created, server entry **SP-SC** for SP and server entry **EN-SC** for EN.

Server Configuration for SP

Server Configuration named **SP-SC** was created for SP. It will be discussed in detail below.

General, **Authentication** and **Advanced** tabs are provisioned for SP on the SIP trunk for every outbound call from enterprise to PSTN. The **Heartbeat** tab is kept as *disabled* as default to allow the Avaya SBCE to forward the OPTIONS heartbeat from EN to SP to query the status of the SIP trunk.

General tab:

Click on the **Edit** button and enter the following information.

- Set **Server Type** for SP as **Trunk Server**.
- In the compliance testing, SP supported **UDP** and listened on port **5060**.

The screenshot shows the Avaya Session Border Controller for Enterprise web interface. The left sidebar contains a navigation menu with options like Dashboard, System Management, Global Parameters, Global Profiles, Domain DoS, Server Interworking, Media Forking, Routing, and Server Configuration (highlighted in red). The main content area is titled 'Server Configuration: SP-SC' and features an 'Add' button and 'Rename', 'Clone', and 'Delete' buttons. Below these are tabs for 'General', 'Authentication', 'Heartbeat', and 'Advanced'. The 'General' tab is active, showing a 'Server Type' dropdown set to 'Trunk Server'. Below this is a table with columns 'IP Address / FQDN', 'Port', and 'Transport'. The table contains one row with the values '192.168.64.220', '5060', and 'UDP'. An 'Edit' button is located at the bottom right of the table.

IP Address / FQDN	Port	Transport
192.168.64.220	5060	UDP

Heartbeat tab:

Click on the **Edit** button and enter following information.

- Check **Enable Heartbeat** check box.
- Select **REGISTER** for **Method**.
- Enter **60s** for **Frequency**.
- Enter **2184022126@192.168.64.220** for **From URI** and **To URI** fields.
- Click **Finish**.

The screenshot shows the Avaya Session Border Controller for Enterprise web interface, specifically the 'Heartbeat' tab of the 'Server Configuration: SP-SC' page. The left sidebar is the same as in the previous screenshot. The main content area has the 'Heartbeat' tab selected. It shows a form with the following fields: 'Enable Heartbeat' (checked), 'Method' (REGISTER), 'Frequency' (60 seconds), 'From URI' (2814022126@192.168.64.220), and 'To URI' (2814022126@192.168.64.220). An 'Edit' button is at the bottom right.

Enable Heartbeat	<input checked="" type="checkbox"/>
Method	REGISTER
Frequency	60 seconds
From URI	2814022126@192.168.64.220
To URI	2814022126@192.168.64.220

Advanced tab:

Click on the **Edit** button and enter following information.

- **Interworking Profile** drop down list, select **SP-SI** as defined in **Section 7.2.2**.
- **Signaling Manipulation Script**, select **SP-SM** as defined in **Section 7.2.3**. This configuration applies the specific SIP profile to the SP traffic.
- The other settings are kept as default.

The screenshot shows the Avaya Session Border Controller for Enterprise web interface. The left sidebar contains a navigation menu with options like Dashboard, Administration, Backup/Restore, System Management, Global Parameters, Global Profiles, Domain DoS, Server Interworking, Media Forking, Routing, Server Configuration (highlighted), Topology Hiding, and Signaling Manipulation. The main content area is titled 'Server Configuration: SP-SC' and features an 'Add' button and 'Rename', 'Clone', and 'Delete' buttons. Below these are tabs for 'General', 'Authentication', 'Heartbeat', and 'Advanced' (selected). The 'Advanced' tab displays several settings: 'Enable DoS Protection' (checkbox), 'Enable Grooming' (checkbox), 'Interworking Profile' (dropdown set to 'SP-SI'), 'Signaling Manipulation Script' (dropdown set to 'SP-SM'), 'Connection Type' (dropdown set to 'SUBID'), and 'Securable' (checkbox). An 'Edit' button is located at the bottom right of the settings area.

Server Configuration for EN

Server Configuration named **EN-SC** created for EN is discussed in detail below. **General** and **Advanced** tabs are provisioned but no configuration is done for **Authentication** tab. The **Heartbeat** tab is kept as *disabled* as default to allow the Avaya SBCE to forward the OPTIONS heartbeat from SP to EN to query the status of the SIP trunk.

General tab:

Click on the **Edit** button then specify the following.

- **Server Type** for EN as **Call Server**.
- **IP Address/FQDN** is Session Manager IP address.
- **Transport**, the link between the Avaya SBCE and EN was **TCP**.
- Listened on **Port 5060**.

The screenshot shows the Avaya Session Border Controller for Enterprise web interface. The left sidebar is the same as the previous screenshot, with 'Server Configuration' highlighted. The main content area is titled 'Server Configuration: EN-SC' and features an 'Add' button and 'Rename', 'Clone', and 'Delete' buttons. Below these are tabs for 'General' (selected), 'Authentication', 'Heartbeat', and 'Advanced'. The 'General' tab displays 'Server Type' as 'Call Server'. Below this is a table with three columns: 'IP Address / FQDN', 'Port', and 'Transport'. The table contains one row with the values '10.33.10.33', '5060', and 'TCP'. An 'Edit' button is located at the bottom right of the table.

Advanced tab:

Click on the **Edit** button to enter the following information.

- **Interworking Profile** drop down list select **EN-SI** as defined in **Section Error!** Reference source not found..
- **Signaling Manipulation Script** drop down list select **None**.
- The other settings are kept as default.

The screenshot shows the Avaya Session Border Controller for Enterprise web interface. The title bar at the top reads "Session Border Controller for Enterprise" with the AVAYA logo on the right. On the left is a navigation menu with items: Dashboard, Administration, Backup/Restore, System Management, Global Parameters, Global Profiles, Domain DoS, Server Interworking, Media Forking, Routing, Server Configuration (highlighted in red), Topology Hiding, and Signaling Manipulation. The main content area is titled "Server Configuration: EN-SC" and includes an "Add" button. Below this is a list of server profiles: EN-SC (selected), SP4, and SMVM. To the right of the profile list are tabs for General, Authentication, Heartbeat, and Advanced (selected). The Advanced tab contains several settings: "Enable DoS Protection" (checkbox), "Enable Grooming" (checkbox), "Interworking Profile" (set to EN-SI), "Signaling Manipulation Script" (set to None), "Connection Type" (set to SUBID), and "Securable" (checkbox). At the bottom right of the settings area is an "Edit" button. Above the tabs are buttons for "Rename", "Clone", and "Delete".

7.2.5. Routing Profiles

Routing Profiles define a specific set of packet routing criteria that are used in conjunction with other types of domain policies to identify a particular call flow and thereby ascertain which security features will be applied to those packets. Parameters defined by Routing Profiles include packet transport settings, name server addresses and resolution methods, next hop routing information and packet transport types.

To create a Routing Profile, select **Global Profiles → Routing**. Click on the **Add** button.

In the compliance testing, a Routing Profile **EN-to-SP** was created to use in conjunction with the server flow defined for EN. This entry is to route the outbound call from the enterprise to service provider.

In the opposite direction, a Routing Profile named **SP-to-EN** was created to be used in conjunction with the server flow defined for SP. This entry is to route the inbound call from service provider to the enterprise.

Routing Profile for SP

The screenshot below illustrate the routing profile from Avaya SBCE to the SP network, **Global Profiles → Routing: EN-to-SP**. As shown in **Figure 1**, the SP SIP trunk is connected with transportation protocol **UDP** (not shown). If there is a match in the “To” or “Request URI” headers with the URI Group **SP** defined in **Section 7.2.1**, the call will be routed to the **Next Hop Address** which is the IP address of SP SIP trunk.

The screenshot shows the Avaya Session Border Controller for Enterprise web interface. The left sidebar contains a navigation menu with options: Dashboard, Administration, Backup/Restore, System Management, Global Parameters, Global Profiles (selected), Domain DoS, Server Interworking, Media Forking, and Routing (highlighted in red). The main content area is titled "Routing Profiles: EN-to-SP" and includes an "Add" button, "Rename", "Clone", and "Delete" buttons. Below this is a "Click here to add a description." link. The "Routing Profile" section shows a table with columns: Priority, URI Group, Time of Day, Load Balancing, Next Hop Address, and Transport. A single entry is visible with Priority 1, URI Group *, Time of Day default, Load Balancing Priority, Next Hop Address 192.168.64.220, and Transport UDP. Edit and Delete buttons are present for this entry.

Priority	URI Group	Time of Day	Load Balancing	Next Hop Address	Transport
1	*	default	Priority	192.168.64.220	UDP

Routing Profile for EN

The Routing Profile for SP to EN, **SP-to-EN**, was defined to route call where the “To” header matches the URI Group **SP** defined in **Section 7.2.1** to **Next Hop Address** which is the IP address of Session Manager as a destination. As shown in **Figure 1**, the SIP trunk between EN and the Avaya SBCE is connected with transportation protocol **TCP**.

The screenshot shows the Avaya Session Border Controller for Enterprise web interface. The left sidebar contains a navigation menu with options: Dashboard, Administration, Backup/Restore, System Management, Global Parameters, Global Profiles (selected), Domain DoS, Server Interworking, Media Forking, and Routing (highlighted in red). The main content area is titled "Routing Profiles: SP-to-EN" and includes an "Add" button, "Rename", "Clone", and "Delete" buttons. Below this is a "Click here to add a description." link. The "Routing Profile" section shows a table with columns: Priority, URI Group, Time of Day, Load Balancing, Next Hop Address, and Transport. A single entry is visible with Priority 1, URI Group *, Time of Day default, Load Balancing Priority, Next Hop Address 10.33.10.33, and Transport TCP. Edit and Delete buttons are present for this entry.

Priority	URI Group	Time of Day	Load Balancing	Next Hop Address	Transport
1	*	default	Priority	10.33.10.33	TCP

7.2.6. Topology Hiding

Topology Hiding is an Avaya SBCE security feature which allows changing certain key SIP message parameters to ‘hide’ or ‘mask’ how the enterprise network may appear to an unauthorized or malicious user.

To create a Topology Hiding profile, select **Global Profiles → Topology Hiding**. Click on the **Add** button.

In the compliance testing, two Topology Hiding profiles **EN-to-SP** and **SP-to-EN** were created.

Topology Hiding Profile for SP

Profile **EN-to-SP** was defined to mask the enterprise SIP domain avayalab.com in “Request-URI”, “From” and “To” headers to SP provided IP Address. It is to secure the enterprise network topology and to meet the SIP requirement of the service provider.

Notes:

- The **Criteria** should be selected as **IP/Domain** to give the Avaya SBCE the capability to mask both domain name and IP address present in URI-Host.
- The masking applied on “From” header also applies to “Referred-By” and “P-Asserted-Identity” headers.
- The masking applied on “To” header also applies to “Refer-To” header.

The screenshots below illustrate the Topology Hiding profile **EN-to-SP**.

The screenshot displays the Avaya Session Border Controller for Enterprise web interface. The left sidebar shows the navigation menu with 'Topology Hiding' selected under 'Global Profiles'. The main content area is titled 'Topology Hiding Profiles: EN-to-SP' and includes an 'Add' button and action buttons (Rename, Clone, Delete). Below this is a table titled 'Topology Hiding' with columns: Header, Criteria, Replace Action, and Overwrite Value. The table lists several SIP headers and their corresponding configurations.

Header	Criteria	Replace Action	Overwrite Value
SDP	IP/Domain	Auto	---
Refer-To	IP/Domain	Auto	---
To	IP/Domain	Overwrite	192.168.64.220
Via	IP/Domain	Auto	---
Request-Line	IP/Domain	Overwrite	192.168.64.220
Record-Route	IP/Domain	Auto	---
From	IP/Domain	Overwrite	192.168.64.220
Referred-By	IP/Domain	Auto	---

Topology Hiding Profile for EN

Profile **SP-to-EN** was also created to mask SP URI-Host in “Request-URI”, “From”, “To” headers to the enterprise domain **avayalab.com**, replace Record-Route, Via headers and SDP added by SP to internal IP address known to EN.

Notes:

- The **Criteria** should be **IP/Domain** to give the Avaya SBCE the capability to mask both domain name and IP address present in URI-Host.
- The masking applied on “From” header also applies to “Referred-By” and “P-Asserted-Identity” headers.
- The masking applied on “To” header also applies to “Refer-To” header.

The screenshots below illustrate the Topology Hiding profile **SP-to-EN**.

The screenshot displays the Avaya Session Border Controller for Enterprise (SBCE) web interface. The left sidebar shows the navigation menu with options like Dashboard, Administration, Backup/Restore, System Management, Global Parameters, Global Profiles, and PPM Services. The main content area is titled "Topology Hiding Profiles: SP-to-EN". It features a table with columns: Header, Criteria, Replace Action, and Overwrite Value. The table lists various headers and their corresponding configurations for the SP-to-EN profile.

Header	Criteria	Replace Action	Overwrite Value
Request-Line	IP/Domain	Overwrite	avayalab.com
Via	IP/Domain	Auto	---
Record-Route	IP/Domain	Auto	---
SDP	IP/Domain	Auto	---
To	IP/Domain	Overwrite	avayalab.com
Refer-To	IP/Domain	Auto	---
From	IP/Domain	Overwrite	avayalab.com
Referred-By	IP/Domain	Auto	---

7.3. Domain Policies

Domain Policies configures various rule sets (policies) to control unified communications based upon criteria of communication sessions originating from or terminating at the enterprise. These criteria can be used to trigger policies which, in turn, activate various security features of the Avaya SBCE security device to aggregate, monitor, control and normalize call flow. There are default policies available for use, or a custom domain policy can be created.

7.3.1. Signaling Rules

Signaling Rules define the action to be taken (Allow, Block, Block with Response, etc.) for each type of SIP-specific signaling request and response message. When SIP signaling packets are received by the Avaya SBCE, they are parsed and “pattern-matched” against the particular signaling criteria defined by these rules. Packets matching the criteria defined by the Signaling Rules are tagged for further policy matching.

To clone a Signaling Rule, navigate to **Domain Policies → Signaling Rules**. With the **default** rule chosen, click on the **Clone** button.

Signaling Rules for SP

In the compliance testing, created signaling rule **SP-SR** is discussed below. All the tabs are kept as default values except **Signaling QoS** tab.

In **Signaling QoS** tab, click on **Edit** button then check on **checkbox**. Then select **EF** value for **DSCP** option.



Signaling Rules for EN

In the compliance testing, created signaling rule **EN-SR** is discussed below. All the tabs are kept as default values except **Signaling QoS** tab.

In **Signaling QoS** tab, click on **Edit** button then check on **checkbox**. Then select **EF** value for **DSCP** option.



7.3.2. Endpoint Policy Groups

The rules created within the **Domain Policies** section are assigned to an **Endpoint Policy Group**. The **Endpoint Policy Group** is then applied to a **Server Flow** defined in the next section. Endpoint Policy Groups were created for SP and EN. To create a new policy group, navigate to **Domain Policies** → **Endpoint Policy Groups** and click on **Add**.

Endpoint Policy Group for SP

The following screen shows **SP-PG** created for SP:

- Set Application Rule to *default-trunk*.
- Set Border Rule to *default*.
- Set Media Rule to *default-low-med*.
- Set Security Rule to *default-high*
- Set Signaling Rule to *SP-SR* as created in **Section 7.3.1**.



Endpoint Policy Group for EN

The following screen shows **EN-PG** created for EN:

- Set Application Rule to *default-trunk*.
- Set Border Rule to *default*.
- Set Media Rule to *default-low-med*.
- Set Security Rule to *default-low*.
- Set Signaling Rule to *EN-SR* as created in **Section 7.3.1**.

The screenshot displays the Avaya Session Border Controller for Enterprise web interface. The left sidebar contains a navigation menu with the following items: Dashboard, Administration, Domain Policies (expanded), Application Rules, Border Rules, Media Rules, Security Rules, Signaling Rules, End Point Policy Groups (highlighted in red), and Session Policies. The main content area is titled "Policy Groups: EN-PG" and includes an "Add" button, a "Filter By Device..." dropdown, and "Rename", "Clone", and "Delete" buttons. Below these are two blue bars with text: "Click here to add a description." and "Hover over a row to see its description." A "Policy Group" section contains a table with the following data:

Order	Application	Border	Media	Security	Signaling	
1	default-trunk	default	default-low-med	default-high	EN-SR	Edit

A "Summary" button is located to the right of the table.

7.4. Device Specific Settings

Device Specific Settings allows aggregate system information to be viewed and various device-specific parameters to be managed to determine how a particular device will function when deployed in the network. Specifically, it gives the ability to define and administer various device-specific protection features such as Message Sequence Analysis (MSA) functionality and protocol scrubber rules, end-point and session call flows, as well as the ability to manage system logs and control security features.

7.4.1. Network Management

The Network Management screen is where the network interface settings are configured and enabled. During the installation process of the Avaya SBCE, certain network-specific information was defined such as; device IP address(es), public IP address(es), netmask, gateway, etc. to interface the device to the network. This information populates the **Network Management** tab, which can be edited as needed to optimize device performance and network efficiency.

Enable the interfaces used to connect to the inside and outside networks on the **Interface** tab. The following screen shows Interface Names, **A1** and **B1** are **Enabled**. To enable an interface, click on its Status corresponding to the interface names.

The screenshot shows the Avaya Session Border Controller for Enterprise web interface. The title bar at the top reads "Session Border Controller for Enterprise" with the AVAYA logo on the right. A left-hand navigation menu lists various system management options, with "Network Management" highlighted in red. The main content area is titled "Network Management: SBCE70" and contains two tabs: "Interfaces" (active) and "Networks". Under the "Interfaces" tab, there is a table with three columns: "Interface Name", "VLAN Tag", and "Status". The table lists four interfaces: A1 (Enabled), A2 (Disabled), B1 (Enabled), and B2 (Disabled). An "Add VLAN" button is located in the top right corner of the table area.

Interface Name	VLAN Tag	Status
A1		Enabled
A2		Disabled
B1		Enabled
B2		Disabled

Navigate to **Device Specific Settings** → **Network** and under the **Network Configuration** tab verify the IP addresses assigned to the interfaces. The following screens show the private interface is assigned to **A1** and the public interface is assigned to **B1** respectively.

Session Border Controller for Enterprise AVAYA

Edit Network X

This Network contains one or more IP Address entries which are in use. If the Interface, an IP Address, or Public IP which is in use is modified, the application **must** be restarted or the device may stop functioning.

Name: Network_A1

Default Gateway: 10.10.98.1

Subnet Mask: 255.255.255.192

Interface: A1

Add

IP Address	Public IP	Gateway Override	
10.10.98.22	Use IP Address	Use Default	Delete

Finish

Session Border Controller for Enterprise AVAYA

Edit Network X

This Network contains one or more IP Address entries which are in use. If the Interface, an IP Address, or Public IP which is in use is modified, the application **must** be restarted or the device may stop functioning.

Name: Network_B1

Default Gateway: 10.10.98.97

Subnet Mask: 255.255.255.224

Interface: B1

Add

IP Address	Public IP	Gateway Override	
10.10.98.119	Use IP Address	Use Default	Delete

Finish

7.4.2. Media Interface

The Media Interface screen is where the media ports are defined. The Avaya SBCE will open a connection for RTP on the defined ports.

To create a new Media Interface, navigate to **Device Specific Settings** → **Media Interface** and click **Add**.

Separate Media Interfaces were created for both inside and outside interfaces. The following screen shows the Media Interfaces created in the compliance testing.

Note: After the media interfaces are created, an application restart is necessary before the changes will take effect.

Session Border Controller for Enterprise AVAYA

Dashboard
Administration
Backup/Restore
System Management
 > Global Parameters
 > Global Profiles
 > PPM Services
 > Domain Policies
 > TLS Management
 > Device Specific Settings
 Network Management
 Media Interface

Media Interface: SBCE70

Devices
SBCE70

Media Interface

Modifying or deleting an existing media interface will require an application restart before taking effect. Application restarts can be issued from [System Management](#).

Add

Name	Media IP Network	Port Range	Edit	Delete
InsideMedia	10.10.98.22 Network_A1 (A1, VLAN 0)	35000 - 40000	Edit	Delete
OutsideMedia	10.10.98.119 Network_B1 (B1, VLAN 0)	35000 - 40000	Edit	Delete

7.4.3. Signaling Interface

The Signaling Interface screen is where the SIP signaling port is defined. The Avaya SBCE will listen for SIP requests on the defined port.

To create a new Signaling Interface, navigate to **Device Specific → Settings → Signaling Interface** and click **Add**.

Separate Signaling Interfaces were created for both inside and outside interfaces. The following screen shows the Signaling Interfaces were created in the compliance testing with UDP/5060 for the outside interface to SP and TCP/5060 for the inside interface to EN.

Session Border Controller for Enterprise AVAYA

Dashboard
Administration
Backup/Restore
System Management
 > Global Parameters
 > Global Profiles
 > PPM Services
 > Domain Policies
 > TLS Management
 > Device Specific Settings
 Network Management
 Media Interface
 Signaling Interface

Signaling Interface: SBCE70

Devices
SBCE70

Signaling Interface

Modifying or deleting an existing signaling interface will require an application restart before taking effect. Application restarts can be issued from [System Management](#).

Add

Name	Signaling IP Network	TCP Port	UDP Port	TLS Port	TLS Profile	Edit	Delete
InsideSignaling	10.10.98.22 Network_A1 (A1, VLAN 0)	5060	5060	---	None	Edit	Delete
OutsideSignaling	10.10.98.119 Network_B1 (B1, VLAN 0)	5060	5060	---	None	Edit	Delete

7.4.4. End Point Flows - Server Flow

When a packet is received by Avaya SBCE, the content of the packet (IP addresses, URIs, etc.) is used to determine which flow it matches. Once the flow is determined, the flow points to a policy which contains several rules concerning processing, privileges, authentication, routing, etc. Once routing is applied and the destination endpoint is determined, the policies for this destination endpoint are applied. The context is maintained, so as to be applied to future packets in the same flow. The following screens illustrate the flow through the Avaya SBCE to secure a SIP Trunk call.

In the compliance testing, separate Server Flows were created for SP and EN. To create a Server Flow, navigate to **Device Specific Settings → End Point Flows**. Select the **Server Flows** tab and click **Add** (not shown). In the new window that appears, enter the following values. The other fields are kept default.

- **Flow Name:** Enter a descriptive name.
- **Server Configuration:** Select a Server Configuration created in **Section 7.2.4** to assign to the Flow.
- **URI Group:** Select the URI Group created in **Section 7.2.1** to assign to the Flow.
Note: URI Group can be set to “*” to match all calls.
- **Received Interface:** Select the Signaling Interface created in **Section 7.4.3** that the Server Configuration is allowed to receive SIP messages from.
- **Signaling Interface:** Select the Signaling Interface created in **Section 7.4.3** used to communicate with the Server Configuration.
- **Media Interface:** Select the Media Interface created in **Section 7.4.2** used to communicate with the Server Configuration.
- **End Point Policy Group:** Select the End Point Policy Group created in **Section 7.3.2** to assign to the Server Configuration.
- **Routing Profile:** Select the Routing Profile created in **Section 7.2.2** that the Server Configuration will use to route SIP messages to.
- **Topology Hiding Profile:** Select the Topology-Hiding profile created in **Section 7.2.6** to apply to the Server Configuration.
- Click **Finish**.

The following screen shows the Server Flow **SP-SF** configured for SP.

The screenshot displays the Avaya Session Border Controller for Enterprise (SBCE70) configuration interface. The left sidebar shows the navigation menu with 'End Point Flows' selected. The main panel is titled 'Edit Flow: SP-SF' and contains the following configuration fields:

Field	Value
Flow Name	SP-SF
Server Configuration	SP-SC
URI Group	*
Transport	*
Remote Subnet	*
Received Interface	InsideSignaling
Signaling Interface	OutsideSignaling
Media Interface	OutsideMedia
End Point Policy Group	SP-PG
Routing Profile	SP-to-EN
Topology Hiding Profile	EN-to-SP
Signaling Manipulation Script	None
Remote Branch Office	Any

A 'Finish' button is located at the bottom right of the configuration panel.

Similarly, the following screen shows the Server Flow **EN-SF** configured for EN.

The screenshot displays the Avaya Session Border Controller for Enterprise (SBCE70) configuration interface. The left sidebar shows the navigation menu with 'End Point Flows' selected. The main panel is titled 'Edit Flow: EN-SF' and contains the following configuration fields:

Field	Value
Flow Name	EN-SF
Server Configuration	EN-SC
URI Group	*
Transport	*
Remote Subnet	*
Received Interface	OutsideSignaling
Signaling Interface	InsideSignaling
Media Interface	InsideMedia
End Point Policy Group	EN-PG
Routing Profile	EN-to-SP
Topology Hiding Profile	SP-to-EN
Signaling Manipulation Script	None
Remote Branch Office	Any

A 'Finish' button is located at the bottom right of the configuration panel.

8. Windstream Service Configuration

Windstream is responsible for the configuration of its SIP Trunking Service. The customer will need to provide the IP address used to reach the Avaya SBCE at the enterprise side. Windstream will provide the customer with the necessary information to configure the SIP connection from the enterprise to Windstream. The information provided by Windstream includes:

- IP address and port number used for signaling through security devices (if any).
- IP address and port number used for media through security devices (if any).
- Windstream SIP domain. In the compliance testing, Windstream preferred to use IP address as an URI-Host.
- CPE SIP domain. In the compliance testing, Windstream preferred to use IP address of the Avaya SBCE as an URI-Host.
- Supported codecs.
- DID numbers.

The sample configuration between Windstream and the enterprise for the compliance testing is a static configuration. There is no registration on the SIP trunk implemented on either Windstream or enterprise side.

9. Verification and Troubleshooting

This section provides verification steps that may be performed in the field to verify that the solution is configured properly. This section also provides a list of useful troubleshooting commands.

9.1. Verification Steps

- Verify that endpoints at the enterprise site can place call to PSTN and that the call remains active for more than 35 seconds. This time period is included to satisfy SIP protocol timers.
- Verify that endpoints at the enterprise site can receive call from PSTN and that the call can remain active for more than 35 seconds. This time period is included satisfy SIP protocol timers.
- Verify that the user on PSTN can end an active call by hanging up.
- Verify that an endpoint at the enterprise site can end an active call by hanging up.

9.2. Protocol Traces

The following SIP headers are inspected using Wireshark trace analysis:

- Request-URI: verify the called party number and SIP domain.
- From: verify the calling party name and number.
- To: verify the called party name and number.
- P-Asserted-Identity: verify the calling party name and number.
- Privacy: verify the value “user” and/or “id” presents the private call scenario.

The following attributes in SIP message body are inspected using Wireshark trace analysis:

- Connection Information (c line): verify IP address of near end and far end endpoints.

- Time Description (t line): verify session timeout value of near end and far end endpoints.
- Media Description (m line): verify audio port, codec, DTMF event description.
- Media Attribute (a line): verify specific audio port, codec, ptime, send/ receive ability, DTMF event and fax attributes.

9.3. Troubleshooting:

9.3.1. The Avaya SBCE

Use a network sniffing tool (e.g., Wireshark) to monitor the SIP signaling messages between Windstream and the Avaya SBCE.

9.3.2. Communication Manager

- **list trace station** <extension number>. Traces call to and from a specific station.
- **list trace tac** <trunk access code number>. Trace call over a specific trunk group.
- **status station** <extension number>. Displays signaling and media information for an active call on a specific station.
- **status trunk** <trunk group number>. Displays trunk group information.
- **status trunk** <trunk group number/channel number>. Displays signaling and media information for an active trunk channel.

10. Conclusion

These Application Notes describe the configuration necessary to connect Avaya Aura® Communication Manager 7.0, Avaya Aura® Session Manager 7.0 and Avaya Session Border Controller for Enterprise 7.0 to Windstream SIP Trunking Service. Windstream SIP Trunking Service is a SIP-based Voice over IP solution for customers ranging from small businesses to large the enterprises. Windstream provides a flexible, cost-saving alternative to traditional analog and ISDN-PRI trunks.

All of the test cases were executed. Despite the number of observations seen during testing as noted in **Section 2.2**, the test results met the objectives outlined in **Section 2.1**. The Windstream SIP Trunking Service is considered **compliant** with Avaya Aura® Communication Manager 7.0, Avaya Aura® Session Manager 7.0 and Avaya Session Border Controller for Enterprise 7.0.

11.References

This section references the documentation relevant to these Application Notes. Additional Avaya product documentation is available at <http://support.avaya.com>.

- [1] *What's New in Avaya Aura Release 7.0*, Release 7.0, 03-601818, Issue 1, August 2015.
- [2] *Deploying Avaya Aura® System Manager*, Release 7.0, Issue 1, October 2015.
- [3] *Administering Avaya Aura® System Manager for Release 7.0*, Issue 1, August 2015.
- [4] *Administering Avaya Aura® Session Manager*, Release 7.0, Issue 1, August 2015.
- [5] *Deploying Avaya Aura Communication Manager in Virtualized Environment*, Release 7.0, Issue 1, August 2015.
- [6] *Avaya Session Border Controller for Enterprise Overview and Specification*, Release 7.0, Issue 1, August 2015.
- [7] *Deploying Avaya Session Border Controller for Enterprise*, Release 7.0, Issue 1, August 2015.
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- [10] *Deploying and Updating Avaya Aura Media Server Appliance*, Release 7.7, Issue 1, August 2015.
- [11] *9600 Series IP Deskphones Overview and Specification*, Release 7.0, Issue 1, August 2015.
- [12] *Installing and Maintaining Avaya 9601/9608/9611G/9621G/9641G/9641GS IP Deskphones SIP*, Release 7.0, Issue 1, August 2015.
- [13] *Administering Avaya 9601/9608/9611G/9621G/9641G/9641GS IP Ddeskphones SIP*, Release 7.0, Issue 2, August 2015.
- [14] *Administering Avaya one-X® Communicator*, Release 6.2, April 2015.
- [15] *RFC 3261 SIP: Session Initiation Protocol*, <http://www.ietf.org/>
- [16] *RFC 3515, The Session Initiation Protocol (SIP) Refer Method*, <http://www.ietf.org/>
- [17] *RFC 2833 RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals*, <http://www.ietf.org/>

Product documentation for Windstream Networks' SIP Trunking Solution is available from Windstream.

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