Configuration Note

AudioCodes Professional Services – Interoperability Lab

Connecting Cisco Unified Communications Manager Ver. 14.0 with Microsoft® Teams Direct Routing using AudioCodes Mediant™ SBC

Version 7.4

Microsoft Partner
Gold Communications

CallManager

Microsoft Teams

audiocodes

Table of Contents

Notice

Information contained in this document is believed to be accurate and reliable at the time of printing. However, due to ongoing product improvements and revisions, AudioCodes cannot guarantee accuracy of printed material after the Date Published nor can it accept responsibility for errors or omissions. Updates to this document can be downloaded from https://www.audiocodes.com/library/technical-documents.

This document is subject to change without notice.

Date Published: July-25-2023

WEEE EU Directive

Pursuant to the WEEE EU Directive, electronic and electrical waste must not be disposed of with unsorted waste. Please contact your local recycling authority for disposal of this product.

Customer Support

Customer technical support and services are provided by AudioCodes or by an authorized AudioCodes Service Partner. For more information on how to buy technical support for AudioCodes products and for contact information, please visit our website at https://www.audiocodes.com/services-support/maintenance-and-support.

Stay in the Loop with AudioCodes

Abbreviations and Terminology

Each abbreviation, unless widely used, is spelled out in full when first used.

Document Revision Record

LTRT	Description
29314	Initial document release for CUCM Version 14.0.1 and SBC Version 7.4.

Documentation Feedback

AudioCodes continually strives to produce high quality documentation. If you have any comments (suggestions or errors) regarding this document, please fill out the Documentation Feedback form on our website at https://online.audiocodes.com/documentation-feedback.

1 Introduction

This Configuration Note describes how to set up the AudioCodes Session Border Controller (hereafter, referred to as *SBC*) for interworking between Cisco CUCM and Microsoft's Teams Direct Routing environment.

You can also use AudioCodes' SBC Wizard tool to automatically configure the SBC based on this interoperability setup. However, it is recommended to read through this document to better understand the various configuration options. For more information on AudioCodes' SBC Wizard including the download option, visit AudioCodes website at https://www.audiocodes.com/partners/interoperability-list.

1.1 Intended Audience

This document is intended for engineers, or AudioCodes and Cisco CUCM partners who are responsible for installing and configuring Cisco CUCM and Microsoft's Teams Direct Routing Service for enabling VoIP calls using AudioCodes SBC.

1.2 About Microsoft Teams Direct Routing

Microsoft Teams Direct Routing allows connecting a customer-provided SBC to the Microsoft Phone System. The customer-provided SBC can be connected to almost any telephony trunk, or connect with third-party PSTN equipment. The connection allows:

- Using virtually any PSTN trunk with Microsoft Phone System
- Configuring interoperability between customer-owned telephony equipment, such as third-party PBXs, analog devices, and Microsoft Phone System

1.3 About AudioCodes SBC Product Series

AudioCodes' family of SBC devices enables reliable connectivity and security between the Enterprise's and the service provider's VoIP networks.

The SBC provides perimeter defense as a way of protecting Enterprises from malicious VoIP attacks; mediation for allowing the connection of any PBX and/or IP-PBX to any service provider; and Service Assurance for service quality and manageability.

Designed as a cost-effective appliance, the SBC is based on field-proven VoIP and network services with a native host processor, allowing the creation of purpose-built multiservice appliances, providing smooth connectivity to cloud services, with integrated quality of service, SLA monitoring, security and manageability. The native implementation of SBC provides a host of additional capabilities that are not possible with standalone SBC appliances such as VoIP mediation, PSTN access survivability, and third-party value-added services applications. This enables Enterprises to utilize the advantages of converged networks and eliminate the need for standalone appliances.

AudioCodes SBC is available as an integrated solution running on top of its field-proven Mediant Media Gateway and Multi-Service Business Router platforms, or as a software-only solution for deployment with third-party hardware. The SBC can be offered as a Virtualized SBC, supporting the following platforms: Hyper-V, AWS, AZURE, AWP, KVM and VMWare.

2 Component Information

2.1 AudioCodes SBC Version

Table 1: AudioCodes SBC Version

SBC Vendor	AudioCodes
Models	■ Mediant 500/L Gateway & E-SBC ■ Mediant 800B/C Gateway & E-SBC ■ Mediant 1000B Gateway & E-SBC ■ Mediant 2600 E-SBC ■ Mediant 4000/B SBC ■ Mediant 9000/9030/9080 SBC ■ Mediant Software SBC (VE/SE/CE)
Software Version	7.40A.500.017 or later
Protocol	■ SIP/UDP or SIP/TCP (to the Cisco CUCM SIP Trunk) ■ SIP/TLS (to the Teams Direct Routing)
Additional Notes	None

2.2 Cisco CUCM Version

Table 2: Cisco CUCM Version

Vendor/Service Provider	Cisco
SSW Model/Service	CUCM
Software Version	14.0.1
Protocol	SIP
Additional Notes	None

2.3 Microsoft Teams Direct Routing Version

Table 3: Microsoft Teams Direct Routing Version

Vendor	Microsoft
Model	Teams Phone System Direct Routing
Software Version	v.2023.6.29.3
Protocol	SIP
Additional Notes	None

2.4 Interoperability Test Topology

Microsoft Teams Direct Routing can be implemented in the *Enterprise* or *Hosting* Models.

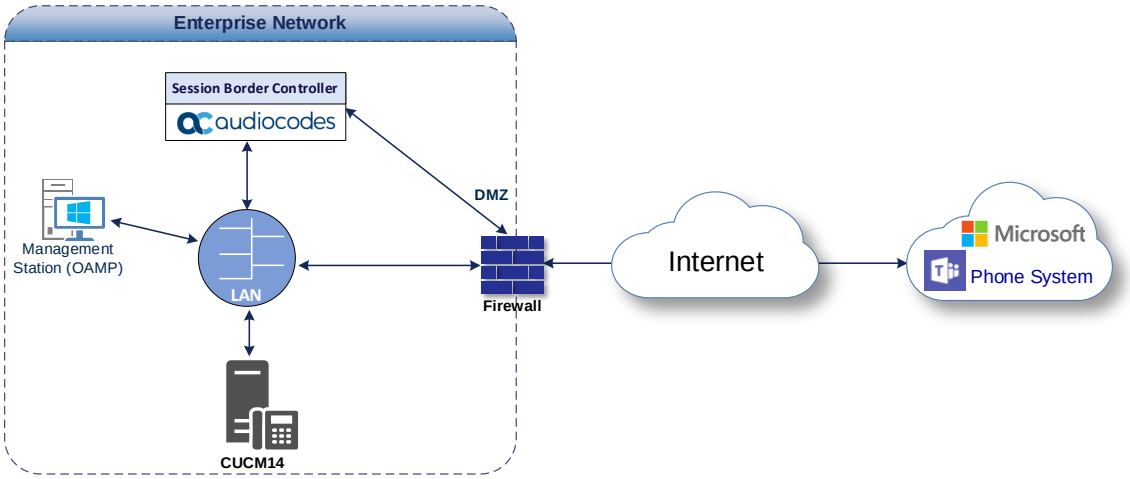
2.4.1 Enterprise Model Implementation

The interoperability testing between AudioCodes SBC and Cisco CUCM with Teams Direct Routing Enterprise Model was done using the following topology setup:

- Enterprise deployed with Cisco CUCM as IP-PBX, analog devices and the administrator's management station, located on the LAN.
- Enterprise deployed with Microsoft Teams Phone System Direct Routing Interface located on the WAN for enhanced communication within the Enterprise.
- AudioCodes SBC is implemented to interconnect between the Cisco CUCM in the Enterprise LAN and Microsoft Teams on the WAN.
  - **Session:** Real-time voice session using the IP-based Session Initiation Protocol (SIP).
  - **Border:** IP-to-IP network border - the Cisco CUCM is located in the Enterprise LAN and the Microsoft Teams Phone Systems is located in the public network.

The figure below illustrates this interoperability test topology:

Figure 1: Interoperability Test Topology between SBC and Microsoft Teams Direct Routing Enterprise Model with Cisco CUCM14



2.4.2 Environment Setup

The interoperability test topology includes the following environment setup:

Table 4: Environment Setup

Area	Setup
Network	■ Microsoft Teams Direct Routing environment is located on the Enterprise's (or Service Provider's) WAN ■ Cisco CUCM is located on the LAN
Signaling Transcoding	■ Microsoft Teams Direct Routing operates with SIP-over-TLS transport type ■ Cisco CUCM operates with SIP-over-UDP or SIP-over-TCP transport type
Codecs Transcoding	■ Microsoft Teams Direct Routing supports G.711A-law, G.711U-law, G.729, G.722 and SILK (NB and WB) coders ■ Cisco CUCM supports G.711A-law, G.711U-law, G.722 and Opus coders
Media Transcoding	■ Microsoft Teams Direct Routing operates with SRTP media type ■ Cisco CUCM operates with RTP media type

2.4.3 Infrastructure Prerequisites

The table below shows the list of infrastructure prerequisites for deploying Microsoft Teams Direct Routing.

Table 5: Infrastructure Prerequisites

Infrastructure Prerequisite	Details
Certified Session Border Controller (SBC)	See Microsoft's document *Plan Direct Routing*.
SIP Trunks connected to the SBC	
Office 365 Tenant	
Domains	
Public IP address for the SBC	
Fully Qualified Domain Name (FQDN) for the SBC	
Public DNS entry for the SBC	
Public trusted certificate for the SBC	
Firewall ports for Direct Routing Signaling	
Firewall IP addresses and ports for Direct Routing Media	
Media Transport Profile	
Firewall ports for Teams Clients Media	

2.4.4 Known Limitations

There were no limitations observed in the interoperability tests done for the AudioCodes SBC interworking between Microsoft Teams Direct Routing and Cisco CUCM.

3 Configuring Teams Direct Routing

This section describes how to configure Microsoft Teams Direct Routing to operate with AudioCodes SBC.

3.1 Prerequisites

Before you begin configuration, make sure you have the following for every SBC you want to pair:

- Public IP address
- FQDN name matching SIP addresses of the users
- Public certificate, issued by one of the supported CAs

3.2 SBC Domain Name in the Teams Enterprise Model

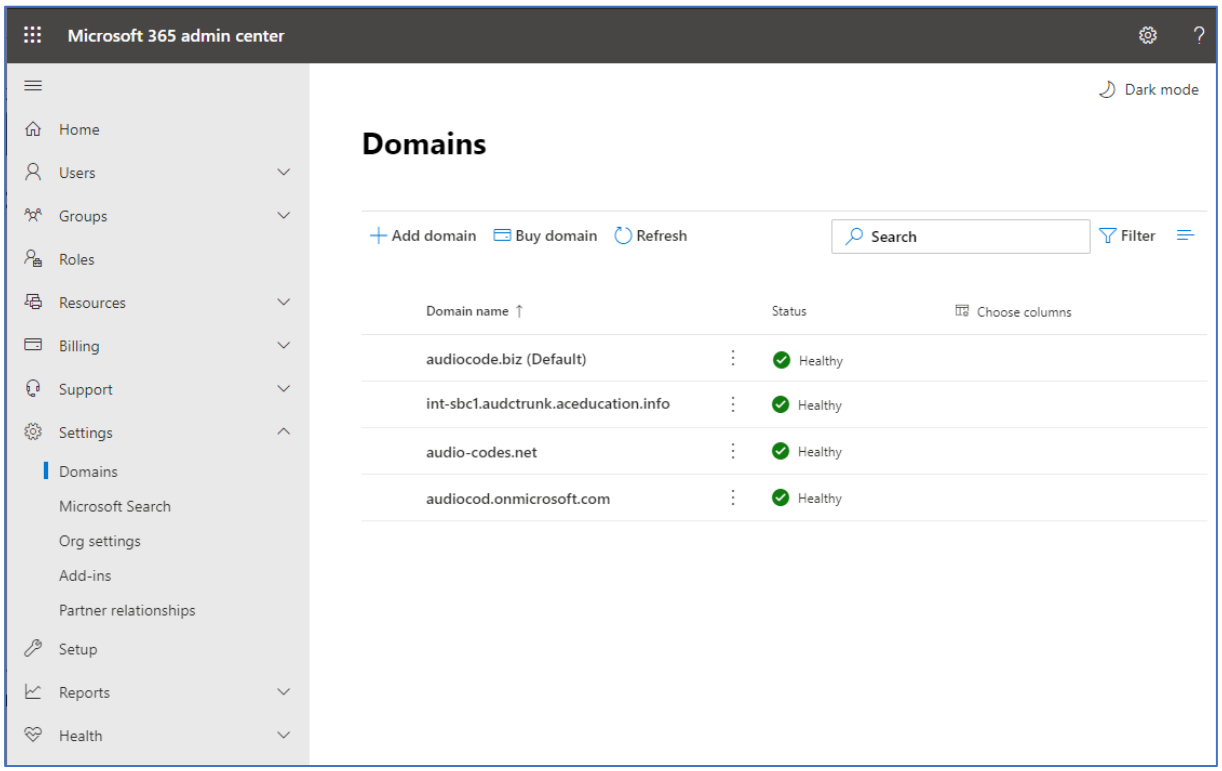
The SBC domain name must be from one of the names registered in 'Domains' of the tenant. You cannot use the ***.onmicrosoft.com** tenant for the domain name. For example, in Figure 2, the administrator registered the following DNS names for the tenant:

Table 6: DNS Names Registered by an Administrator for a Tenant

DNS name	Can be used for SBC FQDN	Examples of FQDN names
ACeducation.info	Yes	**Valid names**: ■ sbc.ACeducation.info ■ ussbcs15.ACeducation.info ■ europe.ACeducation.info **Invalid name:** sbc1.europe.ACeducation.info (requires registering domain name europe.atatum.biz in 'Domains' first)
adatumbiz.onmicrosoft.com	No	Using ***.onmicrosoft.com** domains is not supported for SBC names
hybridvoice.org	Yes	**Valid names**: ■ sbc1.hybridvoice.org ■ ussbcs15.hybridvoice.org ■ europe.hybridvoice.org **Invalid name:** sbc1.europe.hybridvoice.org (requires registering domain name europe.hybridvoice.org in 'Domains' first)

Users can be from any SIP domain registered for the tenant. For example, you can provide users user@ACeducation.info with the SBC FQDN **int-sbc1.audctrunk.aceducation.info** so long as both names are registered for this tenant.

Figure 2: Example of Registered DNS Names



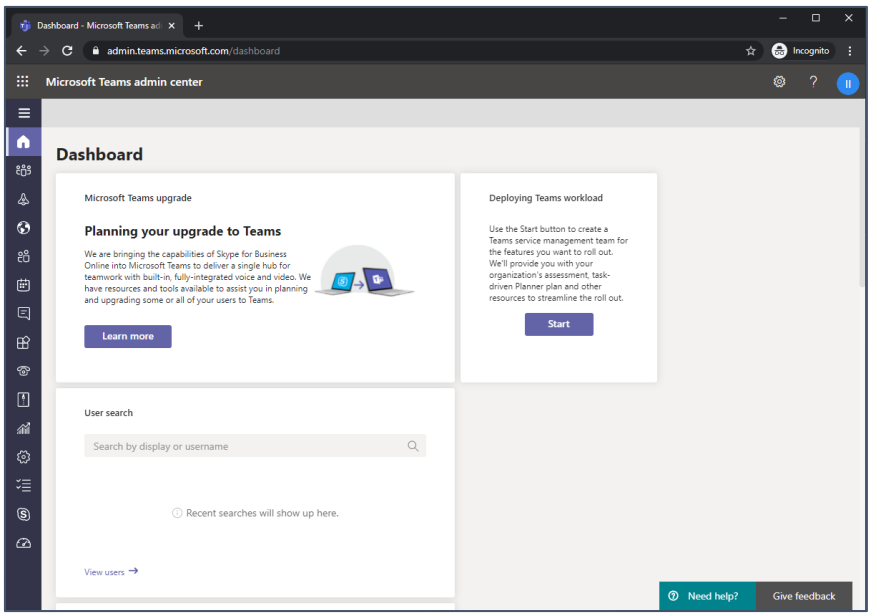
During creation of the Domain, you will be forced to create public DNS record (**int-sbc1.audctrunk.aceducation.info** in our example.)

3.3 Example of the Office 365 Tenant Direct Routing Configuration

Configuration can be done using the web or with PowerShell.

For the web, login to the Teams Admin Center (https://admin.teams.microsoft.com) with Tenant Administrator credentials.

Figure 3: Teams Admin Center



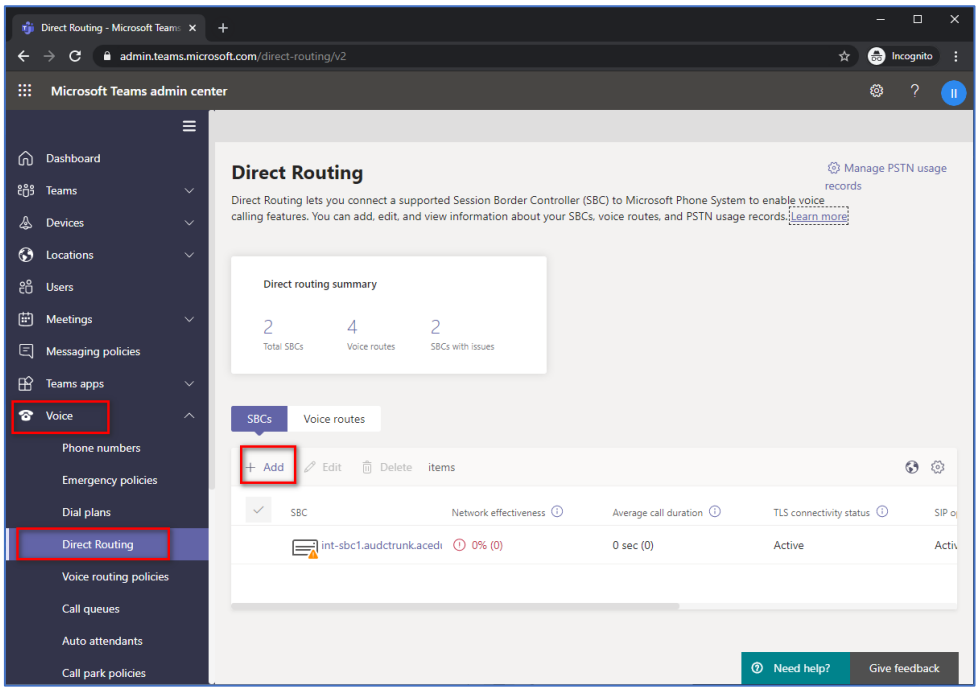
3.3.1 Adding New SBC to Direct Routing

The procedure below describes how add a new SBC to Direct Routing.

To add New SBC to Direct Routing:

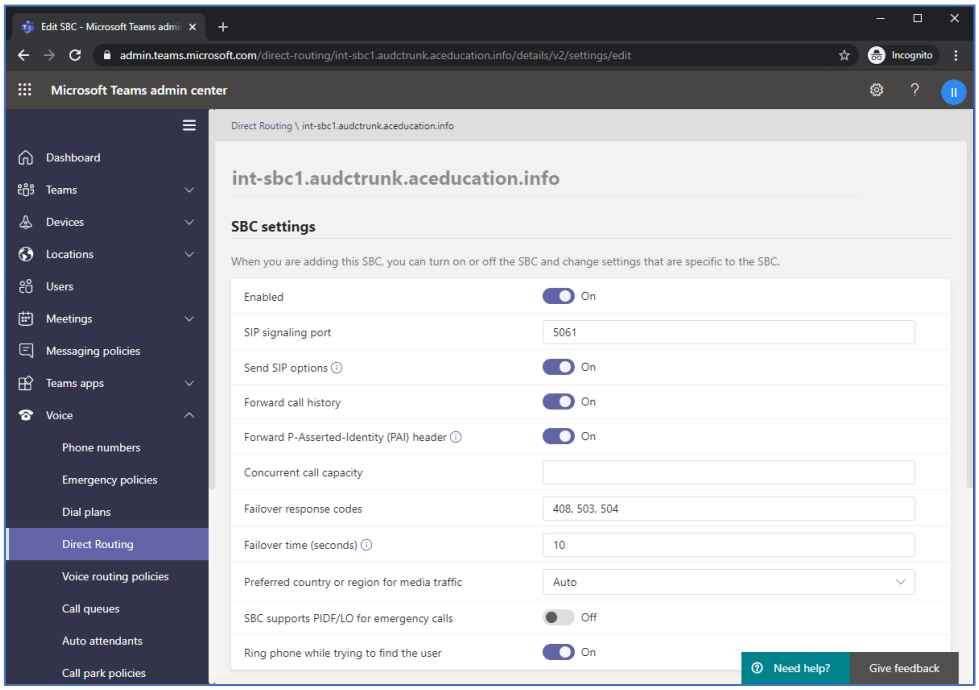
1. In the web interface, select **Voice**, and then select **Direct Routing**.
2. Under SBCs click **Add.**

Figure 4: Add new SBC to Direct Routing



3. Configure SBC.

Figure 5: Configure new SBC



You can use the following PowerShell command for creating a new Online PSTN Gateway:

```
New-CsOnlinePSTNGateway -Identity int-sbc1.audctrunk.aceducation.info -SipSignalingPort 5061 -ForwardCallHistory $True -ForwardPai $True -MediaBypass $True -Enabled $True
```

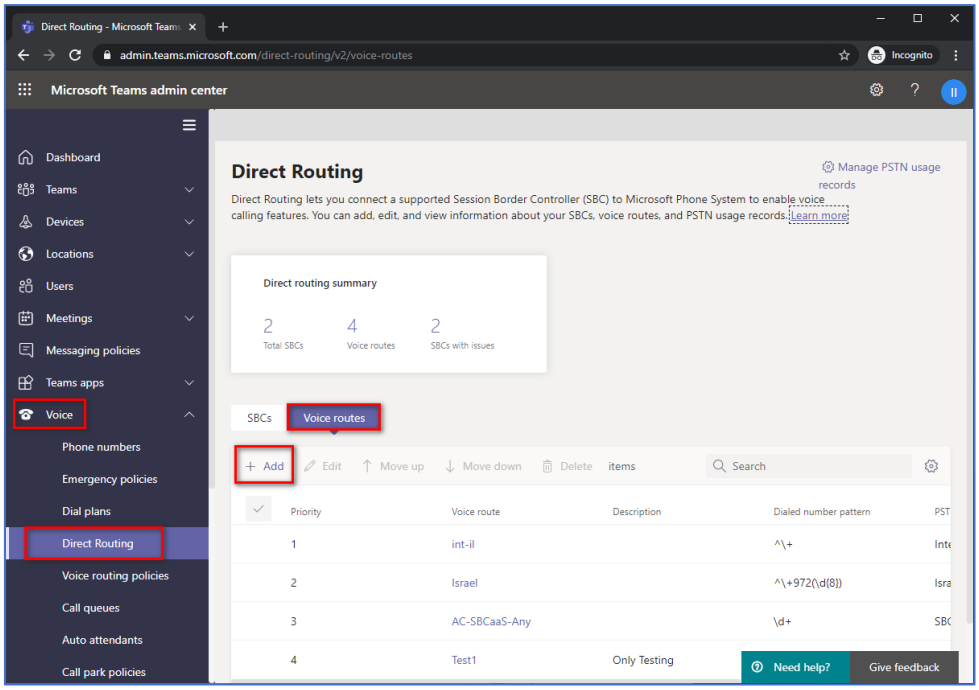
3.3.2 Adding Voice Route and PSTN Usage

The procedure below describes how add a voice route and PSTN usage.

To add voice route and PSTN usage:

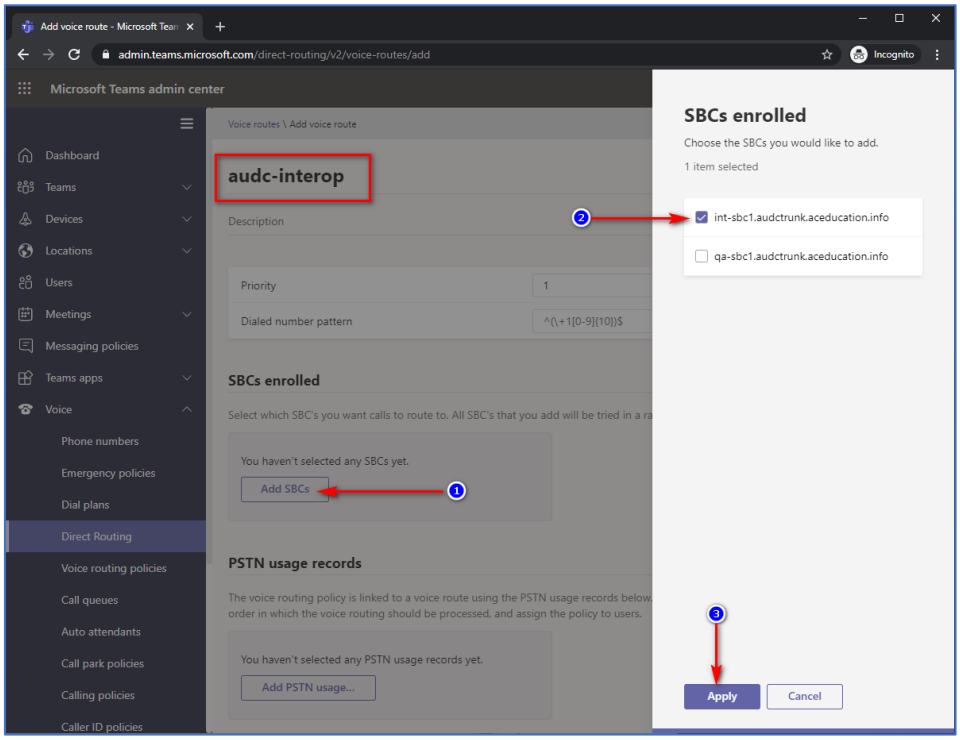
1. In the web interface, under **Direct Routing**, select **Voice routes**, and then click **Add**.

Figure 6: Add New Voice Route



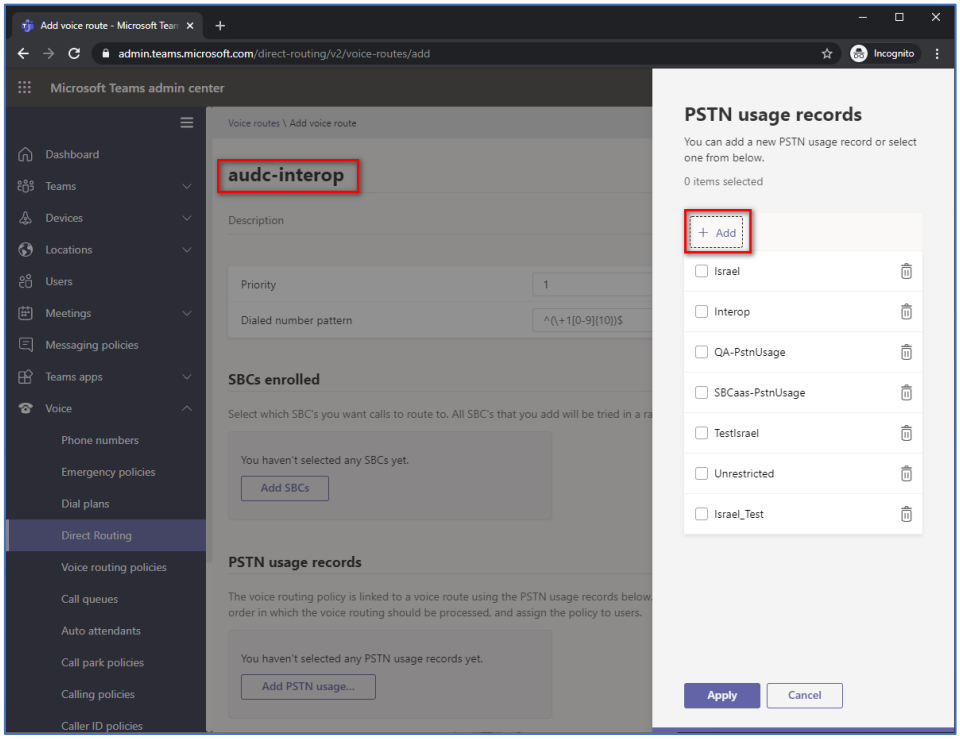
2. Create a new Voice Route and associate it with the SBC, configured in the previous step.

Figure 7: Associate SBC with new Voice Route



3. Add new (or associate existing) PSTN usage.

Figure 8: Associate PSTN Usage with New Voice Route



The same operations can be done using following PowerShell commands:

4. Creating an empty PSTN Usage:

```
Set-CsOnlinePstnUsage -Identity Global -Usage @{Add="Interop"}
```

5. Creating new Online Voice Route and associating it with PSTN Usage:

```
New-CsOnlineVoiceRoute -Identity "audc-interop" -NumberPattern
"^\+" -OnlinePstnGatewayList int-
sbc1.audctrunk.aceducation.info -Priority 1 -OnlinePstnUsages
"Interop"
```

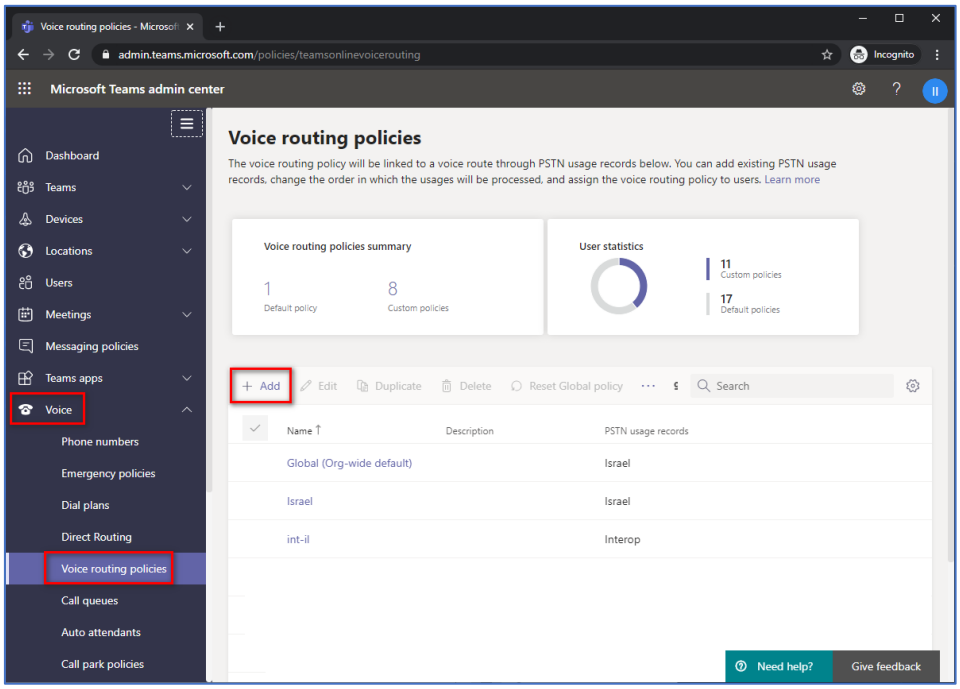
3.3.3 Adding Voice Routing Policy

The procedure below describes how add a voice routing policy.

To add voice routing policy:

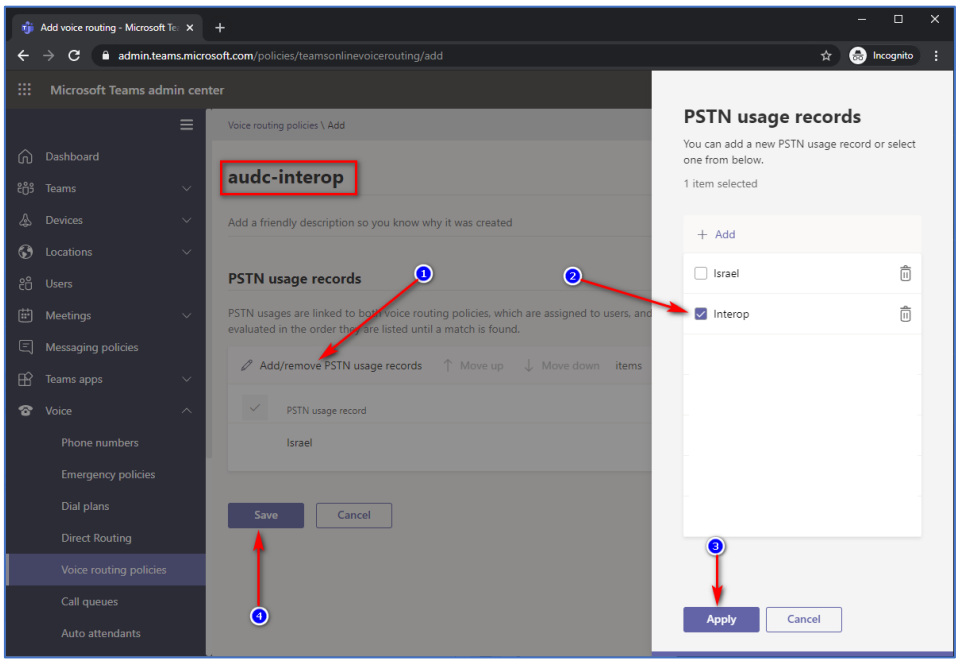
1. In the web interface, under **Voice**, select **Voice routing policies** and click **Add**.

Figure 9: Add New Voice Routing Policy



2. Create a new Voice Routing Policy and associate it with PSTN Usage, configured in the previous step.

Figure 10: Associate PSTN Usage with New Voice Routing Policy



The same operations can be done using following PowerShell command:

```
New-CsOnlineVoiceRoutingPolicy "audc-interop" -OnlinePstnUsages
"Interop"
```

The commands specified in Sections 3.3.4 and 3.3.5, should be run **for each** Teams user in the company tenant.

3.3.4 Enabling Online User

Use the following PowerShell command for enabling online user:

```
Set-CsPhoneNumberAssignment -Identity user1@company.com -
EnterpriseVoiceEnabled $true
Set-CsPhoneNumberAssignment -Identity user1@company.com -
PhoneNumber +12345678901 -PhoneNumberType DirectRouting
```

3.3.5 Assigning Online User to the Voice Routing Policy

Use following PowerShell command for assigning online user to the Voice Route:

```
Grant-CsOnlineVoiceRoutingPolicy -PolicyName "audc-interop" -
Identity user1@company.com
```

4 Configuring Cisco CUCM

This section describes how to configure the Cisco Unified Communications Manager.

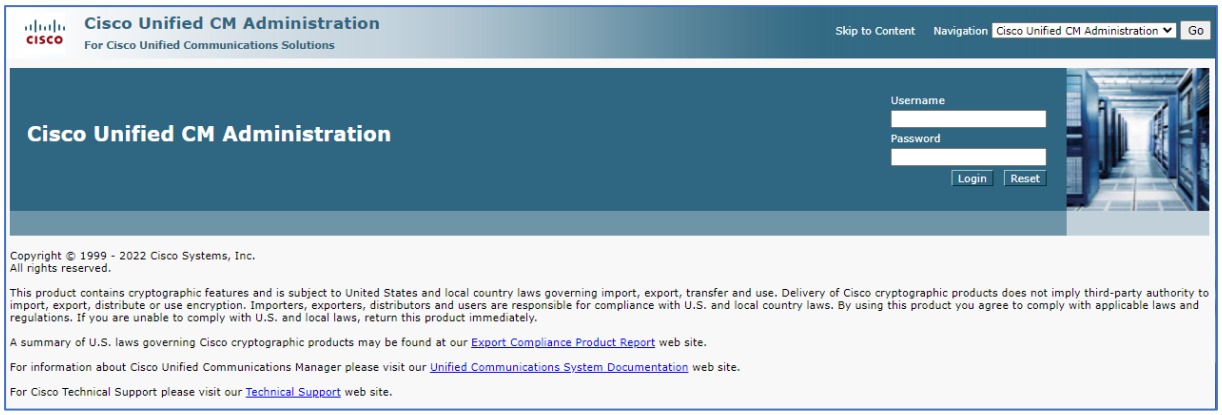
4.1 Log in to Cisco Unified Communications Manager

The procedure below describes how to log in to the Cisco CUCM Administration interface.

To log in to the Cisco Unified CM Administration interface:

1. Log in to the Cisco Unified CM Administration by entering the IP address of the Cisco Unified Communications Manager (CUCM) in the Web browser address field.

Figure 11: Cisco Unified CM Administration



2. In the 'Username' field, enter the user name.
3. In the 'Password' field, enter the password.
4. Click **Login**.

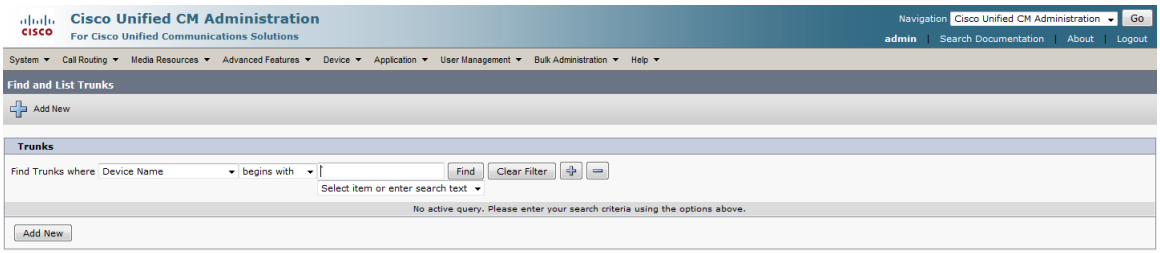
4.2 Creating a New Trunk

This section describes how to create a new trunk.

To create a new trunk:

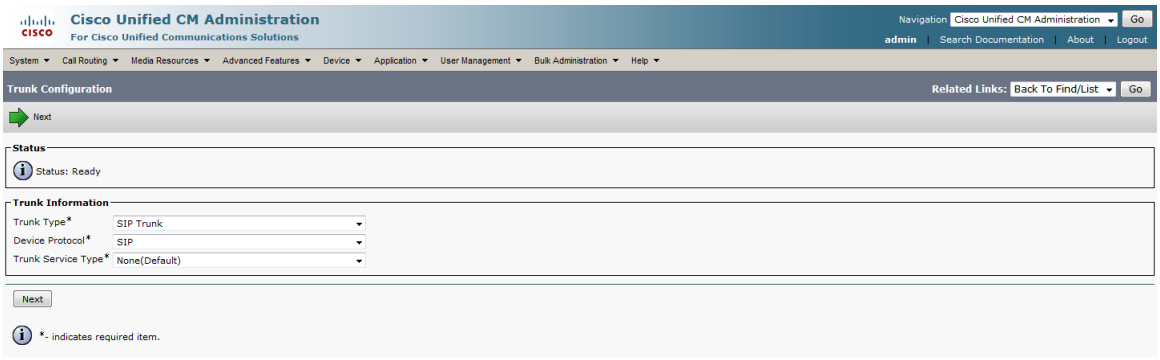
1. From the **Device** menu drop-down list, select **Trunk**.
2. Click **Add New**.

Figure 12: Trunk page



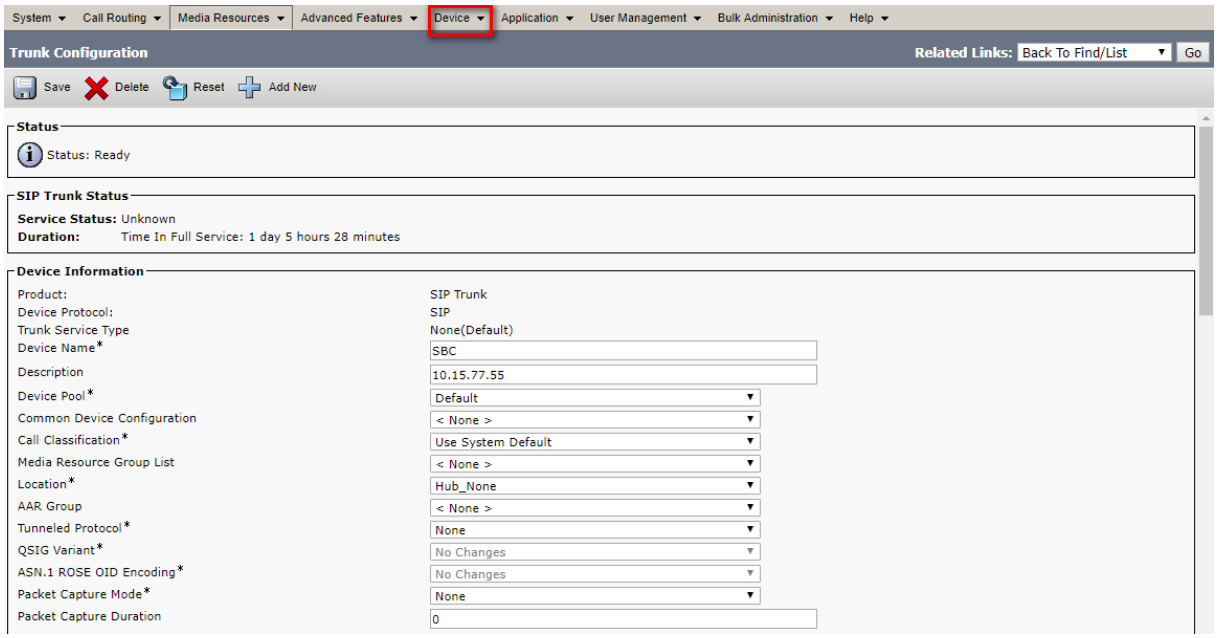
3. Select Trunk Type – **SIP Trunk**.
4. Click **Next**.

Figure 13: Create Trunk Page



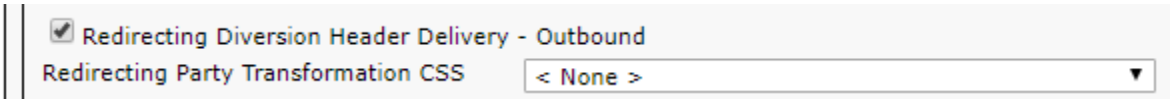
5. In the **Device Name** field, enter a unique SIP Trunk name and optionally provide a description.
6. From the **Device Pool** drop-down list, select a device pool.

Figure 14: SIP Trunk Settings Page



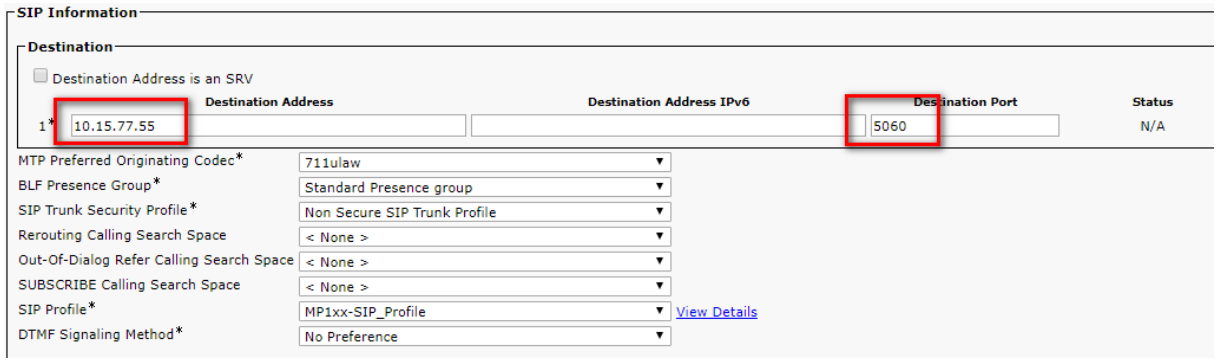
7. Select the 'Redirecting Diversion Header Delivery – Outbound' check box.

Figure 15: Redirecting Diversion Header Delivery



8. Enter the Destination Address and Destination Port of the AudioCodes SBC.

Figure 16: SIP Information Section



9. From the **SIP Trunk Security** drop-down list, select a profile.
10. From the **SIP Profile** drop-down list, select a profile.
11. Click **Save**.

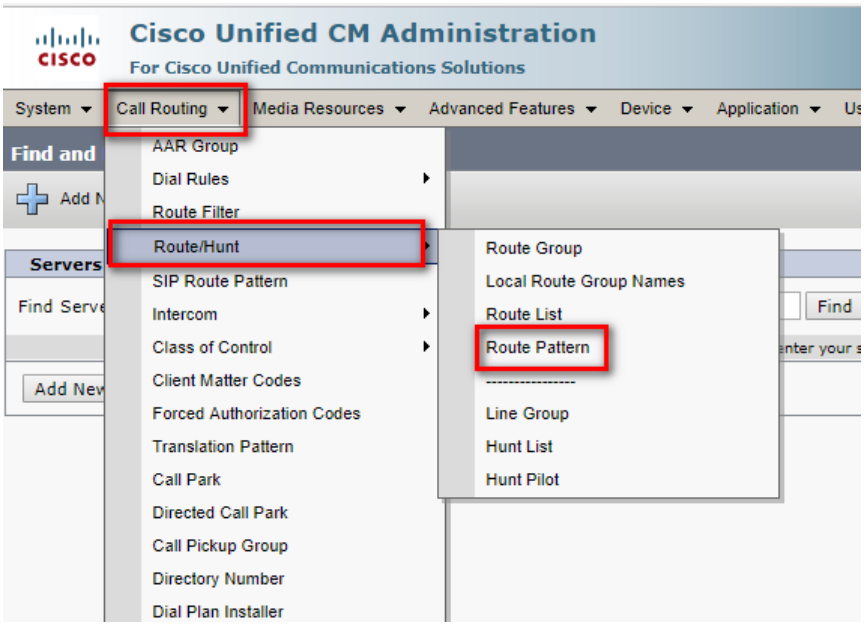
4.3 Creating a New Route Pattern

This section describes how to create a new route pattern.

To create new Route Pattern:

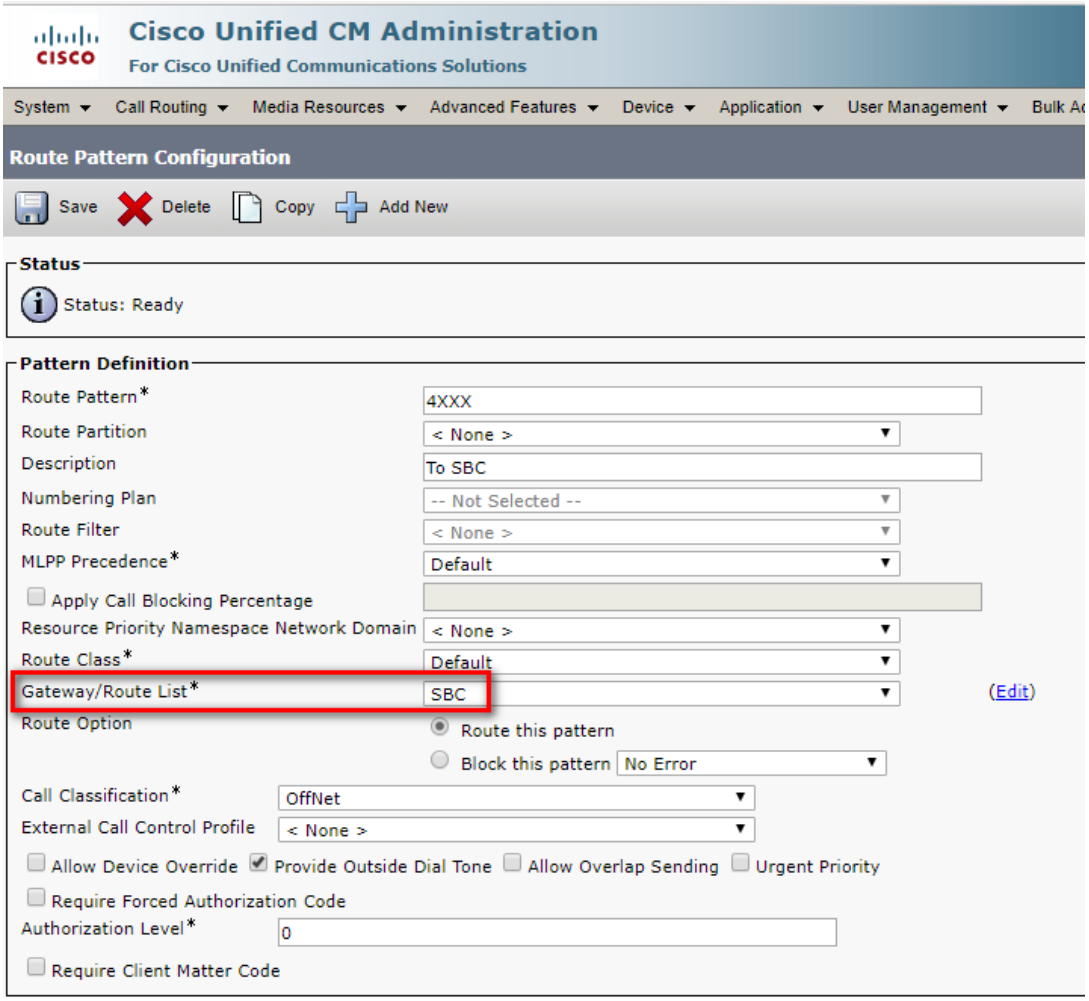
1. From the **Call Routing** menu drop-down list, go to the **Route/Hunt** menu and select **Route Pattern**.

Figure 17: Route Pattern page



2. Click **Add New**.
3. Enter a Route Pattern according to schema (optionally provide a description).
4. From the **Gateway/Route List** drop-down list, select the SIP Trunk device name.

Figure 18: Create Route Pattern Page



5. Click **Save**.

Figure 19: Added Route Pattern

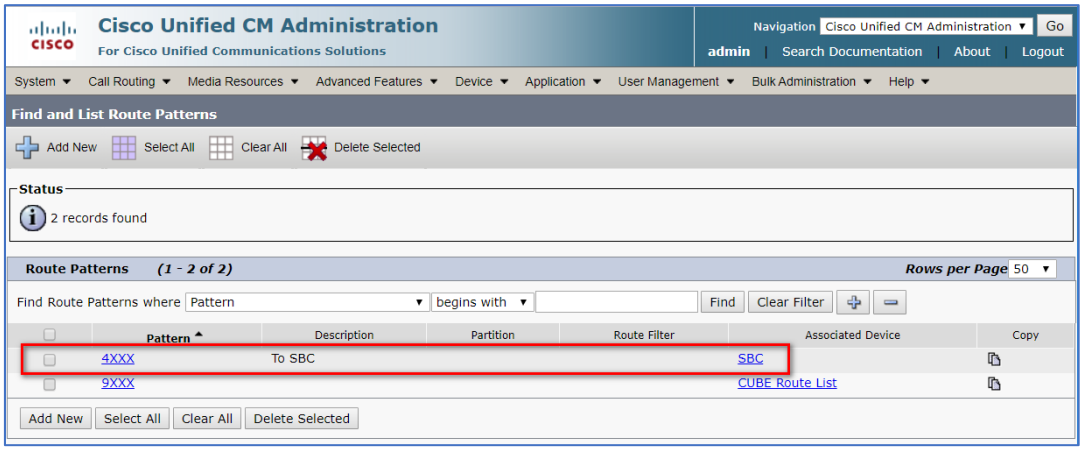
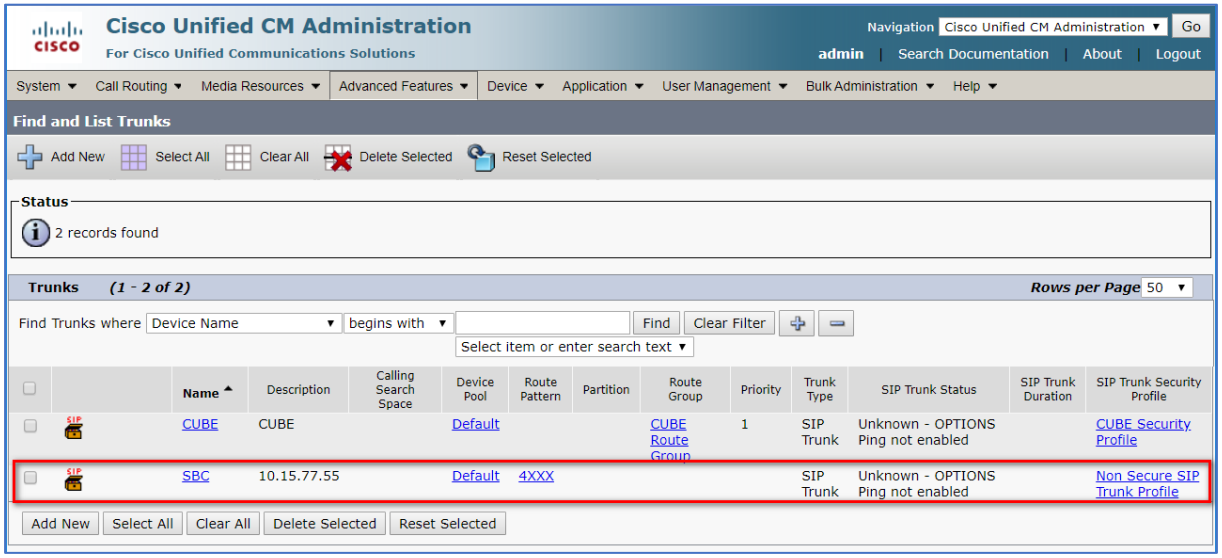


Figure 20: Added Trunk



An '*' indicates a mandatory field.

5 Configuring AudioCodes SBC

This section provides step-by-step procedures on how to configure AudioCodes SBC for interworking between Microsoft Teams Direct Routing and the Cisco CUCM. These configuration procedures are based on the interoperability test topology described in Section 2.4 on page 3, and includes the following main areas:

- SBC LAN interface – Management Station and Cisco CUCM 14
- SBC WAN interface – Teams Direct Routing environment

This configuration is done using the SBC's embedded Web server (hereafter, referred to as *Web interface*).

For implementing Microsoft Teams Direct Routing and Cisco CUCM based on the configuration described in this section, AudioCodes SBC must be installed with a License Key that includes the following software features:

- **MSFT** (general Microsoft license).
  By default, all AudioCodes media gateways and SBCs are shipped with this license (except MSBR products, Mediant 500 SBC, and Mediant 500 Media Gateway).
- **SW/TEAMS** (Microsoft Teams license).
- **Number of SBC sessions** (based on requirements).
- **Transcoding sessions** (only if media transcoding is needed).
- **Coders** (based on requirements).

For more information about the License Key, contact your AudioCodes sales representative.

If your SBC is deployed in a virtual environment and transcoding is required, your virtual machine must have a minimum of two vCPUs. For more information, please refer to the appropriate Installation Manual, which can be found on AudioCodes website.

The scope of this document does **not** cover all security aspects for configuring this topology. Comprehensive security measures should be implemented per your organization's security policies. For security recommendations on AudioCodes' products, refer to the Recommended Security Guidelines document, which can be found at AudioCodes website.

5.1 SBC Configuration Concept in Teams Direct Routing Enterprise Model

The diagram below represents AudioCodes' device configuration concept in the Enterprise Model.

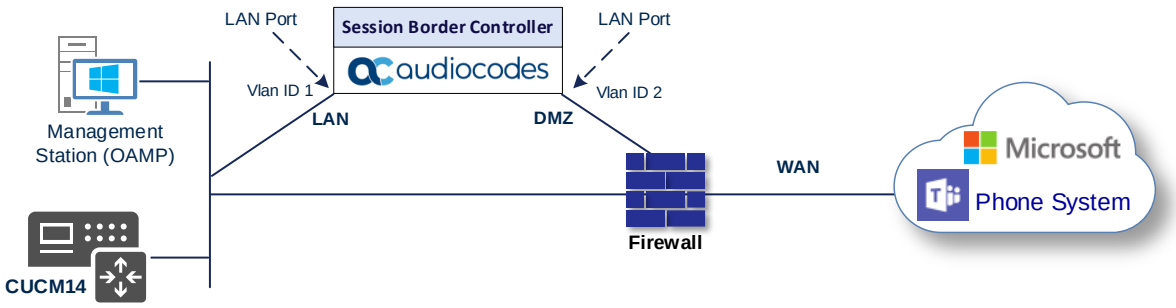
Figure 21: SBC Configuration Concept

5.2 IP Network Interfaces Configuration

This section describes how to configure the SBC's IP network interfaces. There are several ways to deploy the SBC; however, this interoperability test topology employs the following deployment method:

- SBC interfaces with the following IP entities:
  - Management Servers and Cisco CUCM, located on the LAN
  - Microsoft Teams Direct Routing located on the WAN
- SBC connects to the WAN through a DMZ network
- Physical connection: The type of physical connection depends on the method used to connect to the Enterprise's network. In the interoperability test topology, SBC connects to the LAN and DMZ using dedicated ethernet ports
  (i.e., two ports and two network cables are used).
- SBC also uses two logical network interfaces:
  - LAN (VLAN ID 1)
  - DMZ (VLAN ID 2)

Figure 22: Network Interfaces in Interoperability Test Topology



5.2.1 Configuring VLANs

This section describes how to configure VLANs for each of the following interfaces:

- LAN VoIP (assigned the name "LAN_IF")
- WAN VoIP (assigned the name "WAN_IF")

To configure the VLANs:

1. Open the Ethernet Device table (**Setup** menu > **IP Network** tab > **Core Entities** folder > **Ethernet Devices**).
2. There will be one existing row for VLAN ID 1 and underlying interface GROUP_1.
3. Add another VLAN ID 2 for the WAN side.

5.2.2 Configuring Network Interfaces

This section describes how to configure the IP network interfaces for each of the following interfaces:

- LAN Interface (assigned the name "LAN_IF")
- WAN Interface (assigned the name "WAN_IF")

To configure the IP network interfaces:

1. Open the IP Interfaces table (**Setup** menu > **IP Network** tab > **Core Entities** folder > **IP Interfaces**).
2. Configure the IP interfaces as follows (your network parameters might be different):

Table 7: Configuration Example of the Network Interface Table

Index	Application Types	Interface Mode	IP Address	Prefix Length	Gateway	DNS	I/F Name	Ethernet Device
0	OAMP+ Media + Control	IPv4 Manual	10.15.77.77	16	10.15.0.1	10.15.27.1	LAN_IF	vlan 1
1	Media + Control (as this interface points to the Internet, enabling OAMP is not recommended)	IPv4 Manual	195.189.192.157 (DMZ IP address of SBC)	25	195.189.192.129 (router's IP address)	According to your Internet provider's instructions	WAN_IF	vlan 2

5.3 SIP TLS Connection Configuration

This section describes how to configure the SBC for using a TLS connection with the Microsoft Teams Direct Routing Phone System. This configuration is essential for a secure SIP TLS connection. The configuration instructions in this section are based on the following domain structure that must be implemented as part of the certificate which must be loaded to the host SBC:

- CN: int-sbc1.audctrunk.aceducation.info
- SAN: int-sbc1.audctrunk.aceducation.info

This certificate module is based on the Service Provider's own TLS Certificate. For more certificate structure options, see Microsoft Teams Direct Routing documentation.

The Microsoft Phone System Direct Routing Interface allows ***only*** TLS connections from SBCs for SIP traffic with a certificate signed by one of the Trusted Certification Authorities.

Currently, supported Certification Authorities can be found in the following link:

https://docs.microsoft.com/en-us/microsoftteams/direct-routing-plan#public-trusted-certificate-for-the-sbc

5.3.1 Configuring the NTP Server Address

This section describes how to configure the NTP server's IP address. It is recommended to implement an NTP server (Microsoft NTP server or another global server) to ensure that the SBC receives the current date and time. This is necessary for validating certificates of remote parties.

To configure the NTP server address:

1. Open the Time & Date page (**Setup** menu > **Administration** tab > **Time & Date**).
2. In the 'Primary NTP Server Address' field, enter the IP address of the NTP server (e.g., **10.15.28.1**).
3. Click **Apply**.

5.3.2 Creating a TLS Context for Teams Direct Routing

This section describes how to configure TLS Context in the SBC. AudioCodes recommends implementing only TLS to avoid flaws in SSL.

To configure the TLS version:

1. Open the TLS Contexts table (**Setup** menu > **IP Network** tab > **Security** folder > **TLS Contexts**).
2. Create a new TLS Context by clicking **New** at the top of the interface, and then configure the parameters using the table below as reference:

Table 8: New TLS Context

Index	Name	TLS Version
1	Teams (arbitrary descriptive name)	TLSv1.2
All other parameters can be left unchanged with their default values.		

> The table above exemplifies configuration focusing on interconnecting SIP and media. You might want to configure additional parameters according to your company's policies. For example, you might want to configure Online Certificate Status Protocol (OCSP) to check if SBC certificates presented in the online server are still valid or revoked. For more information on the SBC's configuration, see the *User's Manual*, available for download from https://www.audiocodes.com/library/technical-documents.

3. Click **Apply**.

5.3.3 Configuring a Certificate

This section describes how to request a certificate for the SBC and to configure it based on the example of DigiCert Global Root CA. The certificate is used by the SBC to authenticate the connection with Microsoft Teams Direct Routing.

The procedure involves the following main steps:

a. Generating a Certificate Signing Request (CSR).
b. Requesting Device Certificate from CA.
c. Obtaining Trusted Root/ Intermediate Certificate from CA.
d. Deploying Device and Trusted Root/ Intermediate Certificates on SBC.

To configure a certificate:

1. Open the TLS Contexts page (**Setup** menu > **IP Network** tab > **Security** folder > **TLS Contexts**).
2. In the TLS Contexts page, select the required TLS Context index row, and then click the **Change Certificate** link located below the table; the Context Certificates page appears.
3. Under the **Certificate Signing Request** group, do the following:
   a. In the 'Subject Name [CN]' field, enter the SBC FQDN name (based on example above, **int-sbc1.audctrunk.aceducation.info**).
   b. In the '1st Subject Alternative Name [SAN]' field, change the type to 'DNS' and enter the SBC FQDN name (based on example above, **int-sbc1.audctrunk.aceducation.info**).

> The domain portion of the Common Name [CN] and 1st Subject Alternative Name [SAN] must match the SIP suffix configured for Office 365 users.

   c. Fill in the rest of the request fields according to your security provider's instructions.

d. Click the **Create CSR** button; a textual certificate signing request is displayed in the area below the button.

4. Copy the CSR from the line **"----BEGIN CERTIFICATE" to "END CERTIFICATE REQUEST----**" to a text file (such as Notepad), and then save it to a folder on your computer with the file name, for example *certreq.txt*.
5. Send *certreq.txt* file to the Certified Authority Administrator for signing.
6. After obtaining an SBC signed and Trusted Root/Intermediate Certificate from the CA, in the SBC's Web interface, return to the **TLS Contexts** page and do the following:
   a. In the TLS Contexts page, select the required TLS Context index row, and then click the **Change Certificate** link located below the table; the Context Certificates page appears.
   b. Scroll down to the **Upload certificates files from your computer** group, click the **Choose File** button corresponding to the '**Send Device Certificate**...' field, navigate to the certificate file obtained from the CA, and then click **Load File** to upload the certificate to the SBC.
7. Confirm that the certificate was uploaded correctly. A message indicating that the certificate was uploaded successfully is displayed in blue in the lower part of the page.
8. In the SBC's Web interface, return to the **TLS Contexts** page, select the required TLS Context index row, and then click the **Certificate Information** link, located at the bottom of the TLS. Then validate the Key size, certificate status and Subject Name.
9. In the SBC's Web interface, return to the **TLS Contexts** page.
   a. In the TLS Contexts page, select the required TLS Context index row, and then click the **Trusted Root Certificates** link, located at the bottom of the TLS Contexts page; the Trusted Certificates page appears.
   b. Click the **Import** button, and then select all Root/Intermediate Certificates obtained from your Certification Authority to load.
10. Click **OK**; the certificate is loaded to the device and listed in the Trusted Certificates store.

5.3.4 Method of Generating and Installing the Wildcard Certificate

To use the same certificate on multiple devices, you may prefer using 3rd party application (e.g., DigiCert Certificate Utility for Windows) to process the certificate request from your Certificate Authority on another machine, with this utility installed.

After you've processed the certificate request and response using the DigiCert utility, test the certificate private key and chain and then export the certificate with private key and assign a password.

To install the certificate:

1. Open the TLS Contexts page (**Setup** menu > **IP Network** tab > **Security** folder > **TLS Contexts**).
2. In the TLS Contexts page, select the required TLS Context index row, and then click the **Change Certificate** link located below the table; the Context Certificates page appears.
3. Scroll down to the **Upload certificates files from your computer** group and do the following:
   a. Enter the password assigned during export with the DigiCert utility in the **'Private key pass-phrase'** field.
   b. Click the **Choose File** button corresponding to the 'Send **Private Key**...' field and then select the SBC certificate file exported from the DigiCert utility.

5.3.5 Deploying Trusted Root Certificate for MTLS Connection

Loading Trusted Root Certificates to AudioCodes' SBC is mandatory when implementing an MTLS connection with the Microsoft Teams network

Microsoft 365 is updating services powering messaging, meetings, telephony, voice, and video to use TLS certificates from a different set of Root Certificate Authorities (CAs). For more details of the new Root CAs, refer to Microsoft technical guidance at Office TLS Certificate Changes. Services began transitioning to the new Root CAs (e.g., DigiCert) beginning in January 2022 and will continue through October 2022. During this migration period, it's possible to load both the old (Baltimore) and the new (DigiCert) Root certificate to the same TLS Context.

The DNS name of the Teams Direct Routing interface is **sip.pstnhub.microsoft.com**. In this interface, a certificate is presented which is signed by

DigiCert with Serial Number: 0x033af1e6a711a9a0bb2864b11d09fae5, SHA-1

Thumbprint: DF3C24F9BFD666761B268073FE06D1CC8D4F82A4 and

SHA-256 Thumbprint:
CB3CCBB76031E5E0138F8DD39A23F9DE47FFC35E43C1144CEA27D46A5AB1CB5F.

To trust this certificate, your SBC must have the certificate in Trusted Certificates storage. Download the **DigiCert Global Root G2** (df3c) certificate in **PEM format** from https://www.digicert.com/kb/digicert-root-certificates.htm and follow the steps above to import the certificate to the Trusted Root storage.

Before importing the DigiCert Root Certificate into AudioCodes' SBC, make sure it's in .PEM or .PFX format. If it isn't, you need to convert it to .PEM or .PFX format. Otherwise, you will receive a 'Failed to load new certificate' error message. To convert to PEM format, use the Windows local store on any Windows OS and then export it as 'Base-64 encoded X.509 (.CER) certificate'.

5.4 Configuring Media Realms

This section describes how to configure Media Realms. The simplest configuration is to create two Media Realms - one for the Cisco CUCM traffic and one for the Teams traffic.

To configure Media Realms:

1. Open the Media Realms table (**Setup** menu > **Signaling & Media** tab > **Core Entities** folder > **Media Realms**).
2. Configure Media Realms as follows (you can use the default Media Realm (Index 0), but modify it):

Table 9: Configuration Example Media Realms in Media Realm Table

Index	Name	Topology Location	IPv4 Interface Name	Port Range Start	Number of Media Session Legs
0	MR-LAN (arbitrary name)		LAN_IF	6000	100 (media sessions assigned with port range)
1	MR-WAN (arbitrary name)	Up	WAN_IF	7000	100 (media sessions assigned with port range)

5.5 Configuring SIP Signaling Interfaces

This section describes how to configure SIP Interfaces. For the interoperability test topology, towards the SIP Trunk and towards the Teams Direct Routing SIP Interfaces must be configured for the SBC.

To configure SIP Interfaces:

1. Open the SIP Interfaces table (**Setup** menu > **Signaling & Media** tab > **Core Entities** folder > **SIP Interfaces**).
2. Configure SIP Interfaces. You can use the default SIP Interface (Index 0), but modify it as shown in the table below. The table below shows an example of the configuration. You can change some parameters according to your requirements.

> The Direct Routing interface can only use TLS for a SIP port. It does not support using TCP due to security reasons. The SIP port might be any port of your choice. When pairing the SBC with Office 365, the chosen port is specified in the pairing command.

Table 10: Configured SIP Interfaces in SIP Interface Table

Index	Name	Network Interface	Application Type	UDP Port	TCP Port	TLS Port	Enable TCP Keepalive	Classification Failure Response Type	Media Realm	TLS Context Name
0	**SI-LAN** (arbitrary name)	**LAN_IF**	**SBC**	**5060** (according to customer requirement)	**5060** (according to customer requirement)	**0**	**Disable** (leave default value)	**500** (leave default value)	**MR-LAN**	-
1	**SI-WAN** (arbitrary name)	**WAN_IF**	**SBC**	**0** (Phone System does not use UDP or TCP for SIP signaling)	**0**	**5061** (as configured in the Office 365)	**Enable**	**0** (Recommended to prevent DoS attacks)	**MR-WAN**	**Teams**

5.6 Configuring Proxy Sets and Proxy Address

This section describes how to configure Proxy Sets. The Proxy Set defines the destination address (IP address or FQDN) of the IP entity server. Proxy Sets can also be used to configure load balancing between multiple servers.

For the interoperability test topology, two Proxy Sets need to be configured for the following IP entities:

- Cisco CUCM
- Teams Direct Routing

The Proxy Sets will later be applied to the VoIP network by assigning them to IP Groups.

To configure Proxy Sets:

1. Open the Proxy Sets table (**Setup** menu > **Signaling & Media** tab > **Core Entities** folder > **Proxy Sets**).
2. Configure Proxy Sets as shown in the table below:

Table 11: Configuration Example Proxy Sets in Proxy Sets Table

Index	Name	SBC IPv4 SIP Interface	TLS Context Name	Proxy Keep-Alive	Proxy Hot Swap	Proxy Load Balancing Method
1	CUCM14 (arbitrary name)	SI-LAN	Default	Using Options	-	-
2	Teams (arbitrary name)	SI-WAN	Teams	Using Options	Enable	Random Weights

5.6.1 Configuring a Proxy Address

This section shows how to configure a Proxy Address.

To configure a Proxy Address for SIP Trunk:

1. Open the Proxy Sets table (Setup menu > Signaling & Media tab > Core Entities folder > Proxy Sets) and then click the Proxy Set **CUCM14**, and then click the **Proxy Address** link located below the table; the Proxy Address table opens.
2. Click **+New**; and configure the address of the Proxy Set according to the parameters described in the table below:

Table 12: Configuration Proxy Address for SIP Trunk

Index	Proxy Address	Transport Type	Proxy Priority	Proxy Random Weight
0	10.15.26.10:5060 (CUCM14 IP and port)	UDP	0	0

3. Click **Apply**.

To configure a Proxy Address for Teams:

1. Open the Proxy Sets table (**Setup** menu > **Signaling & Media** tab > **Core Entities** folder > **Proxy Sets**) and then click the Proxy Set **Teams**, and then click the **Proxy Address** link located below the table; the Proxy Address table opens.
2. Click **+New**; and configure the address of the Proxy Set according to the parameters described in the table below:

Table 13: Configuration Proxy Address for Teams Direct Routing

Index	Proxy Address	Transport Type	Proxy Priority	Proxy Random Weight
0	sip.pstnhub.microsoft.com:5061	TLS	1	1
1	sip2.pstnhub.microsoft.com:5061	TLS	2	1
2	sip3.pstnhub.microsoft.com:5061	TLS	3	1

3. Click Appl**y**.

5.7 Configuring Coders

This section describes how to configure coders (termed *Coder Group*). Depending on configuration, Cisco CUCM may not send a list of supported coders in the initial offer, a Coder Group with the list of supported coders for the Microsoft Teams Direct Routing leg will be added.

Note that the Coder Group ID for this entity will be assigned to its corresponding IP Profile in the next step.

To configure audio coders:

1. Open the Coder Groups table (**Setup** menu > **Signaling & Media** tab > **Coders & Profiles** folder > **Coders Groups**).
2. Click **New** and configure a name for the Audio Coders Group for Teams (*e.g., AudioCodersGroups_Teams*).
3. Click **Apply**.
4. Select the new row that you configured, and then click the **Coders Table 0 items** link located below the table; the Coders Group table opens.
5. Click New and configure an Audio Coders Group for Teams Direct Routing as follows:

Coder Name	Packetization Time	Rate	Payload Type	Silence Suppression
G.711 A-law	20	64	8	Disable
G.711 U-law	20	64	0	Disable
G722	20	64	9	Disable
SILK-NB	20	8	103	N/A
SILK-WB	20	16	104	N/A

6. Click **Apply,** and then confirm the configuration change in the prompt that pops up.

The procedure below describes how to configure an Allowed Coders Group to ensure that voice sent to the Cisco CUCM uses the dedicated coders list whenever possible. Note that this Allowed Coders Group ID will be assigned to the IP Profile belonging to the CUCM in the next step.

To set a preferred coder for the CUCM:

1. Open the Allowed Audio Coders Groups table (**Setup** menu > **Signaling & Media** tab > **Coders & Profiles** folder > **Allowed Audio Coders Groups**).
2. Click **New** and configure a name for the Allowed Audio Coders Group for CUCM (*e.g., AllowedCoders_CUCM*).
3. Click **Apply**.
4. Select the new row that you configured, and then click the **Allowed Audio Coders** link located below the table; the Allowed Audio Coders table opens.
5. Click **New** and configure an Allowed Coders for CUCM as follows:

Index	Coder
0	G.711 U-law
1	G.711 A-law
2	G722

6. Open the Media Settings page (**Setup** menu > **Signaling & Media** tab > **Media** folder > **Media Settings**).
7. From the '**Extended Coders Behavior**' drop-down list, select **Include Extensions**.
8. Click **Apply**.

5.8 Configuring IP Profiles

This section describes how to configure IP Profiles. The IP Profile defines a set of call capabilities relating to signaling (e.g., SIP message terminations such as REFER) and media (e.g., coder and transcoding method).

In this interoperability test topology, IP Profiles need to be configured for the following IP entities:

- Cisco CUCM – to operate in non-secure mode using RTP and SIP over UDP or TCP
- Microsoft Teams Direct Routing – to operate in secure mode using SRTP and SIP over TLS

To configure an IP Profile for the Cisco CUCM :

1. Open the IP Profiles table (**Setup** menu > **Signaling & Media** tab > **Coders & Profiles** folder > **IP Profiles**).
2. Click **New**, and then configure the parameters as follows:

Parameter	Value
General	
Index	**0**
Name	**CUCM** (arbitrary descriptive name)
Media Security	
SBC Media Security Mode	**Not Secured**
SBC Media	
Allowed Audio Coders	**AllowedCoders_CUCM**
Allowed Coders Mode	**Restriction and Preference**
Allowed Media Types	**audio**
SBC Forward and Transfer	
Remote REFER Mode	**Handle Locally**
Remote Replaces Mode	**Handle Locally**
Remote 3xx Mode	**Handle Locally**

3. Click **Apply**.

To configure IP Profile for the Microsoft Teams Direct Routing:

1. Open the IP Profiles table (**Setup** menu > **Signaling & Media** tab > **Coders & Profiles** folder > **IP Profiles**).
2. Click **New**, and then configure the parameters as follows:

Parameter	Value
General	
Index	**1**
Name	**Teams** (arbitrary descriptive name)
Media Security	
SBC Media Security Mode	**Secured**
SBC Early Media	
Remote Early Media RTP Detection Mode	**By Media** (required, as Microsoft Teams Direct Routing does not send RTP immediately to remote side when it sends a SIP 18x response)
SBC Media	
Extension Coders Group	**AudioCodersGroups_Teams**
RFC 2833 Mode	**Extend**
ICE Mode	**Lite** (required only when Media Bypass enabled on Microsoft Teams)
SBC Signaling	
Remote Update Support	**Not Supported**
Remote re-INVITE Support	**Supported Only With SDP**
Remote Delayed Offer Support	**Not Supported**
SBC Forward and Transfer	
Remote REFER Mode	**Handle Locally**
Remote Replaces Mode	**Handle Locally**
Remote 3xx Mode	**Handle Locally**
SBC Hold	
Remote Hold Format	**Inactive** (some SIP Trunk may answer with a=inactive and IP=0.0.0.0 in response to the Re-Invite with Hold request from Teams. Microsoft Media Stack doesn't support this format. So, SBC will replace 0.0.0.0 with its IP address)

3. Click **Apply**.

5.9 Configuring IP Groups

This section describes how to configure IP Groups. The IP Group represents an IP entity on the network with which the SBC communicates. This can be a server (e.g., IP PBX or ITSP) or it can be a group of users (e.g., LAN IP phones). For servers, the IP Group is typically used to define the server's IP address by associating it with a Proxy Set. Once IP Groups are configured, they are used to configure IP-to-IP routing rules for denoting source and destination of the call.

In this interoperability test topology, IP Groups must be configured for the following IP entities:

- Cisco CUCM14 located on LAN.
- Teams Direct Routing located on WAN.

To configure IP Groups:

1. Open the IP Groups table (**Setup** menu > **Signaling & Media** tab > **Core Entities** folder > **IP Groups**).
2. Configure an IP Group for the Cisco CUCM:

Parameter	Value
Index	**1**
Name	**CUCM**
Type	**Server**
Proxy Set	**CUCM**
IP Profile	**CUCM**
Media Realm	**MR-LAN**
SIP Group Name	According to requirement. (based on our example, int-sbc1.audctrunk.aceducation.info)

3. Configure an IP Group for the Microsoft Teams Direct Routing:

Parameter	Value
Index	**2**
Name	**Teams**
Topology Location	**Up**
Type	**Server**
Proxy Set	**Teams**
IP Profile	**Teams**
Media Realm	**MR-WAN**
Classify By Proxy Set	**Disable**
Local Host Name	**< FQDN name of your SBC in the Microsoft Teams tenant >** (based on our example, int-sbc1.audctrunk.aceducation.info)
Always Use Src Address	**Yes**
Proxy Keep-Alive using IP Group settings	**Enable**

5.10 Configuring SRTP

This section describes how to configure media security. The Direct Routing Interface needs to use of SRTP only, so you need to configure the SBC to operate in the same manner.

To configure media security:

1. Open the Media Security page (**Setup menu > Signaling & Media tab > Media folder > Media Security**).
2. From the 'Media Security' drop-down list, select **Enable** to enable SRTP.
3. Click **Apply**.

5.11 Configuring Message Condition Rules

This section describes how to configure the Message Condition Rules. A Message Condition defines special conditions (pre-requisites) for incoming SIP messages. These rules can be used as additional matching criteria for the IP-to-IP routing rules in the IP-to-IP Routing table.

The following condition verifies that the Contact header contains Microsoft Teams FQDN.

To configure a Message Condition rule:

1. Open the Message Conditions table (**Setup** menu > **Signaling & Media** tab > **Message Manipulation** folder > **Message Conditions**).
2. Click **New**, and then configure the parameters as follows:

Parameter	Value
Index	**0**
Name	**Teams-Contact** (arbitrary descriptive name)
Condition	**header.contact.url.host contains 'pstnhub.microsoft.com'**

3. Click **Apply**.

5.12 Configuring Classification Rules

This section describes how to configure Classification rules. A Classification rule classifies incoming SIP dialog-initiating requests (e.g., INVITE messages) to a 'source' IP Group. The source IP Group is the SIP entity that sent the SIP dialog request. Once classified, the device uses the IP Group to process the call (manipulation and routing).

You can also use the Classification table for employing SIP-level access control for successfully classified calls, by configuring Classification rules with whitelist and blacklist settings. If a Classification rule is configured as a whitelist ("Allow"), the device accepts the SIP dialog and processes the call. If the Classification rule is configured as a blacklist ("Deny"), the device rejects the SIP dialog.

To configure a Classification rule:

1. Open the Classification table (**Setup** menu > **Signaling & Media** tab > **SBC** folder > **Classification Table**).
2. Configure Classification rules as shown in the table below:

Index	Name	Source SIP Interface	Source IP Address	Destination Host	Message Condition	Action Type	Source IP Group
0	Teams_52_112 (arbitrary name)	Teams	52.112.*.*	<FQDN name of your SBC in the Microsoft Teams tenant> (e.g., int-sbc1.audctrunk.aceducation.info)	Teams-Contact	Allow	Teams
1	Teams_52_113 (arbitrary name)	Teams	52.113.*.*	<FQDN name of your SBC in the Microsoft Teams tenant> (e.g., int-sbc1.audctrunk.aceducation.info)	Teams-Contact	Allow	Teams
2	Teams_52_114 (arbitrary name)	Teams	52.114.*.*	<FQDN name of your SBC in the Microsoft Teams tenant> (e.g., int-sbc1.audctrunk.aceducation.info)	Teams-Contact	Allow	Teams
3	Teams_52_115 (arbitrary name)	Teams	52.115.*.*	<FQDN name of your SBC in the Microsoft Teams tenant> (e.g., int-sbc1.audctrunk.aceducation.info)	Teams-Contact	Allow	Teams
4	Teams_52_120 (arbitrary name)	Teams	52.120.*.*	<FQDN name of your SBC in the Microsoft Teams tenant> (e.g., int-sbc1.audctrunk.aceducation.info)	Teams-Contact	Allow	Teams
5	Teams_52_121 (arbitrary name)	Teams	52.121.*.*	<FQDN name of your SBC in the Microsoft Teams tenant> (e.g., int-sbc1.audctrunk.aceducation.info)	Teams-Contact	Allow	Teams
6	Teams_52_122 (arbitrary name)	Teams	52.122.*.*	<FQDN name of your SBC in the Microsoft Teams tenant> (e.g., int-sbc1.audctrunk.aceducation.info)	Teams-Contact	Allow	Teams
7	Teams_52_123 (arbitrary name)	Teams	52.123.*.*	<FQDN name of your SBC in the Microsoft Teams tenant> (e.g., int-sbc1.audctrunk.aceducation.info)	Teams-Contact	Allow	Teams

3. Click **Apply**.

5.13 Configuring IP-to-IP Call Routing Rules

This section describes how to configure IP-to-IP call routing rules. These rules define the routes for forwarding SIP messages (e.g., INVITE) received from one IP entity to another. The SBC selects the rule whose configured input characteristics (e.g., IP Group) match those of the incoming SIP message. If the input characteristics do not match the first rule in the table, they are compared to the second rule, and so on, until a matching rule is located. If no rule is matched, the message is rejected.

For the interoperability test topology, the following IP-to-IP routing rules need to be configured to route calls between Teams Direct Routing and Cisco CUCM:

- Terminate SIP OPTIONS messages on the SBC that are received from any entity
- Terminate REFER messages to Teams Direct Routing
- Calls from Teams Direct Routing to Cisco CUCM
- Calls from Cisco CUCM to Teams Direct Routing

To configure IP-to-IP routing rules:

1. Open the IP-to-IP Routing table (**Setup** menu > **Signaling & Media** tab > **SBC** folder > **Routing** > **IP-to-IP Routing**).
2. Configure routing rules as shown in the table below:

Table 14: Configuration IP-to-IP Routing Rules

Index	Name	Source IP Group	Request Type	Call Triger	ReRoute IP Group	Dest Type	Dest IP Group	Internal Action
0	Terminate OPTIONS	Any	OPTIONS			Dest Address		Reply (Response='200')
1	Refer from Teams (arbitrary name)	Any		REFER	Teams	Request URI	Teams	
2	Teams to CUCM (arbitrary name)	Teams				IP Group	CUCM	
3	CUCM to Teams (arbitrary name)	CUCM				IP Group	Teams	

The routing configuration may change according to your specific deployment topology.

5.14 Configuring Firewall Settings (Optional)

As an extra security to the above note, there is option to configure traffic filtering rules (*access list*) for incoming traffic on AudioCodes SBC. For each packet received on the configured network interface, the SBC searches the table from top to bottom until the first matching rule is found. The matched rule can permit (*allow*) or deny (*block*) the packet. Once a rule in the table is located, subsequent rules further down the table are ignored. If the end of the table is reached without a match, the packet is accepted. Please note that the firewall is stateless. The blocking rules will apply to all incoming packets, including UDP or TCP responses.

To configure a firewall rule:

1. Open the Firewall table (**Setup** menu > **IP Network** tab > **Security** folder> **Firewall**).
2. Configure the following Access list rules for Teams Direct Rout IP Interface:

Table 15: Firewall Table Rules

Index	Source IP	Subnet Prefix	Start Port	End Port	Protocol	Use Specific Interface	Interface ID	Allow Type
0	<Public DNS Server IP> (e.g., 8.8.8.8)	32	0	65535	Any	Enable	WAN_IF	Allow
1	52.112.0.0	14	0	65535	TCP	Enable	WAN_IF	Allow
2	52.120.0.0	14	0	65535	TCP	Enable	WAN_IF	Allow
3	xxx.xxx.xxx.xxx	32	0	65535	TCP	Enable	WAN_IF	Allow
49	0.0.0.0	0	0	65535	Any	Enable	WAN_IF	Block

Be aware, that if in your configuration, connectivity to SIP Trunk (or other entities) is performed through the same IP Interface as Teams (WAN_IF in our example), you must add rules to allow traffic from these entities. See an example in the row of index 3.

5.15 Configuring Number Manipulation Rules

This section describes how to configure IP-to-IP manipulation rules. These rules manipulate the SIP Request-URI user part (source or destination number). The manipulation rules use the configured IP Groups (as configured in Section 5.9 on page 25) to denote the source and destination of the call.

> Adapt the manipulation table according to your environment dial plan.

For example, for this interoperability test topology, a manipulation is configured to remove the "+" (plus sign) from the destination number for calls from the Teams Direct Routing IP Group.

To configure a number manipulation rule:

1. Open the Inbound Manipulations table (**Setup** menu > **Signaling & Media** tab > **SBC** folder > **Manipulation** > **Inbound Manipulations**).
2. Configure the rules according to your setup.

The table below shows an example of configured IP-to-IP outbound manipulation rules for calls between Teams Direct Routing and Cisco CUCM:

Rule Index	Description
0	Calls from Teams IP Group with the prefix destination number "+", remove one character from left.
1	Calls from CUCM IP Group to Teams IP Group with any destination number (*), add "+" to the prefix of the destination number.

5.16 Configuring Message Manipulation Rules

This section describes how to configure SIP message manipulation rules. SIP message manipulation rules can include insertion, removal, and/or modification of SIP headers. Manipulation rules are grouped into Manipulation Sets, enabling you to apply multiple rules to the same SIP message (IP entity).

Once you have configured the SIP message manipulation rules, you need to assign them to the relevant IP Group (in the IP Group table) and determine whether they must be applied to inbound or outbound messages.

To configure SIP message manipulation rule:

1. Open the Message Manipulations page (**Setup** menu > **Signaling & Media** tab > **Message Manipulation** folder > **Message Manipulations**).
2. Configure a new manipulation rule (Manipulation Set 0) for Cisco CUCM. This rule applies to messages received from the Cisco CUCM on the LAN SIP Interface. Cisco CUCM send SIP OPTIONS messages with Max Forwards Header value 0, which cause errors in the SBC syslog. This rule increases the value of the SIP Max Forwards Header.

Parameter	Value
Index	**0**
Name	**Change Max-Forwards from CUCM**
Manipulation Set ID	**0**
Message Type	**Options**
Condition	**Header.Max-Forwards=='0'**
Action Subject	**Header.Max-Forwards**
Action Type	**Modify**
Action Value	**'10'**

3. Configure another manipulation rule (Manipulation Set 2) for Cisco CUCM. This rule applies to messages sent to the Cisco CUCM IP Group. This replaces the host part of the SIP Request-URI Header with the Cisco CUCM IP address.

Parameter	Value
Index	**1**
Name	**Change R-URI host toward CUCM**
Manipulation Set ID	**2**
Condition	**Any.Request**
Action Subject	**Header.Request-URI.URL.Host**
Action Type	**Modify**
Action Value	**Param.Message.Address.Dst.IP**

4. Configure another manipulation rule (Manipulation Set 3) for Teams Direct Routing IP Group. This rule applies to messages received from the Teams IP Group. This rule replaces user part of the second index (in the SIP URI format) of the SIP P-Asserted-Identity Header with the value from the first index (in the telephone format).

Parameter	Value
Index	**2**
Name	**Build 1 PAI from 2**
Manipulation Set ID	**3**
Action Subject	**Header.P-Asserted-Identity.1.URL.User**
Action Type	**Modify**
Action Value	**Header.P-Asserted-Identity.0.URL.User**

5. Configure another manipulation rule (Manipulation Set 3) for Teams Direct Routing IP Group. This rule applies to messages received from the Teams IP Group. This rule removes the first index (in the telephone format) of the SIP P-Asserted-Identity Header.

Parameter	Value
Index	**3**
Name	**Remove PAI tel**
Manipulation Set ID	**3**
Action Subject	**Header.P-Asserted-Identity.0**
Action Type	**Remove**

6. Configure another manipulation rule (Manipulation Set 3) for Teams Direct Routing IP Group. This rule applies to messages received from the Teams IP Group. This removes the SIP Privacy Header in all messages, except of call with presentation restriction.

Parameter	Value
Index	**4**
Name	**Remove Privacy Header**
Manipulation Set ID	**3**
Condition	**Header.Privacy exists And Header.From.URL !contains 'anonymous'**
Action Subject	**Header.Privacy**
Action Type	**Remove**

The table displayed below includes SIP message manipulation rules which are grouped together under Manipulation Set IDs (Manipulation Set IDs 2 and 3) and which are executed for messages sent to and from the Cisco CUCM IP Group as well as the Teams Direct Routing IP Group. These rules are specifically required to enable proper interworking between Cisco CUCM and Teams Direct Routing. Refer to the *User's Manual* for further details concerning the full capabilities of header manipulation.

Rule Index	Rule Description	Reason for Introducing Rule
0	This rule applies to messages received from the Cisco CUCM on the LAN SIP Interface. Cisco CUCM sends SIP OPTIONS messages with Max Forwards Header value 0, which cause errors in the SBC syslog. This rule increases the value of the SIP Max Forwards Header	Per Cisco CUCM implementation.
1	This rule applies to messages sent to the Cisco CUCM IP Group; It replaces the host part of the SIP Request-URI Header with the Cisco CUCM IP address.	Per Cisco CUCM implementation.
2	This rule applies to messages received from the Teams IP Group. This rule replaces user part of the second index (in the SIP URI format) of the SIP P-Asserted-Identity Header with the value from the first index (in the telephone format).	Microsoft Office 365 may be configured to send a PAI header. We recommend doing this in the SBC, for better interoperability.
3	This rule applies to messages received from the Teams IP Group. This rule removes the first index (in the telephone format) of the SIP P-Asserted-Identity Header.	The same as in the previous rule.
4	This rule applies to messages received from the Teams IP Group. This removes the SIP Privacy Header in all messages, except for calls with presentation restriction.	Microsoft Office 365 may be configured to send SIP Privacy header. For better interoperability we recommend to remove it from all messages, except the calls with presentation restriction.

7. Assign Manipulation Set ID 0 to the LAN SIP Interface:
   a. Open the SIP Interfaces table (**Setup** menu > **Signaling & Media** tab > **Core Entities** folder > **SIP Interfaces**).
   b. Select the row of the LAN SIP Interface, and then click **Edit**.
   c. Set the 'Pre-classification Manipulation Set ID' field to **0**.
   d. Click **Apply**.
8. Assign Manipulation Set IDs 2 to the Cisco CUCM IP Group:
   a. Open the IP Groups table (**Setup** menu > **Signaling & Media** tab > **Core Entities** folder > **IP Groups**).
   b. Select the row of the Cisco CUCM IP Group, and then click **Edit**.
   c. Set the 'Outbound Message Manipulation Set' field to **2**.
   d. Click **Apply**.
9. Assign Manipulation Set ID 3 to the Teams Direct Routing IP Group:
   a. Open the IP Groups table (**Setup** menu > **Signaling & Media** tab > **Core Entities** folder > **IP Groups**).
   b. Select the row of the Teams Direct Routing IP Group, and then click **Edit**.
   c. Set the 'Inbound Message Manipulation Set' field to **3**.
   d. Click **Apply**.

5.17 Miscellaneous Configuration

This section describes miscellaneous SBC configuration.

5.17.1 Configuring Call Forking Mode

This section describes how to configure the SBC's handling of SIP 18x responses received for call forking of INVITE messages. For the interoperability test topology, if a SIP 18x response with SDP is received, the SBC opens a voice stream according to the received SDP. The SBC re-opens the stream according to subsequently received 18x responses with SDP or plays a ringback tone if a 180 response without SDP is received. It is mandatory to set this field for the Teams Direct Routing environment.

To configure call forking:

1. Open the SBC General Settings page (**Setup** menu > **Signaling & Media** tab > **SBC** folder > **SBC General Settings**).
2. From the 'SBC Forking Handling Mode' drop-down list, select **Sequential**.
3. Click **Apply**.

5.17.2 Optimizing CPU Cores Usage for a Specific Service (relevant for Mediant 9000 and Software SBC only)

This section describes how to optimize the SBC's CPU cores usage for a specified profile to achieve maximum capacity for that profile. The supported profiles include:

- SIP profile – improves SIP signaling performance, for example, SIP calls per second (CPS).
- SRTP profile – improves maximum number of SRTP sessions.
- Transcoding profile – enables all DSP-required features, for example, transcoding and voice in-band detectors.

To optimize core allocation for a profile:

1. Open the SBC General Settings page (**Setup** menu > **Signaling & Media** tab > **SBC** folder > **SBC General Settings**).
2. From the 'SBC Performance Profile' drop-down list, select the required profile:

3. Click **Apply**, and then reset the device with a burn-to-flash for your settings to take effect.

International Headquarters
1 Hayarden Street,
Airport City
Lod 7019900, Israel
Tel: +972-3-976-4000
Fax: +972-3-976-4040

AudioCodes Inc.
80 Kingsbridge Rd
Piscataway, NJ 08854, USA
Tel: +1-732-469-0880
Fax: +1-732-469-2298

Contact us: https://www.audiocodes.com/corporate/offices-worldwide
Website: https://www.audiocodes.com

Document #: LTRT-29314