



Avaya Solution & Interoperability Test Lab

Application Notes for Configuring CenturyLink BroadWorks SIP Trunk with Avaya IP Office 8.0 - Issue 1.0

Abstract

These Application Notes describe the procedures for configuring Session Initiation Protocol (SIP) Trunking between the CenturyLink BroadWorks SIP Trunk service and Avaya IP Office.

The CenturyLink BroadWorks SIP Trunk service provides PSTN access via a SIP trunk between the enterprise and the CenturyLink network as an alternative to legacy analog or digital trunks. This approach generally results in lower cost for the enterprise.

CenturyLink 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 was conducted via the DevConnect Program at the Avaya Solution and Interoperability Test Lab.

1. Introduction

These Application Notes describe the procedures for configuring Session Initiation Protocol (SIP) Trunking between the CenturyLink BroadWorks SIP Trunk service and Avaya IP Office.

The CenturyLink BroadWorks SIP Trunk service provides PSTN access via a SIP trunk between the enterprise and CenturyLink network as an alternative to legacy analog or digital trunks. This approach generally results in lower cost for the enterprise.

2. General Test Approach and Test Results

The general test approach was to connect a simulated enterprise site to CenturyLink BroadWorks SIP Trunk service via the public Internet and exercise the features and functionality listed in **Section 2.1**. The simulated enterprise site was comprised of Avaya IP Office and various Avaya endpoints.

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.

2.1. Interoperability Compliance Testing

To verify SIP trunking interoperability, the following features and functionality were covered during the interoperability compliance test.

- Response to SIP OPTIONS queries
- Incoming PSTN calls to H.323, digital, and analog telephones at the enterprise. All inbound PSTN calls were routed to the enterprise over the SIP trunk from the service provider.
- Outgoing PSTN calls from H.323, digital, and analog telephones at the enterprise. All outbound PSTN calls were routed from the enterprise over the SIP trunk to the service provider.
- Inbound and outbound PSTN calls to/from soft clients. Avaya IP Office supports two soft clients: Avaya IP Office Phone Manager and Avaya IP Office Video Softphone. Avaya IP Office Phone Manager supports two modes (PC softphone and telecommuter). Both clients were tested in their respective supported modes.
- Various call types including: local, long distance, international, outbound toll-free, operator (0), operator services (0 +10 digits), TTY relay (711), auto-attendant and emergency (911) calls
- Codec G.711MU
- Caller ID presentation and Caller ID restriction
- DTMF transmission passed in-band and using RFC 2833
- Response to incomplete call attempts and trunk errors
- Voicemail navigation for inbound and outbound calls
- User features such as hold and resume, forwarding, transfer, and conference
- Off-net call forwarding and twinning
- G.711 fax

- Long duration calls

Items not supported or not tested included the following:

- Only codec G.711MU is supported.
- Inbound toll-free calls and calls between TTY devices are supported but were not tested as part of the compliance test.
- T.38 fax calls are not supported.
- The SIP REFER method is not supported for network call redirection.
- A 302 response from Avaya IP Office is not supported for network call redirection.

2.2. Test Results

Interoperability testing of the CenturyLink BroadWorks SIP Trunk service was completed successfully. The following observations were made during the testing.

- **CenturyLink modifies SIP URI host in SIP headers received from Avaya IP Office:** Avaya IP Office was unable to populate the SIP URI host in all necessary headers with the domain required by CenturyLink. In some headers such as the Diversion header, Avaya IP Office would populate an IP address instead of the domain. As a result, CenturyLink installed a set of SIP header manipulations on the CenturyLink Acme SBC to modify the SIP URI host to the desired value on all necessary headers.
- **Error response for outbound call with no matching codec:** If Avaya IP Office is misconfigured so that no supported codec is offered to CenturyLink on an outbound call, CenturyLink does not return a “488 Not Acceptable Here”. Instead, it returns a “480 Exhausted Redirects”. Caller hears a solid tone from IP Office.
- **Caller ID for calls between Avaya IP Office endpoints via CenturyLink:** Local calls between Avaya IP Office endpoints dialed with 10 digits are sent to CenturyLink across the CenturyLink BroadWorks SIP Trunk. CenturyLink then routes the call back across the same trunk to the Avaya IP Office destination extension. On the inbound side, the number of digits sent in the Caller ID is configurable by CenturyLink. For the compliance test, CenturyLink sent 4 digits in the Caller ID for these Avaya IP Office station to station calls routed through CenturyLink.
- **Outbound Privacy calls From Avaya IP Office:** In the outbound INVITE, Avaya IP Office masks both the number and domain in the SIP From header inserting anonymous@anonymous.invalid.

2.3. Support

Contact information for technical support on the CenturyLink BroadWorks SIP Trunk service is provided by CenturyLink at the time of service installation.

Avaya customers may obtain documentation and support for Avaya products by visiting <http://support.avaya.com>. Selecting the **Support Contact Options** link followed by **Maintenance Support** provides the worldwide support directory for Avaya Global Services. Specific numbers are provided for both customers and partners based on the specific type of support or consultation services needed. Some services may require specific Avaya service support agreements. Alternatively, in the United States, (866) GO-AVAYA (866-462-8292) provides access to overall sales and service support menus.

3. Reference Configuration

Figure 1 illustrates the test configuration. The test configuration shows an enterprise site connected to the CenturyLink BroadWorks SIP Trunk service.

Located at the enterprise site is an Avaya IP Office 500. The LAN port of Avaya IP Office is connected to the enterprise LAN while the WAN port is connected to the public network. Endpoints include an Avaya 1600 Series IP Telephone (with H.323 firmware), an Avaya 5600 Series IP Telephone (with H.323 firmware), an Avaya 9600 Series IP Telephone (with H.323 firmware), an Avaya IP Office Phone Manager, an Avaya IP Office Softphone, an Avaya 5420 Digital Telephone, an Avaya 6210 Analog Telephone and a fax machine. The site also has a Windows 2003 Server running Avaya Voicemail Pro for voicemail and running Avaya IP Office Manager to configure the Avaya IP Office.

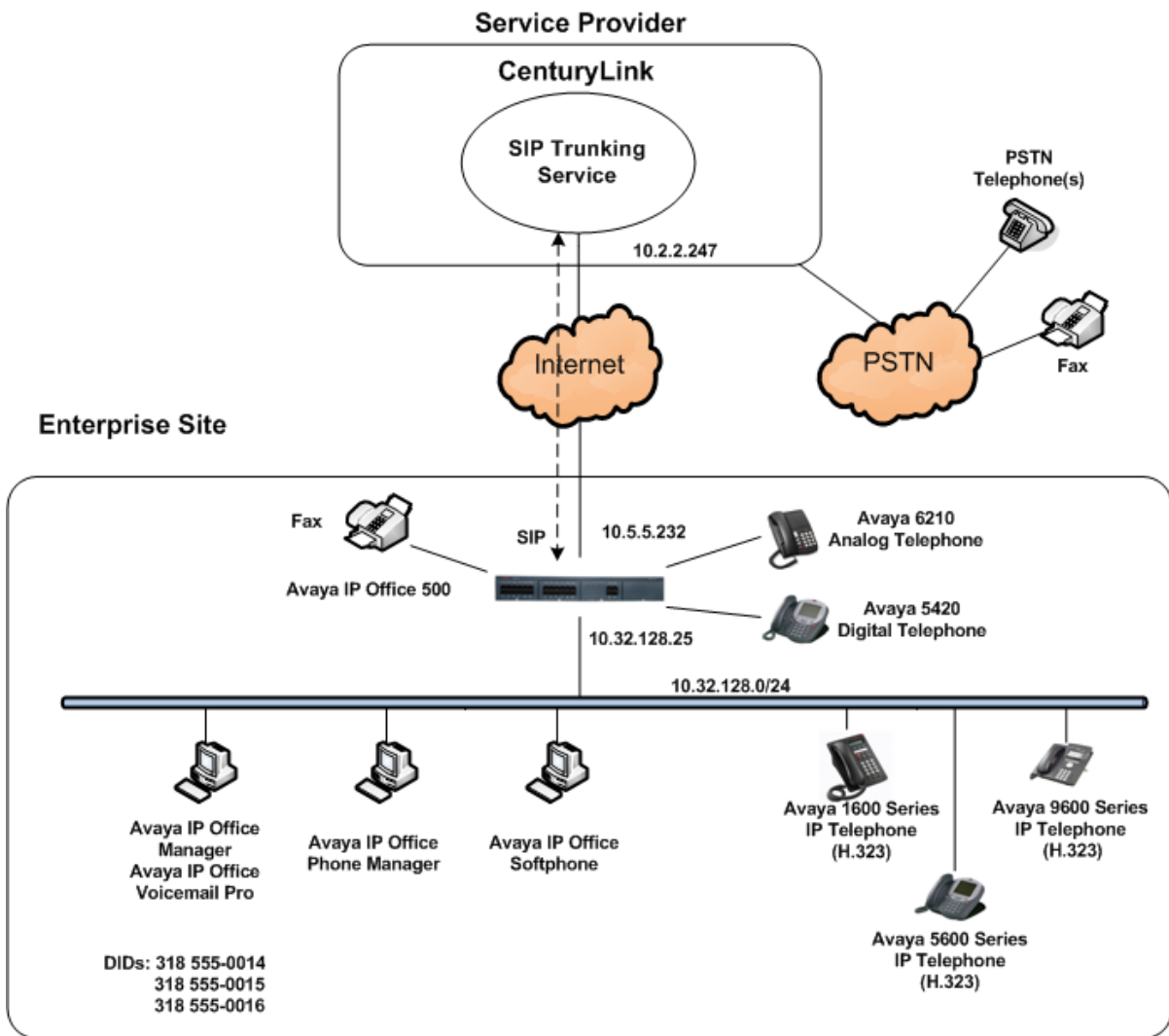


Figure 1: Test Configuration

For security purposes, any public IP addresses or PSTN routable phone numbers used in the compliance test are not shown in these Application Notes. Instead, public IP addresses have been replaced with private addresses and all phone numbers have been replaced with numbers that can not be routed by the PSTN.

For the purposes of the compliance test, users dialed a short code of 9 + N digits to send digits across the SIP trunk to CenturyLink. The short code of 9 was stripped off by Avaya IP Office but the remaining N digits were sent unaltered to CenturyLink. For calls within the North American Numbering Plan (NANP), the user dialed 11 (1 + 10) digits. Thus for these NANP calls, Avaya IP Office sent 11 digits in the Request URI and the To header of an outbound SIP INVITE message. It was configured to send 10 digits in the From header. For inbound calls, CenturyLink sent 10 digits in the Request URI and the To header of inbound SIP INVITE messages.

In an actual customer configuration, the enterprise site may also include additional network components between the service provider and the Avaya IP Office such as a session border controller or data firewall. A complete discussion of the configuration of these devices is beyond the scope of these Application Notes. However, it should be noted that SIP and RTP traffic between the service provider and the Avaya IP Office must be allowed to pass through these devices.

4. Equipment and Software Validated

The following equipment and software/firmware were used for the sample configuration provided:

Avaya Telephony Components	
Equipment/Software	Release/Version
Avaya IP Office 500	8.0 (16)
Avaya IP Office Manager	10.0 (16)
Avaya Voicemail Pro	8.0 (Build 8.0.8.29)
Avaya 1608SW IP Telephone (H.323)	Avaya one-X Deskphone Value Edition 1.300B
Avaya 5620 IP Telephone (H.323)	2.9.1
Avaya 9640SW IP Telephone (H.323)	Avaya one-X Deskphone Edition 3.102S
Avaya IP Office Phone Manager	4.2.36
Avaya IP Office Softphone	3.2.3.15 (64595)
Avaya 5420 Digital Telephone	N/A
Avaya 6210 Analog Telephone	N/A
CenturyLink BroadWorks SIP Trunk Components	
Equipment	Release
BroadSoft BroadWorks Softswitch	17.sp2
Sonus Network Border Switch (NBS)	B07.02.07 F004
Sonus GSX Media Gateway	B07.02.07 F004
Acme Packet Net-Net 4250 Session Border Controller	Release SC6.1.0 MR-5 GA (Build 704)

5. Configure Avaya IP Office

This section describes the Avaya IP Office configuration to support connectivity to the CenturyLink BroadWorks SIP Trunk service. Avaya IP Office is configured through the Avaya IP Office Manager PC application. From the PC running the Avaya IP Office Manager application, select **Start → All Programs → IP Office → Manager** to launch the application. A pop-up window will appear with a list of Avaya IP Office systems reachable from the current Avaya IP Office Manager. Alternatively, navigate to **File → Open Configuration** to reach this window. Select the proper Avaya IP Office system from the pop-up window, and log in with the appropriate credentials. A management window will appear similar to the one in the next section. All the Avaya IP Office configurable components are shown in the left pane known as the Navigation Pane. The pane on the right is the Details Pane. These panes will be referenced throughout the Avaya IP Office configuration. All licensing and feature configuration that is not directly related to the interface with the service provider (such as twinning and Avaya IP Office Softphone support) is assumed to already be in place.

5.1. LAN2 Settings

In the sample configuration, *Atlantic City* was used as the system name and the WAN port was used to connect the Avaya IP Office to the public network. The LAN2 settings correspond to the WAN port on the Avaya IP Office. To access the LAN2 settings, first navigate to **Atlantic City → System → Atlantic City** in the Navigation Pane and then navigate to the **LAN2 → LAN Settings** tab in the Details Pane. Set the **IP Address** field to the IP address assigned to the Avaya IP Office WAN port. Set the **IP Mask** field to the mask used on the public network. All other parameters should be set according to customer requirements.

The screenshot displays the Avaya IP Office Manager configuration window for the 'Atlantic City' system. The left pane, titled 'IP Offices', shows a tree view with 'Atlantic City' selected. The right pane, titled 'Atlantic City', has the 'LAN2' tab selected. Within the 'LAN2' tab, the 'LAN Settings' sub-tab is active. The configuration fields are as follows:

Field	Value
IP Address	10 . 5 . 5 . 232
IP Mask	255 . 255 . 255 . 224
Primary Trans. IP Address	0 . 0 . 0 . 0
Firewall Profile	<None>
RIP Mode	None
Enable NAT	<input type="checkbox"/>
Number Of DHCP IP Addresses	200
DHCP Mode	Disabled (selected)

At the bottom right of the configuration pane, there is an 'Advanced' button.

On the **VoIP** tab in the Details Pane, check the **SIP Trunks Enable** box to enable the configuration of SIP trunks. The **RTP Port Number Range** can be customized to a specific range of receive ports for the RTP media. Based on this setting, Avaya IP Office would request RTP media be sent to a UDP port in the configurable range for calls using LAN2. Avaya IP Office can also be configured to mark the Differentiated Services Code Point (DSCP) in the IP header with specific values to support Quality of Services policies for both signaling and media. The **DSCP** field is the value used for media and the **SIG DSCP** is the value used for signaling.

The screenshot shows the configuration interface for Atlantic City, specifically the VoIP tab. The interface includes several sections:

- System Settings:**
 - H.323 Gatekeeper Enable
 - SIP Trunks Enable
 - SIP Registrar Enable
- H.323 Settings:**
 - H.323 Auto-create Extn
 - H.323 Auto-create User
 - H.323 Remote Extn Enable
 - Enable RTCP Monitoring On Port 5005
- RTP Port Number Range:**
 - Port Range (Minimum): 49152
 - Port Range (Maximum): 53246
- DiffServ Settings:**
 - DSCP (Hex): B8, DSCP Mask (Hex): FC, SIG DSCP (Hex): 88
 - DSCP: 46, DSCP Mask: 63, SIG DSCP: 34
- DHCP Settings:**
 - Primary Site Specific Option Number (SSON): 176
 - Secondary Site Specific Option Number (SSON): 242
 - VLAN: Not Present
 - 1100 Voice VLAN Site Specific Option Number (SSON): 232
 - 1100 Voice VLAN IDs: (Empty field)
- RTP Keepalives:**
 - Scope: Disabled, Periodic timeout: 30
 - Initial keepalives: Enabled

On the **Network Topology** tab in the Details Pane, configure the following parameters:

- Select the **Firewall/NAT Type** from the pull-down menu that matches the network configuration. No firewall or network address translation (NAT) device was used in the compliance test as shown in **Figure 1**, so the parameter was set to **Open Internet**. Since this parameter is set to **Open Internet**, then the **STUN Server IP Address** is not used.
- The **Binding Refresh Time** is used as one input to determine the frequency at which Avaya IP Office will send SIP OPTIONS messages to the service provider if it has not received an OPTIONS request from the far-end. See **Section 5.9** for complete details. For the compliance test, the **Binding Refresh Time** was set to **120** seconds.
- Set **Public IP Address** to the IP address of the Avaya IP Office WAN port.
- Set the **Public Port** to **5060**.
- All other parameters should be set according to customer requirements.

The screenshot shows the 'Atlantic City' configuration interface. The 'Network Topology' tab is selected, and the 'Network Topology Discovery' section is active. The settings are as follows:

Parameter	Value
STUN Server IP Address	10 . 90 . 168 . 13
STUN Port	3478
Firewall/NAT Type	Open Internet
Binding Refresh Time (seconds)	120
Public IP Address	10 . 5 . 5 . 232
Public Port	5060

Buttons: Run STUN, Cancel

Run STUN on startup

5.2. System Telephony Settings

Navigate to the **Telephony** → **Telephony** tab on the Details Pane. Choose the **Companding Law** typical for the enterprise location. For the compliance test, **ULAW** was used. Uncheck the **Inhibit Off-Switch Forward/Transfer** box to allow call forwarding and call transfer to the PSTN via the service provider across the SIP trunk.

The screenshot displays the 'Atlantic City' configuration interface for the 'Telephony' tab. The interface is divided into two main sections: 'Analogue Extensions' and 'Companding Law'.

Analogue Extensions:

- Default Outside Call Sequence: Normal
- Default Inside Call Sequence: Ring Type 1
- Default Ring Back Sequence: Ring Type 2
- Restrict Analogue Extension Ringer Voltage:
- Dial Delay Time (secs): 4
- Dial Delay Count: 0
- Default No Answer Time (secs): 15
- Hold Timeout (secs): 120
- Park Timeout (secs): 300
- Ring Delay (secs): 5
- Call Priority Promotion Time (secs): Disabled
- Default Currency: USD
- Default Name Priority: Favor Trunk

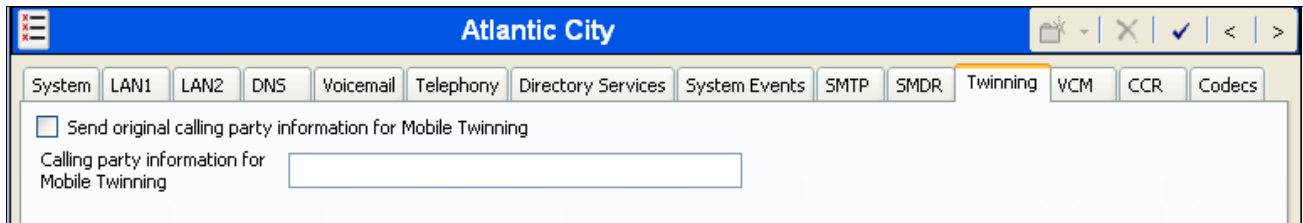
Companding Law:

- Switch:** U-Law, A-Law
- Line:** U-Law Line, A-Law Line
- DSS Status:
- Auto Hold:
- Dial By Name:
- Show Account Code:
- Inhibit Off-Switch Forward/Transfer: (This is the box to be unchecked according to the instructions)
- Restrict Network Interconnect:
- Drop External Only Impromptu Conference:
- Visually Differentiate External Call:
- Unsupervised Analog Trunk Disconnect Handling:
- High Quality Conferencing:

5.3. Twinning Calling Party Settings

Navigate to the **Twining** tab on the Details Pane. Uncheck the **Send original calling party information for Mobile Twinning** box. This will allow the Caller ID for Twinning and Call Forwarding to be controlled by the setting on the SIP Line (**Section 5.4**).

Click the **OK** Button at the bottom of the page (not shown).



5.4. Administer SIP Line

A SIP line is needed to establish the SIP connection between Avaya IP Office and the CenturyLink BroadWorks SIP Trunk service. To create a SIP line, begin by navigating to **Line** in the Navigation Pane. Right-click and select **New** → **SIP Line** (not shown). On the **SIP Line** tab in the Details Pane, configure the parameters as shown below.

- Set the **ITSP Domain Name** to the domain provided by CenturyLink (**bsoft.nc.labnet**).
- Check the **In Service** box.
- Check the **Check OOS** box.
- Set the **Call Routing Method** to **Request URI**. Avaya IP Office will route inbound calls based on the number in the Request URI.
- Set **Send Caller ID** to **Diversion Header**. For forwarded or twinning calls, this setting results in the original calling party appearing in the SIP From header and the forwarding/twinning party in the Diversion header.
- Uncheck the **REFER Support** box.
- Default values may be used for all other parameters.

The screenshot displays the Avaya IP Office configuration interface. On the left, the 'IP Offices' navigation pane is expanded to show a tree structure including categories like BOOTP (4), Operator (3), Atlantic City, System (1), Line (11), Control Unit (3), Extension (23), User (25), HuntGroup (1), Short Code (58), Service (0), RAS (1), Incoming Call Route (10), WanPort (0), Directory (0), Time Profile (0), Firewall Profile (1), IP Route (4), Account Code (0), License (76), Tunnel (0), User Rights (8), ARS (1), RAS Location Request (0), and E911 System (1). The main configuration area is titled 'SIP Line - Line 19' and has tabs for 'SIP Line', 'Transport', 'SIP URI', 'VoIP', 'T38 Fax', and 'SIP Credentials'. The 'SIP Line' tab is active, showing the following configuration:

Line Number	19	In Service	<input checked="" type="checkbox"/>
ITSP Domain Name	bsoft.nc.labnet	Use Tel URI	<input type="checkbox"/>
Prefix		Check OOS	<input checked="" type="checkbox"/>
National Prefix	0	Call Routing Method	Request URI
Country Code		Originator number for forwarded and twinning calls	
International Prefix	00	Name Priority	System Default
Send Caller ID	Diversion Header		
Association Method	By Source IP address		
<input type="checkbox"/> REFER Support			
Incoming	Auto		
Outgoing	Auto		

Navigate to the **Transport** tab and set the following:

- Set the **ITSP Proxy Address** to the IP address of the CenturyLink SIP Proxy provided by CenturyLink.
- Set the **Layer 4 Protocol** to **UDP**.
- Set **Use Network Topology Info** to **LAN2** as configured in **Section 5.1**.
- Set the **Send Port** to the port provided by CenturyLink. For the compliance test, CenturyLink listened on port **6002** instead of the standard port of 5060..
- Default values may be used for all other parameters.

The screenshot shows the configuration window for 'SIP Line - Line 19'. The 'Transport' tab is selected. The 'ITSP Proxy Address' is set to '10.2.2.247'. Under 'Network Configuration', 'Layer 4 Protocol' is set to 'UDP', 'Send Port' is '6002', and 'Use Network Topology Info' is 'LAN 2'. 'Listen Port' is '5060'. 'Explicit DNS Server(s)' are both '0 . 0 . 0 . 0'. 'Calls Route via Registrar' is checked. 'Separate Registrar' is empty.

Field	Value
ITSP Proxy Address	10.2.2.247
Layer 4 Protocol	UDP
Send Port	6002
Use Network Topology Info	LAN 2
Listen Port	5060
Explicit DNS Server(s)	0 . 0 . 0 . 0
Explicit DNS Server(s)	0 . 0 . 0 . 0
Calls Route via Registrar	<input checked="" type="checkbox"/>
Separate Registrar	

Select the **SIP URI** tab, to create a SIP URI entry. A SIP URI entry must be created to match each incoming number that Avaya IP Office will accept on this line. Click the **Add** button and the **New Channel** area will appear at the bottom of the pane. For the compliance test, a single SIP URI entry was created that matched any number assigned to an Avaya IP Office user. The entry was created with the parameters shown below.

- Set **Local URI** to **Use Internal Data**. This setting allows calls on this line whose SIP URI matches the **SIP Name** set on the **SIP** tab of any **User** as shown in **Section 5.6**.
- Set **Contact** and **Display Name** to **Use Internal Data**. This setting will cause the Contact and Display Name data to be set from the corresponding fields on the **SIP** tab of the individual **User** as shown in **Section 5.6**.
- Set **PAI** to **None**.
- For the **Registration** field, select **0:<None>** from the pull-down menu.
- Associate this line with an incoming line group by entering a line group number in the **Incoming Group** field. This line group number will be used in defining incoming call routes for this line. Similarly, associate the line to an outgoing line group using the **Outgoing Group** field. The outgoing line group number is used in defining short codes for routing outbound traffic to this line. For the compliance test, a new incoming and outgoing group **19** was defined that only contains this line (line 19).
- Set **Max Calls per Channel** to the number of simultaneous SIP calls that are allowed using this SIP URI pattern.
- Default values may be used for all other parameters.

Click **OK**.

The screenshot shows the 'SIP Line - Line 19' configuration window. The 'SIP URI' tab is selected. Below the tab are buttons for 'Add...', 'Remove', and 'Edit...'. The 'New Channel' form is visible, with the following fields and values:

Field	Value
Via	10.5.5.232
Local URI	Use Internal Data
Contact	Use Internal Data
Display Name	Use Internal Data
PAI	None
Registration	0: <None>
Incoming Group	19
Outgoing Group	19
Max Calls per Channel	10

Buttons for 'OK', 'Cancel', and 'Help' are located at the bottom of the window.

Select the **VoIP** tab, to set the Voice over Internet Protocol parameters of the SIP line. Set the parameters as shown below.

- Configure the trunk to only use the G.711 ULAW codec. Set the **Codec Selection** to **Custom**. Move all codecs except **G.711 ULAW 64K** from the Selected box to the Unused box.
- Uncheck the **VoIP Silence Suppression** box.
- Check the **Re-invite Supported** box.
- Set **Fax Transport Support** to **G.711**.
- Set the **DTMF Support** field to **RFC2833**. This directs Avaya IP Office to send DTMF tones using RTP events messages as defined in RFC2833.
- Default values may be used for all other parameters.

Click the **OK** button at the bottom of the page (not shown).

The screenshot shows the configuration interface for a SIP Line (Line 19). The interface has a blue header bar with the title "SIP Line - Line 19" and navigation icons. Below the header, there are tabs for "SIP Line", "Transport", "SIP URI", "VoIP", "T38 Fax", and "SIP Credentials". The "VoIP" tab is selected. The main configuration area is divided into several sections:

- Codec Selection:** A dropdown menu is set to "Custom". Below it are two boxes: "Unused" and "Selected". The "Unused" box contains "G.711 ALAW 64K", "G.729(a) 8K CS-ACELP", and "G.723.1 6K3 MP-MLQ". The "Selected" box contains "G.711 ULAW 64K". Navigation buttons (">>>", "↑", "↓", "<<") are between the boxes.
- Checkboxes:** On the right side, there are five checkboxes: "VoIP Silence Suppression" (unchecked), "Re-invite Supported" (checked), "Use Offerer's Preferred Codec" (unchecked), "Codec Lockdown" (unchecked), and "PRACK/100rel Supported" (unchecked).
- Fax Transport Support:** A dropdown menu is set to "G.711".
- Call Initiation Timeout (s):** A numeric input field is set to "4".
- DTMF Support:** A dropdown menu is set to "RFC2833".

5.5. Short Code

Define a short code to route outbound traffic to the SIP line. To create a short code, right-click on **Short Code** in the Navigation Pane and select **New** (not shown). On the **Short Code** tab in the Details Pane, configure the parameters as shown below:

- In the **Code** field, enter the dial string which will trigger this short code, followed by a semi-colon. In this case, **9N;**. This short code will be invoked when the user dials 9 followed by any number.
- Set **Feature** to **Dial**. This is the action that the short code will perform.
- Set **Telephone Number** to **N"@bsoft.nc.labnet"**. This field is used to construct the Request URI and To headers in the outgoing SIP INVITE message. The value **N** represents the number dialed by the user. The CenturyLink SIP domain follows the **@** sign in the above expression.
- Set the **Line Group Id** to the outgoing line group number defined on the **SIP URI** tab on the **SIP Line** in **Section 5.4**. This short code will use this line group when placing the outbound call.
- Default values may be used for all other parameters.

Click the **OK** button (not shown).

The screenshot displays the Avaya IP Office configuration interface. On the left is the 'IP Offices' navigation pane with a tree view containing categories like BOOTP (4), Operator (3), Atlantic City, System (1), Line (11), Control Unit (3), Extension (23), User (25), HuntGroup (1), Short Code (58), Service (0), RAS (1), and Incoming Call Route (1). The 'Short Code (58)' item is selected. The main pane shows the configuration for a short code named '9N;: Dial'. The configuration fields are as follows:

Field	Value
Code	9N;
Feature	Dial
Telephone Number	N"@bsoft.nc.labnet"
Line Group ID	19
Locale	
Force Account Code	<input type="checkbox"/>

5.6. User

Configure the SIP parameters for each user that will be placing and receiving calls via the SIP line defined in **Section 5.4**. To configure these settings, first navigate to **User**→*Name* in the Navigation Pane where *Name* is the name of the user to be modified. In the example below, the name of the user is **Extn240**. Select the **SIP** tab in the Details Pane. The **SIP Name** and **Contact** are set to one of the DID numbers assigned to the enterprise from CenturyLink. The **SIP Display Name (Alias)** parameter can optionally be configured with a descriptive name. The value entered for the **Contact** field will be used in the SIP INVITE for outgoing SIP trunk calls. The value entered for the **SIP Name** is used as the user part of the SIP URI in the From header for outgoing SIP trunk calls.

Click the **OK** button (not shown).

The screenshot displays the configuration interface for a user named 'Extn240: 240'. The left-hand navigation pane is titled 'IP Offices' and lists various system components: BOOTP (4), Operator (3), Atlantic City, System (1), Line (11), Control Unit (3), Extension (23), User (25), HuntGroup (1), Short Code (58), and Service (0). The 'User (25)' item is highlighted. The main configuration area is titled 'Extn240: 240' and features a series of tabs: User, Voicemail, DND, ShortCodes, Source Numbers, Telephony, Forwarding, Dial In, Voice Recording, Menu Programming, Mobility, Phone Manager Options, Hunt Group Membership, Announcements, SIP, and Pe. The 'SIP' tab is currently active. Within this tab, there are three input fields: 'SIP Name' containing '3185550014', 'SIP Display Name (Alias)' containing 'Extn240', and 'Contact' containing '3185550014'. Below these fields is an unchecked checkbox labeled 'Anonymous'.

5.7. Incoming Call Route

An incoming call route maps an inbound DID number on a specific line to an internal extension. This procedure should be repeated for each DID number provided by the service provider. To create an incoming call route, right-click **Incoming Call Route** in the Navigation Pane and select **New** (not shown). On the **Standard** tab of the Details Pane, enter the parameters as shown below:

- Set the **Bearer Capacity** to **Any Voice**.
- Set the **Line Group ID** to the incoming line group of the SIP line defined in **Section 5.4**.
- Set the **Incoming Number** to the incoming number on which this route should match. Matching is right to left.
- Default values can be used for all other fields.

The screenshot shows the configuration window for an Incoming Call Route. The left pane shows a tree view of IP Offices, with 'Incoming Call Route (1)' selected. The right pane shows the configuration for line 19 318550014. The 'Standard' tab is active, showing the following fields:

Field	Value
Bearer Capability	Any Voice
Line Group ID	19
Incoming Number	318550014
Incoming Sub Address	
Incoming CLI	
Locale	
Priority	1 - Low
Tag	
Hold Music Source	System Source

On the **Destinations** tab, select the destination extension from the pull-down menu of the **Destination** field. Click the **OK** button (not shown). In this example, incoming calls to 318550014 on line 19 are routed to extension 240.

The screenshot shows the configuration window for an Incoming Call Route, with the 'Destinations' tab active. The window title is '19 318550014'. The 'Destinations' tab shows a table with the following data:

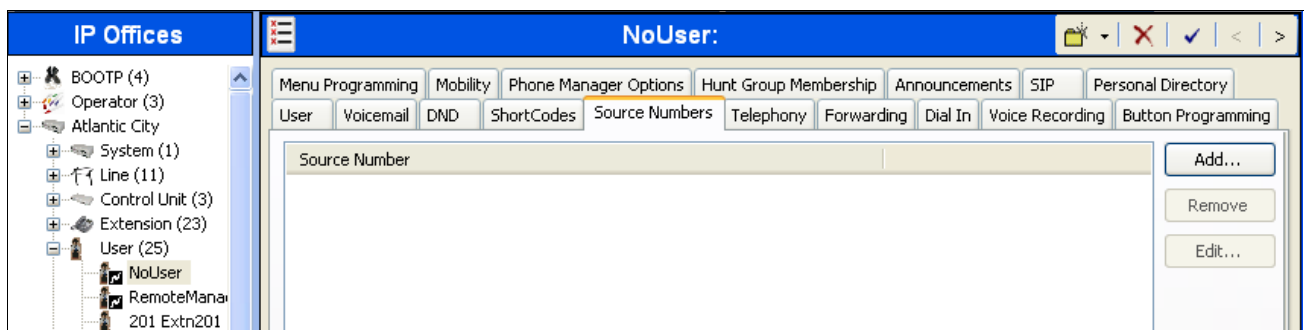
TimeProfile	Destination	Fallback Extension
Default Value	240 Extn240	

5.8. Privacy/Anonymous Calls

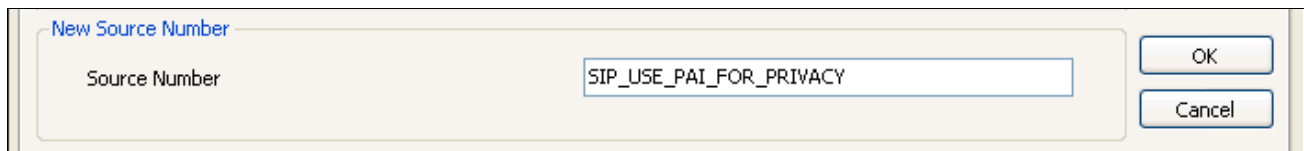
For outbound calls with privacy (anonymous) enabled, Avaya IP Office will mask the calling party number in the From and Contact headers of the SIP INVITE message. Avaya IP Office can be configured to use the P-Preferred-Identity (PPI) or P-Asserted-Identity (PAI) header to pass the actual calling party information for authentication and billing. By default, Avaya IP Office will use PPI.

CenturyLink recommends using PAI. So for the compliance test, PAI was used for the purposes of privacy.

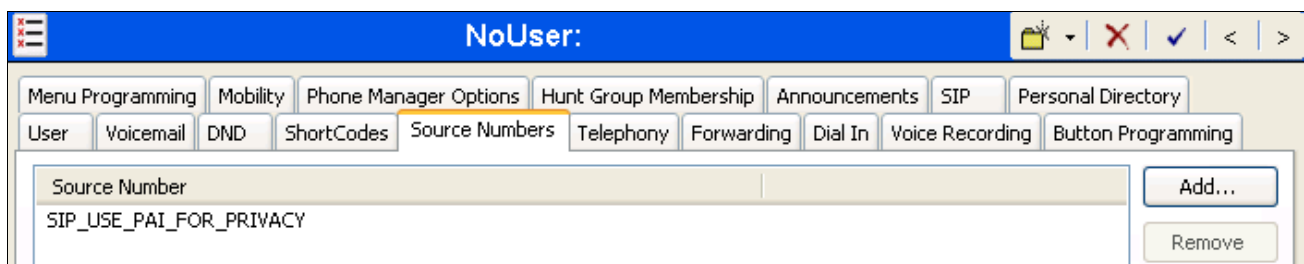
To configure PAI for privacy calls, then perform the following. Navigate to **User** → **NoUser** in the Navigation Pane. Select the **Source Numbers** tab in the Details Pane. Click the **Add** button.



At the bottom of the Details Pane, the **Source Number** field will appear. Enter **SIP_USE_PAI_FOR_PRIVACY**. Click **OK**.



The **SIP_USE_PAI_FOR_PRIVACY** parameter will appear in the list of Source Numbers as shown below.



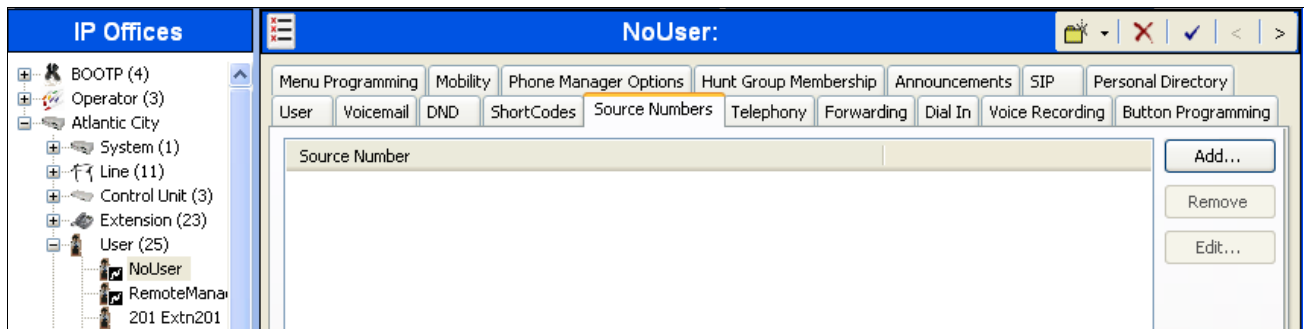
5.9. SIP Options

Avaya IP Office sends SIP OPTIONS messages periodically to determine if the SIP connection is active. Avaya IP Office will send a SIP OPTIONS message only if an OPTIONS request is not received from the far-end during the defined interval. The rate at which the messages are sent is determined by the combination of the **Binding Refresh Time** (in seconds) set on the **Network Topology** tab in **Section 5.1** and the **SIP_OPTIONS_PERIOD** parameter (in minutes) that can be set on the **Source Number** tab of the **NoUser** user. The OPTIONS period is determined in the following manner:

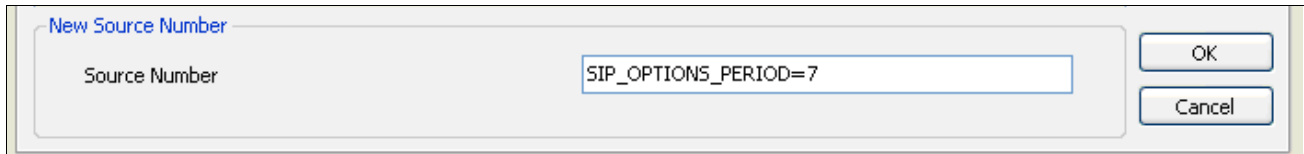
- If no **SIP_OPTIONS_PERIOD** parameter is defined and the **Binding Refresh Time** is 0, then the default value of 300 seconds is used.
- To establish a period less than 300 seconds, do not define a **SIP_OPTIONS_PERIOD** parameter and set the **Binding Refresh Time** to a value less than 300 seconds. The OPTIONS message period will be equal to the **Binding Refresh Time**.
- To establish a period greater than 300 seconds, a **SIP_OPTIONS_PERIOD** parameter must be defined. The **Binding Refresh Time** must be set to a value greater than 300 seconds. The OPTIONS message period will be the smaller of the **Binding Refresh Time** and the **SIP_OPTIONS_PERIOD**.

For the compliance test, an OPTIONS period of 2 minutes was used. Thus, the **Binding Refresh Time** was set to **120** seconds (2 minutes) in **Section 5.1** and no **SIP_OPTIONS_PERIOD** parameter was defined.

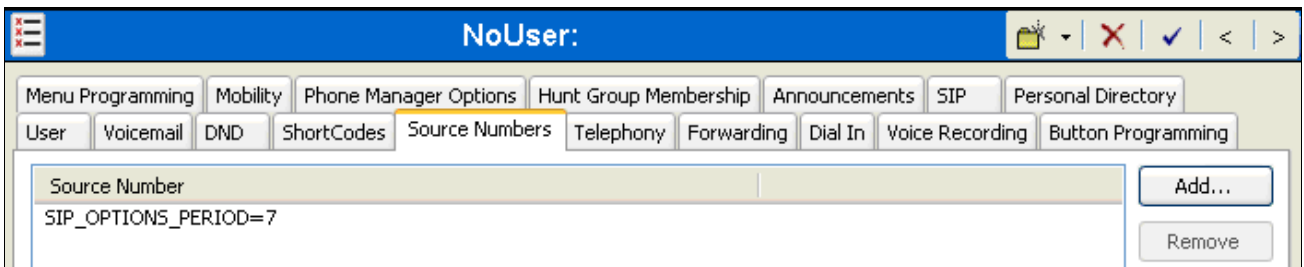
Alternatively, if an OPTIONS period greater than 300 seconds is desired then set the **Binding Refresh Time** to a value greater than 300 seconds and define the **SIP_OPTIONS_PERIOD** by doing the following. Navigate to **User** → **NoUser** in the Navigation Pane. Select the **Source Numbers** tab in the Details Pane. Click the **Add** button.



At the bottom of the Details Pane, the **Source Number** field will appear. Enter **SIP_OPTIONS_PERIOD=X**, where **X** is the desired value in minutes. Click **OK**.



The **SIP_OPTIONS_PERIOD** parameter will appear in the list of Source Numbers as shown below. Click the **OK** button (not shown).



The resulting OPTIONS message period will be the smaller of the **Binding Refresh Time** and the **SIP_OPTIONS_PERIOD** parameter.

5.10. Save Configuration

Navigate to **File** → **Save Configuration** in the menu bar at the top of the screen to save the configuration performed in the preceding sections.

6. CenturyLink BroadWorks SIP Trunk Configuration

CenturyLink is responsible for the configuration of the CenturyLink BroadWorks SIP Trunk. The customer will need to provide the IP address used to reach the Avaya IP Office at the enterprise. CenturyLink will provide the customer the necessary information to configure the Avaya IP Office SIP connection to CenturyLink including:

- CenturyLink SIP domain
- IP address of the CenturyLink SIP proxy and port number used for SIP traffic
- DID numbers to assign to users
- Supported codecs
- All IP addresses and port numbers used for signaling or media that will need access to the enterprise network through any security devices.

7. Verification Steps

The following steps may be used to verify the configuration:

- Use the Avaya IP Office System Status application to verify the state of the SIP connection. Launch the application. Select the SIP line of interest from the left pane. On the **Status** tab in the right pane, verify that the **Current State** is a non-error state such as **Idle** for each channel.

The screenshot shows the Avaya IP Office System Status application. The left sidebar contains a navigation menu with categories like System, Alarms (2), Extensions (19), Trunks (11), Active Calls, Resources, Voicemail, and IP Networking. The main content area is titled "IP Office System Status" and has tabs for Status, Utilization Summary, and Alarms. The "Status" tab is active, displaying a "SIP Trunk Summary" for Line 19. The summary includes fields for Peer Domain Name (bsoft.nc.labnet), Resolved Address (10.2.2.247), Line Number (19), Number of Administered Channels (10), Number of Channels in Use (0), Administered Compression (G711 Mu), Silence Suppression (Off), SIP Trunk Channel Licenses (Unlimited), and SIP Trunk Channel Licenses in Use (0). A green progress indicator shows 0% utilization. Below the summary is a table with columns for Channel Number, URI, Call Ref, Current State, Time in State, Remote Media, Co..., Conn..., Caller ID or ... on Call, Other Party, Directi..., Round Trip ..., Receive Jitter, Receive Pack..., and Trans... Tr... The table shows 8 channels, all in an "Idle" state with a time in state of "00:36...". At the bottom of the application, there are buttons for Trace, Trace All, Pause, Ping, Call Details, Print..., and Save As...

- Select the **Alarms** tab and verify that no alarms are active on the SIP line.

The screenshot shows the "Alarms" tab selected in the application. The title is "Alarms for Line: 19 SIP bsoft.nc.labnet". Below the title is a table with columns for Last Date Of Error, Occurrences, and Error Description. The table is currently empty, indicating no active alarms.

- Verify that a phone connected to Avaya IP Office can successfully place a call to the PSTN with two-way audio.
- Verify that a phone connected to PSTN can successfully place a call to the Avaya IP Office with two-way audio.

8. Conclusion

The CenturyLink BroadWorks SIP Trunk service passed compliance testing. These Application Notes describe the procedures required to configure the connectivity between Avaya IP Office and the CenturyLink BroadWorks SIP Trunk service as shown in **Figure 1**.

9. Additional References

- [1] *IP Office Documentation CD*, December 2011
- [2] *IP Office Installation Manual*, Document number 15-601042, December 2011.
- [3] *IP Office Manager Manual*, Document number 15-601011, December 2011.
- [4] *IP Office System Status Application*, Document number 15-601758, November 2011.

Product documentation for Avaya products may be found at <http://support.avaya.com>. Product documentation for the CenturyLink BroadWorks SIP Trunk service is available from CenturyLink.

Appendix: SIP Line Template

Avaya IP Office Release 8.0 supports a SIP Line Template (in xml format) that can be created from an existing configuration and imported into a new installation to simplify configuration procedures as well as to reduce potential configuration errors.

Not all of the configuration information is included in the SIP Line Template. Therefore, it is critical that the SIP Line configuration be verified/updated after a template has been imported and additional configuration be supplemented using **Section 5.4** in these Application Notes as a reference.

The SIP Line Template created from the configuration as documented in these Application Notes is as follows:

```
<?xml version="1.0" encoding="utf-8" ?>
<Template xmlns="urn:SIPTrunk-schema">
  <TemplateType>SIPTrunk</TemplateType>
  <Version>20120322</Version>
  <SystemLocale>enu</SystemLocale>
  <DescriptiveName>CenturyLink</DescriptiveName>
  <ITSPDomainName>bsoft.nc.labnet</ITSPDomainName>
  <SendCallerID>CallerIDDIV</SendCallerID>
  <ReferSupport>false</ReferSupport>
  <ReferSupportIncoming>2</ReferSupportIncoming>
  <ReferSupportOutgoing>2</ReferSupportOutgoing>
  <RegistrationRequired>false</RegistrationRequired>
  <UseTelURI>false</UseTelURI>
  <CheckOOS>true</CheckOOS>
  <CallRoutingMethod>1</CallRoutingMethod>
  <OriginatorNumber />
  <AssociationMethod>SourceIP</AssociationMethod>
  <LineNamePriority>SystemDefault</LineNamePriority>
  <ITSPProxy>10.2.2.247</ITSPProxy>
  <LayerFourProtocol>SipUDP</LayerFourProtocol>
  <SendPort>6002</SendPort>
  <ListenPort>5060</ListenPort>
  <DNSServerOne>0.0.0.0</DNSServerOne>
  <DNSServerTwo>0.0.0.0</DNSServerTwo>
  <CallsRouteViaRegistrar>true</CallsRouteViaRegistrar>
  <SeparateRegistrar />
  <CompressionMode>AUTOSELECT</CompressionMode>
  <UseAdvVoiceCodecPrefs>true</UseAdvVoiceCodecPrefs>
  <AdvCodecPref>G.711 ULAW 64K</AdvCodecPref>
  <CallInitiationTimeout>4</CallInitiationTimeout>
  <DTMFSupport>DTMF_SUPPORT_RFC2833</DTMFSupport>
  <VoipSilenceSuppression>false</VoipSilenceSuppression>
  <ReinviteSupported>true</ReinviteSupported>
```

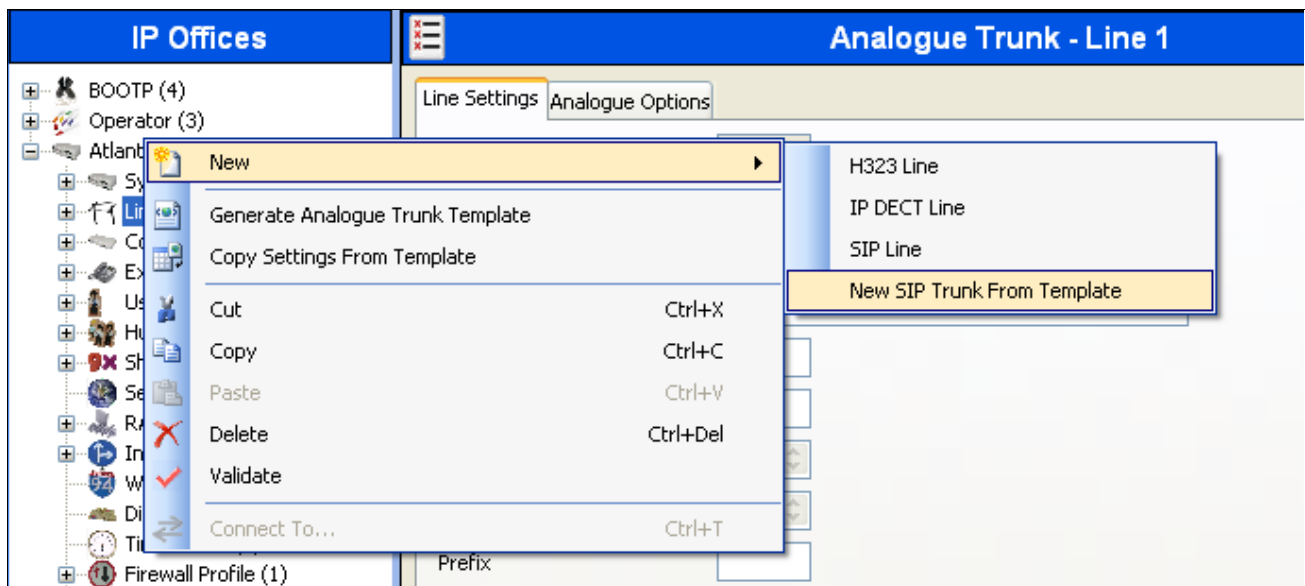
```

<FaxTransportSupport>FOIP_G711</FaxTransportSupport>
<UseOffererPrefferedCodec>false</UseOffererPrefferedCodec>
<CodecLockdown>false</CodecLockdown>
<Rel100Supported>false</Rel100Supported>
<T38FaxVersion>3</T38FaxVersion>
<Transport>UDPTL</Transport>
<LowSpeed>0</LowSpeed>
<HighSpeed>0</HighSpeed>
<TCFMethod>Trans_TCF</TCFMethod>
<MaxBitRate>FaxRate_14400</MaxBitRate>
<EflagStartTimer>2600</EflagStartTimer>
<EflagStopTimer>2300</EflagStopTimer>
<UseDefaultValues>true</UseDefaultValues>
<ScanLineFixup>true</ScanLineFixup>
<TFOPEnhancement>true</TFOPEnhancement>
<DisableT30ECM>false</DisableT30ECM>
<DisableEflagsForFirstDIS>false</DisableEflagsForFirstDIS>
<DisableT30MRCompression>false</DisableT30MRCompression>
<NSFOVERRIDE>false</NSFOVERRIDE>
</Template>

```

To import the above template into a new installation:

1. On the PC where Avaya IP Office Manager is installed, copy and paste the above template into a text document named **US_CenturyLink_SIPTrunk.xml**. Move the .xml file to the Avaya IP Office Manager template directory (C:\Program Files\Avaya\IP Office\Manager\Templates).
2. Import the template into an Avaya IP Office installation by creating a new SIP Line as shown in the screenshot below. In the Navigation Pane on the left, right-click on **Line** then navigate to **New → New SIP Trunk From Template**:



3. Verify that **United States** is automatically populated for **Country** and **CenturyLink** is automatically populated for **Service Provider** in the resulting Template Type Selection screen as shown below. Click **Create new SIP Trunk** to finish the importing process.

Template Type Selection

Locale: United States (US English)

Country: United States

Service Provider: CenturyLink Display All

Create new SIP Trunk Cancel

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