



Avaya Solution & Interoperability Test Lab

Sample Configuration for SIP Trunking between Avaya IP Office R6.1 and Cisco Unified Communications Manager 8.0 – Issue 1.0

Abstract

These Application Notes describe the steps for configuring a SIP trunk between Avaya IP Office R6.1 and Cisco Unified Communications Manager (CUCM) Release 8.0.

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1. Introduction

Session Initiation Protocol (SIP) is a standards-based communication protocol capable of supporting voice, video, instant messaging and other multi-media communication. These Application Notes will outline a solution for using SIP as a trunking protocol between Avaya IP Office and Cisco Unified Communications Manager.

2. Overview

The sample network shown in **Figure 1** consists of two IP PBX systems each belonging to a different domain with its own dialing plan. The Avaya IP PBX system consists of Avaya IP Office system capable of supporting a variety of Avaya 1600 Series IP Telephones along with digital and analog phone/fax stations. The Cisco IP PBX system consists of Cisco Unified Communications Manager (CUCM) supporting Cisco SIP and SCCP stations along with analog fax station through the use of an optional Cisco VG248 gateway (not shown). A SIP trunk is configured between Avaya IP Office and CUCM to support calling between the Avaya and Cisco IP PBX systems. With the use of the SIP trunk trans-coding, media and protocol conversion, calls between any 2 telephones are supported in this sample network regardless of whether they are between SIP, H.323, digital, SCCP or analog stations.

3. Configuration

Figure 1 illustrates the configuration used in these Application Notes. All IP telephones in the 33.1.1.0/24 IP network are registered with Avaya IP Office and use extension 2xx. All IP telephones in the 10.80.60.0/24 IP network are registered with CUCM and use extension 8xxx. A single SIP trunk between Avaya IP Office and CUCM manages call control between the Avaya and Cisco IP PBX systems.

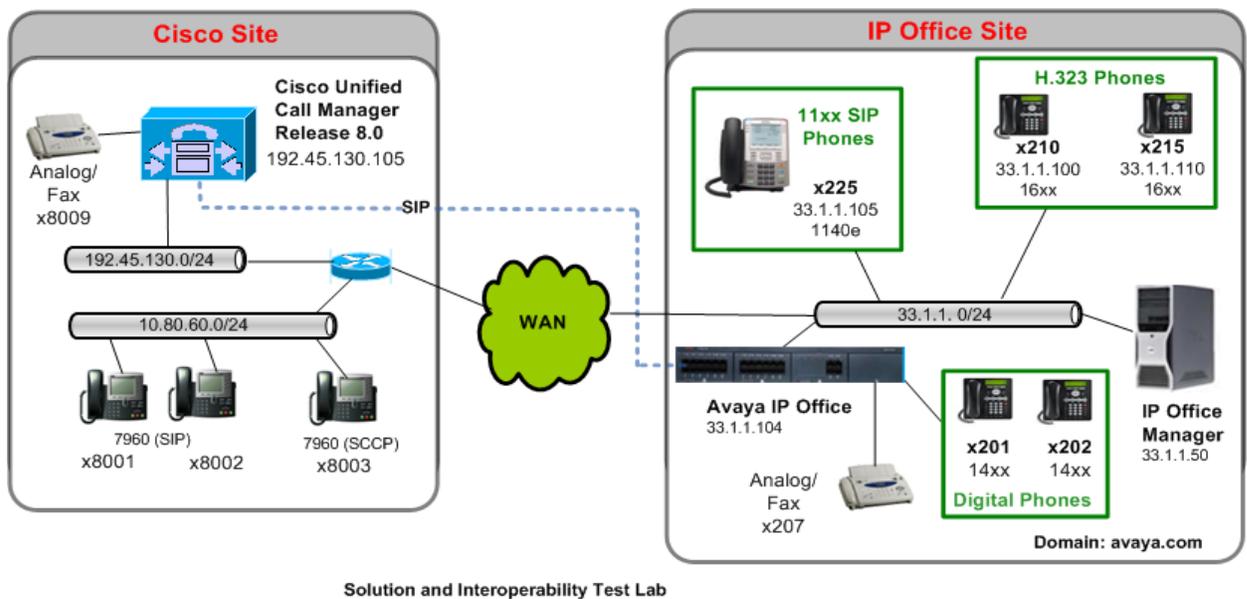


Figure 1: Sample Network Configuration

4. Equipment and Software Validated

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

DEVICE DESCRIPTION	VERSION TESTED
Avaya IP Office 500v2	6.1(5)
Avaya IP Office Manager	8.1(5)
Avaya 1608/1616L IP Telephone (H323)	1.22
Avaya 1408 Digital Telephone	n/a
Avaya 1140eSIP	4.0
Cisco Unified Communications Manager	8.0.3.20000-2
Cisco 7960 Unified IP Phone (SIP)	P0S3-8-12-0
Cisco 7960 Unified IP Phone (SCCP)	8.1 (2.0)

5. Configure Cisco Unified CM

This section describes the SIP Trunk configuration for CUCM as shown in **Figure 1**. Fields left using default values are not highlighted. It is assumed that the basic configuration needed to support the VG248 gateway (needed for analog phone and fax support) and support for Cisco IP telephones has been completed. For further information on Cisco UCM, please consult **Section 10**: references [3]-[7].

5.1. Login to Cisco Unified CM Administration

Open Cisco Unified CM Administration by entering the IP address of the CUCM into the Web Browser address field, and log in using an appropriate Username and Password.

Cisco Unified CM Administration
For Cisco Unified Communications Solutions

Navigation Cisco Unified CM

Cisco Unified CM Administration

Username

Password

Login Reset

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

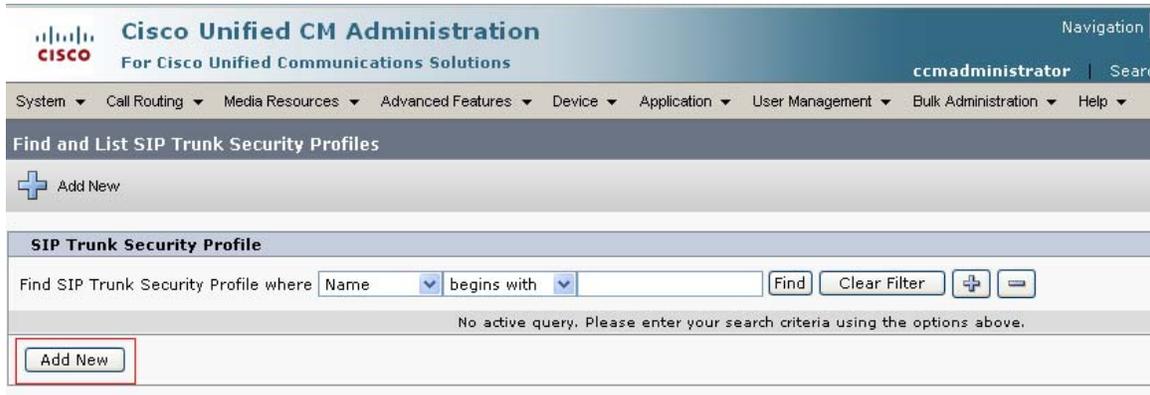
A summary of U.S. laws governing Cisco cryptographic products may be found at our [Export Compliance Product Report](#) web site.

For information about Cisco Unified Communications Manager please visit our [Unified Communications System Documentation](#) web site.

For Cisco Technical Support please visit our [Technical Support](#) web site.

5.2. Add a SIP Trunk Security Profile

Select **System** → **Security Profile** → **SIP Trunk Security Profile** from the top menu then click **Add New** to add a new SIP Trunk Security Profile.



The following is a screen capture of the SIP Trunk Security Profile used in the sample network. The following values were used in the sample configuration:

- Name A descriptive name for the profile
- Device Security Mode “**Non Secure**” indicates unencrypted SIP signaling
- Incoming Transport Type “**TCP+UDP**” indicates CUCM will listen for both protocols
- Outgoing Transport Type “**TCP**” indicates CUCM will only use TCP to initiate SIP signaling
- Incoming Port “**5060**”. Typical value for UDP and TCP SIP Signaling

- Accept Presence Subscription Enable
- Accept Out-of-Dialog REFER ** Enable
- Accept Unsolicited Notification Enable
- Accept Replaces Header Enable

Cisco Unified CM Administration
For Cisco Unified Communications Solutions

System ▾ Call Routing ▾ Media Resources ▾ Advanced Features ▾ Device ▾ Application ▾ User Management ▾

SIP Trunk Security Profile Configuration

 Save

Status

 Status: Ready

SIP Trunk Security Profile Information

Name*

Description

Device Security Mode

Incoming Transport Type*

Outgoing Transport Type

Enable Digest Authentication

Nonce Validity Time (mins)*

X.509 Subject Name

Incoming Port*

Enable Application Level Authorization

Accept Presence Subscription

Accept Out-of-Dialog REFER**

Accept Unsolicited Notification

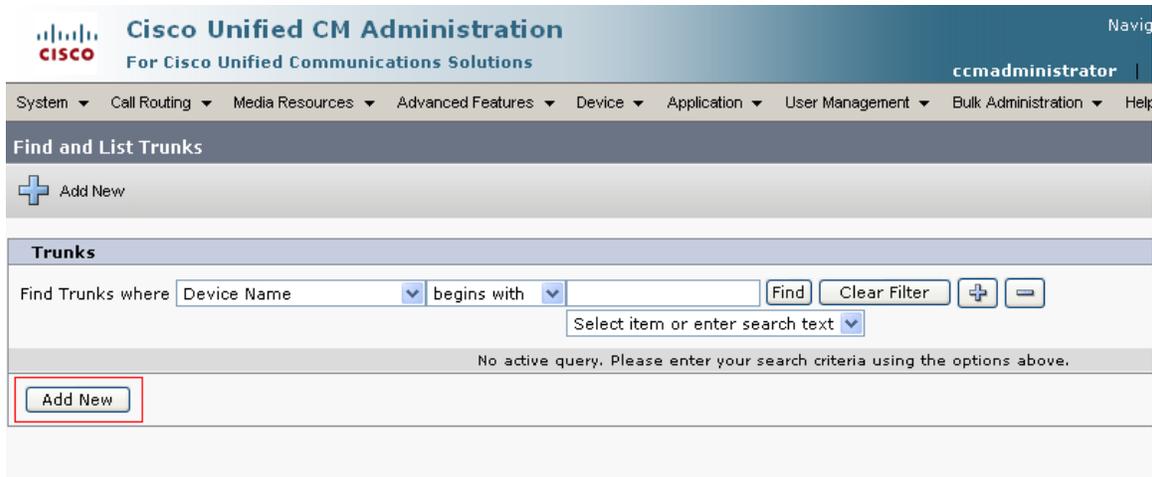
Accept Replaces Header

Transmit Security Status

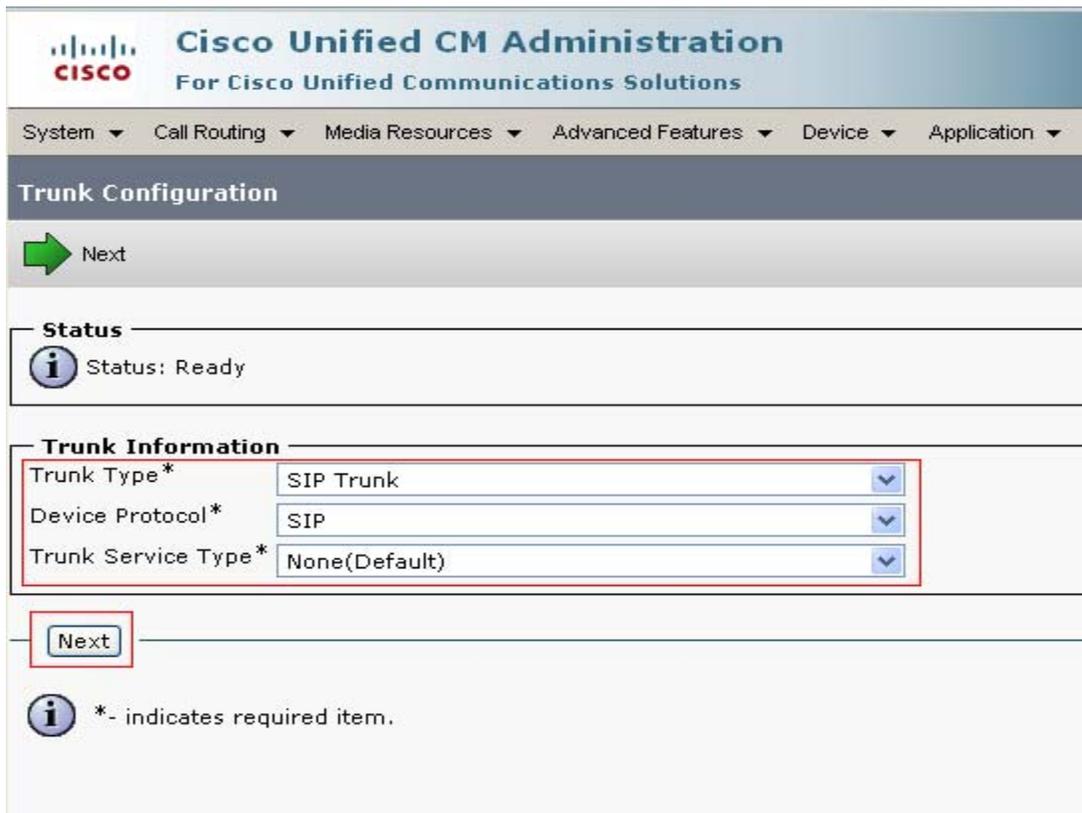
Click **Save** to commit the configuration.

5.3. Create a SIP Trunk

Select **Device** → **Trunk** from the top menu then click **Add New** to begin adding a new SIP trunk.



Select **SIP Trunk** as the **Trunk Type** and the **Device Protocol** field will automatically change to **SIP**. Click **Next** to continue.



Enter the following information for the SIP Trunk.

- **Device Name** A descriptive name/identifier for the SIP Trunk.
(Make sure there are no spaces in the device name).
- **Description** Additional descriptive information about the SIP Trunk
- **Device Pool** Select **Default**
- **Media Termination Point Required** This will cause CUCM to include SDP information in its initial SIP Invite message.

The screenshot shows the Cisco Unified CM Administration interface for configuring a SIP Trunk. The 'Device Information' section is highlighted with a red box. The configuration details are as follows:

Field	Value
Product	SIP Trunk
Device Protocol	SIP
Trunk Service Type	None(Default)
Device Name*	SIP_to_IPO_6.1
Description	Direct SIP Trunk to IPO 6.1
Device Pool*	Default
Common Device Configuration	< None >
Call Classification*	Use System Default
Media Resource Group List	< None >
Location*	Hub_None
AAR Group	< None >
Packet Capture Mode*	None
Packet Capture Duration	0
<input checked="" type="checkbox"/> Media Termination Point Required	
<input checked="" type="checkbox"/> Retry Video Call as Audio	
<input type="checkbox"/> Transmit UTF-8 for Calling Party Name	
<input type="checkbox"/> Unattended Port	
<input type="checkbox"/> SRTP Allowed - When this flag is checked, Encrypted TLS needs to be configured in the network to provide end to end security. Failure to do so will e information.	
Route Class Signaling Enabled*	Default
Use Trusted Relay Point*	Default
<input checked="" type="checkbox"/> PSTN Access	

Scroll down to the section titled **SIP Information** and fill in the fields as indicated below.

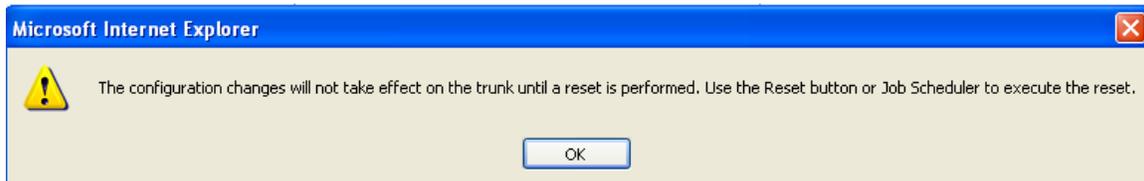
- **Destination Address** IP Address of IP Office
- **Destination Port** Port 5060 is typically used for TCP and UDP SIP signaling
- **SIP Trunk Security Profile** Use the Security Profile defined in **Section 5.2**
- **DTMF Signaling Method** Select **RFC2833**.

SIP Information	
Destination Address	33.1.1.104
Destination Address IPv6	
<input type="checkbox"/> Destination Address is an SRV	
Destination Port*	5060
MTP Preferred Originating Codec*	711ulaw
Presence Group*	Standard Presence group
SIP Trunk Security Profile*	SIP Trunk to IPO 6.1
Rerouting Calling Search Space	< None >
Out-Of-Dialog Refer Calling Search Space	< None >
SUBSCRIBE Calling Search Space	< None >
SIP Profile*	Standard SIP Profile
DTMF Signaling Method*	RFC 2833

Geolocation Configuration	
Geolocation	< None >
Geolocation Filter	< None >
<input type="checkbox"/> Send Geolocation Information	

Click **Save** to complete.

Following screen will appear and click **OK**.



Follow the instructions from **Section 10**, Reference 5 and perform a reset for the Cisco Call Manager.

Create a Route Pattern

Select **Call Routing** → **Route/Hunt** → **Route Pattern** then click **Add New** to add a new route pattern for extension **2xx** which are for telephones registered with Avaya IP Office.

The screenshot shows the Cisco Unified CM Administration web interface. At the top, there is a navigation bar with the Cisco logo and the text "Cisco Unified CM Administration For Cisco Unified Communications Solutions". The user is logged in as "ccmadministrator". Below the navigation bar, there is a menu with options: System, Call Routing, Media Resources, Advanced Features, Device, Application, User Management, and Bulk Administration. The main content area is titled "Find and List Route Patterns". There is a "+ Add New" button. Below this, there is a search section with the text "Route Patterns". The search criteria are set to "Pattern" and "begins with". There are "Find", "Clear Filter", and "+" buttons. A message below the search section reads "No active query. Please enter your search criteria using the options above." At the bottom of the search section, there is a red-bordered "Add New" button.

The following screen shows the route pattern used in the sample network. The route pattern **2xx** will cause all 3-digit calls beginning with “2” to be routed to the SIP Trunk defined in **Section 5.3**. Click **Save** to complete.

Cisco Unified CM Administration
For Cisco Unified Communications Solutions

System ▾ Call Routing ▾ Media Resources ▾ Advanced Features ▾ Device ▾ Application ▾ User Management ▾ Bulk Admin

Route Pattern Configuration

 Save

Status
 Status: Ready

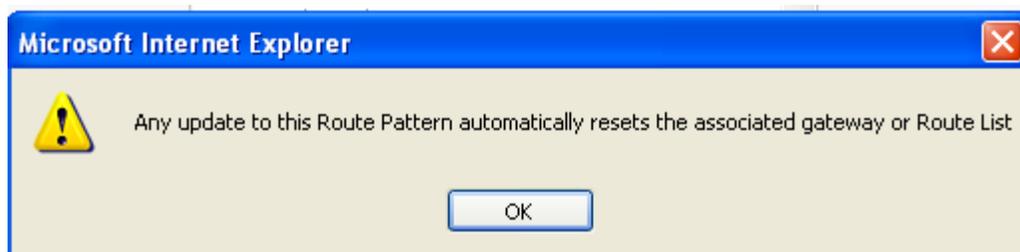
Pattern Definition

Route Pattern*	2XX
Route Partition	< None >
Description	to IPO R6.1
Numbering Plan	-- Not Selected --
Route Filter	< None >
MLPP Precedence*	Default
Resource Priority Namespace Network Domain	< None >
Route Class*	Default
Gateway/Route List*	SIP_to_IPO_6.1 (Edit)
Route Option	<input checked="" type="radio"/> Route this pattern <input type="radio"/> Block this pattern No Error
Call Classification*	OffNet
<input type="checkbox"/> Allow Device Override <input checked="" type="checkbox"/> Provide Outside Dial Tone <input type="checkbox"/> Allow Overlap Sending <input type="checkbox"/> Urgent Priority <input type="checkbox"/> Require Forced Authorization Code	
Authorization Level*	0
<input type="checkbox"/> Require Client Matter Code	

Following screen will appear and click **OK**.



Following screen will appear and click **OK**.

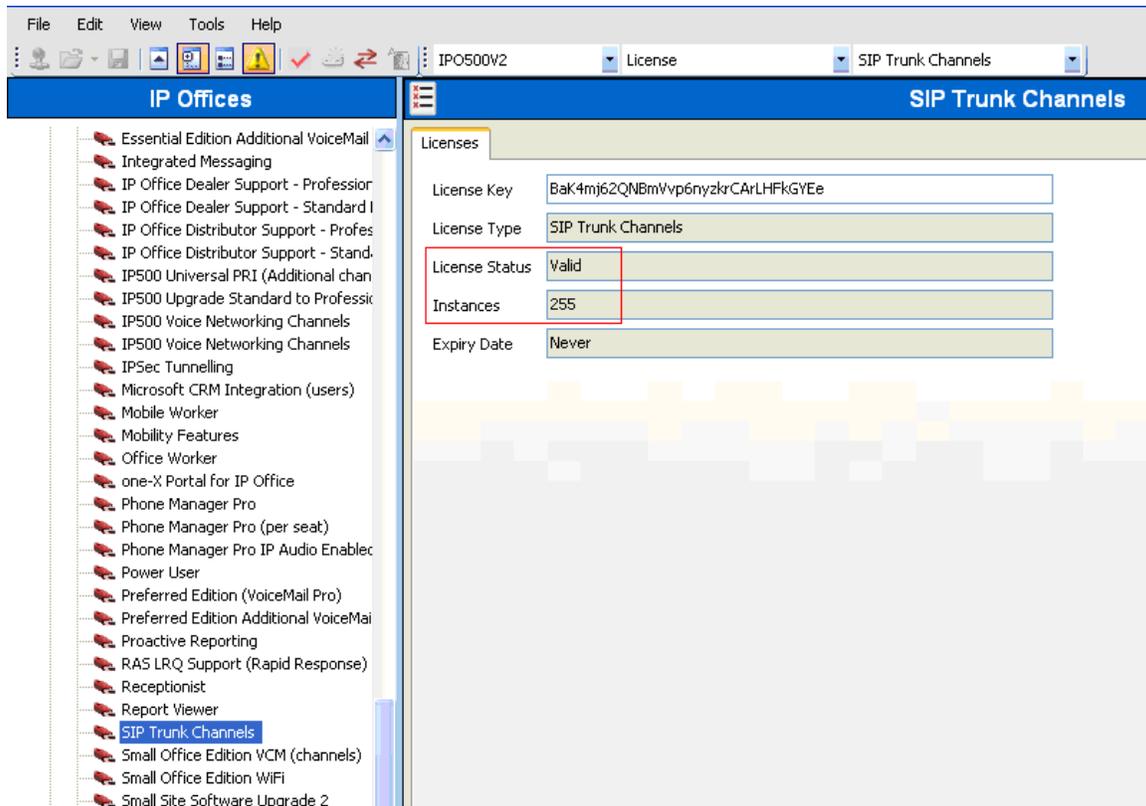


6. Configure Avaya IP Office

This section describes the SIP Trunk configuration for Avaya IP Office as shown in **Figure 1**. It is assumed that the basic configuration has been completed and Avaya IP Office is accessible from the network. Begin by connecting to the Avaya IP Office using the Avaya IP Office Manager and log in using an appropriate User name and Password. Fields that need to be configured are highlighted, all other fields are left with their default value. For further information on Avaya IP Office, please consult **Section 10: Reference [1]**.

6.1. Verify SIP License

Select **License** → **SIP Trunk Channels** from the left panel menu and verify that there is a valid **SIP Trunk Channel** license and the quantity. If a required feature is not enabled or there is insufficient capacity, contact an authorized Avaya sales representative to make the appropriate changes.

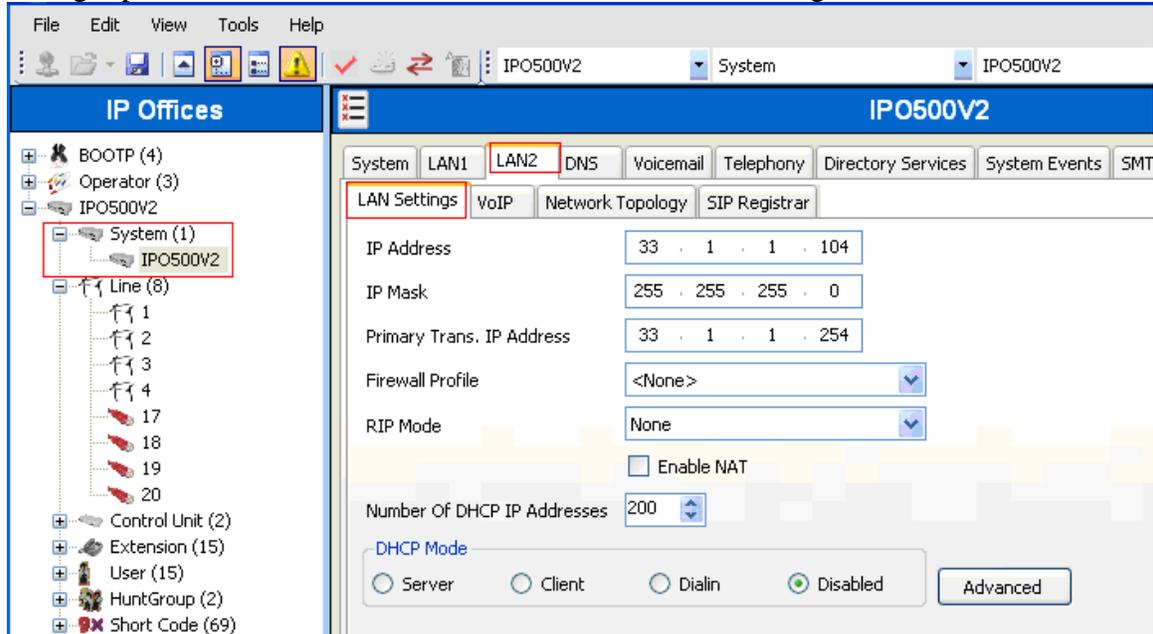


The screenshot displays the Avaya IP Office Manager interface. The left-hand navigation pane shows a list of IP Office features, with 'SIP Trunk Channels' selected and highlighted in blue. The main window is titled 'SIP Trunk Channels' and shows the 'Licenses' section. The license details are as follows:

Field	Value
License Key	BaK4mj62QN8mVvp6nyzkrCARLHFkGYEe
License Type	SIP Trunk Channels
License Status	Valid
Instances	255
Expiry Date	Never

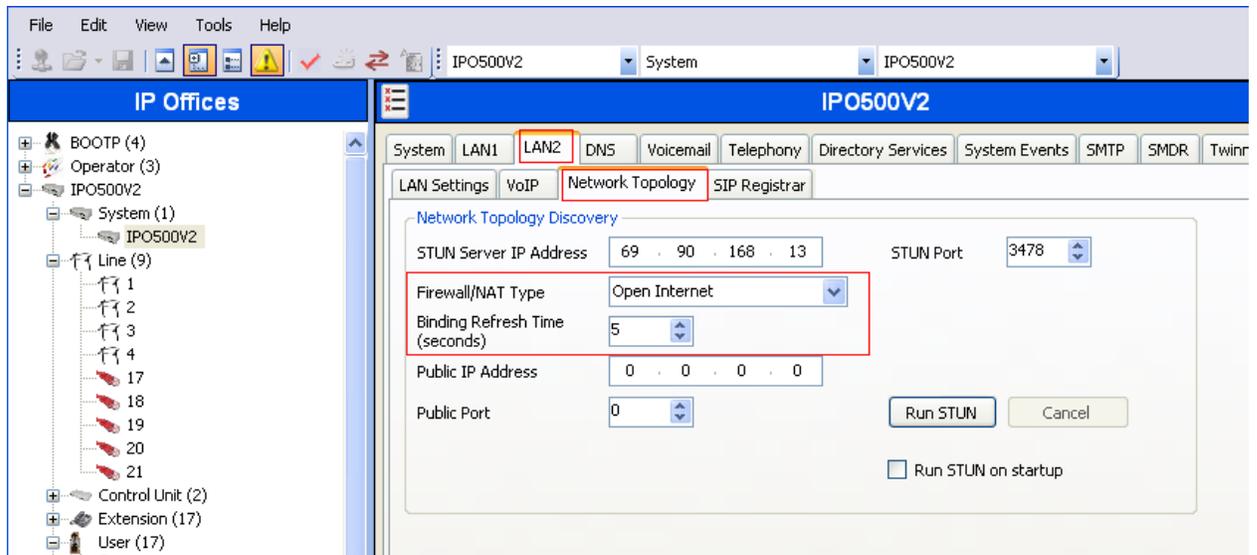
6.2. Obtain LAN IP Address

From the configuration tree in the left pane, select **System** to display the **IPO500V2** screen in the right pane. Select the **LAN2** tab, followed by the **LAN Settings** sub-tab in the right pane. This **IP Address** is used in **Section 5.3** to configure SIP Trunks.



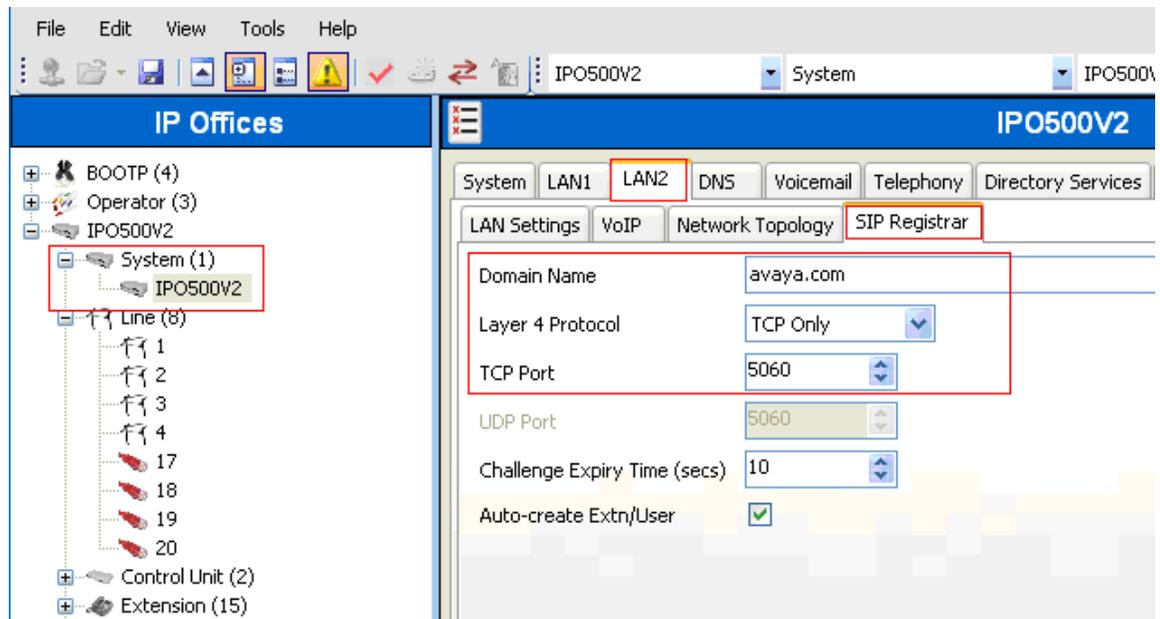
6.3. Configure Network Topology

From the configuration tree in the left pane, select **System** to display the **IPO500V2** screen in the right pane. Select the **LAN2** tab, followed by the **Network Topology** sub-tab in the right pane. Configure **Firewall/NAT Type** to “Open Internet”. Configure **Binding Refresh Time** to “5”. Click **OK**.



6.4. Administer SIP Registrar

Select **SIP Registrar** sub-tab in the right pane. Enter a valid **Domain Name**. Select **TCP only** from the drop down menu for **Layer 4 Protocol**. Make a note of the **TCP Port** number. These will be used later to configure SIP endpoints. Click **OK** (not shown).



6.5. Create a SIP Line

Select **Line** from the left panel menu and then right-click and select **New** → **SIP Line** to create an SIP line to CUCM.

In the **SIP Line** tab, enter the following

- **ITSP Domain Name:** Enter the domain name from **Section 6.4**
- **Call Routing Method:** Select “To Header” from drop down menu

The screenshot shows the 'SIP Line - Line 20*' configuration window. The 'SIP Line' tab is selected. The 'Line Number' is 20. The 'ITSP Domain Name' is 'avaya.com'. The 'Call Routing Method' is set to 'To Header'. The 'REFER Support' section is expanded, showing 'Incoming' and 'Outgoing' both set to 'Auto'. The 'In Service' checkbox is checked, and 'Check OOS' is also checked. The 'Use Tel URI' checkbox is unchecked. The 'Originator number for forwarded and twinning calls' field is empty.

In the **Transport** tab, enter the following

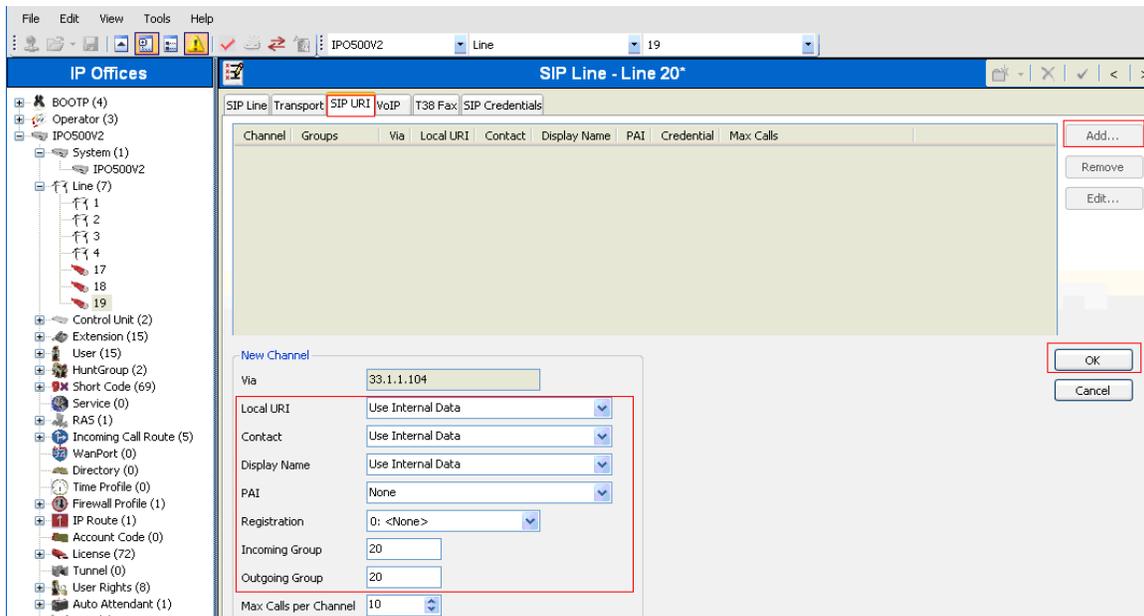
- **ITSP Proxy Address:** Enter the IP address of CUCM 8.0.
- **Layer 4 Protocol:** Select “TCP” from drop down menu
- **Send Port:** Select “5060” from drop down menu
- **Use Network Topology Info:** Select the LAN port from **Section 6.2**

The screenshot shows the 'SIP Line - Line 20*' configuration window with the 'Transport' tab selected. The 'ITSP Proxy Address' is '192.45.130.100'. The 'Layer 4 Protocol' is 'TCP' and the 'Send Port' is '5060'. The 'Use Network Topology Info' is 'LAN 2' and the 'Listen Port' is '5060'. The 'Explicit DNS Server(s)' field contains '0 . 0 . 0 . 0' and '0 . 0 . 0 . 0'. The 'Calls Route via Registrar' checkbox is checked. The 'Separate Registrar' field is empty.

In the **SIP URI** tab, select **Add** button and enter the following:

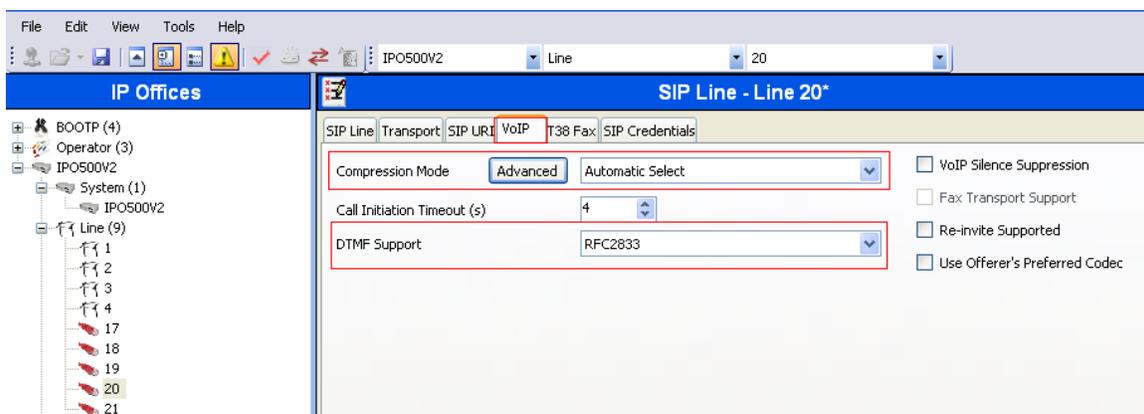
- **Local URI:** Select “Use Internal Data” from drop down menu
- **Contact:** Select “Use Internal Data” from drop down menu
- **Display Name:** Select “Use Internal Data” from drop down menu
- **Incoming Group:** Enter the line number created above
- **Outgoing Group:** Enter the line number created above

Select the **OK** button when done.



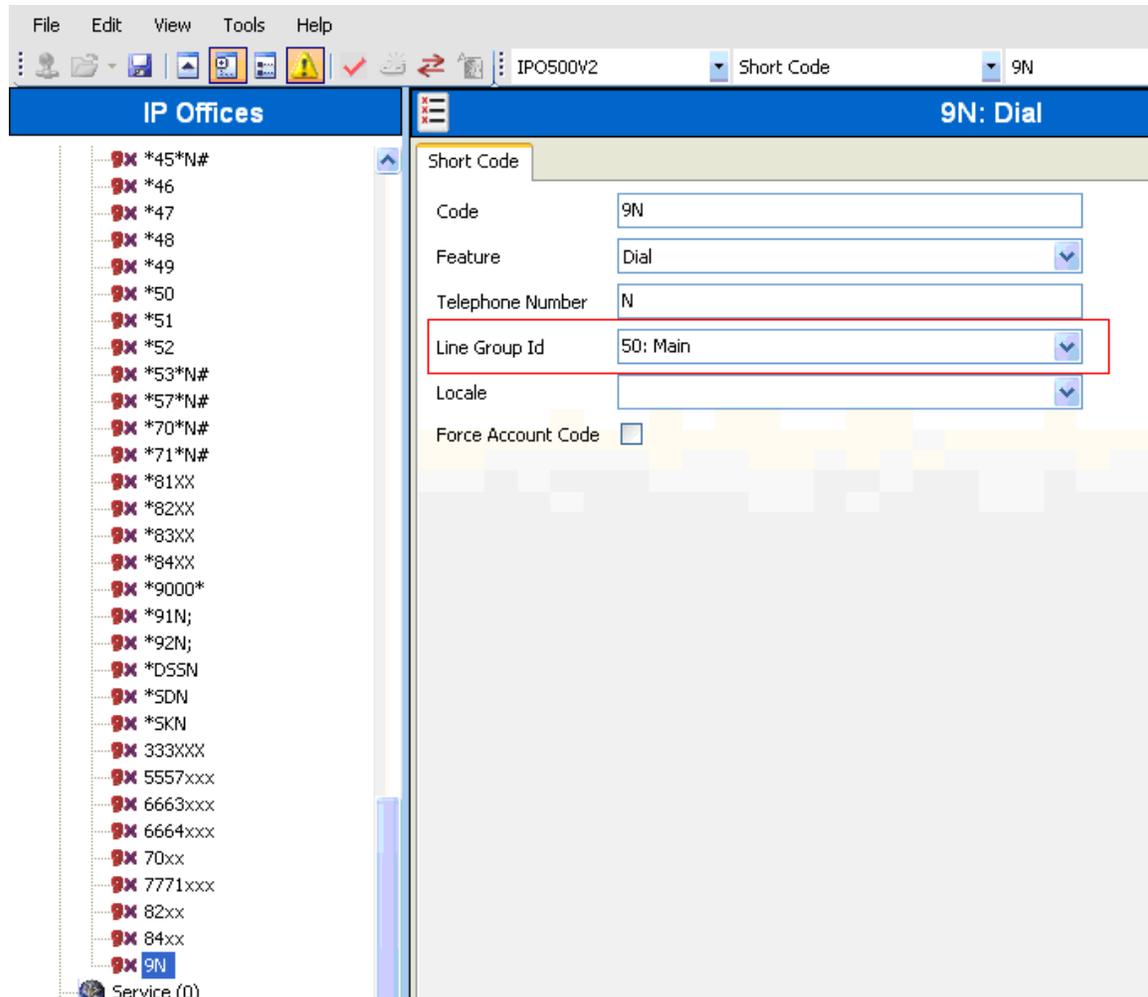
In the **VoIP** tab:

- Select **Automatic Select** for **Compression Mode**.
- **DTMF Support** should be set for **RFC2833**.
- Select the **OK** button (not shown) at the bottom of the screen once all changes have been made.

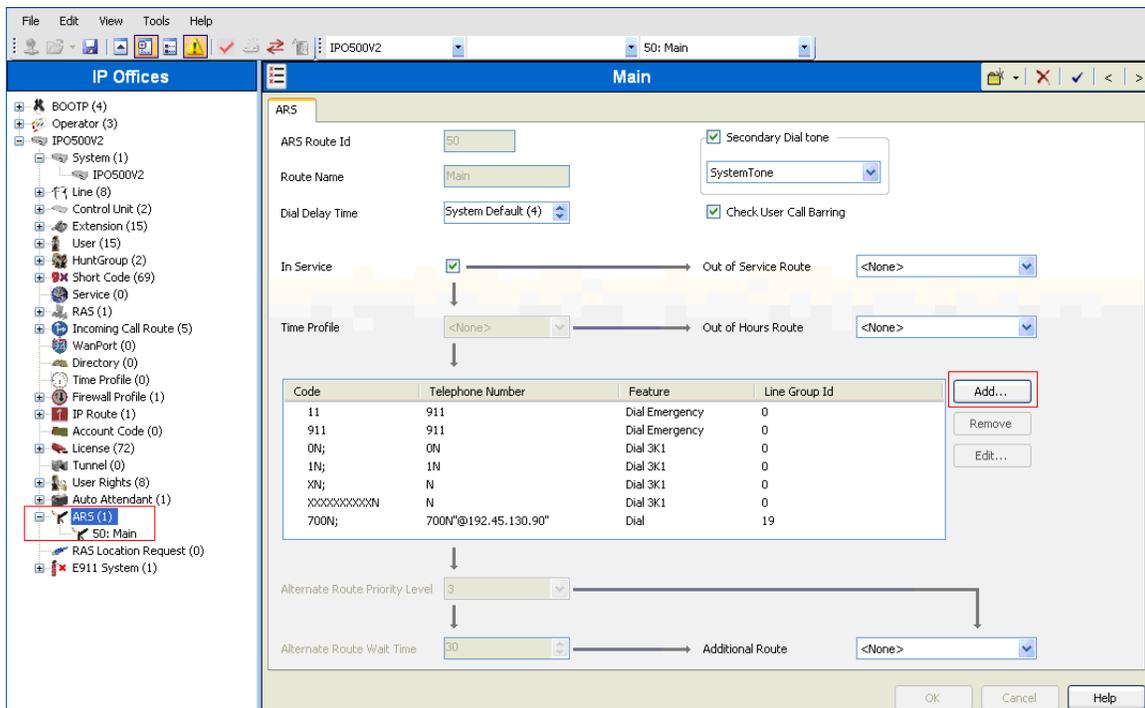


6.6. Create Outgoing Routing Entry for Calls to Cisco UCM

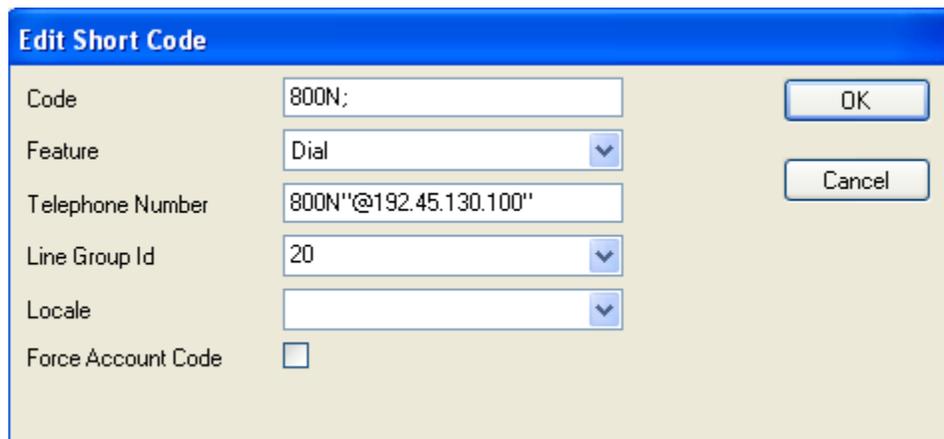
In the left pane, under **9x Short Codes**, by default there should be a short code for **9N** that routes calls to a default ARS group called **Main**. These Application Notes will use ARS to route call to CUCM. The screen capture below shows the default **9N** Short Code.



1. Select **ARS** → **Main** from the left panel menu, and then click on **Add** to create a new Code entry to route calls to CUCM. Note: 50:Main is the default Line Group Id for ARS.

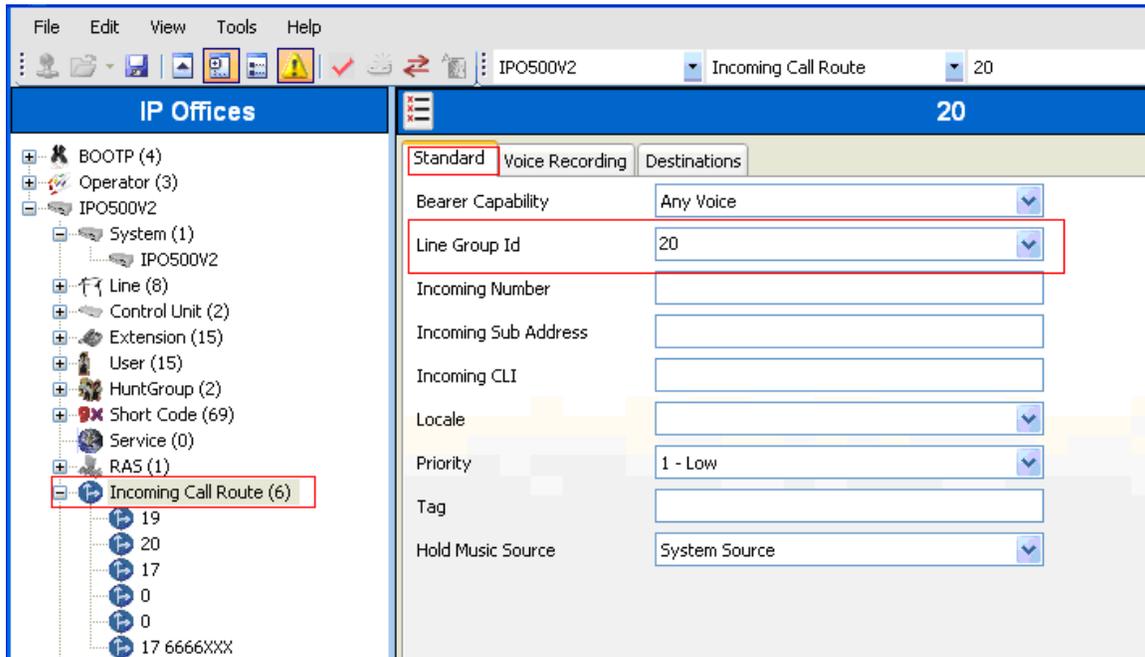


- Enter the appropriate information for the Code entry. The following screen capture shows a portion of the Cisco dialing plan “800” is being used as part of the Code. The Telephone Number is composed of the called phone number appended with “@” and the CUCM IP Address. **Line Group ID** created in **Section 6.5** will be used to send out the call.

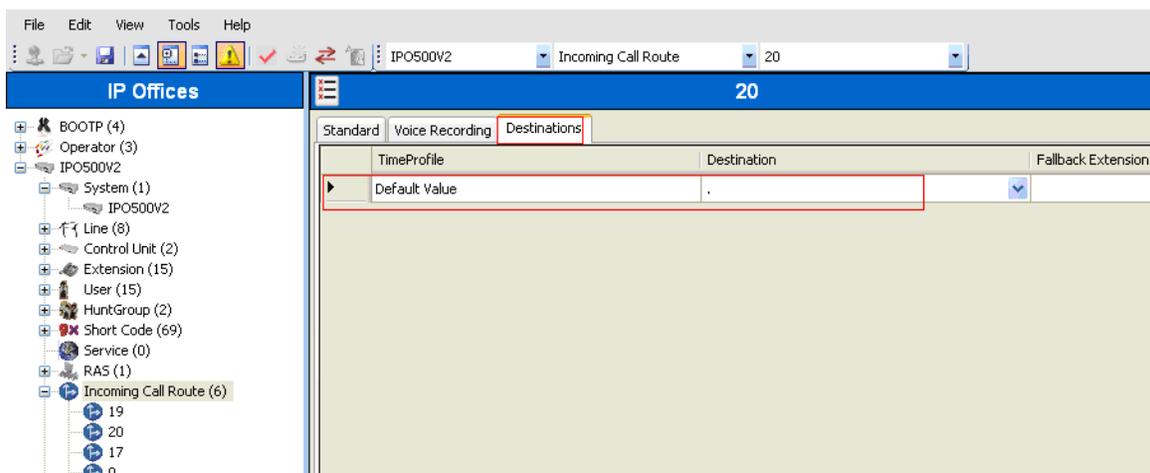


6.7. Create Incoming Routing Entry for Calls From Cisco UCM

1. Select **Incoming Call Route** from the left panel menu and then right-click it and select **New** (not shown) to create a new Incoming Call Route. Under the **Standard** tab, select the Line Group number created in **Section 6.5** in the **Line Group Id** field. The following screen shows the setting used in the sample network.



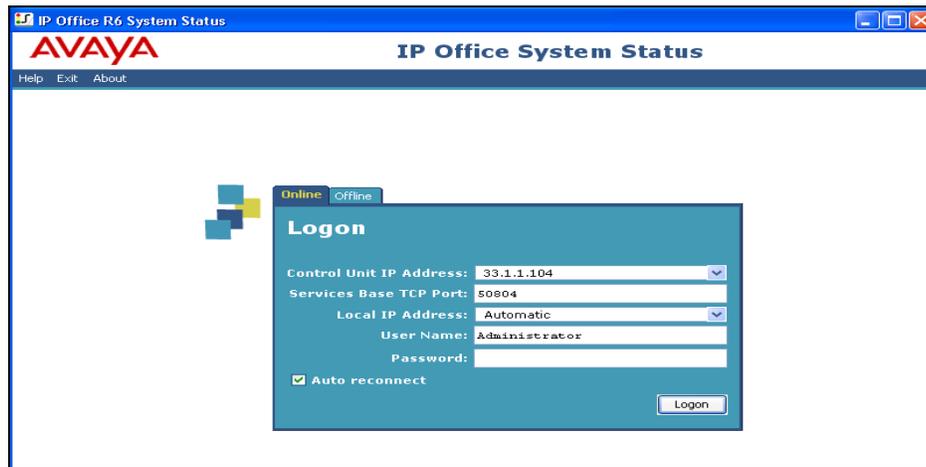
2. Under the **Destination** tab, enter “.” as the **Default Value**. The “.” indicates the incoming call can be routed to the extension specified by the caller. The following screen shows the setting used. Select the **OK** button when complete.



7. Verification

The following steps may be used to verify the configuration:

1. Call and trunk status (among other things) can be monitored using **IP Office System Status**. From IP Office Manager select the **File** menu → **Advanced** → **System Status**. Log in with appropriate credentials.



Once logged in, in the left-pane expand **Trunks** and select the appropriate SIP Trunk. In the sample configuration this is **Line 20**. The screen below shows 1 active call and several idle channels on Line 20.

The screenshot shows the main interface of the 'IP Office System Status' application. The left-hand pane shows a tree view with 'System', 'Alarms (2)', 'Extensions (13)', and 'Trunks (8)'. Under 'Trunks (8)', 'Line: 20' is selected. The main pane displays the 'SIP Trunk Summary' for Line 20. The summary includes the following information:

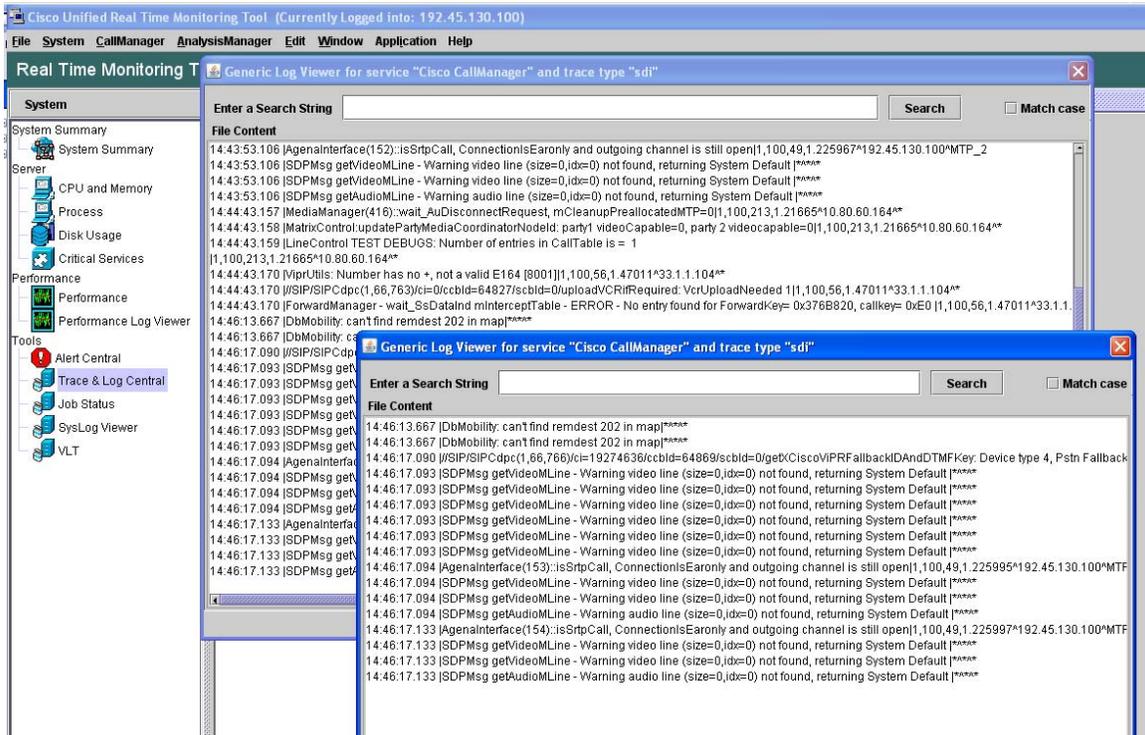
- Peer Domain Name: avaya.com
- Resolved Address: 192.45.130.100
- Line Number: 20
- Number of Administered Channels: 10
- Number of Channels in Use: 1
- Administered Compression: Auto
- Silence Suppression: Off
- SIP Trunk Channel Licences: Unlimited
- SIP Trunk Channel Licences in Use: 1
- SIP Device Features: REFER (incoming and outgoing), UPDATE (incoming and outgoing)

A green circle indicates 0% utilization. Below the summary is a table showing channel status:

Channel Number	URI	Call Ref	Current State	Time in State	Remote Address	RTI	Code	Connecti Type	Caller ID	Other Party	Direction of Call	Round Tr Delay	Receive Jitter	Receive Loss	Transmit Jitter	Transmit Loss
1	1	10	Conne...	00:00:08	192.45.1...	G7...	VCM	8001@...	Extn 202, Deb	Incoming	0ms	0ms	0%			
2			Idle	00:10:32												
3			Idle	00:10:32												
4			Idle	00:10:32												

Below the table is a 'Trace Output - All Channels' section with a scrollable list of SIP messages. At the bottom of the window are buttons for 'Trace Clear', 'Pause', 'Ping', 'Call Details', 'Print...', and 'Save As...'.

- The Cisco **Real Time Monitoring Tool (RTMT)** can be used to monitor events on Cisco UCM. This tool can be downloaded by selecting **Application → Plugins** from the top menu of the Cisco Unified CM Administration Web interface. The following is a screen capture of the Cisco Unified Communications Manager Real Time Monitoring Tool showing a call being traced in real time. For further information on this tool, please consult with reference **Section 10**: reference [7].



8. Features Tested

Basic calling features are supported including Hold, Transfer, Conference and Fax Pass-through. Supplemental features such as Call Forward All, Call Park/Unpark are also supported by this configuration.

8.1. Known Limitations

During interoperability testing, several functional limitations were observed:

- G.729 Codec is not supported with this solution.
- The version of IP Office shown in these Application Notes only supports an initial SIP Invite message that contains SDP information, which is not the default configuration for CUCM. One way to configure CUCM to include SDP with its initial SIP Invite message is to enable the **Media Terminal Point Required** option as shown in **Section 5.3**.
- A number of telephone display anomalies were observed while testing call-transfer and call-forwarding scenarios. In several test scenarios it was observed

that phones on both Cisco UCM and IP Office would not update their display with the 'connected to' name and/or number.

9. Conclusion

These Application Notes described the administrative steps required to configure a SIP trunk to support calls between Avaya IP Office and a Cisco Unified Communications Manager system.

10. Additional References

Product documentation for Avaya products may be found at <http://support.avaya.com>

- [1] *Avaya IP Office Release 6.1 Manager 8.0*
- [2] *Avaya IP Office 6.1: IP Office Installation*

Product documentation for Cisco Systems products may be found at <http://www.cisco.com>

- [3] *Cisco Unified IP Phones 7960G/7940G Administration Guide for Cisco Unified Communications Manager 7.0 (SCCP)*, Part Number: OL-15498-01
- [4] *Cisco Unified IP Phones 7960G/7940G Administration Guide for Cisco Unified Communications Manager 7.0 (SIP)*, Part Number: OL-15499-01
- [5] *Cisco Unified Communications Manager Administration Guide 7.1(2)*, Release 7.1(2), Part Number: OL-18611-01
- [6] *Cisco Unified Communications Manager Features and Services Guide*, Release 7.1(2), Part Number: OL-18610-01
- [7] *Cisco Unified Real-Time Monitoring Tool Administration Guide*, Release 7.1(2), Part Number: OL-18620-01

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