Oracle SBC with Microsoft Teams Direct Routing

Technical Application Note

ORACLE
COMMUNICATIONS

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Contents

1 REVISION HISTORY 6

2 INTENDED AUDIENCE 6

3 VALIDATED ORACLE SOFTWARE VERSIONS 6

4 RELATED DOCUMENTATION 6

4.1 ORACLE SBC 6

4.2 MICROSOFT TEAMS 7

5 ABOUT TEAMS DIRECT ROUTING 7

5.1 PLANNING DIRECT ROUTING 7

5.2 MEDIA BYPASS VS NON MEDIA BYPASS 7

5.3 INFRASTRUCTURE REQUIREMENTS 8

5.4 DNS REQUIREMENTS 8

5.4.1 SBC Domain Names 8

5.4.2 Adding the SBC Domain to Microsoft O365 9

5.4.3 Creating a User in Microsoft O365 11

5.5 CONNECT THE SBC TO THE TEAMS TENANT 12

5.5.1 Remote Connection to Teams via Powershell 13

5.5.2 Connect the Oracle SBC 13

5.5.3 Configuring User Online Voice Settings 14

5.5.4 Configure Voice Routing for Direct Routing 14

6 ORACLE SBC CONFIGURATION 17

6.1 SYSTEM-CONFIG 19

6.1.1 NTP-Sync 19

6.2 NETWORK CONFIGURATION 20

6.2.1 Physical Interfaces 20

6.2.2 Network Interfaces 21

6.3 SECURITY CONFIGURATION 21

6.3.1 Certificate Records 21

6.3.2 TLS Profile 26

6.3.3 Media Security 27

6.4 TRANSCODING CONFIGURATION 30

6.4.1 Media Profiles 30

6.4.2 Codec Policies 31

6.4.3 RTCP Policy 32

6.4.4 ICE Profile 33

6.5 MEDIA CONFIGURATION 33

6.5.1 Media Manager 34

6.5.2 Realm Config 35

6.5.3 Steering Pools 36

6.6 SIP CONFIGURATION 37

6.6.1 Sip-Config 37

6.6.2 Replaces Header Support 38

6.6.3 Sip Interface 39

6.6.4 Session Agents 40

6.6.5 Session Group 41
6.7 ROUTING CONFIGURATION 42
6.8 SIP ACCESS CONTROLS 45
7 ORACLE SBC CONFIGURATION ASSISTANT 47
7.1 MICROSOFT TEAMS CONFIGURATION ASSISTANT 47
8 VERIFY CONNECTIVITY 51
8.1 ORACLE SBC OPTIONS PINGS 51
8.2 MICROSOFT SIP TESTER CLIENT 51
9 SYNTAX REQUIREMENTS FOR SIP INVITE AND SIP OPTIONS: 52
9.1 TERMINOLOGY 52
9.2 REQUIREMENTS FOR INVITE MESSAGES AND FINAL RESPONSES 52
9.2.1 Contact Header-Invite and Final Response 52
9.3 REQUIREMENTS FOR OPTIONS MESSAGES 53
9.3.1 Contact Header-OPTIONS: 53
10 MICROSOFT TEAMS DIRECT ROUTING INTERFACE CHARACTERISTICS 53
11 APPENDIX A 55
11.1 ORACLE SBC TDM WITH TEAMS 55
11.1.1 Interface Requirements 55
12 APPENDIX B 55
12.1 ORACLE SBC DEPLOYED BEHIND NAT 55
13 APPENDIX C 57
13.1 RINGBACK ON INBOUND CALLS TO TEAMS AND EARLY MEDIA 57
13.2 ORACLE SBC LOCAL MEDIA PLAYBACK 59
13.2.1 Ringback on Transfer 59
14 APPENDIX D 61
14.1 CONFIGURATION FOR EMERGENCY CALLING 61
14.1.1 E911 61
14.1.2 Emergency Session Handling 61
14.2 ELIN GATEWAY 65
14.2.1 Sip-Manipulation for Teams ELIN 66
15 ACLI RUNNING CONFIGURATION 68

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1 Revision History

Document Version	Description	Revision Date
1.1	• Document Based on 9.0 Release • Removed sip manipulations for Teams • Added Config Assistant Section	11-16-2021
1.2	• Removed Session Translation for E911 • Removed sip-all fqdn • Added new Access Controls	01-05-2022

2 Intended Audience

This document describes how to connect the Oracle SBC to Microsoft Teams Direct Routing. This paper is intended for IT or telephony professionals.

Note: To zoom in on screenshots of Web GUI configuration examples, press Ctrl and +.

3 Validated Oracle Software Versions

All testing was successfully conducted with the Oracle Communications SBC versions:

SCZ830, SCZ840

These software releases with the configuration listed below can run on any of the following products:

- AP 1100
- AP 3900
- AP 3950 (Release SCZ9.0.0 Only)
- AP 4600
- AP 4900 (Release SCZ9.0.0 Only)
- AP 6350
- AP 6300
- VME

Please visit https://docs.microsoft.com/en-us/microsoftteams/direct-routing-border-controllers for further information

4 Related Documentation

4.1 Oracle SBC

- Oracle® Enterprise Session Border Controller Web GUI User Guide
- Oracle® Enterprise Session Border Controller ACLI Reference Guide
- Oracle® Enterprise Session Border Controller Release Notes
- Oracle® Enterprise Session Border Controller Configuration Guide

- Oracle® Enterprise Session Border Controller Security Guide

4.2 Microsoft Teams

- Microsoft Teams Direct Routing Overview
- Microsoft Teams Direct Routing Configuration
- Microsoft Teams Public Trusted Certificate for the SBC

5 About Teams Direct Routing

Microsoft Phone System Direct Routing lets you connect a supported, customer-provided Session Border Controller (SBC) to Microsoft Phone System. With this capability, for example, you can configure on-premises Public Switched Telephone Network (PSTN) connectivity with Microsoft Teams client

With Direct Routing, you can connect your SBC to almost any telephony trunk or interconnect with third-party PSTN equipment. Direct Routing enables you to:

- Use virtually any PSTN trunk with Microsoft Phone System.
- Configure interoperability between customer-owned telephony equipment, such as a third-party private branch exchange (PBX), analog devices, and Microsoft Phone System.

5.1 Planning Direct Routing

When planning to configure MSFT Teams Direct Routing with the Oracle SBC, the following prerequisites are required: Please read through the following information before proceeding.

- Microsoft Phone System Licensing
- Fully Qualified Domain Name for your Session Border Controller
- Public trusted certificate for the Oracle SBC

5.2 Media Bypass vs Non Media Bypass

When planning and setting up Microsoft Teams Phone System Direct Routing, one of the main features you need to pay attention to is whether or not you enable media bypass in your Teams tenant, or leave it disabled. This feature changes the way media flows on calls.

The default configuration is to have Media Bypass disabled, which forces the Microsoft phone system media processors to anchor media for all calls. In other words, all media packets will flow from the Oracle SBC to Microsoft phone system, and from there, to the Teams client.

Media bypass enables you to shorten the path of media traffic and reduce the number of hops in transit for better performance. With media bypass, media is kept between the Oracle Session Border Controller (SBC) and the client instead of sending it via the Microsoft Phone System. Media bypass leverages protocols called **Interactive Connectivity Establishment** (ICE) on the Teams client and ICE lite on the Oracle SBC. These protocols enable Direct Routing to use the most direct media path for optimal quality

For more information, please see "About Media Bypass with Direct Routing"

5.3 Infrastructure Requirements

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

Infrastructure Prerequisite	Details
Certified Session Border Controller (SBC)	**See Microsoft's Plan Direct Routing document and Microsoft Trusted Root Program with Included CA Certificate List**
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 client media	

5.4 DNS Requirements

You must create DNS records for domains in your network that resolve your Oracle SBC.
Before you begin, the following is required for every Oracle SBC you want to pair:

- Public IP address
- FQDN resolving to the Public IP address

5.4.1 SBC Domain Names

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 FQDN name of the SBC.

The following table shows examples of DNS names registered for the tenant, whether the name can be used as an FQDN for the SBC, and examples of valid FQDN names:

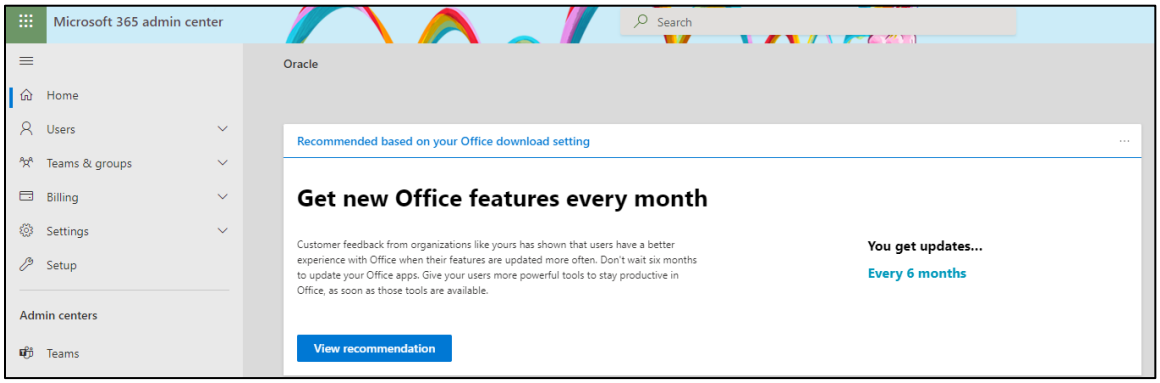
DNS name	Can be used for SBC FQDN	Examples of FQDN names
contoso.com	Yes	**Valid names:** sbc1.contoso.com ssbcs15.contoso.com europe.contoso.com
contoso.onmicrosoft.com	No	Using *.onmicrosoft.com domains is not supported for SBC names

5.4.2 Adding the SBC Domain to Microsoft O365

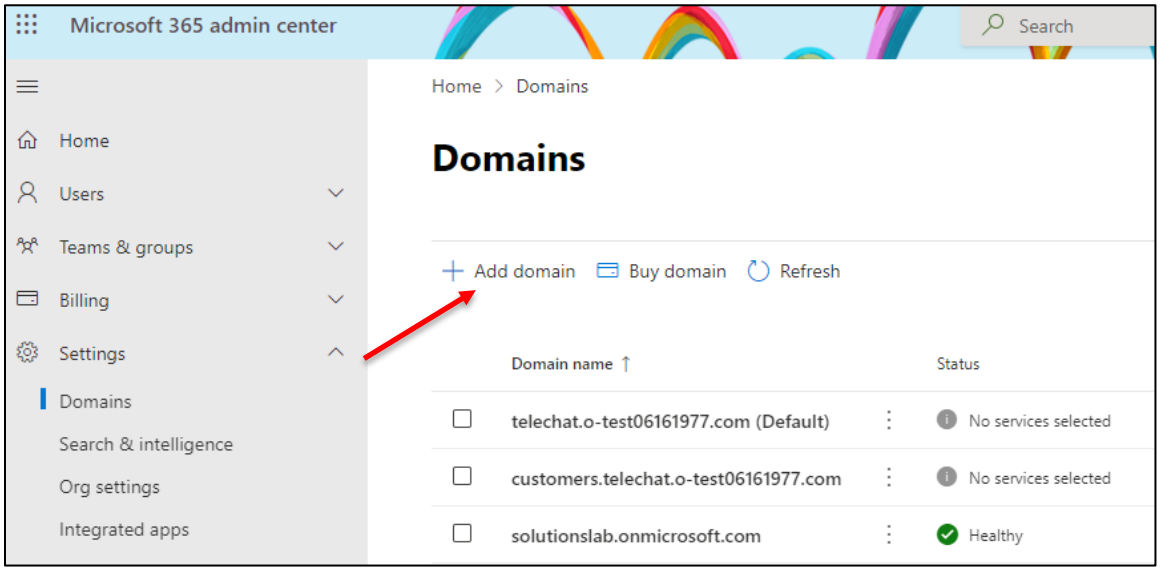
The steps below will walk you through adding/registering your Oracle SBC domain in Microsoft O365.

*To add, modify or remove domains you **must** be a **Global Administrator** of a business or enterprise plan. These changes affect the whole tenant, Customized administrators or regular users won't be able to make these changes*

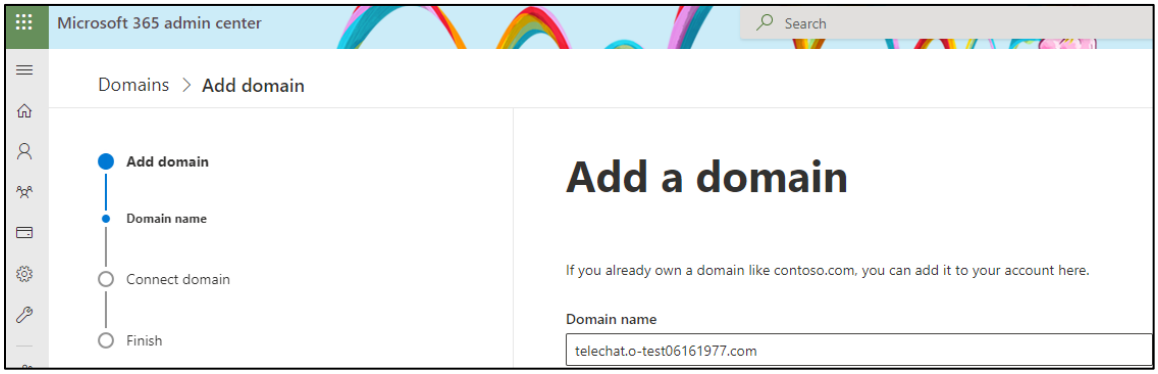
1. Go to the admin center at https://admin.microsoft.com. Enter your credentials to access the Microsoft 365 admin center



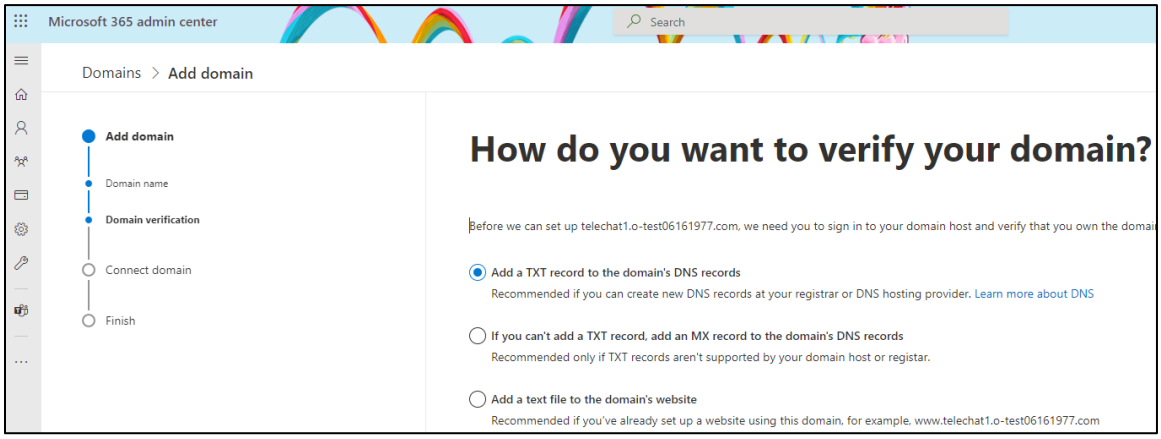
2. Go to the Settings > Domains page, click Add Domain



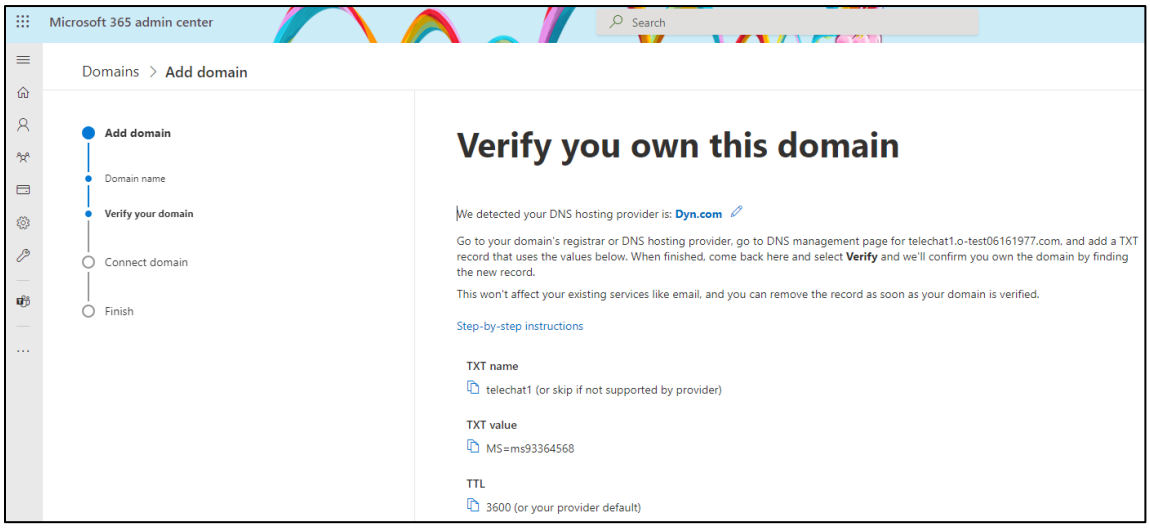
3. Enter the name of the domain you want to add, then select “Use this domain” at the bottom



4. Next, choose how you want to verify that you own the domain. For the purposes of this example, we select “Add a TXT record” select continue.



5. Follow the instructions on the screen. Once complete, select “verify” to complete the process



In this application note, we are using the following FQDN that is registered in Microsoft O365 to pair the Oracle SBC to Microsoft Teams Direct Routing Interface. Since our SBC is deployed behind NAT, we will only be displaying the private IP addresses configured on the SBC.

Public IP Address	FQDN Name
<Public IP of SBC or NAT>	telechat.o-test06161977.com

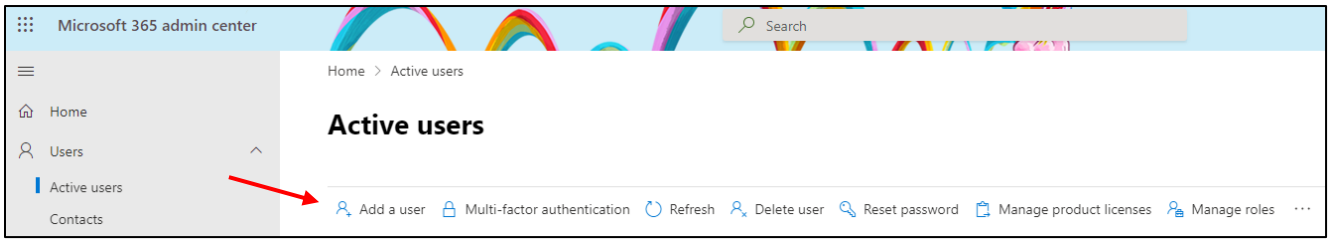
Next, we can create a User and assign Microsoft Phone System license.

5.4.3 Creating a User in Microsoft O365

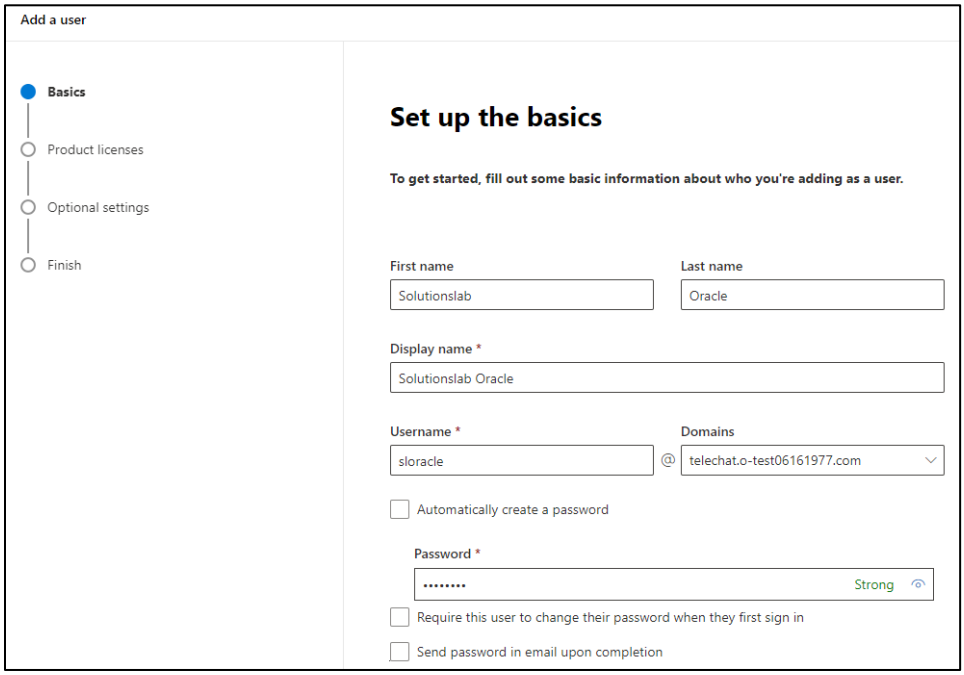
After your Domain has been added and verified in Microsoft O365, the domain must be activated by adding at least one licensed user with the SIP address matching that registered domain.

The steps below will outline how to add a user and assign privileges and licenses to that user.

1. In the Microsoft 365 admin center, go to **User management**, and select Add user.

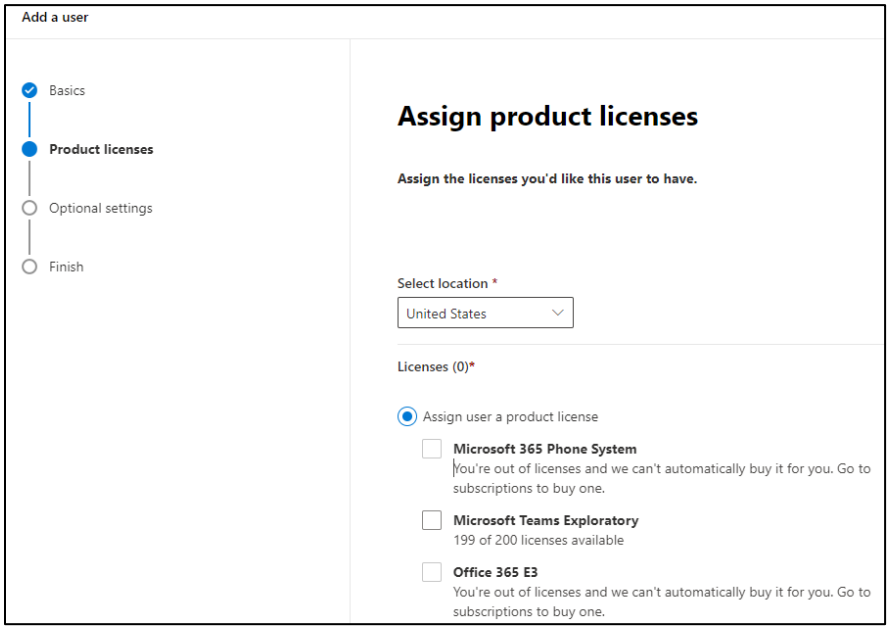


2. Fill in the required fields for basic information of the user and select Next

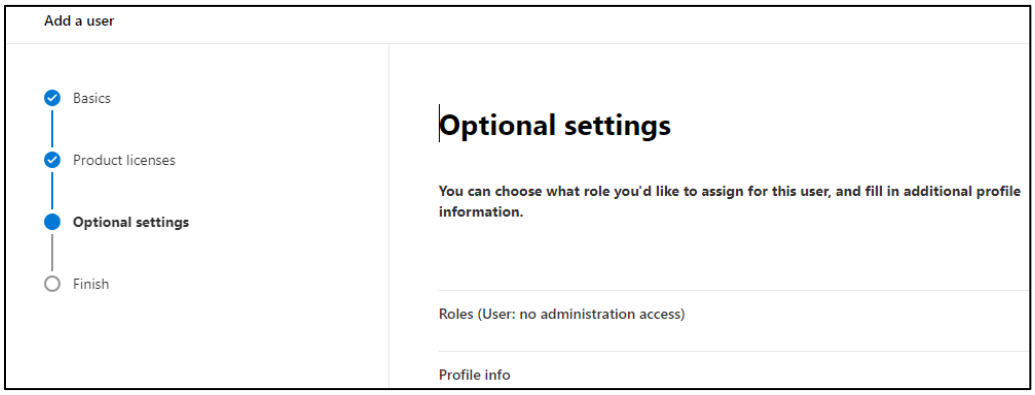


3. Assign the user a product license. To allow for Microsoft Teams Direct Routing, the following licenses must be assigned to users

- Microsoft 365 Phone System
- Office 365 E3



4. Finally, select Roles and add any additional Profile info to the user account. Select next, and follow the on screen instructions to complete the addition of the user.



5.5 Connect the SBC to the Teams tenant

The following describes how to configure your Teams tenant to accept a connection from the Oracle SBC. It will also cover how to enable your users for Direct routing, and the basics on how to setup call routing.

There are two ways to configure Microsoft Teams to accept a connection from the SBC. Using the Microsoft Teams admin center GUI, or by using the CLI in powershell.

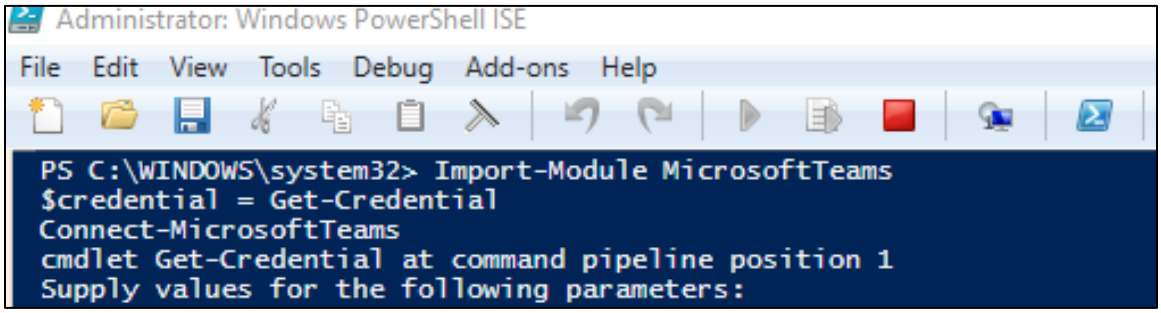
In this example, we'll connect to Teams online via powershell and provide some examples of a basic configuration.

In order you use Powershell to connect to your Teams tenant, you must first follow the step outlined in [Set up your computer for Windows Powershell]

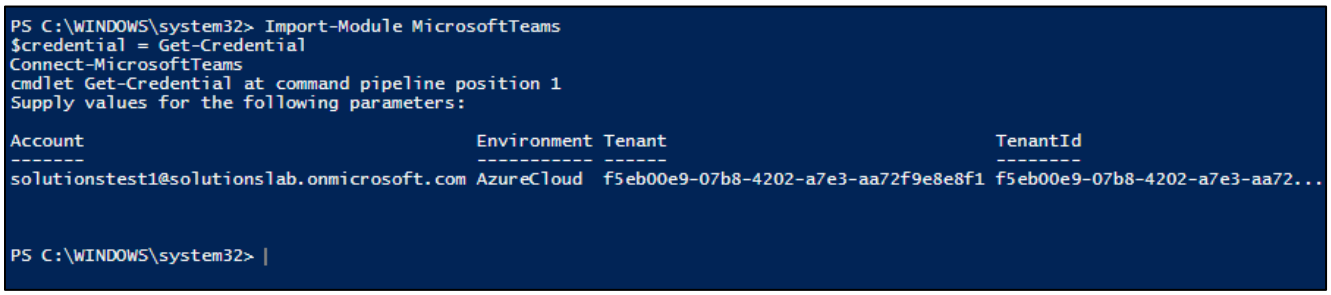
5.5.1 Remote Connection to Teams via Powershell

To establish a remote connection to your Teams tenant via powershell, you must first run the following commands and enter your admin credentials when prompted:

- Import-Module MicrosoftTeams
- $credential = Get-Credential
- Connect-MicrosoftTeams



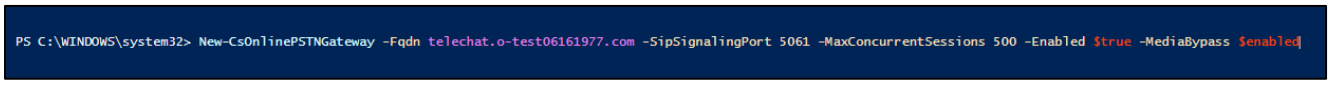
You will be prompted for your admin credentials twice in order to gain access to the tenant. Once logged in, you will see something similar to the following:



5.5.2 Connect the Oracle SBC

Use the New-CsOnlinePSTNGateway cmdlet to connect the SBC to the tenant. In a PowerShell session, type the following, and then press Enter:

"**New-CsOnlinePSTNGateway -Fqdn** <SBC FQDN> **-SipSignalingPort** <SBC SIP Port> **-MaxConcurrentSessions** <Max Concurrent Sessions the SBC can handle> **-Enabled $true**"



Although not provided in the example config, we also recommend setting the option "SendSipOptions" to $true. For a complete list of other options and configurable fields on the Teams PSTN Gateway, please refer to the following SBC Settings

*You can control media bypass for each SBC by using the **Set-CSOnlinePSTNGateway** command with the **-MediaBypass** parameter set to true or false*

After your PSTNGatway is configured, use the Get-CsOnlinePSTNGateway cmdlet to verify that the SBC is present in the list of paired SBCs. Type the following in a remote PowerShell session, and then press Enter:

Get-CsOnlinePSTNGateway -Identity <FQDN>

```
PS C:\WINDOWS\system32> Get-CsOnlinePSTNGateway -id telechat.o-test06161977.com


Identity                              : telechat.o-test06161977.com
InboundTeamsNumberTranslationRules    : {}
InboundPstnNumberTranslationRules     : {}
OutboundTeamsNumberTranslationRules   : {}
OutboundPstnNumberTranslationRules    : {}
Fqdn                                  : telechat.o-test06161977.com
SipSignalingPort                      : 5061
FailoverTimeSeconds                   : 10
ForwardCallHistory                    : True
ForwardPai                            : True
SendSipOptions                        : True
MaxConcurrentSessions                 : 500
Enabled                               : True
MediaBypass                           : True
GatewaySiteId                         :
GatewaySiteLbrEnabled                 : False
GatewayLbrEnabledUserOverride         : False
FailoverResponseCodes                 : 408,503,504
PidfLoSupported                       : False
MediaRelayRoutingLocationOverride     :
ProxySbc                              :
BypassMode                            : None
Description                           :
```

5.5.3 Configuring User Online Voice Settings

Earlier is the application note, we created a user and assigned that user the proper licenses. The next step is to configure the user's online phone settings.

Since we'll be managing the user's phone number online, we'll use the following powershell cmdlet:

Set-CsUser -Identity "<User name>" **-EnterpriseVoiceEnabled $true -HostedVoiceMail $true -OnPremLineURI tel**:<phone number>

```
PS C:\WINDOWS\system32> set-csuser -Identity teamsuser1@telechat.o-test06161977.com -EnterpriseVoiceEnabled $true -HostedVoiceMail $true -OnPremLineURI tel:+17814437247
```

It's recommended, but not required, that the phone number used is configured as a full E.164 phone number with country code

5.5.4 Configure Voice Routing for Direct Routing

We'll now go through how to configure voice routing for Phone System Direct Routing.

Please see "Configure Voice Routing for Direct Routing" for more details and in depth examples.

1. Create a PSTN Usage named "US and Canada"

Set-CsOnlinePstnUsage -Identity Global **-Usage** US and Canada"

```
PS C:\WINDOWS\system32> Set-CsOnlinePstnUsage -Identity Global -Usage "US and Canada"
```

2. Verify that the usage was created by entering:

Get-CSOnlinePSTNUsage

```
PS C:\WINDOWS\system32> Get-CSOnlinePSTNUsage


Identity : Global
Usage    : {US and Canada, DE933, USandCanada, US Canada...}
```

3. We'll create a voiceroute to point traffic to the our SBC (PSTNGatway)

New-CsOnlineVoiceRoute -Identity "Bedford 1" **-NumberPattern** .*
-OnlinePstnGatewayList telechat.o-test06161977.com **-Priority** 1 **-OnlinePstnUsages** "US and Canada"

```
PS C:\WINDOWS\system32> New-CsOnlineVoiceRoute -Identity "Bedford 1" -NumberPattern .* -OnlinePstnGatewayList telechat.o-test06161977.com -Priority 1 -OnlinePstnUsages "US and Canada"
```

4. Verify it's been created with

Get-CSOnlineVoiceRoute

```
PS C:\WINDOWS\system32> get-csonlinevoiceroute -id "Bedford 1"


Identity                : Bedford 1
Priority                : 1
Description             :
NumberPattern           : .*
OnlinePstnUsages        : {US and Canada}
OnlinePstnGatewayList   : {telechat.o-test06161977.com}
BridgeSourcePhoneNumber :
Name                    : Bedford 1
```

5. Now, we'll create a Voice Routing policy

New-CsOnlineVoiceRoutingPolicy "US Only" **-OnlinePstnUsages** "US and Canada"

```
PS C:\WINDOWS\system32> New-CsOnlineVoiceRoutingPolicy "US Only" -OnlinePstnUsages "US and Canada"
```

Get-CSOnlineVoiceRoutingPolicy

```
PS C:\WINDOWS\system32> Get-CSOnlineVoiceRoutingPolicy -id "US Only"


Identity         : Tag:US Only
OnlinePstnUsages : {US and Canada, US Canada, USandCanada, US}
Description      :
RouteType        : BYOT
```

6. Lastly, we'll assign the policy to users:

Grant-CsOnlineVoiceRoutingPolicy -Identity "teamsuser1" **-PolicyName** "US Only"

```
PS C:\WINDOWS\system32> Grant-CsOnlineVoiceRoutingPolicy -Identity teamsuser1 -PolicyName "US Only"
```

This concludes the basic setup in Microsoft Teams tenant to pair the SBC, assign DID's to users, and create voice routing for Phone System Direct Routing.

We'll now move on to configuring the Oracle SBC.

6 Oracle SBC Configuration

This chapter provides step-by-step guidance on how to configure Oracle SBC for interworking with Microsoft Teams Direct Routing Interface.

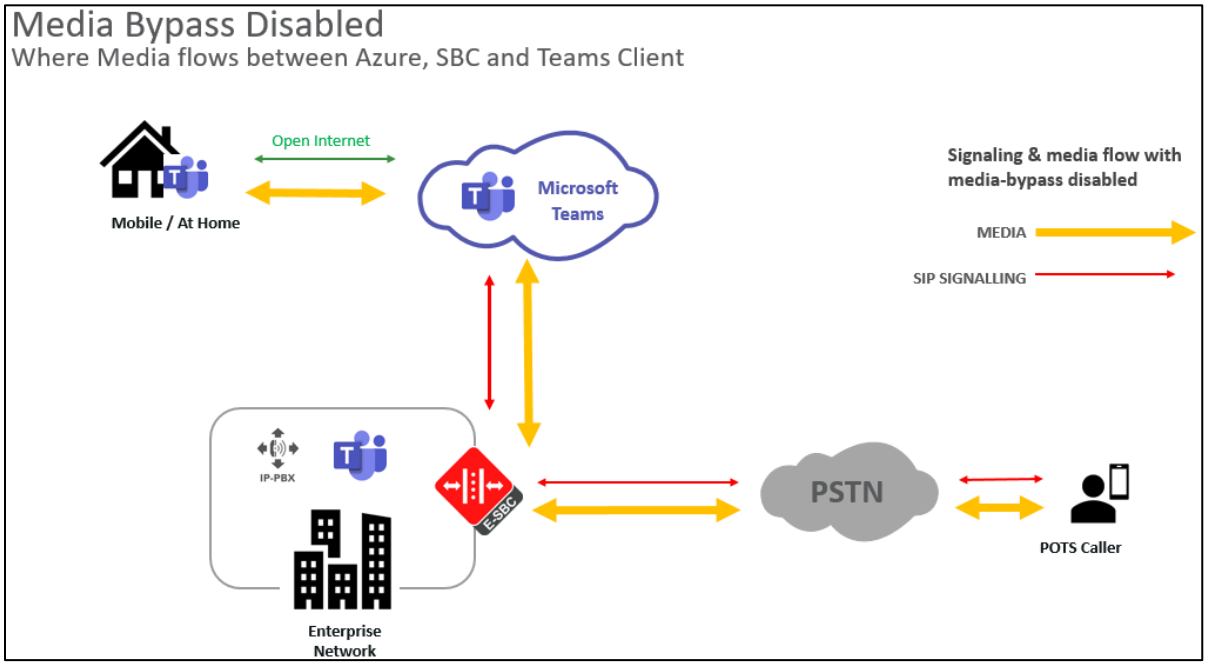
If the Oracle SBC being deployed is new, with no existing configuration, the simplest way to configure it to interface with Microsoft Teams Phone System Direct Routing is by utilizing the Configuration Assistant.

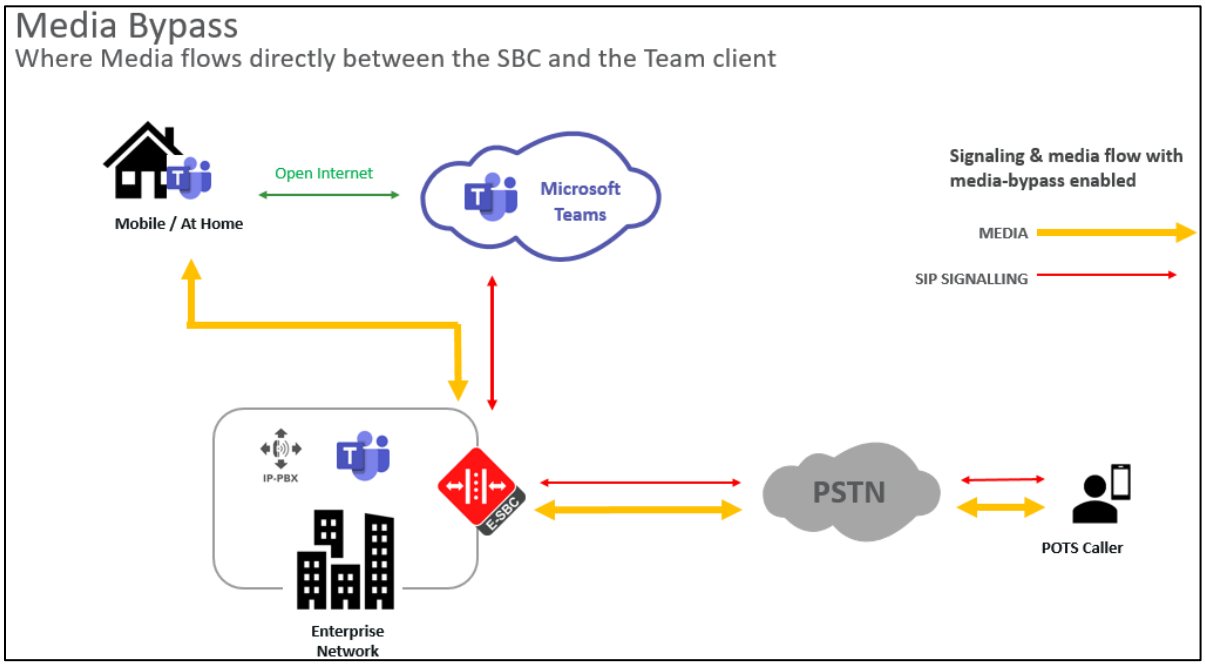
If an existing SBC is being used to interface with Microsoft Teams, follow the steps in this chapter to successfully configure the Oracle SBC.

Below shows the connection topology example for MSFT Teams for both Media Bypass and Non Media Bypass deployments

There are multiple connections shown:

- Teams Direct Routing Interface on the WAN
- Service provider Sip trunk terminating on the SBC





There are two methods for configuing the OCSBC, ACLI, or GUI.

For the purposes of this note, we'll be using the OCSBC GUI for all configuration examples. We will however provide the ACLI path to each element.

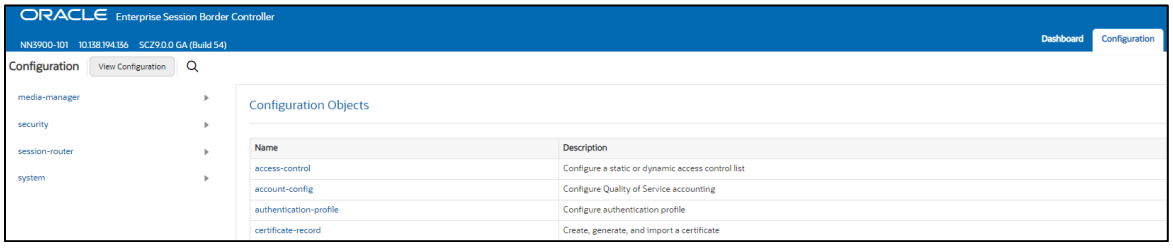
This guide assumes the OCSBC has been installed, management interface has been configured, product selected and entitlements have been assigned. Also, web-server-config has been enabled for GUI access. If you require more information on how to install your SBC platform, please refer to the ACLI configuration guide.

To access the OCSBC GUI, enter the management IP address into a web brower.
When the login screen appears, enter the username and password to access the OCSBC.

Once you have access to the OCSBC GUI, at the top, click the Configuration Tab. This will bring up the OCSBC Configuration Objects List on the left hand side of the screen.

Any configuration parameter not specifically listed below can remain at the OCSBC default value and does not require a change for the connection to MSFT Teams Phone System Direct routing to function properly.

Note: the configuration examples below were captured from a system running the latest GA software, 9.0.0



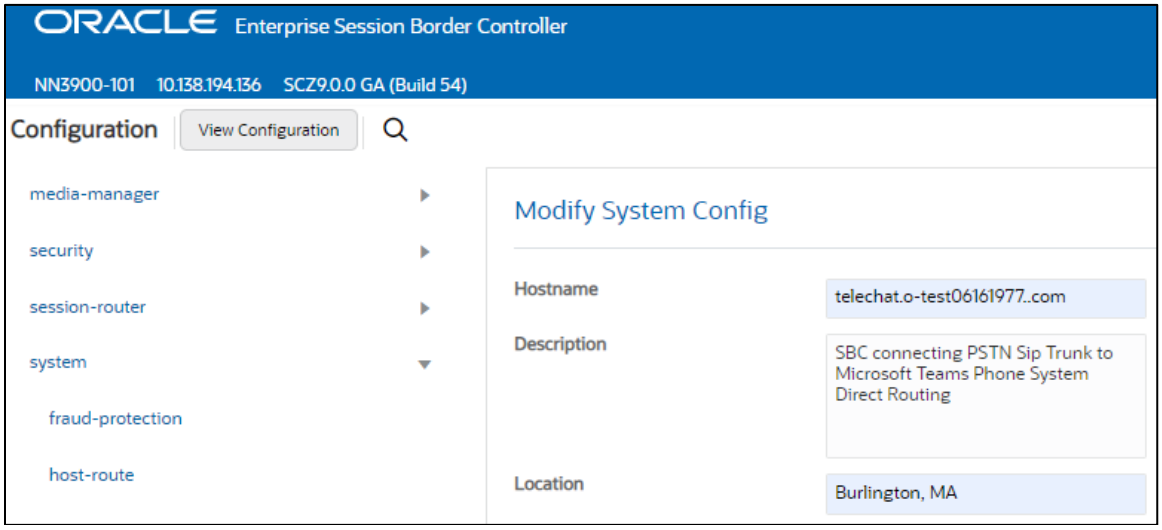
6.1 System-Config

To enable system level functionality for the OCSBC, you must first enable the system-config
.
GUI Path: system/system-config

ACLI Path: config t→system→system-config

Note: The following parameters are optional but recommended for system config

- Hostname
- Description
- Location
- Default Gateway (recommended to be the same as management interface gateway)
- Transcoding Core (This field is only required if you have deployed a VME SBC)



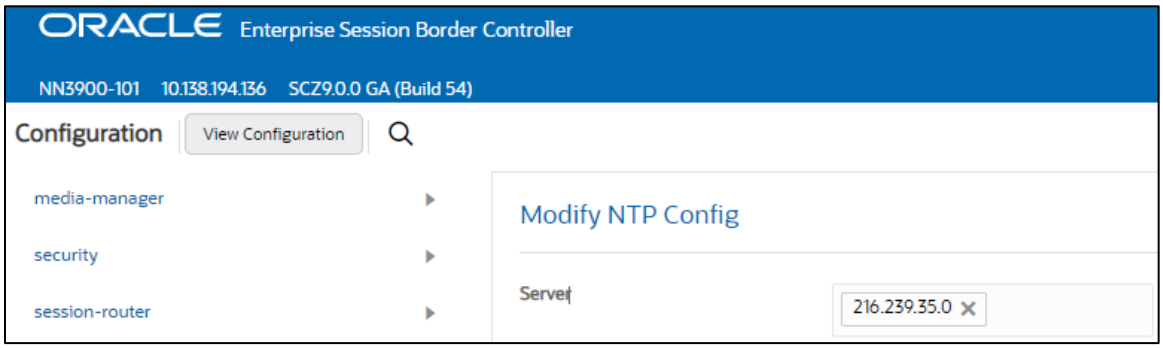
- Click OK at the bottom

6.1.1 NTP-Sync

You can use the following example to connect the Oracle SBC to any network time servers you have in your network. This is an optional configuration, but recommended.

GUI Path: system/ntp-config

ACLI Path: config t→system→ntp-sync



- Select OK at the bottom

Now we'll move on configuring network connection on the SBC.

6.2 Network Configuration

To connect the SBC to network elements, we must configure both physical and network interfaces. For the purposes of this example, we will configure two physical interfaces, and two network interfaces. One to communicate with MSFT Teams Direct Routing, the other to connect to PSTN Network. The slots and ports used in this example may be different from your network setup.

6.2.1 Physical Interfaces

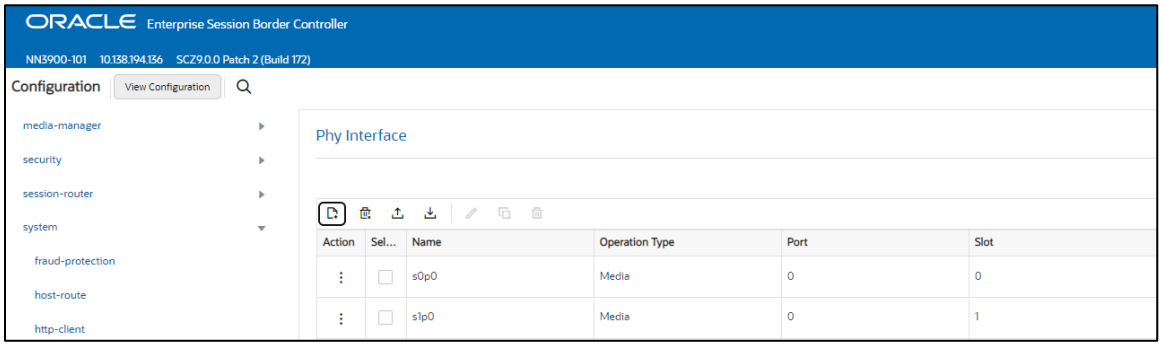
GUI Path: system/phy-interface

ACLI Path: config t→system→phy-interface

- Click Add, use the following table as a configuration example:

Config Parameter	Teams	PSTN
Name	s0p0	S1p0
Operation Type	Media	Media
Slot	0	1
Port	0	0

Note: Physical interface names, slot and port may vary depending on environment



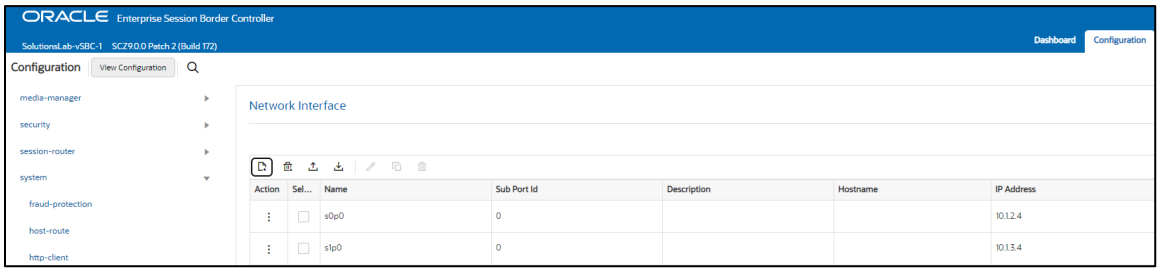
6.2.2 Network Interfaces

GUI Path: system/network-interface

ACLI Path: config t→system→network-interface

- Click Add, use the following table as a configuration example:

Configuration Parameter	Teams	PSTN
Name	s1p0	s0p0
IP Address	10.1.3.4	10.1.2.4
Netmask	255.255.255.0	255.255.255.0
Gateway	10.1.3.1	10.1.2.1
DNS Primary IP	8.8.8.8	
DNS Domain	Telechat.o-test06161977.com	



- Click OK at the bottom of each after entering config information

Next, we'll configure the necessary elements to secure signaling and media traffic between the Oracle SBC and Microsoft Phone System Direct Routing.

6.3 Security Configuration

This section describes how to configure the SBC for both TLS and SRTP communication with Teams Direct Routing Interface.

Microsoft Teams Direct Routing only allows TLS connections from SBC's for SIP traffic, and SRTP for media traffic. It requires a certificate signed by Certificate Authorities (CAs) that are part of the **Microsoft Trusted Root Certificate Program**. A list of currently supported Certificate Authrities can be found at:

Public trusted certificate for the SBC

6.3.1 Certificate Records

"Certificate-records" are configuration elements on Oracle SBC which capture information for a TLS certificate such as common-name, key-size, key-usage etc.

This section walks you through how to configure certificate records, create a certificate signing request, and import the necessary certificates into the SBC's configuration.

GUI Path: security/certificate-record

ACLI Path: config t→security→certificate-record

For the purposes of this application note, we'll create three certificate records. They are as follows:

- SBC Certificate (end-entity certificate)
- DigiCert RootCA Cert (Root CA used to sign the SBC's end entity certificate)
- BaltimoreRoot CA Cert (Microsoft Presents the SBC a certficate signed by this authority)

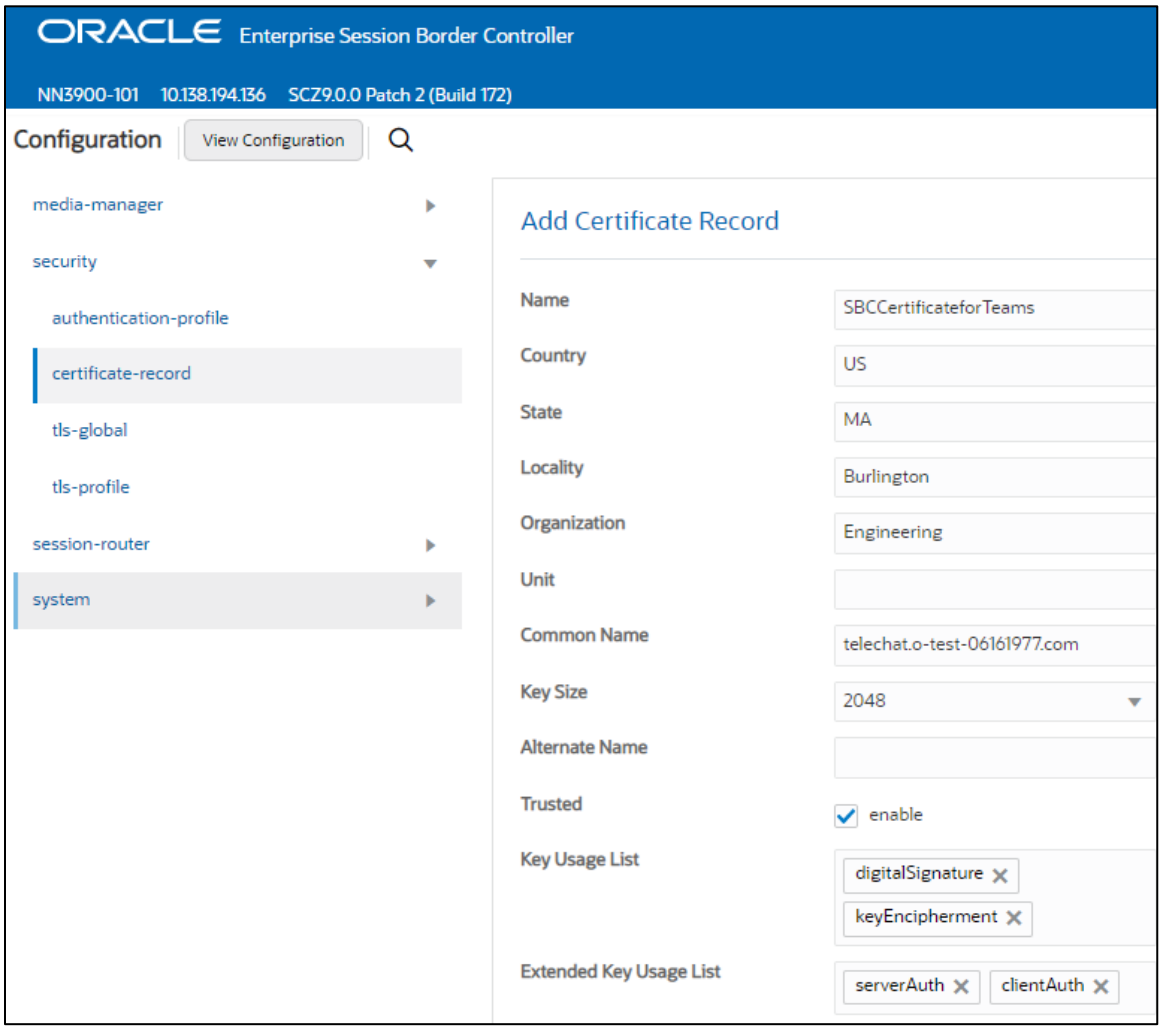
Note: The DigiCert RootCA is only part of this example, as that is the Authority we used to sign our SBC certificate. You would replace this with the root and/or intermediate certificates used to sign the CSR generated from your SBC.

6.3.1.1 SBC End Entity Certificate

The SBC's end entity certificate is the certificate the SBC presents to Microsoft to secure the connection. The only requirements when configuring this certificate is the common name must contain the SBC's FQDN. In this example our common name will be **telechat.o-test06161977.com.** You must also give it a name. All other fields are optional, and can remain at default values.

To Configure the certificate record:

Click Add, and use the following example to configure the SBC certificate



- Click OK at the bottom

Next, using this same procedure, configure certificate records for the Root CA certificates

6.3.1.2 Root CA and Intermediate Certificates

6.3.1.2.1 DigiCert Root CA

The following, DigitCertRoot, is the root CA certificate used to sign the SBC's end entity certificate. As mentioned above, your root CA and/or intermediate certificate may differ. This is for example purposes only.

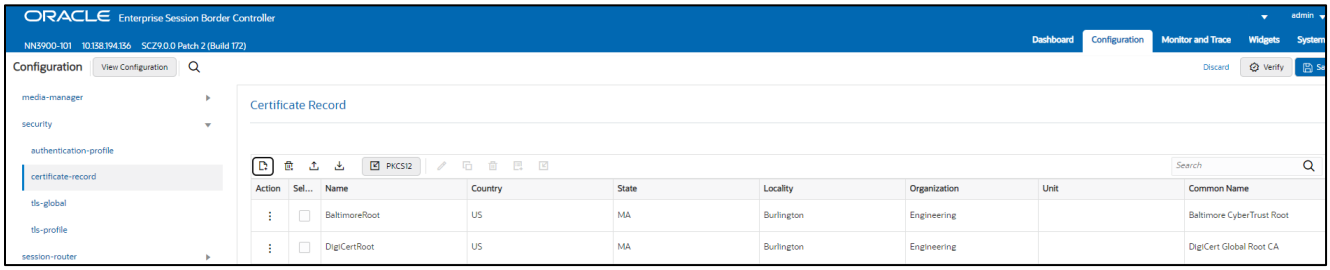
6.3.1.2.2 Baltimore Root

The DNS name of the Microsoft Teams Direct Routing interface is sip.pstnhub.microsoft.com. Microsoft presents a certificate to the SBC which is signed by Baltimore Cyber Baltimore CyberTrust Root. To trust this certificate, your SBC must have the certificate listed as a trusted ca certificate.

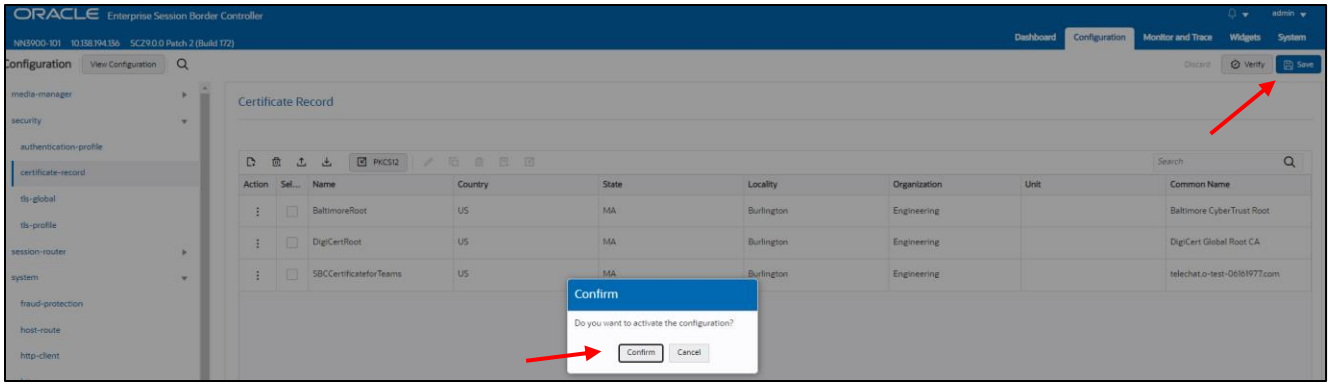
You can download this certificate here: https://cacerts.digicert.com/BaltimoreCyberTrustRoot.crt.pem

Please use the following table as a configuration reference: Modify the table according to the certificates in your environment.

Config Parameter	Baltimore Root	DigiCert Root CA
Common Name	Baltimore CyberTrust Root	DigiCert Global Root CA
Key Size	2048	2048
Key-Usage-List	digitalSignature keyEncipherment	digitalSignature keyEncipherment
Extended Key Usage List	serverAuth	serverAuth
Key algor	rsa	rsa
Digest-algor	Sha256	Sha256



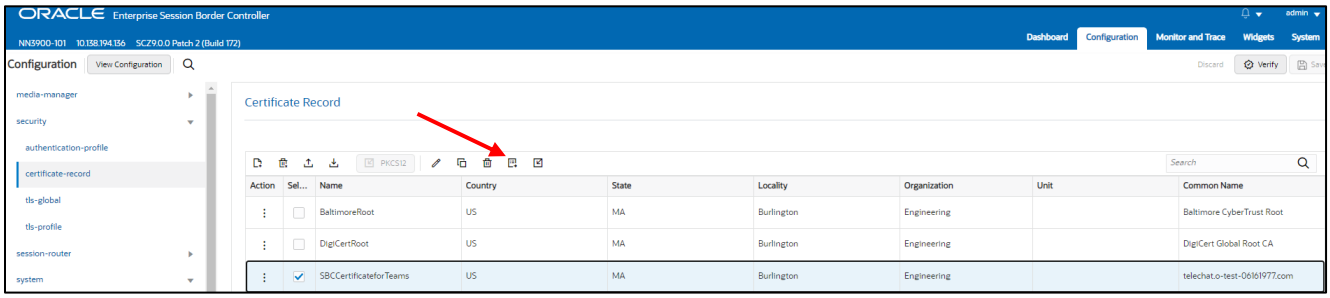
At this point, before generating a certificate signing request, or importing any of the Root CA certs, we must **save and activate** the configuration of the SBC.



6.3.1.3 Generate Certificate Signing Request

Now that the SBC's certificate has been configured, create a certificate signing request for the SBC's end entity only. **This is not required for any of the Root CA or intermidiate certificates that have been created**.

On the certificate record page in the Oracle SBC GUI, select the SBC's end entity certificate that was created above, and click the "generate" tab at the top:



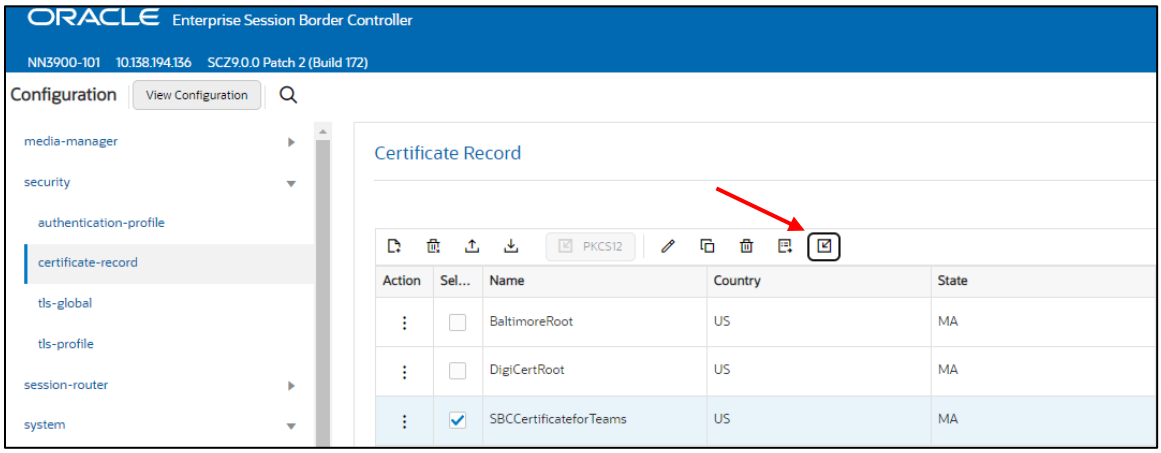
Copy/paste the text that gets printed on the screen as shown above and upload to your CA server for signature. Also note, at this point, **another save and activate is required** before you can import the certificates to each certificate record created above.

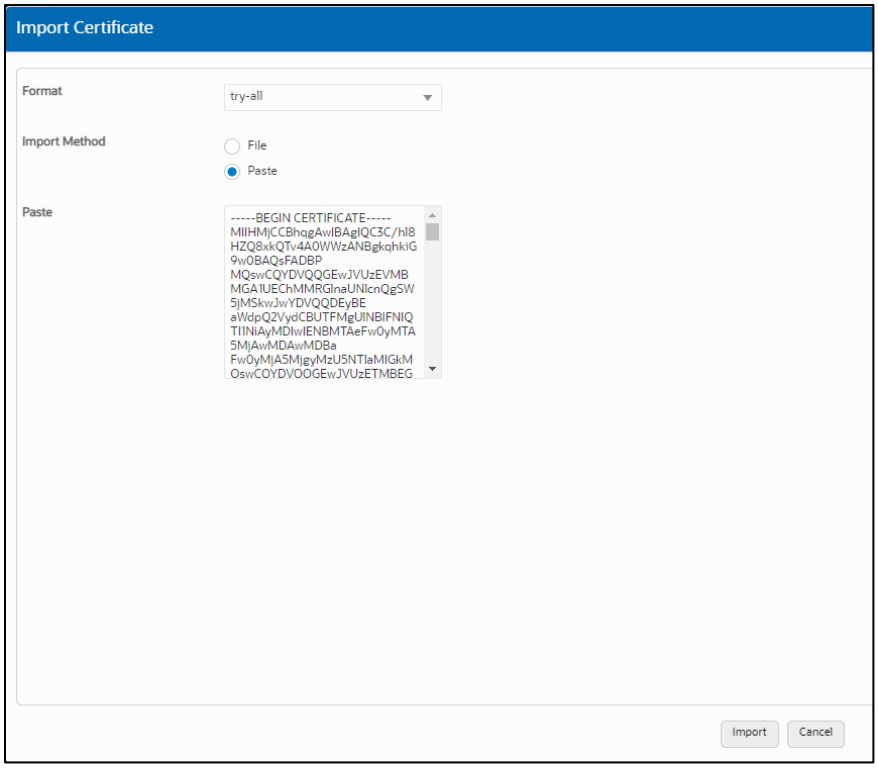
Once you have received the signed certificate back from your signing authority, we can now import all certificates to the SBC configuration.

6.3.1.4 Import Certificates to SBC

Once certificate signing request has been completed – import the signed certificate to the SBC.

Please note – all certificates including root and intermediate certificates are required to be imported to the SBC. Once all certificates have been imported, issue a third **save/activate** from the WebGUI to complete the configuration of certificates on the Oracle SBC.





- Once pasted in the text box, select Import at the bottom, then **save and activate** your configuration.

Repeat these steps to import all the root and intermediate CA certificates into the SBC:

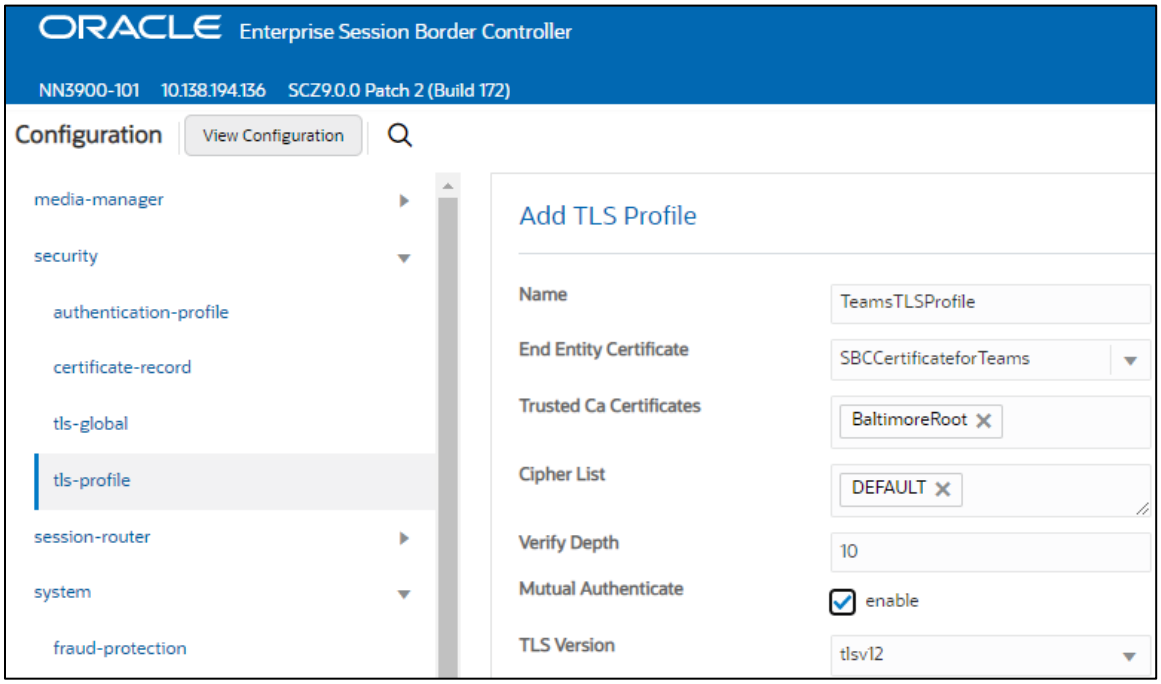
6.3.2 TLS Profile

TLS profile configuration on the SBC allows for specific certificates to be assigned.

GUI Path: security/tls-profile

ACLI Path: config t→security→tls-profile

- Click Add, use the example below to configure



- Select OK at the bottom

Next, we'll move to securing media between the SBC and Microsoft Teams.

6.3.3 Media Security

This section outlines how to configure support for media security between the OCSBC and Microsoft Teams Direct Routing.

6.3.3.1 SDES-Profile

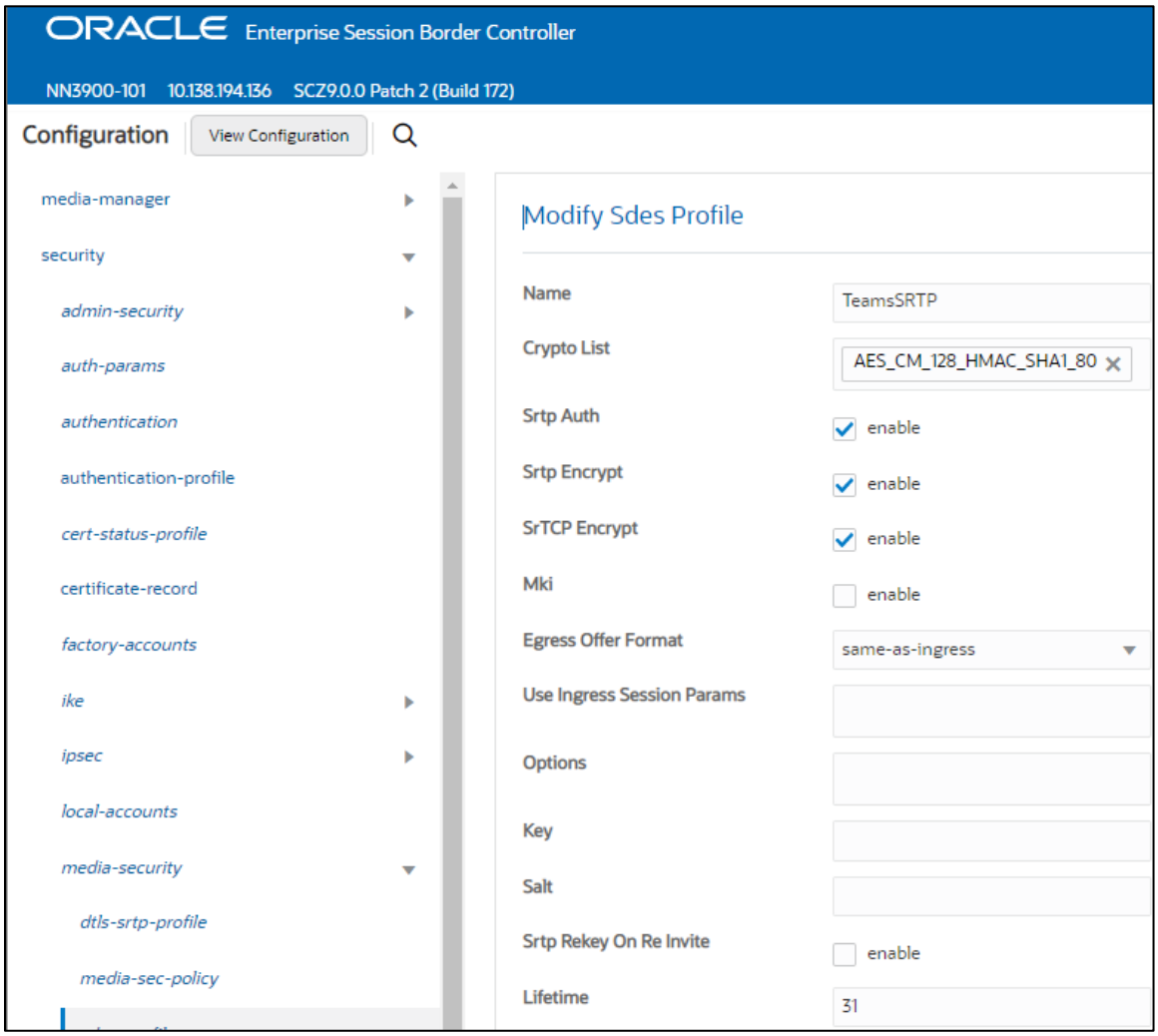
This is the first element to be configured for media security, where the algorithm and the crypto's to be used are configured. The only crypto-suite option supported by Microsoft is AES_CM_128_HMAC_SHA1_80 and must be included in the crypto list

In the SBC's GUI, on the bottom left, you will need to enable the switch "Show All" to access the media security configuration elements.

GUI Path: security/media-security/sdes-profile

ACLI Path: config t→security→media-security→sdes-profile

- Click Add, and use the example below to configure



Please note, if you have media bypass enabled in your environment, the lifetime value of 31 is required for Teams clients to decrypt SRTP packets sent by the Oracle SBC.

- Select OK at the bottom

6.3.3.2 Media Security Policy

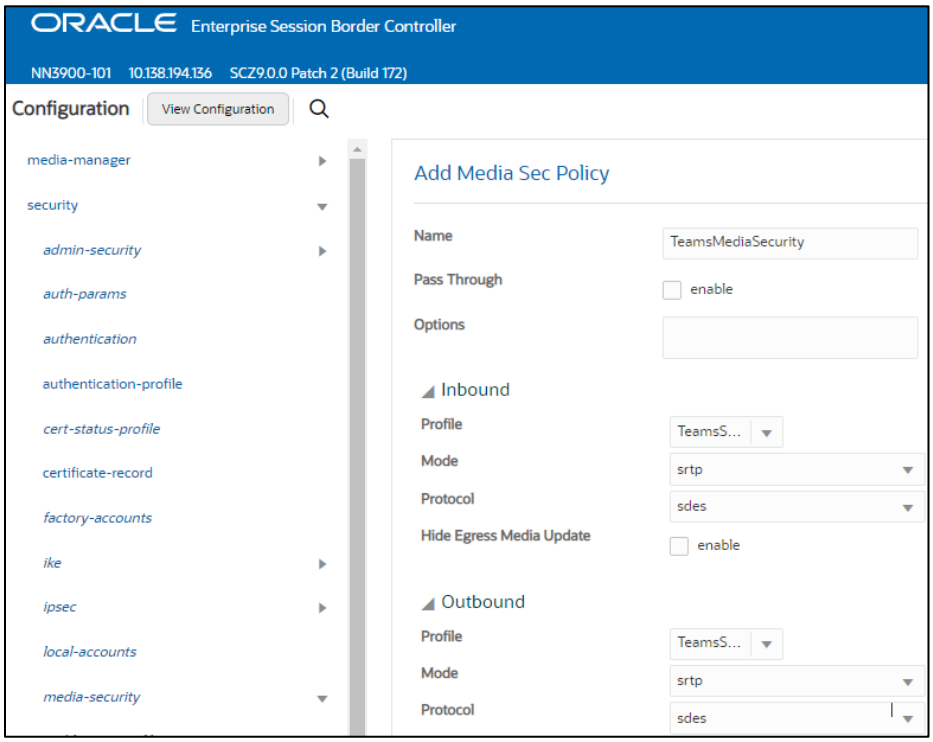
Media-sec-policy instructs the SBC how to handle the SDP received/sent under a realm (RTP, SRTP or any) and, if SRTP needs to be used, the sdes-profile that needs to be used

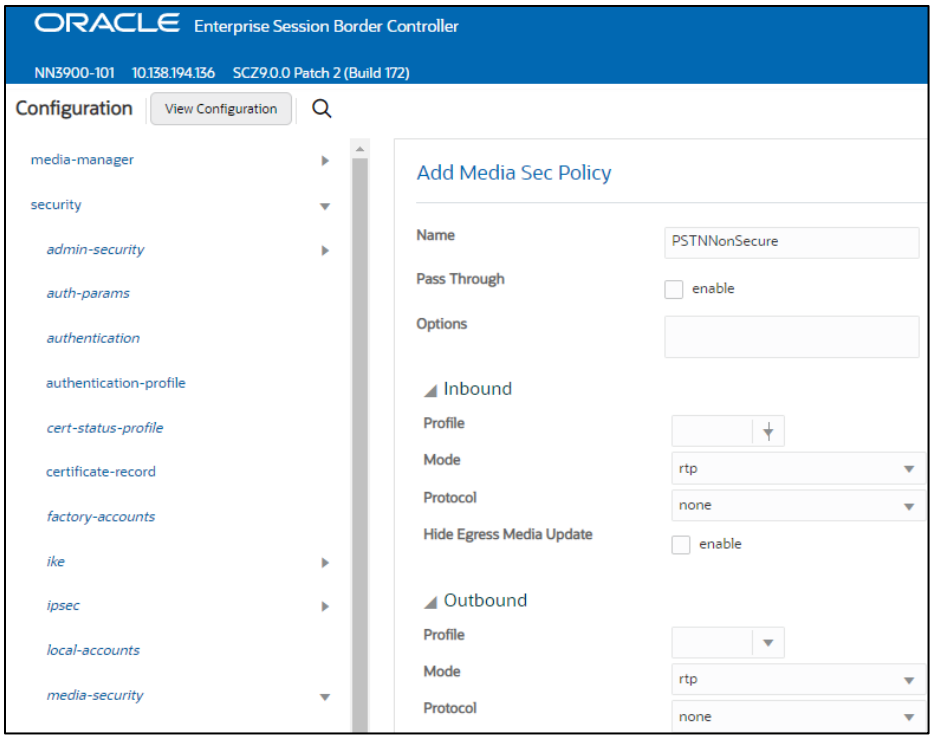
In this example, we are configuring two media security policies. One to secure and decrypt media toward Microsoft Teams, the other for non secure media facing PSTN.

GUI Path: security/media-security/media-sec-policy

ACLI Path: config t→security→media-security→media-sec-policy

- Click Add, use the examples below to configure





- Select OK at the bottom of each when finished

This finishes the security configuration portion of the application note. We'll now move on to configuring media and transcoding.

6.4 Transcoding Configuration

Transcoding is the abilityto convert between media streams that are based upon disparate codecs. The OCSBC supports IP-to-IP transcoding for SIP sessions, and can connect two voice streams that use different coding algorithm s with one another

6.4.1 Media Profiles

For different codecs and media types, you can setup customized media profiles that serve to police media values and define media bandwidth policies.

SILK & CN offered by Microsoft teams are using a payload type which is different than usual, so to support this, we configure the following media profiles on the SBC.

This is an optional configuration, and only needs to be implemented on the SBC if you are planning to use the SILK codec or wideband comfort noise between the SBC and Microsoft Phone System Direct Routing.

GUI Path: session-router/media-profile

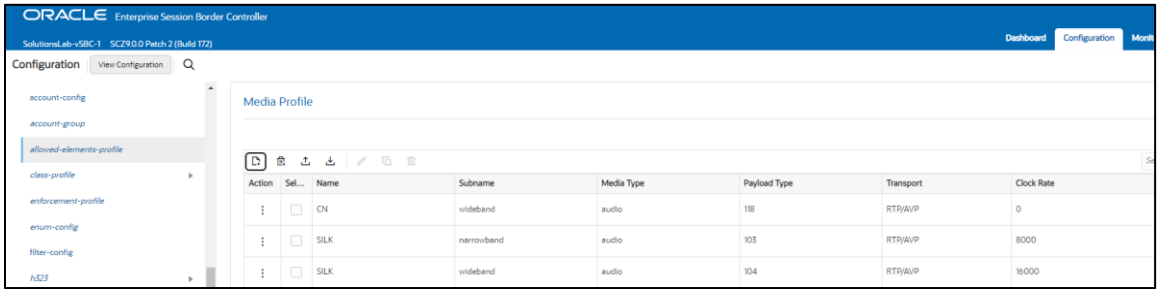
ACLI Path: config t→session-router→media-profile

Configure three media profiles to support the following:

- Silk Wideband
- Silk Narrowband
- CN

Click Add, then use the table below as an example to configure each:

Parameters	Silk	Silk	CN
Subname	narrowband	wideband	wideband
Payload-Type	103	104	118
Clock-rate	8000	16000	0



- Select OK at the bottom or each after entering the required values

6.4.2 Codec Policies

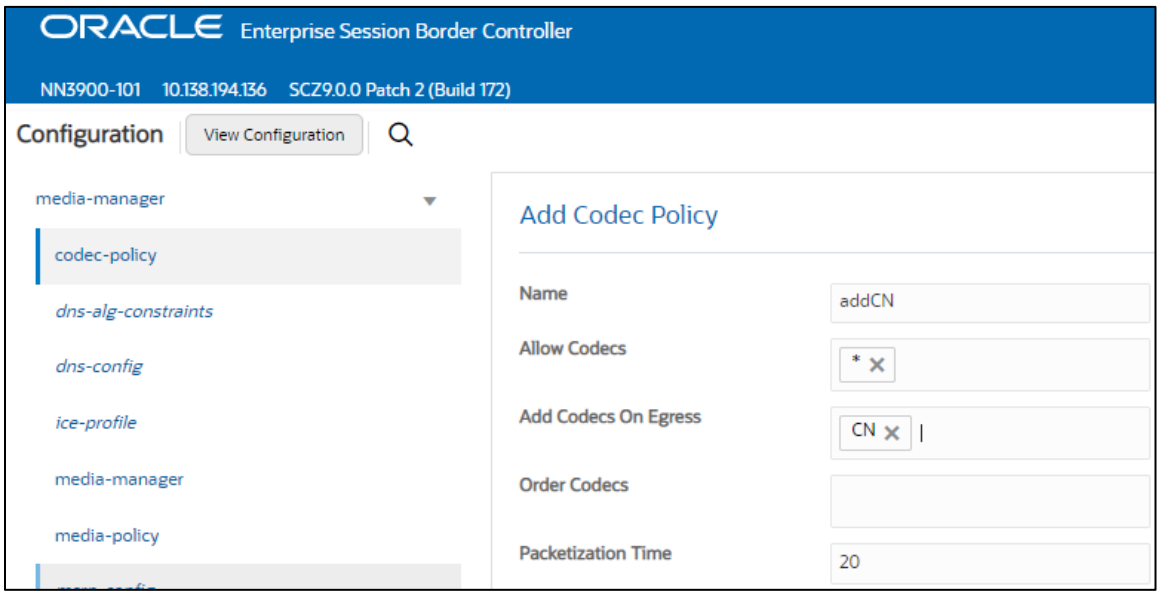
Codec policies are sets of rules that specify the manipulations to be performed on SDP offers allowing the Oracle SBC the ability to add, strip, and reorder codecs for SIP sessions.

While transcoding media codecs is optional, Microsoft does require the SBC generate Comfort Noise and RTCP packets towards Teams if the connection on the other side of the SBC (PSTN, IPPBX, etc..) does not support either. In order to satisfy this requirement, the SBC uses transcoding resources to generate those packets, which does require a codec policy be configured and assigned.

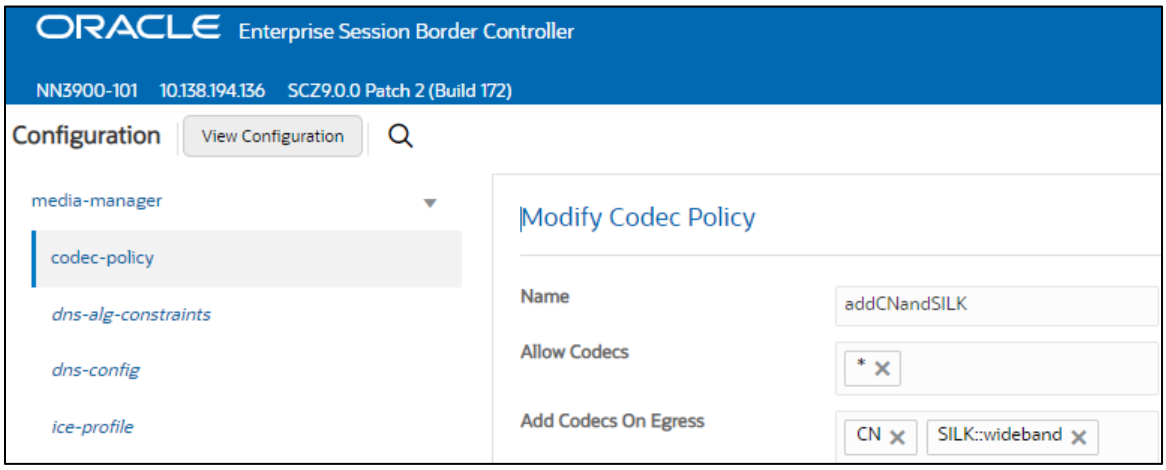
GUI Path: media-manager/codec-policy

ACLI Path: config t→media-mangaer→codec-policy

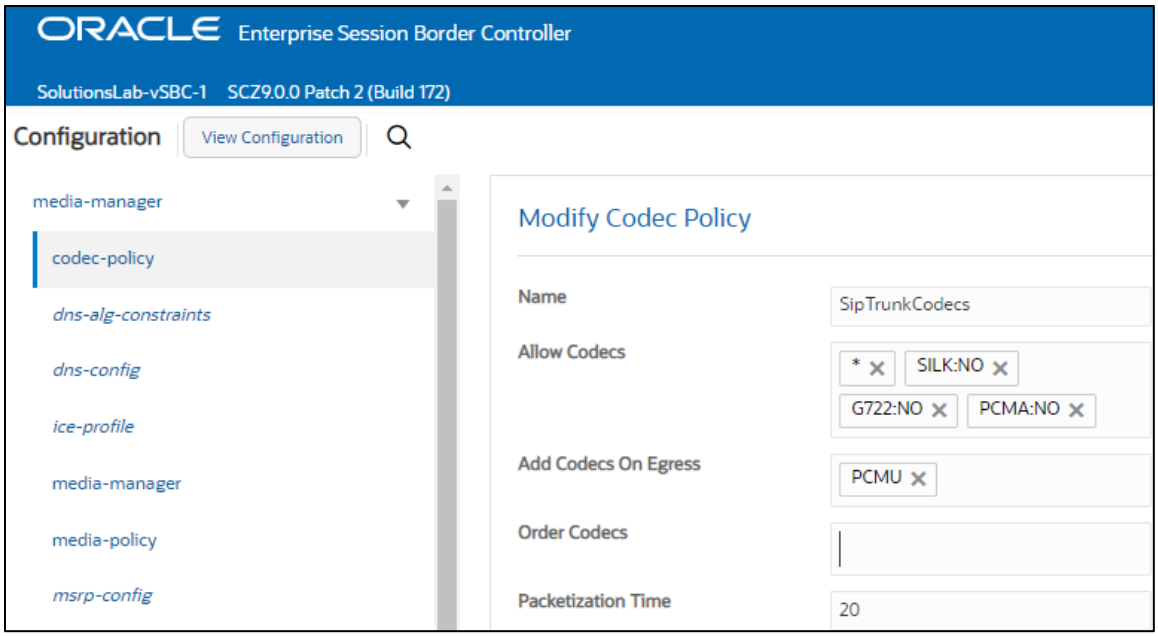
Here is an example config of a codec policy used for the SBC to generate CN packets towards Teams.



If you have chosen to configure the media profiles in the previous section to use SILK or wideband CN, you would set your codec policy to add them on egress. Here is an example:



Lastly, since some SIP Trunks may have issues with the codecs being offerened by Microsoft Teams, you can create another codec policy to remove unwanted or unsupported codecs from the request/responses to your Sip Trunk provider.



- Select OK at the bottom

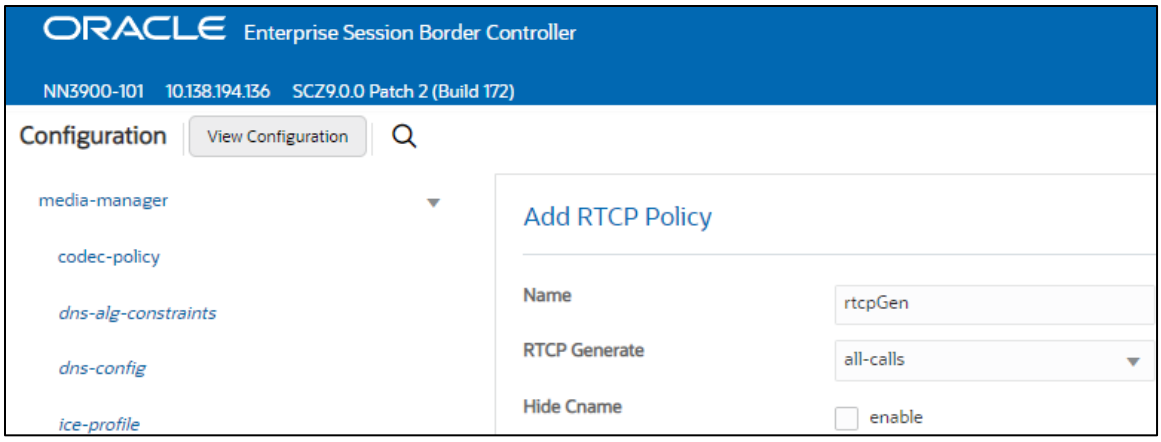
6.4.3 RTCP Policy

The following RTCP policy needs to be configured for the Oracle SBC to generate RTCP sender reports toward Microsoft Teams.

GUI Path: media-manager/rtcp-policy

ACLI Path: config t→media-manger→rtcp-policy

- Click Add, use the example below as a configuration guide



FYI, for the SBC to generate RTCP sender reports to Teams, the realm in which this policy is assigned must also have a codec policy assigned. This is to evoke the required transcoding resources needed to generate RTCP packets.

- Select OK

6.4.4 ICE Profile

Interactive Connectivity Establishment - Session Traversal Utility for NAT (ICE STUN lite mode) enables an Advanced Media Termination client to perform connectivity checks, and can provide several STUN servers to the browser. ICE STUN support requires configuring an ICE Profile

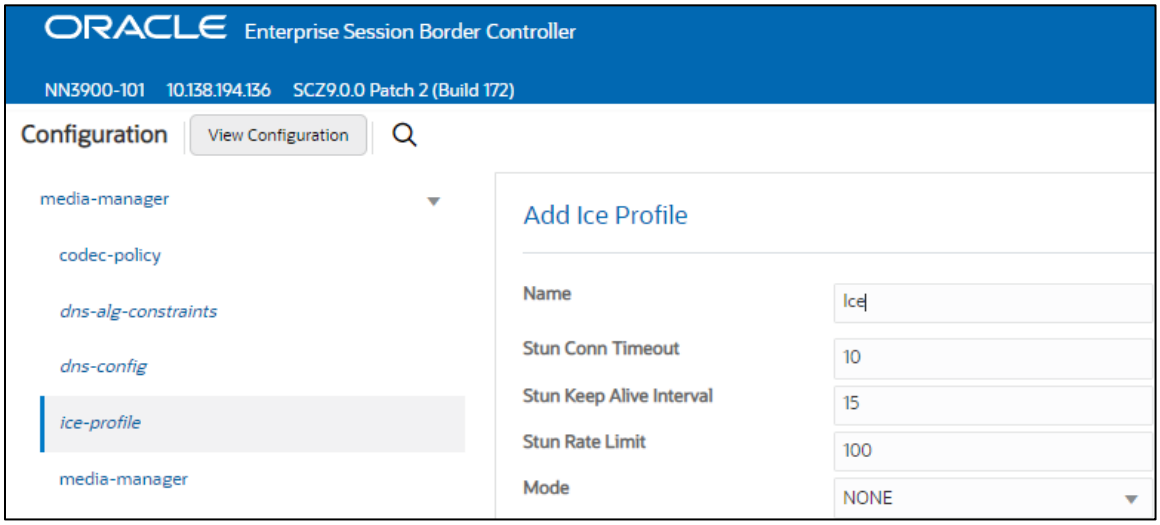
The use of ICE is required only if using Teams with Media Bypass enabled.

This is the only Oracle SBC configuration difference between Media Bypass and Non Media Bypass deployments.

GUI Path: media-manager/ice-profile

ACLI Path: config t→media-manger→ice-profile

- Click Add, use the example below as a guide to configure



In some environments, it may be necessary to change the default values for Stun Conn Timeout, Stun Keep Alive Interval, and Stun Rate Limit to a value of 0 (zero).

Select OK at the bottom.

This concludes the configuration for transcoding and Advanced Media Termination options on the SBC. We can now move to setup Media.

6.5 Media Configuration

This section will guide you through the configuration of media manager, realms and steering pools, all of which are required for the SBC to handle signaling and media flows toward Teams and PSTN.

6.5.1 Media Manager

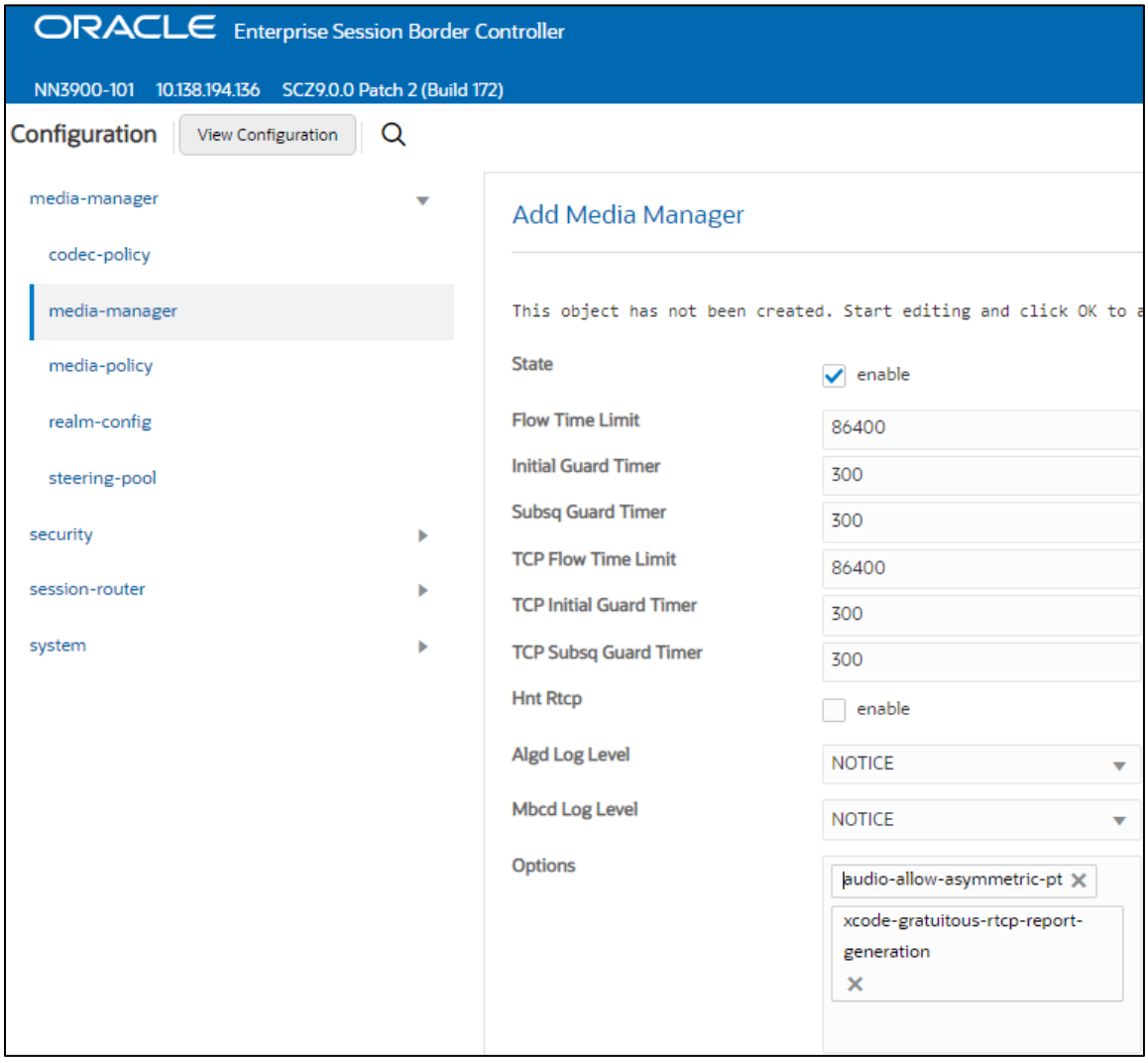
To configure media functionality on the SBC, you must first enabled the global media manager

GUI Path: media-manager/media-manager

ACLI Path: config t→media-manager→media-manager-config

The following two hidden options are recommended for the global media manager when interfacing with Microsoft Teams Phone System Direct Routing.

- audio-allow-asymmetric-pt: Provides transcoding support for asymmetric dynamic payload types enables the Oracle® Session Border Controller to perform transcoding when the RTP is offered with one payload type and is answered with another payload type.
- xcode-gratuitous-rtcp-report-generation: This option allows the Oracle SBC to generate a Real-Time Transport Control Protocol (RTCP) Receiver Report separately from the default Sender-Receiver Report (RFC 3550). This option requires a reboot to take effect.



- Click OK at the bottom

6.5.2 Realm Config

Realms are a logical distinction representing routes (or groups of routes) reachable by the Oracle® Session Border Controller and what kinds of resources and special functions apply to those routes. Realms are used as a basis for determining ingress and egress associations to network interfaces.

.

GUI Path; media-manger/realm-config

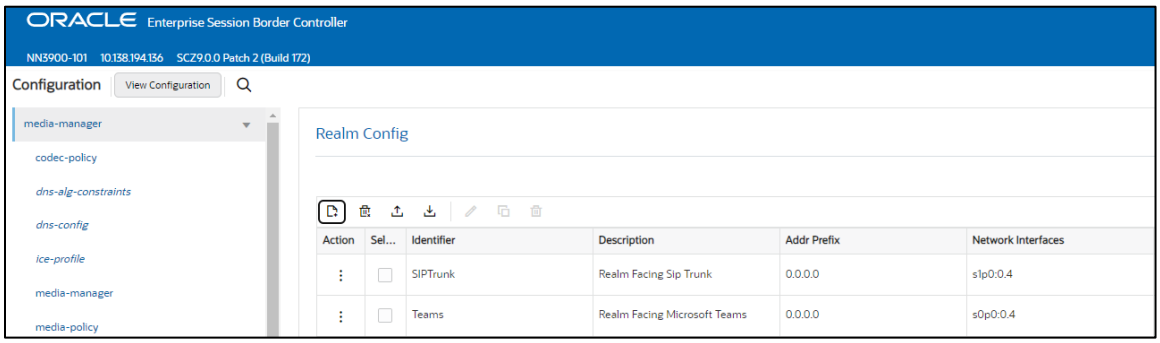
ACLI Path: config t→media-manger→realm-config

- Click Add, and use the following table as a configuration example for the realms. The following parameters are all required unless mentioned as optional below.

Config Parameter	Teams Realm	PSTN Realm
Identifier	Teams	SipTrunk
Network Interface	s0p0:0	s1p0:0
Mm in realm	☑	☑
Media Sec policy	TeamsSecurityPolicy	PSTNNonSecure
Teams-FQDN	telechat.o-test06161977.com	
Teams-fqdn-in-uri	☑	
Sdp-inactive-only	☑	
RTCP mux	☑	
ice profile	Ice (required for media bypass only)	
Codec policy	addCN	SipTrunkCodecs
RTCP policy	rtcpGen	
Access-control-trust-level	HIGH	HIGH

Also notice the realm configuration is where we assign some of the elements configured earlier in this document. IE…

- Network Interface
- Media Security Policy
- Ice Profile (optional, only required if using Media Bypass)
- Codec Policy (optional on the PSTN Realm)
- RTCP Policy



- Select OK at the bottom of each

6.5.3 Steering Pools

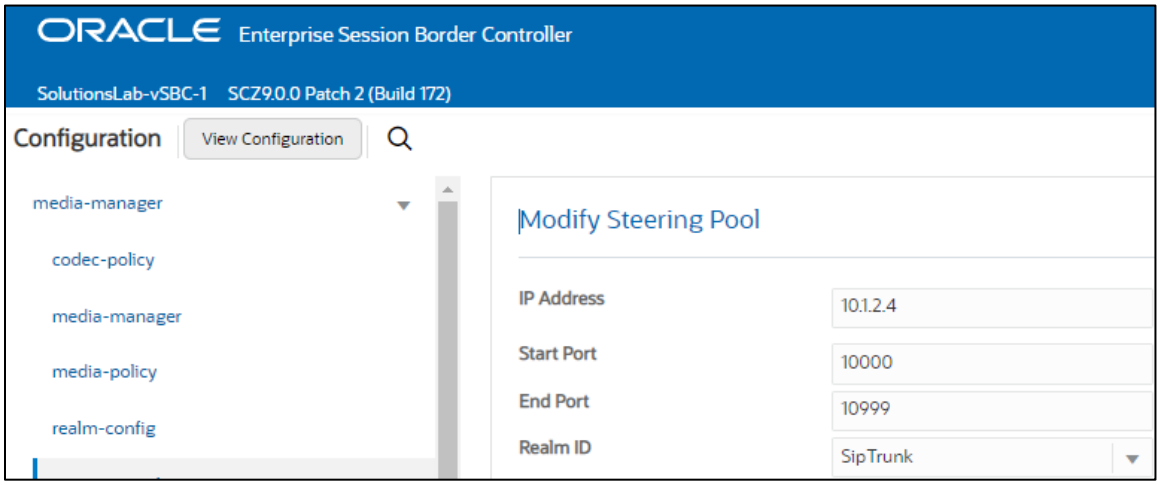
Steering pools define sets of ports that are used for steering media flows through the OCSBC.
These selected ports are used to modify the SDP to cause receiving session agents to direct their media toward this system.

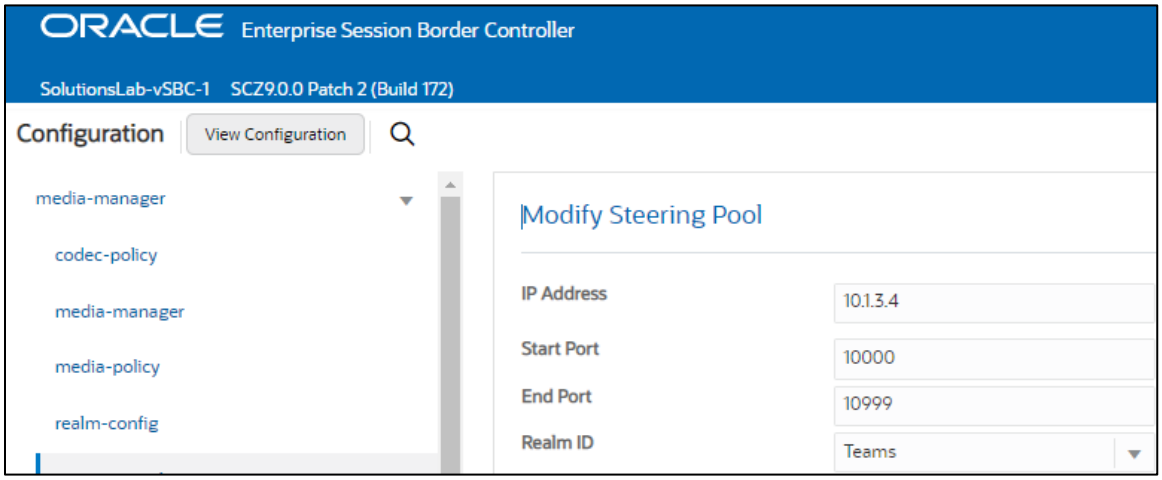
We configure one steering pool for PSTN. The other facing Teams.

GUI Path: media-manger/steering-pool

ACLI Path: config t→media-manger→steering-pool

- Click Add, and use the below examples to configure





- Select OK at the bottom

We will now work through configuring what is needed for the SBC to handle SIP signaling.

6.6 Sip Configuration

This section outlines the configuration parameters required for processing, modifying and securing sip signaling traffic.

6.6.1 Sip-Config

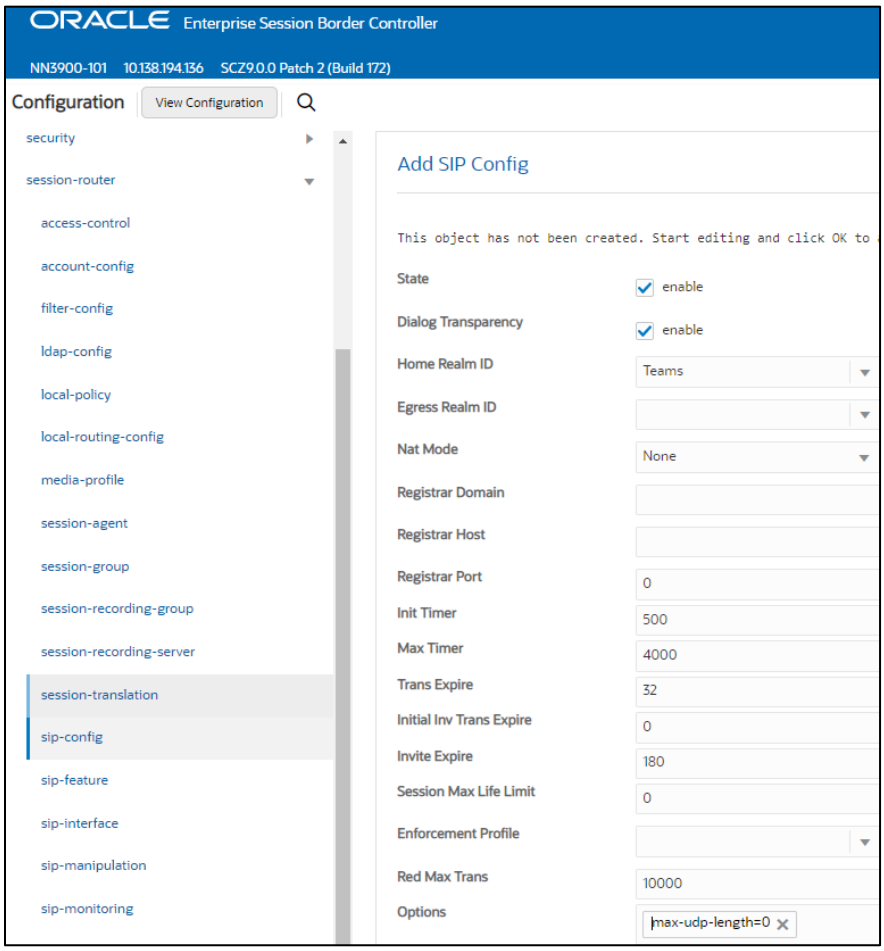
To enable sip related objects on the Oracle SBC, you must first configure the global Sip Config element:

GUI Path: session-router/sip-config

ACLI Path: config t→session-router→sip-config

There are only two recommended changes/additions to the global Sip Config.

- Set the home realm ID parameter to Teams Realm,
  and add the following hidden option:
- Max-udp-length=0: Setting this option to zero (0) forces sipd to send fragmented UDP packets. Using this option, you override the default value of the maximum UDP datagram size (1500 bytes; sipd requires the use of SIP/TCP at 1300 bytes).



- Select OK at the bottom

6.6.2 Replaces Header Support

The Oracle® Session Border Controller supports the Replaces header in SIP messages according to RFC 3891. The header, included within SIP INVITE messages, provides a mechanism to replace an existing early or established dialog with a different dialog. The different dialog can be used for Microsoft Teams services such as call parking, attended call transfer and various conferencing features.

The Oracle SBC's support for Replaces header is required to properly interwork with Microsoft Teams, but Microsoft Teams does not support the use of Replaces header. In other words, Microsoft sends Replaces to the SBC, the SBC cannot send Replaces to Microsoft.

To configure support for Replaces, we configure the following:

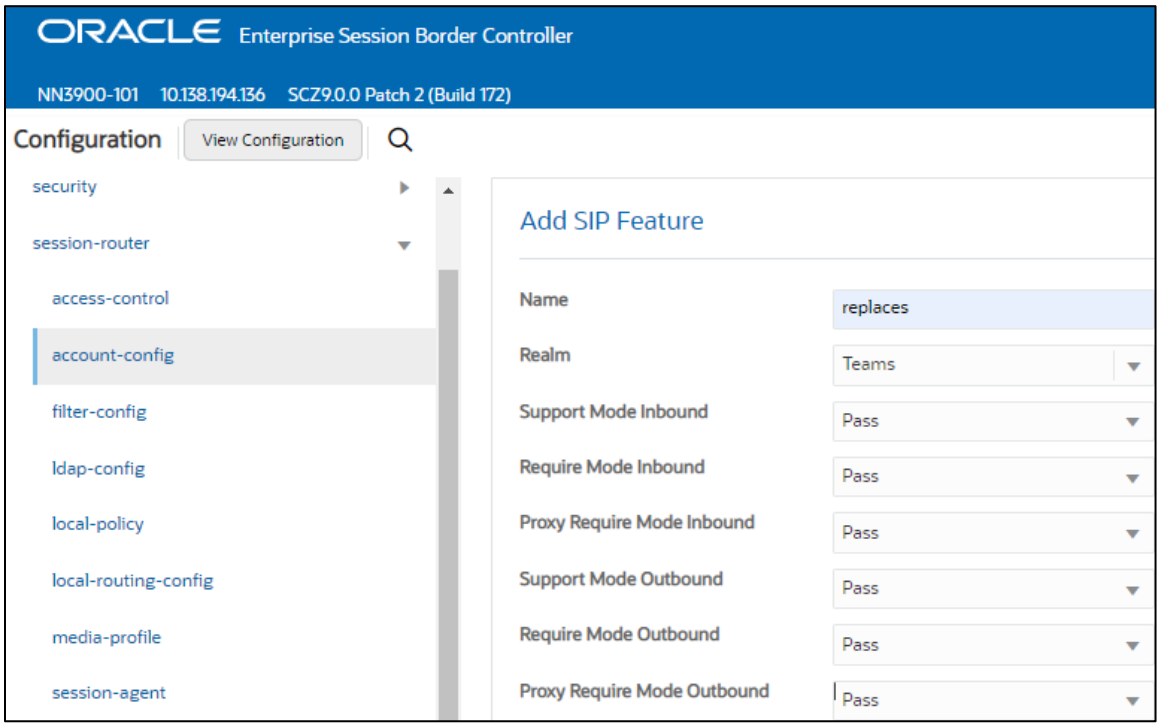
6.6.2.1 Sip Feature

The sip feature configuration element allow the SBC to support the Replaces value in the SIP Require and Supported Headers to and from Microsoft Teams.

GUI Path: session-router/sip-feature

ALCI Path: config t→session-router→sip-feature

Click add and use the following to configure:



- Click OK at the bottom

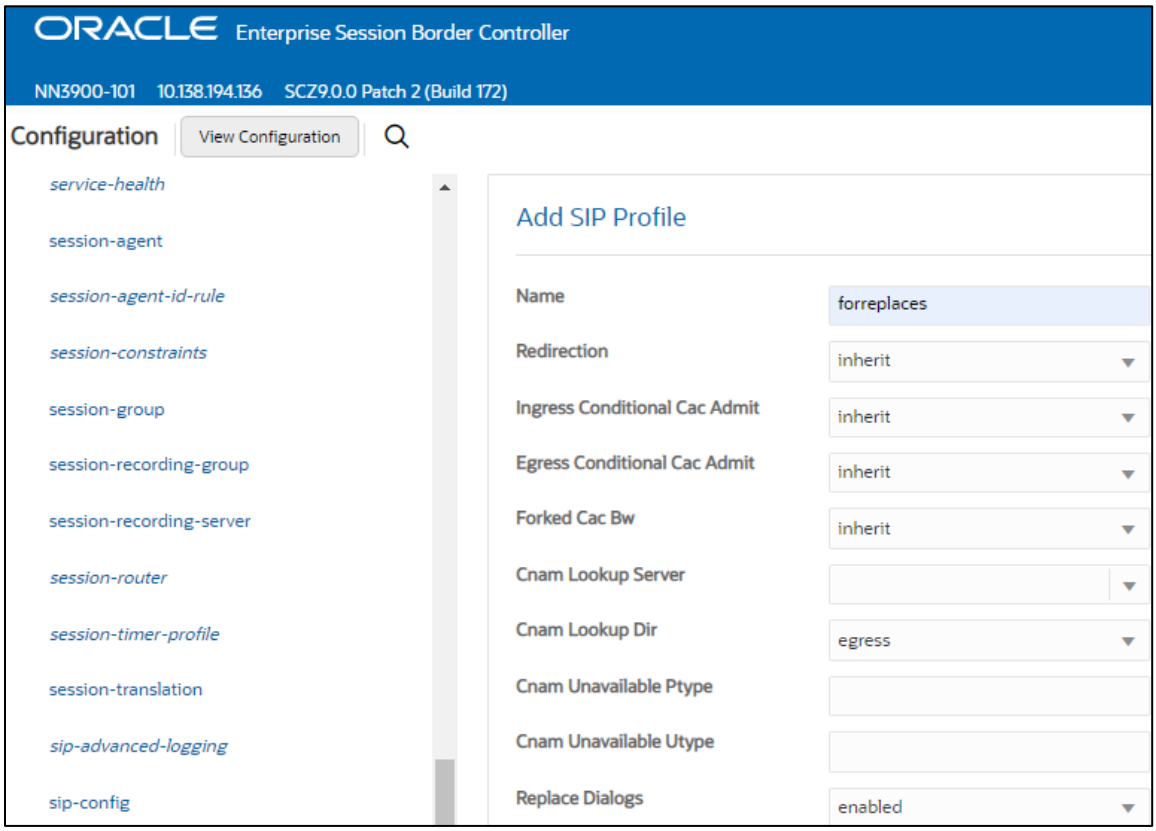
6.6.2.2 Sip Profile

Sip Profile, once configured and assigned to a sip interface, will act on a Replaces header when received by Microsoft teams to replace a dialog.

GUI Path: session-router/sip-feature

ALCI Path: config t→session-router→sip-profile

The toggle switch "Show All" on the bottom left must be enabled to reveal the sip-profile option.



- Click OK at the bottom

6.6.3 Sip Interface

The SIP interface defines the transport addresses (IP address and port) upon which the Oracle SBC receives and sends SIP messages

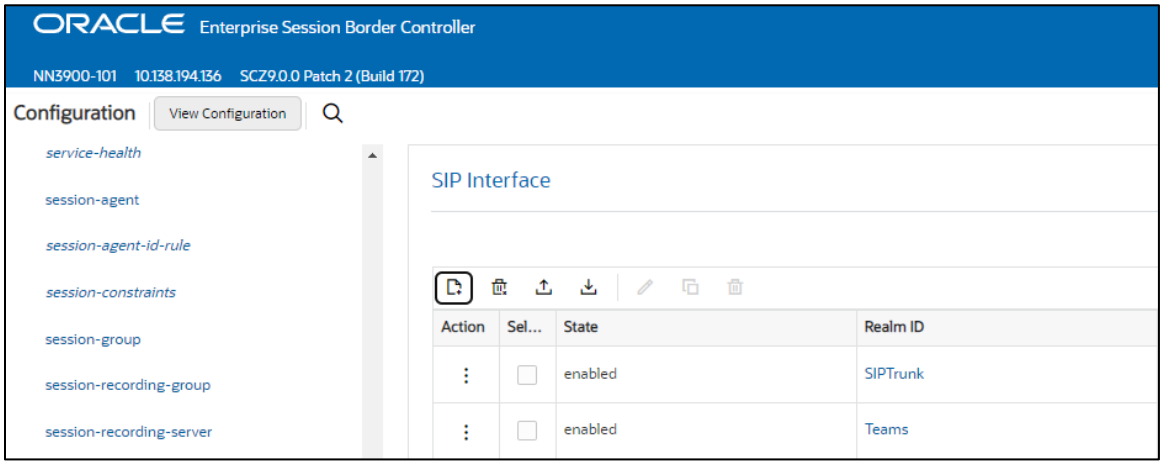
Configure two sip interfaces, one associated with PSTN Realm, and the other for Teams.

GUI Path: session-router/sip-interface

ACLI Path: config t→session-router→sip-interface

Click Add, and use the table below as an example to configure:

Config Parameter	SipTrunk	Teams
Realm ID	SipTrunk	Teams
Sip-Profile		forreplaces
Sip Port Config Parmeter	**Sip Trunk**	**Teams**
Address	10.1.2.4	10.1.3.4
Port	5060	5061
Transport protocol	UDP	TLS
TLS profile		TeamsTLSProfile
Allow anonymous	agents-only	all



Notice this is where we assign the TLS profile configured under the Security section of this guide, and the sip-profile which allows the SBC to act on the Replaces header when received by Microsoft Teams.

- Select OK at the bottom of each when applicable

6.6.4 Session Agents

Session Agents are configuration elements which are trusted agents that can both send and receive traffic from the Oracle SBC with direct access to the trusted data path.

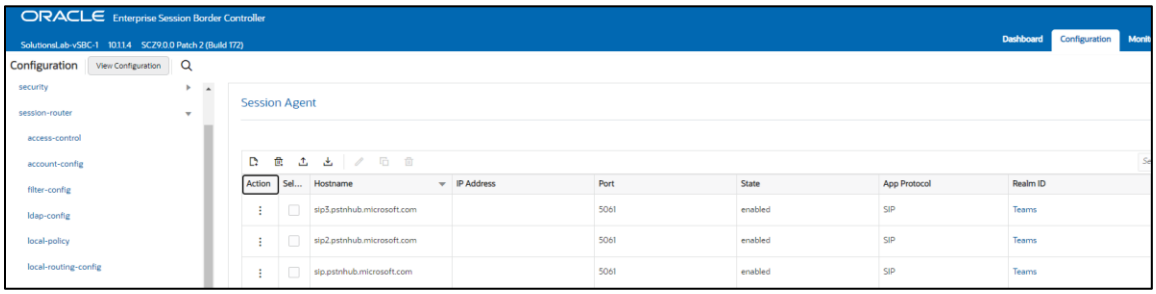
GUI Path: session-router/session-agent

ACLI Path: config t→session-router→session-agent

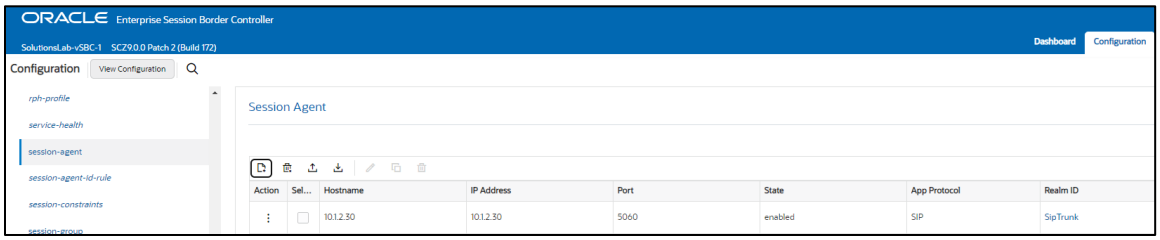
You will need to configure three Session Agents for the Microsoft Direct Routing Interface

- Click Add, and use the table below to configure:

Config parameter	Session Agent 1	Session Agent 2	Session Agent 3
Hostname	sip.pstnhub.microsoft.com	sip2.pstnhub.microsoft.com	sip3.pstnhub.microsoft.com
Port	5061	5061	5061
Transport method	StaticTLS	StaticTLS	StaticTLS
Realm ID	Teams	Teams	Teams
Ping Method	OPTIONS	OPTIONS	OPTIONS
Ping Interval	30	30	30
Refer Call Transfer	enabled	enabled	enabled
Ping Response	☑	☑	☑



Next, we'll configure a session agent for PSTN.



- Select OK at the bottom

6.6.5 Session Group

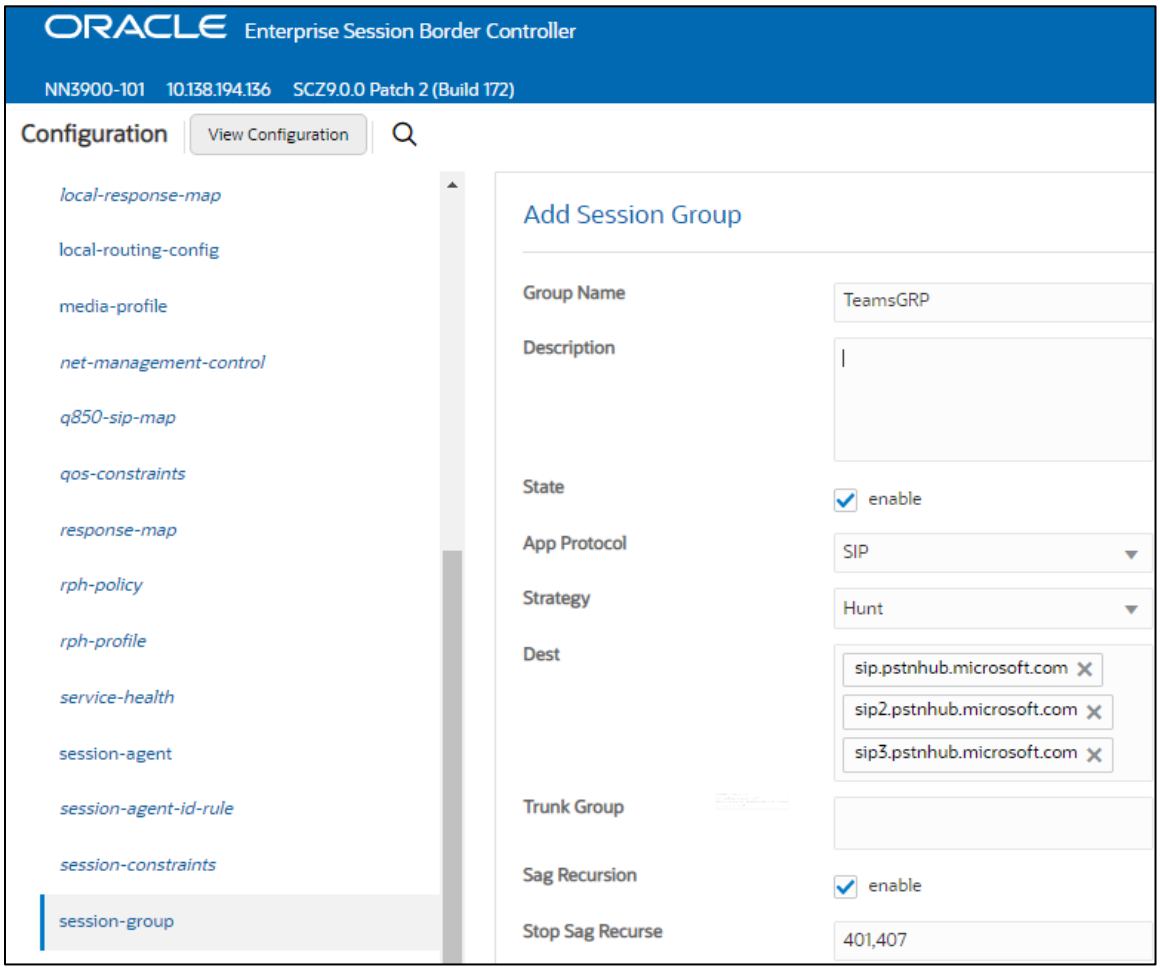
A session agent group allows the SBC to create a load balancing model:

All three Teams session agents configured above will be added to the group. The session agents listed under destination must be in this order, and the strategy must be set to HUNT.

GUI Path: session-router/session-group

ACLI Path: config t→session-router→session-group

- Click Add, and use the following as an example to configure:



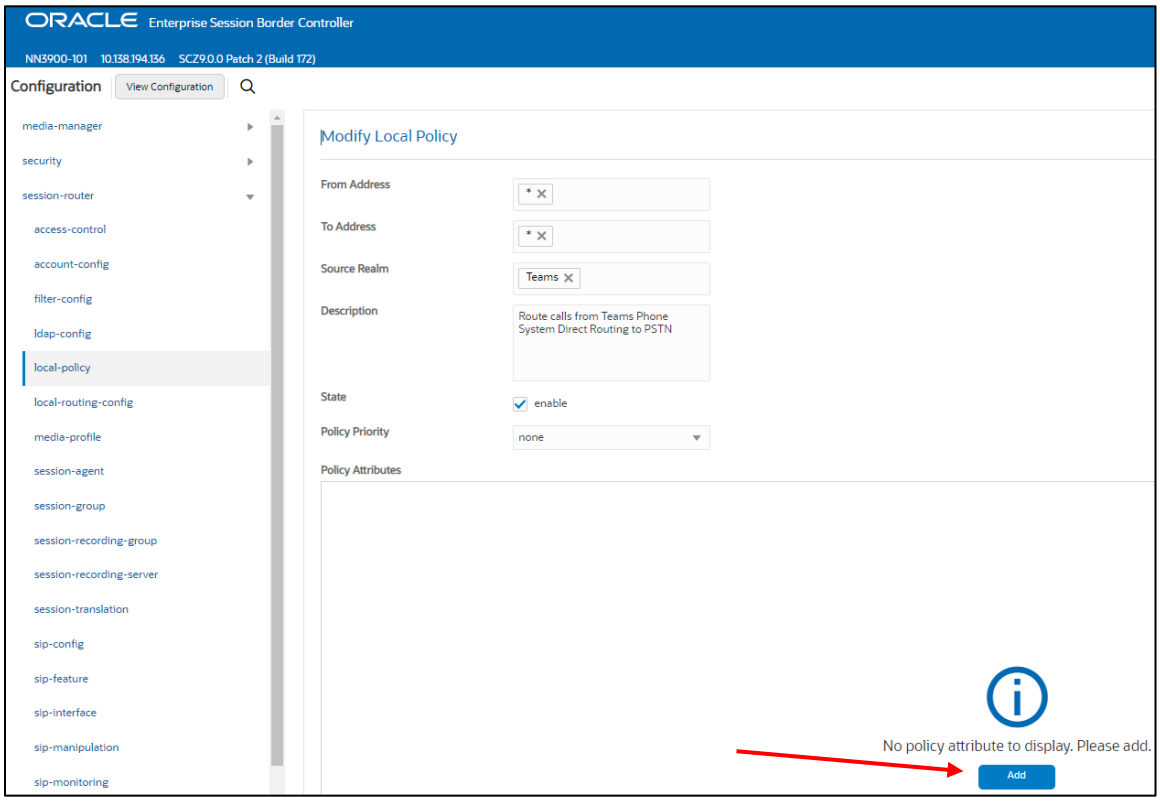
- Click OK at the bottom

6.7 Routing Configuration

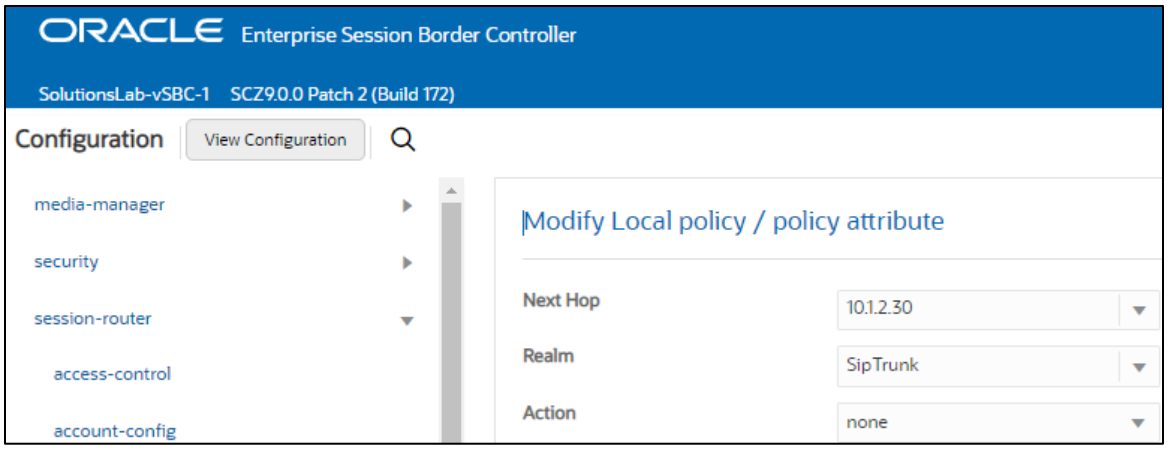
Now that a majority of the signaling, security and media configuration is in place, we can configure the SBC to route calls from one end of the network to the other. The SBC has multiple routing features that can be utilized, but for the purposes of this example configuration, we'll configure local policies to route calls from Microsoft Teams to our Sip trunk, and vice versa…

GUI Path: session-router/local-policy

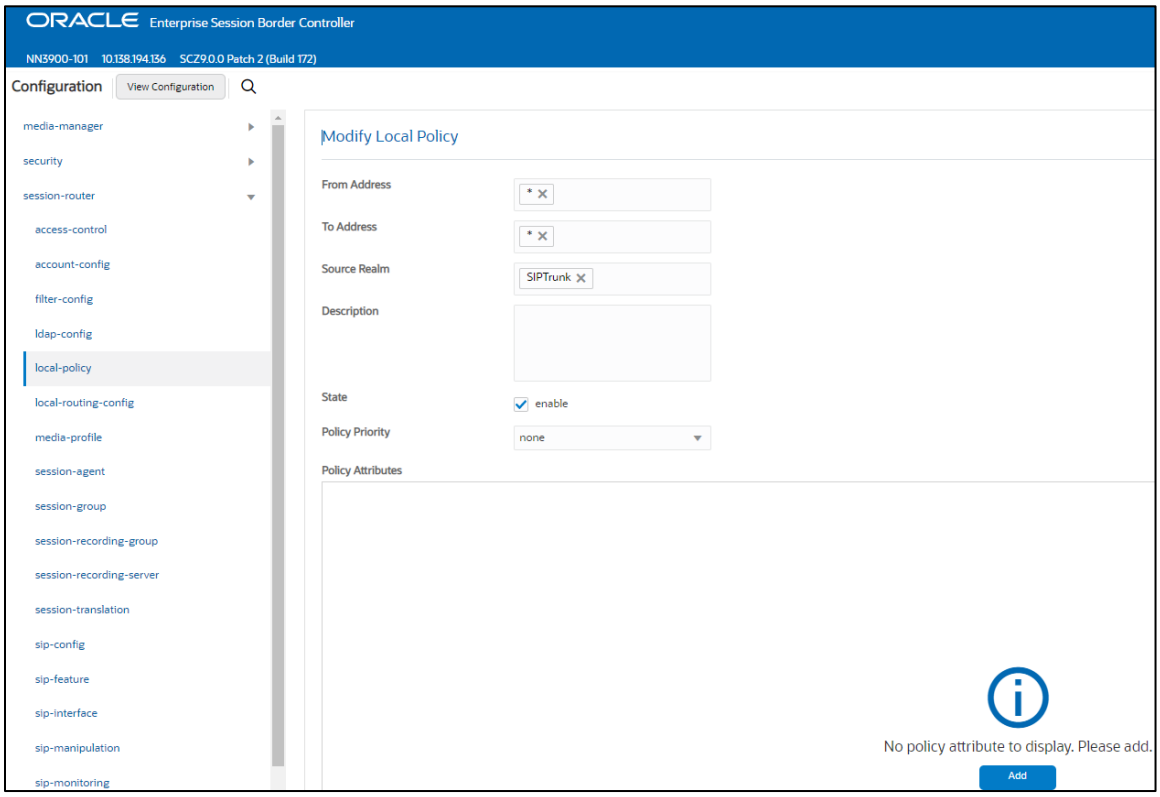
ACLI Path: config t→session-router→local-policy

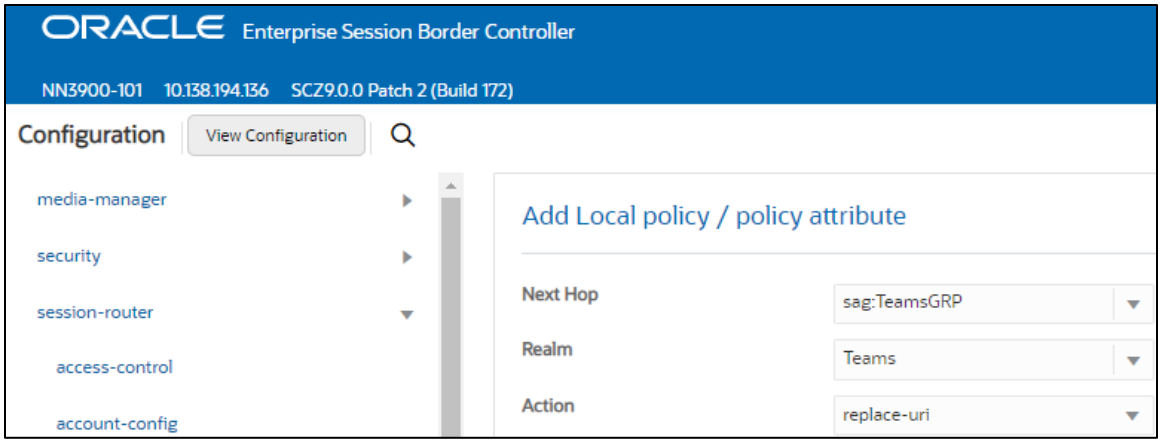


After entering values for to and from address and source realm, click Add under policy attribute to configure the next hop destination.



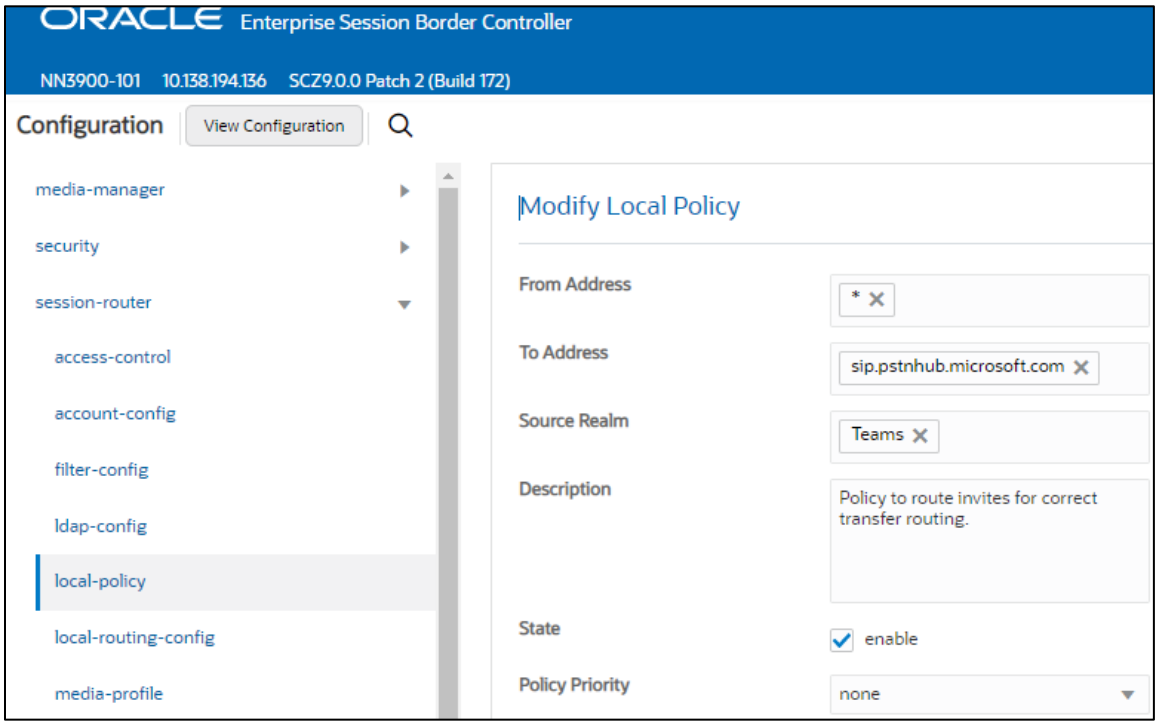
Next, we'll setup routing from our SIP Trunk to Microsoft Teams:

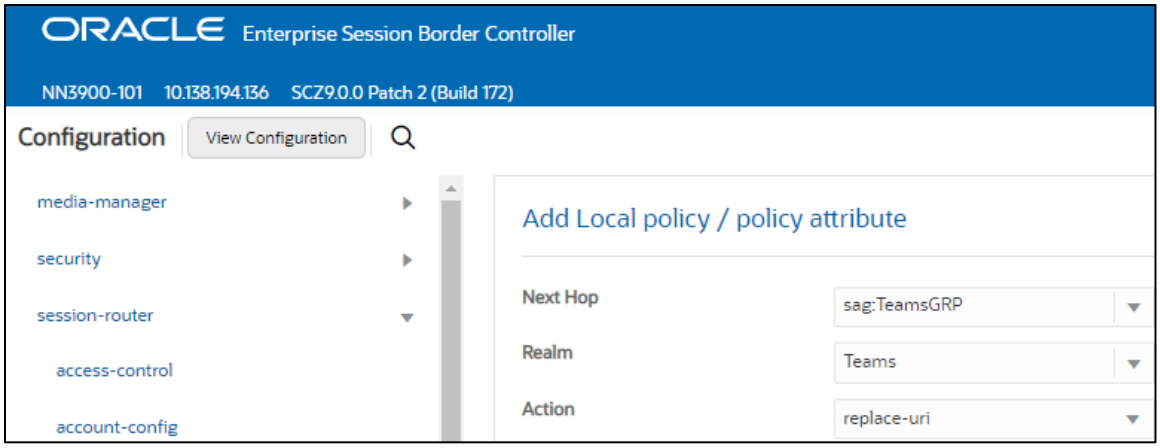




- Select OK when applicable on each screen

All transfers that use an SIP Refer message must go through the Microsoft Teams infrastructure. When the Microsoft SIP proxy sends an SIP Refer message to the Oracle SBC, an SIP Invite message should be returned to the SIP proxy, not to PSTN or to any other destination. It is true even if the call is transferred to an external PSTN number. To accommodate this requirement, we can configure another routing policy on the Oracle SBC to ensure call Invites generated by the SBC off SIP REFER's are routed properly.





- Select OK when applicable.

6.8 SIP Access Controls

The Oracle Session Border Controller (SBC) family of products are designed to increase security when deploying Voice over IP (VoIP) or Unified Communications (UC) solutions. Properly configured, Oracle's SBC family helps protect IT assets, safeguard confidential information, and mitigate risks—all while ensuring the high service levels which users expect from the corporate phone system and the public telephone network.

Please note, DDOS values are specific to platform and environment. For more detailed information please refer to the Oracle Communications SBC Security Guide.

https://docs.oracle.com/en/industries/communications/session-border-controller/9.0.0/security/security-guide.pdf

However. While some values are environment specific, there are some basic security parameters that can be implemented on the SBC that will help secure your setup.

1. On all public facing interfaces, create Access-Controls to only allow sip traffic from trusted IP's with a trust level of high

2. Set the access control trust level on public facing realms to HIGH

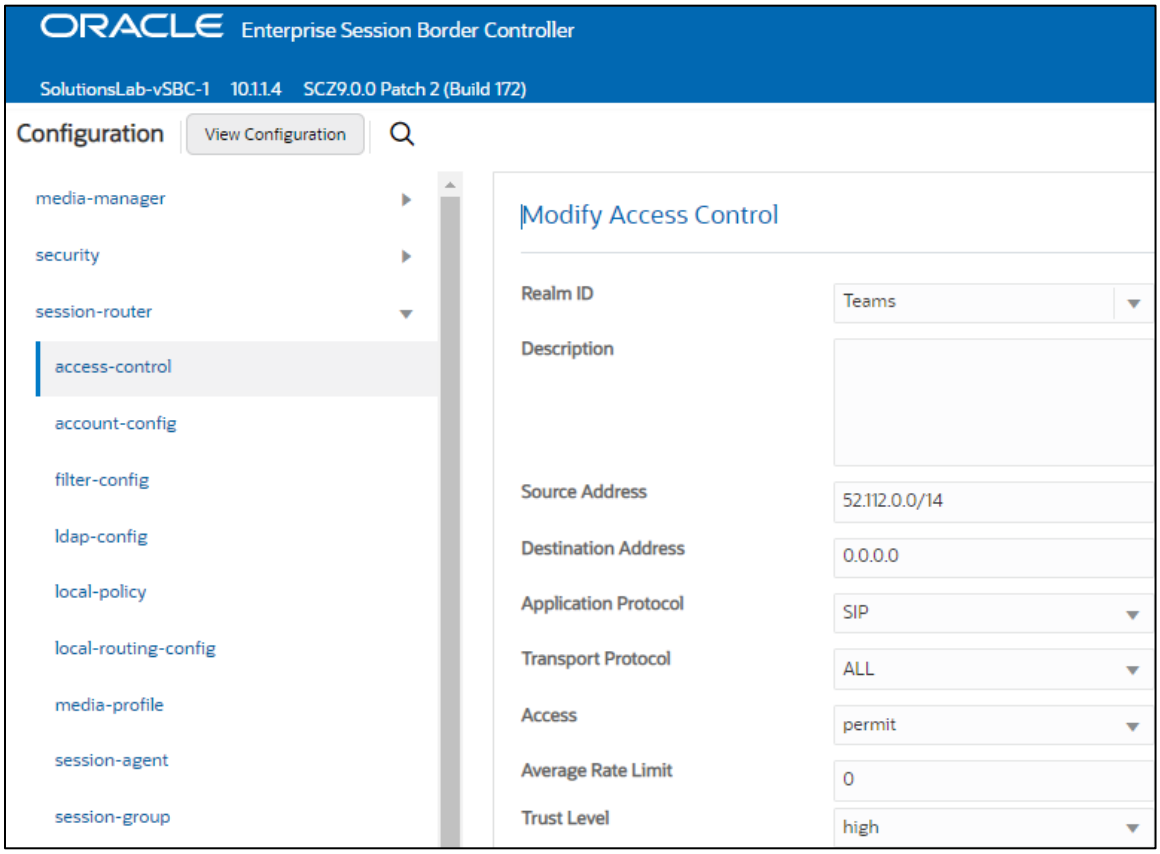
Microsoft Teams has two subnets, 52.112.0.0/14 and 52.120.0.0/14 that must be allowed to send traffic to the SBC. Both must be configured as an access control on the Oracle SBC and associated with the realm facing Teams.

Use this example to create ACL's for all MSFT Teams subnets. This example can be followed for any of the public facing interfaces, ie…SipTrunk, etc…

GUI Path: session-router/access-control

ACLI Path: config t→session-router→access-control

Use this example to create ACL's for both MSFT Teams subnets, 52.112.0.0/14 and 52.120.0.0/14.



- Select OK at the bottom

This concludes the required configuration of the SBC to properly interface with Microsoft Teams Phone System Direct Routing.

7 Oracle SBC Configuration Assistant

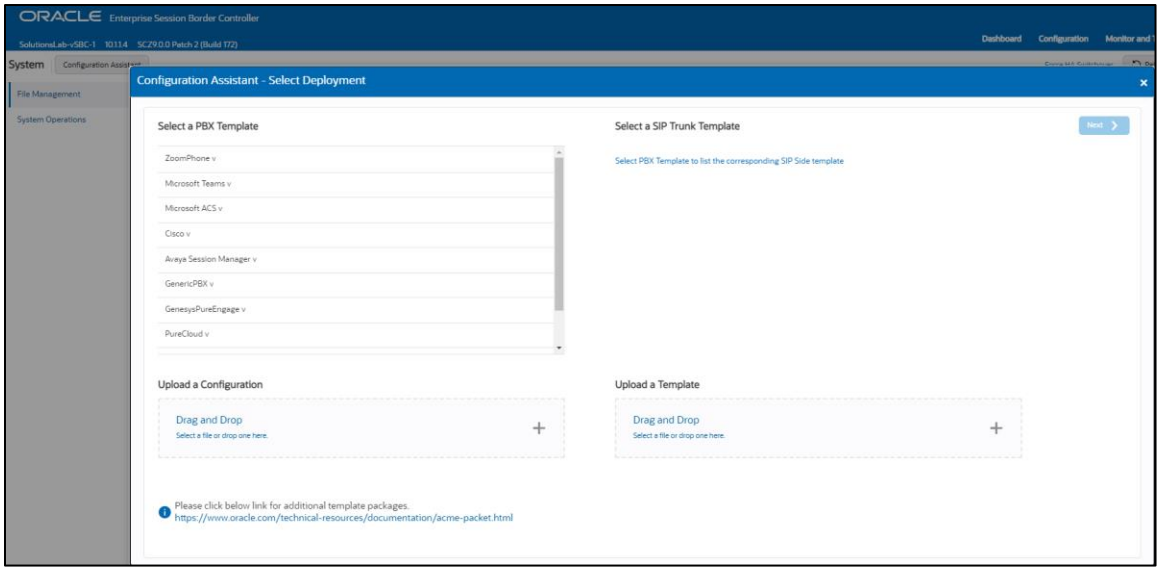
When you first log on to the E-SBC, the system requires you to set the configuration parameters necessary for basic operation. To help you set the initial configuration with minimal effort, the E-SBC provides the Configuration Assistant. The Configuration Assistant, which you can run from the Web GUI or the Acme Command Line Interface (ACLI), asks you questions and uses your answers to set parameters for managing and securing call traffic between the SBC and Microsoft Teams Phone System. You can use the Configuration Assistant for the initial set up to make to the basic configuration. See "Configuration Assistant Operations" in the Web GUI User Guide and "Run Configuration Assistant" in the ACLI Configuration Guide

Configuration assistant is available starting in release nnSCZ840P5 and nnSCZ900p2.

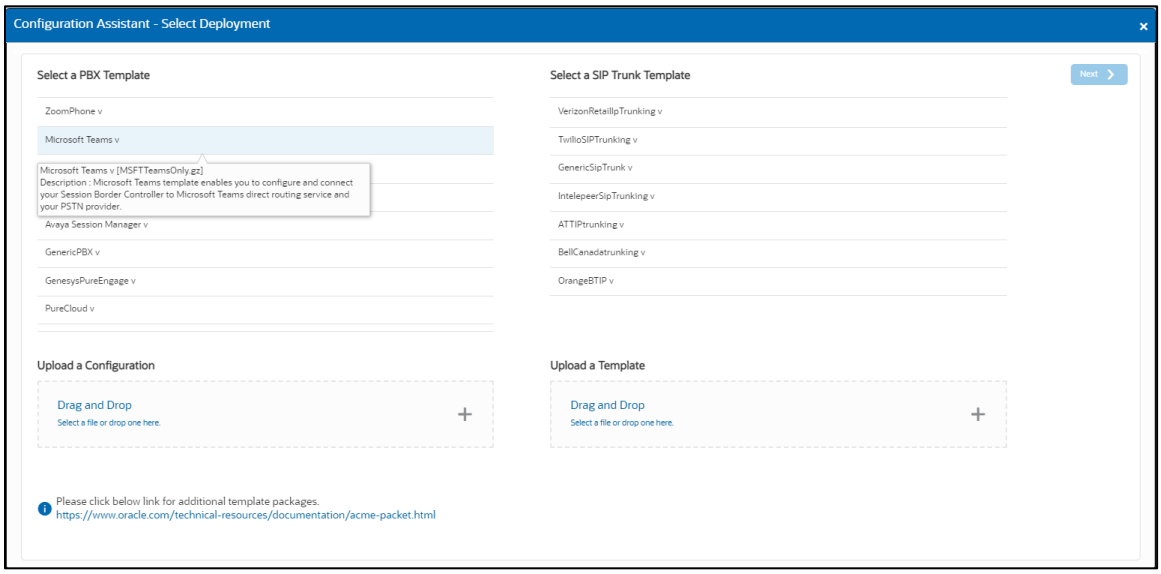
7.1 Microsoft Teams Configuration Assistant

The screenshots below are from an Oracle SBC GUI running 900p2.

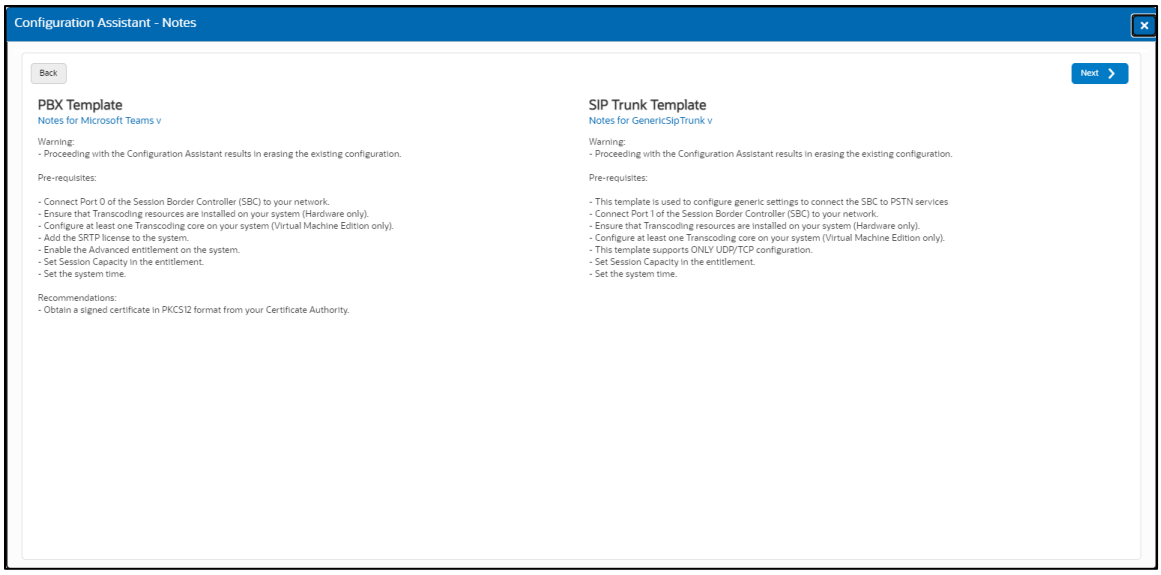
For a new SBC deployment, once access to the GUI is configured, you will see the following when logging in for the first time:



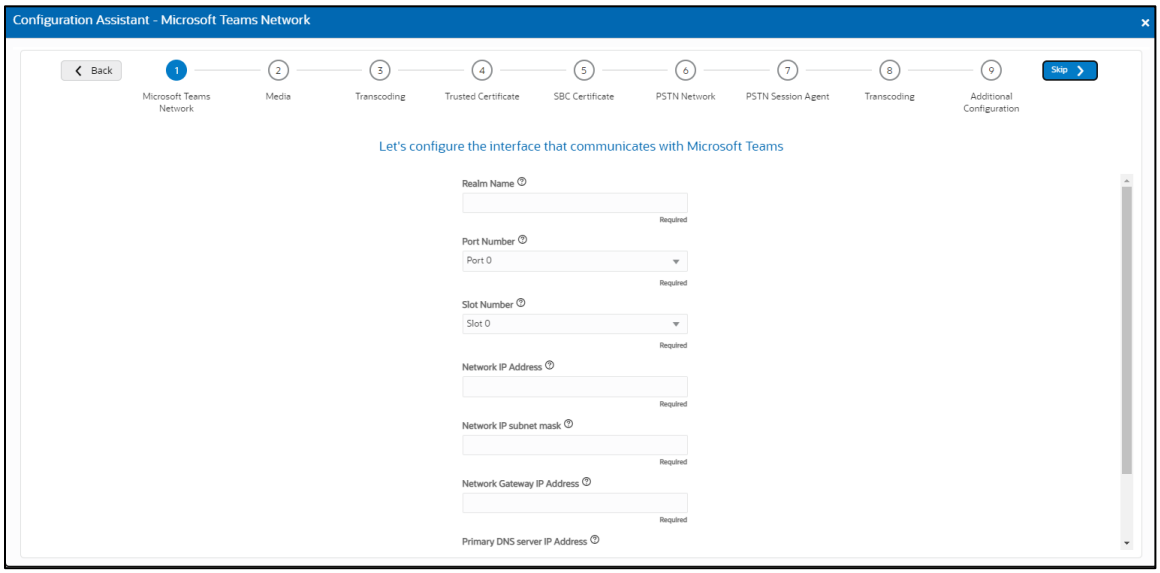
Under PBX template, we'll select Microsoft Teams template. This brings up a list of available sip trunk templates.



Select a sip trunk template and click next at the top to access the Notes page. Pay close attention to the information here, as this is a list of warnings, pre-requisites and recommendations:

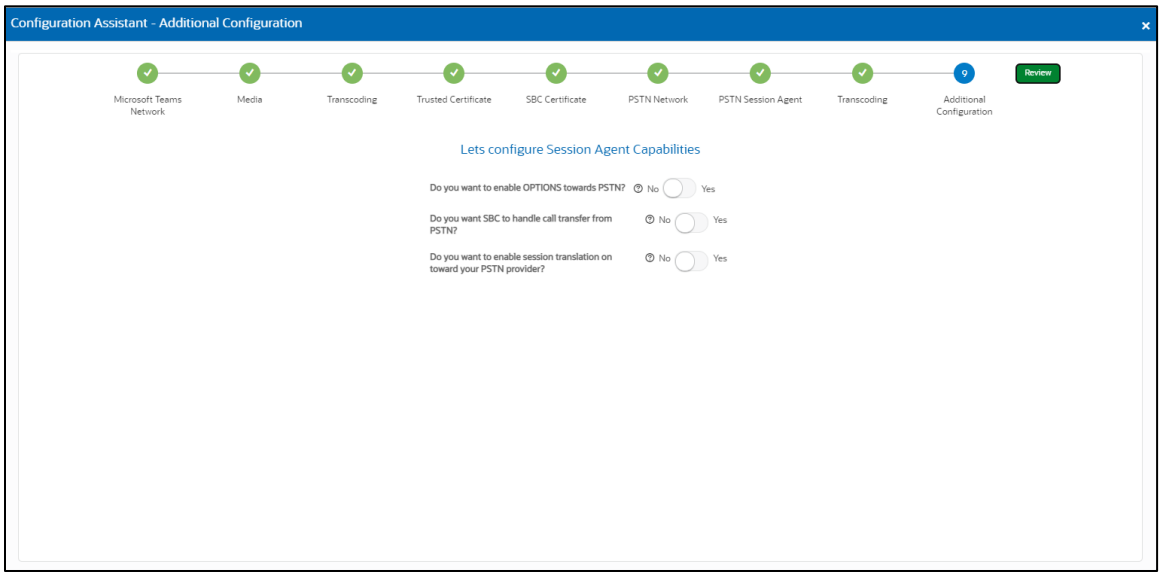


Clicking “Next” on the Notes page triggers the configuration assistant to do a system check. This ensures that all of the system requirements for the platform and sip trunk you have selected have been met before proceeding to configuration pages. If they have not been met, you will be greeted by a page providing the opportunity to setup entitlements, add license keys, etc…before moving on to the configuration. Once all requirements for your selected templates have been satisfied, you can proceed to the configuration pages.



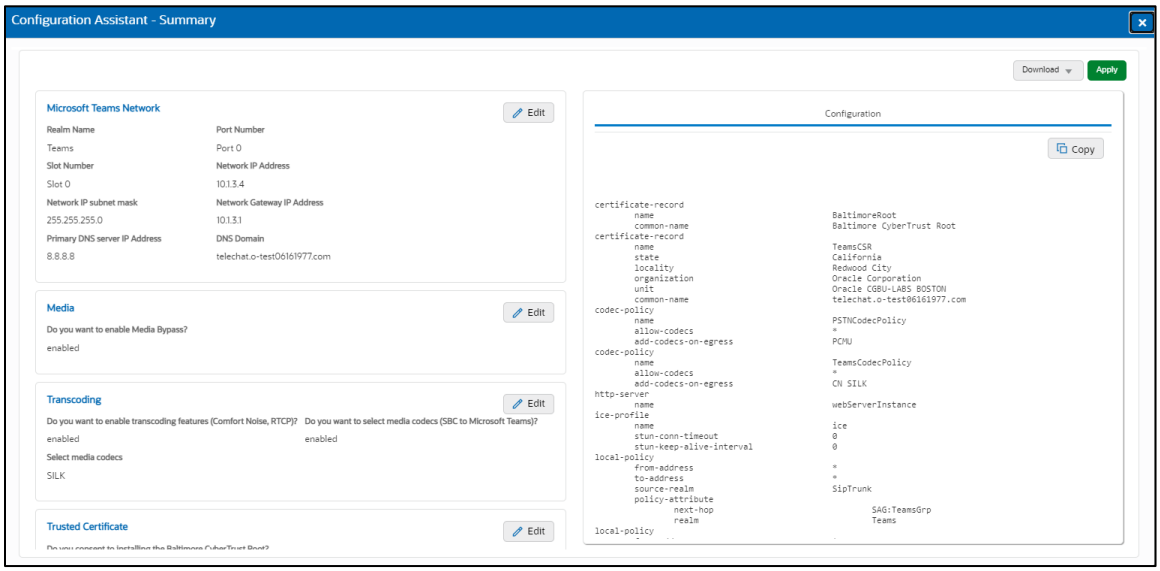
Follow the instructions on each page. Any field that is labeled required must contain an entry.

Once you have entered all information in required fields on all pages, select the option to Review in the top right of the screen:



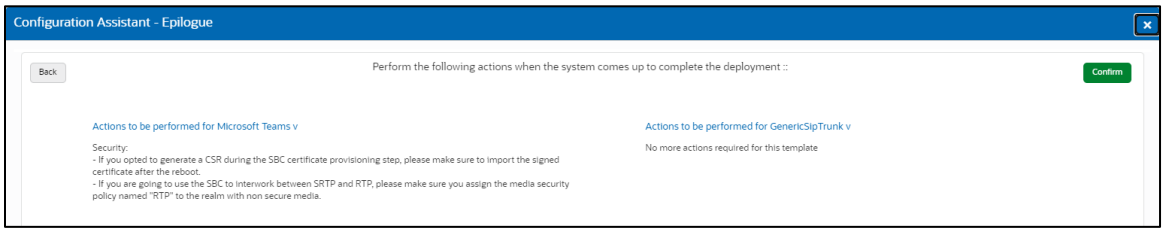
The left side of the review page contains all of the entries added on each page, and allows for editing each page individually if necessary.

The right side displays the entire configuration created and when applicable, will also have a CSR tab that contains a certificate that can be signed by a CA authority.

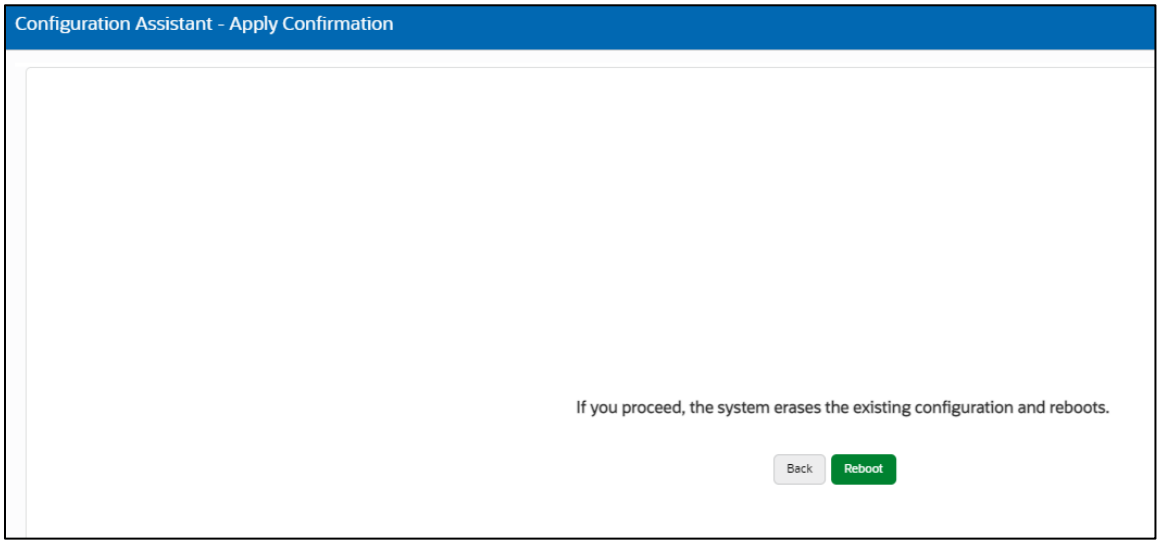


Once all the information has been reviewed and accepted, click Apply.

The SBC now presents the Epilogue.



Confirm, and then select reboot to apply the new configuration to the SBC.



8 Verify Connectivity

8.1 Oracle SBC Options Pings

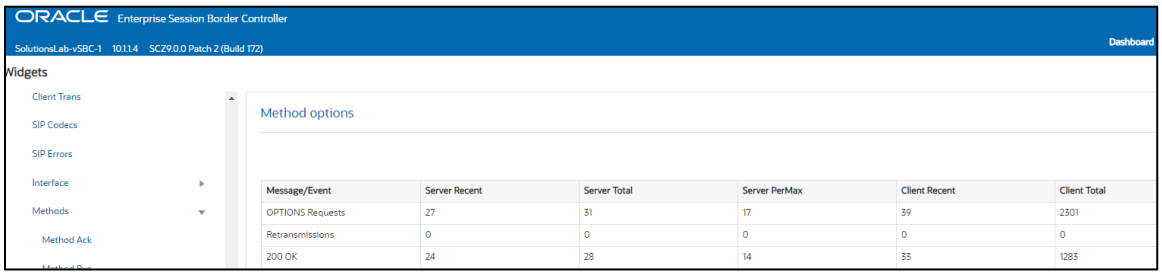
After you've paired the OCSBC with Direct Routing using the New-CsOnlinePSTNGateway PowerShell cmdlet, validate that the SBC can successfully exchange SIP Options with Microsoft Direct Routing.

While in the Oracle SBC GUI, Utilize the "Widgets" to check for OPTIONS to and from the SBC.

- At the top, click "Wigits"

This brings up the Wigits menu on the left hand side of the screen

GUI Path: Signaling/SIP/Method Options



- Looking at both the **Server Recent** and **Client Recent**, verify the counters are showing OPTIONS Requests and 200OK responses.

8.2 Microsoft SIP tester Client

SIP Tester client is a sample PowerShell script that you can use to test Direct Routing Session Border Controller (SBC) connections in Microsoft Teams. This script tests basic functionality of a customer-paired Session Initiation Protocol (SIP) trunk with Direct Routing.

The script submits an SIP test to the test runner, waits for the result, and then presents it in a human-readable format. You can use this script to test the following scenarios:

- Outbound and inbound calls
- Simultaneous ring
- Media escalation
- Consultative transfer

Download the script and Documentation here:

Sip Tester Client script and documentation

9 Syntax Requirements for SIP Invite and SIP Options:

Microsoft Teams Hybrid Voice Connectivity interface has requirements for the syntax of SIP messages.
This section covers high-level requirements to SIP syntax of Invite and Options messages. The information can be used as a first step during troubleshooting when calls don't go through. From our experience most of the issues are related to the wrong syntax of SIP messages.

9.1 Terminology

- Recommended – not required, but to simplify the troubleshooting, it is recommended to configure as in examples as follow
- Must – strict requirement, the system does not work without the configuration of these parameters

9.2 Requirements for Invite Messages and Final Responses

Picture 1 Example of INVITE and 200OK message

```
INVITE sip:17815551345@sip.pstnhub.microsoft.com:5061;user=phone;transport=tls SIP/2.0
Via: SIP/2.0/TLS 10.1.3.4:5061;branch=z9hG4bKcm87o2205o1rkbb1vnp0.1
Max-Forwards: 65
From: "Test" <sip:+17815551212@telechat.o-test06161977.com:5060;user=phone>;tag=19fc69fc0a020100
To: <sip:+17815551345@10.1.2.4:5060;user=phone>
Call-ID: 1-19fc69fc0a020100.318f0133@68.68.117.67
CSeq: 2 INVITE
Contact: <sip:+17815551212@telechat.o-test06161977.com:5061;user=phone;transport=tls>;sip.ice
Allow: ACK, BYE, CANCEL, INVITE, OPTIONS, PRACK, REFER
User-Agent: T7100/3.0
Supported: 100rel
Content-Type: application/sdp
Content-Length: 550
X-MS-SBC: Oracle/AP3900/8.4.0p7
```

```
SIP/2.0 200 Ok
FROM: <sip:+ 17815551212@10.1.2.4:5060;user=phone>;tag=e520638effffffff2c68c
TO: <sip:+ 17815551345@telechat.o-test06161977.com:5060;user=phone>;tag=19ec632b0a020100
CSEQ: 1 INVITE
CALL-ID: 1-19ec632b0a020100.74184225@68.68.117.67
VIA: SIP/2.0/TLS 52.114.32.169:5061;branch=z9hG4bKf74789d
Contact: <sip:+17815551345@telechat.o-test06161977.com:5061;user=phone;transport=tls>;sip.ice
Allow: ACK, BYE, CANCEL, INVITE, OPTIONS, PRACK, REFER
Server: T7100/1.0
Content-Type: application/sdp
Content-Length: 477
Supported: timer,replaces
Session-Expires: 1800; refresher=uas
X-MS-SBC: Oracle/AP3900/8.4.0p7-ws
```

9.2.1 Contact Header-Invite and Final Response

- Must have the FQDN sub-domain name of a specific Teams tenant for media negotiation in both requests and final responses.
- Syntax: Contact:: <phone number>@< subdomain FQDN >:<SBC Port>;<transport type>
- MSFT Direct Routing will reject calls if not configured correctly

9.3 Requirements for OPTIONS Messages

Example of OPTIONS message

```
OPTIONS sip:sip.pstnhub.microsoft.com:5061;transport=tls SIP/2.0
Via: SIP/2.0/TLS 10.1.3.4:5061;branch=z9hG4bKumatcr30fod0o13gi060
Call-ID: 4cf0181d4d07a995bcc46b8cd42f9240020000sg52@10.1.3.4
To: sip:ping@sip.pstnhub.microsoft.com
From: <sip:ping@sip.pstnhub.microsoft.com>;tag=0b8d8daa0f6b1665b420aa417f5f4b18000sg52
Max-Forwards: 70
CSeq: 3723 OPTIONS
Route: <sip:52.114.14.70:5061;lr>
Content-Length: 0
Contact: <sip:ping@telechat.o-test06161977.com:5061;transport=tls>
Record-Route: <sip:telechat.o-test06161977.com >
X-MS-SBC: Oracle/AP3900/8.4.0p7-ws
```

9.3.1 Contact Header-OPTIONS:

- When sending OPTIONS to the Direct Routing Interface Interface “Contact” header should have SBC FQDN in URI
- hostname along with Port & transport parameter set to TLS.
- Syntax: Contact: sip: <FQDN of the SBC:port;transport=tls>
- If the parameter is not set correctly, Teams Direct Routing Interface will not send SIP Options to the SBC

10 Microsoft Teams Direct Routing Interface characteristics

The following table contains the technical characteristics of the Direct Routing Interface. Microsoft, in most cases, uses RFC standards as a guide during the development. However, Microsoft does not guarantee interoperability with SBCs even if they support all the parameters in table 1 due to specifics of implementation of the standards by SBC vendors. Microsoft has a partnership with some SBC vendors and guarantees their device’s interoperability with the interface. All validated devices are listed on Microsoft’s site. Microsoft only supports the validated devices to connect to Direct Routing Interface. Oracle is one of the vendors who have a partnership with Microsoft.

Category	Parameter	Value	Comments
Ports and IP	SIP Interface FQDN	Refer to Microsoft documentation	
	IP Addresses range for SIP interfaces	Refer to Microsoft documentation	
	SIP Port	5061	
	IP Address range for Media	Refer to Microsoft documentation	
	Media port range on Media Processors	Refer to Microsoft documentation	
	Media Port range on the client	Refer to Microsoft documentation	
Transport and Security	SIP transport	TLS	
	Media Transport	SRTP	
	SRTP Security Context	DTLS, SIPS Note: DTLS is not supported until later time. Please configure SIPS at this moment. Once support of DTLS announced it will be the recommended context	https://tools.ietf.org/html/rfc5763
	Crypto Suite	AES_CM_128_HMAC_SHA1_80, non-MKI	
	Control protocol for media transport	SRTCP (SRTCP-Mux recommended)	Using RTCP mux helps reduce number of required ports
	Supported Certification Authorities	Refer to Microsoft documentation	
	Transport for Media Bypass (of configured)	ICE-lite (RFC5245) – recommended, · Client also has Transport Relays	
Codecs	Audio codecs	· G711 · Silk (Teams clients) · Opus (WebRTC clients) - Only if Media Bypass is used; · G729 · G722	
	Other codecs	· CN o Required narrowband and wideband · RED – Not required · DTMF – Required · Events 0-16 · Silence Suppression – Not required	

11 Appendix A

11.1 Oracle SBC TDM with Teams

Oracle® designed the Time Division Multiplexing (TDM) functionality for companies planning to migrate from TDM to SIP trunks by using a hybrid TDM-SIP infrastructure, rather than adopting VoIP-SIP as their sole means of voice communications. The TDM interface on the Oracle® Enterprise Session Border Controller (E-SBC) provides switchover for egress audio calls, when the primary SIP trunk becomes unavailable. You can use TDM with legacy PBXs and other TDM devices.

- Only the Acme Packet 1100 and the Acme Packet 3900 platforms support TDM, which requires the optional TDM card.
- TDM supports bidirectional calls as well as unidirectional calls.
- TDM operations require you to configure TDM Config and TDM Profile, as well as local policies for inbound and outbound traffic.
- The software upgrade procedure supports the TDM configuration.
- Options for the Acme Packet 1100 and the Acme Packet 3900 platforms include CallingLine Identification Presentation (CLIP) and Connected-Line Identification Presentation (COLP).
- Options for the Acme Packet 1100 platform include the four-port Primary Rate Interface (PRI), the Euro ISDN Basic Rate Interface (BRI), and the Foreign Exchange OfficeForeign Exchange Subscriber (FXO-FXS) card.

11.1.1 Interface Requirements

- PRI—Digium1TE133F single-port or Digium 1TE435BF four-port card.
- BRI—Digium 1B433LF four-port card
- FXS—Digium 1A8B04F eight-port card, green module (ports 1-4)
- FXO—Diguim 1A8B04F eight-port card, red module (ports 5-8)

Oracle SBC Time Division Multiplexing (TDM) functionality has been fully tested with Microsoft Teams Phone System Direct Routing.

For further information on the setup and configuration of TDM on the Oracle SBC, please refer to the TDM Configuration Guide

12 Appendix B

12.1 Oracle SBC deployed behind NAT

The Support for SBC Behind NAT SPL plug-in changes information in SIP messages to hide the end point located inside the private network.

The specific information that the Support for SBC Behind NAT SPL plug-in changes depends on the direction of the call, for example, from the NAT device to the SBC or from the SBC to the NAT device.

Configure the Support for SBC Behind NAT SPL plug-in for each SIP interface that is connected to a NAT device. One public-private address pair is required for each SIP interface that uses the SPL plug-in, as follows.

- The private IP address must be the same IP as configured on both the SIP Interface and Steering Pool

- The public IP address must be the public IP address of the NAT device

Here is an example configuration with SBC Behind NAT SPL config.

The SPL is applied to the Teams side SIP interface.

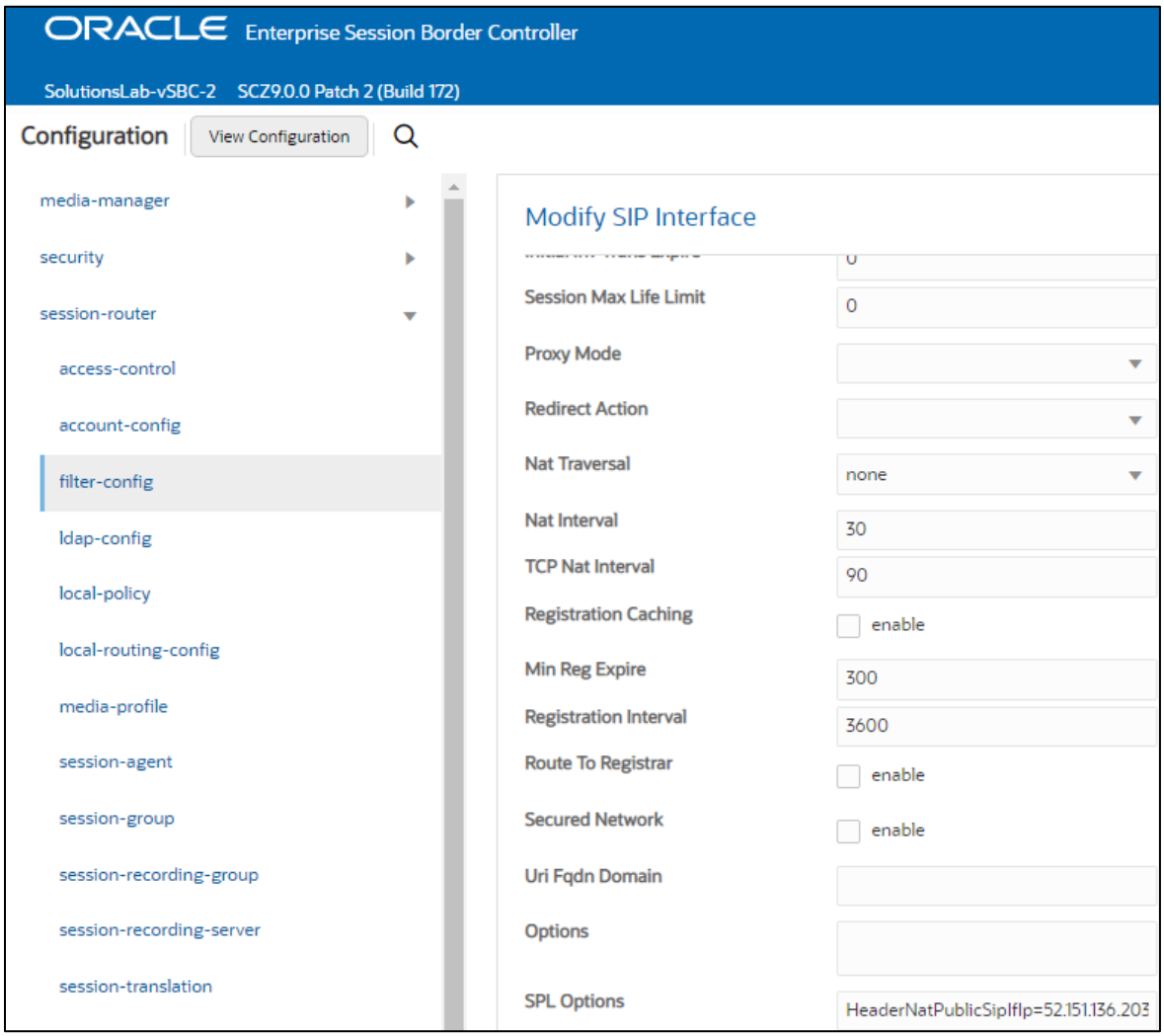
GUI Path: session-router/sip-interface

ACLI Path: config t→session-router→sip-interface

HeaderNatPublicSipIfIp=52.151.236.203,HeaderNatPrivateSipIfIp=10.1.3.4

HeaderNatPublicSipIfIp is the public interface ip

HeaderNatPrivateSipIfIp is the private ip.



You will need to apply these options to every sip interface on the SBC that is connected through a NAT.

13 Appendix C

13.1 Ringback on Inbound Calls to Teams and Early Media

In certain deployments, on certain call flows, PSTN callers may experience silence on inbound calls to Microsoft Teams instead of an expected ring back tone.

When Teams receives an INVITE, after sending a 183 with SDP response back to the Oracle SBC, Teams does not play ring back. Microsoft's expectation is the Oracle SBC will signal appropriately to the Sip Trunk in order for local ring back to be generated.

To properly signal the trunk to play the ring back, the SBC presents a 180 Ringing response to the trunk instead of the 183 Session Progress received from Teams.

In order to accommodate the 183 with SDP message that signal early media in cases of simultaneous ringing set to IVR, etc… we inspect the SDP of the 183 received before converting it to 180 Ringing.

If the SDP of the 183 does not contain the IP address of SBC (which is the case when Teams clients have simultaneous ringing set to IVRs), we use a sip manipulation to strip the SDP from the 183. Next, we convert the 183 response to a 180 Ringing before forwarding it to the Sip Trunk.

Due to the complexity of this sip manipulation, the SBC ACLI output has been provided.

GUI Path: Session Router/sip-manipulation

ACLI Path: config t→session-router→sip-manipulation

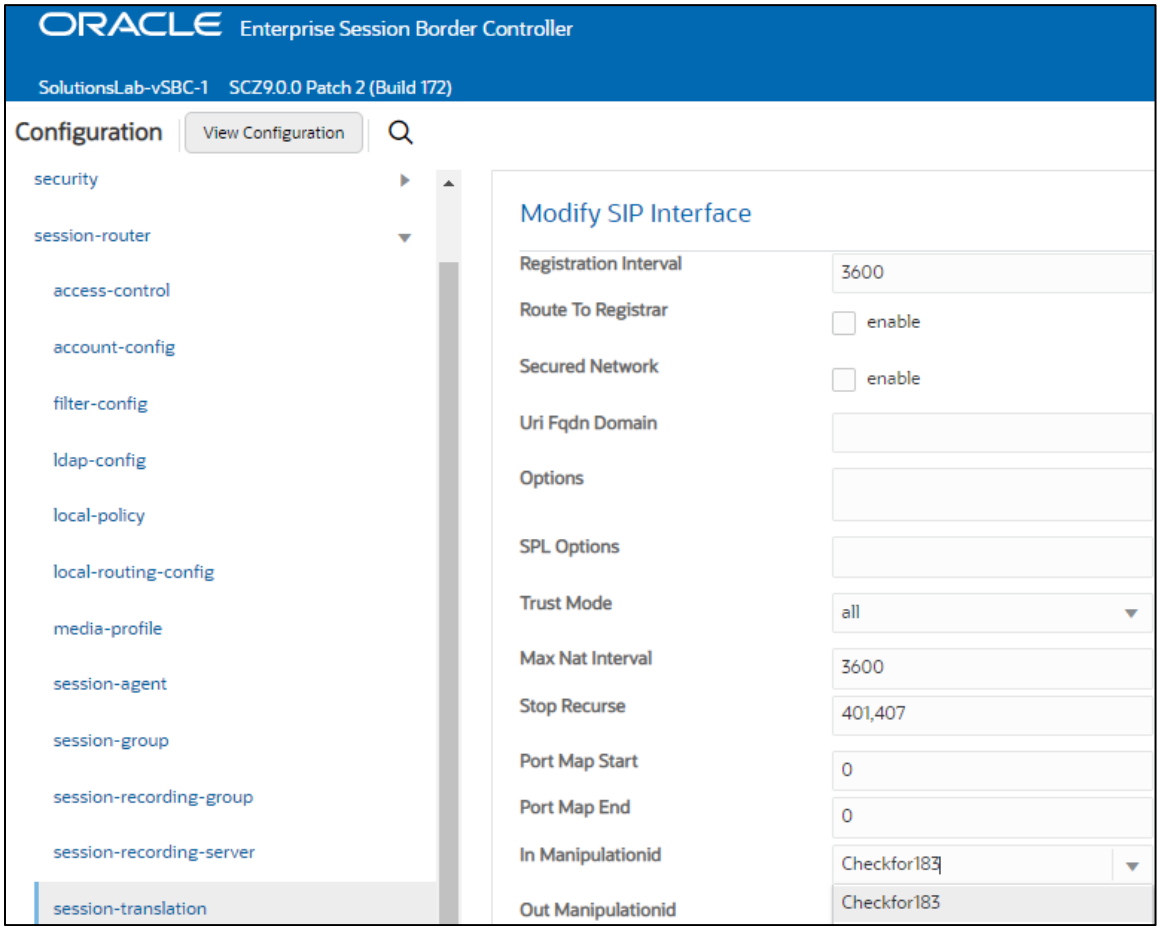
This sip manipulation will be applied as the in-manipulationid on the Teams Sip Interface.

```
sip-manipulation
    name                        Checkfor183
    header-rule
        name                    check183
        header-name             @status-line
        action                  manipulate
        msg-type                reply
        methods                 Invite
        element-rule
            name                is183
            type                status-code
            action              store
            comparison-type     pattern-rule
            match-value         183
    mime-sdp-rule
        name                    if183
        msg-type                reply
        methods                 Invite
        action                  manipulate
        comparison-type         boolean
        match-value             $check183.$is183
        sdp-session-rule
            name                au
            action              manipulate
            sdp-line-rule
                name            checkclineforsbcip
                type            c
                action          store
                comparison-type pattern-rule
                match-value     ^(.(?!(10.1.3.4))).*$
    mime-sdp-rule
        name                    delete183SDP
        msg-type                reply
        methods                 Invite
        action                  delete
        comparison-type         boolean
        match-value             $if183.$au.$checkclineforsbcip
    header-rule
        name                    change183to180
        header-name             @status-line
        action                  manipulate
        comparison-type         boolean
        match-value             $if183.$au.$checkclineforsbcip
        element-rule
            name                changestatus
            type                status-code
            action              replace
            match-value         183
            new-value           180
        element-rule
            name                changereasonphrase
            type                reason-phrase
            action              replace
            match-value         Session Progress
            new-value           Ringing
```

This sip manipulation will be applied as the In Manipulationid on the Teams Sip Interface:

GUI Path: Session Router/Sip Interface

ACLI Path: config t→session-router→sip-interface



13.2 Oracle SBC Local Media Playback

13.2.1 Ringback on Transfer

During a call transfer initiated by Microsoft Teams, the calling party does not hear a ring back tone while the Oracle SBC is acting on the sip REFER received from Microsoft. In order to avoid this period of silence, we utilize the Oracle SBC's local playback feature.

Once configured, the Oracle SBC has the ability to generate ringback upon receipt of the sip REFER from Microsoft.

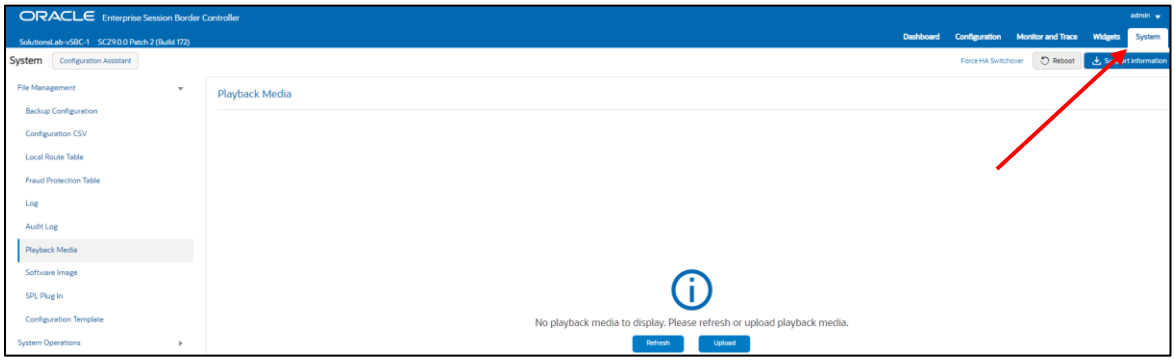
First, you must create a media file.

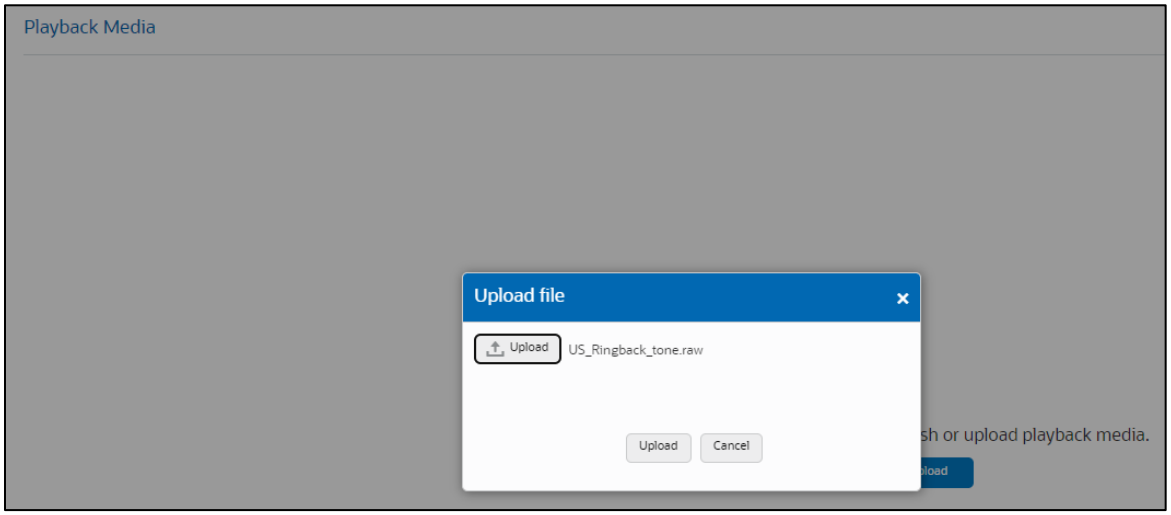
13.2.1.1 Media Files

Media files of ringback tones are uploaded to /code/media to the Oracle SBC. This file differs based on your media generation method and must be raw media binary. For Transcoding based RBT, ensure that the files RAW PCM 16-bit MONO samples, sampled at 8-khz encapsulated with little-endian formatting and cannot exceed 4.8 MB.

Next, upload the file to the /code/media directory on the Oracle SBC.

GUI Path: System/Playback Media/Upload

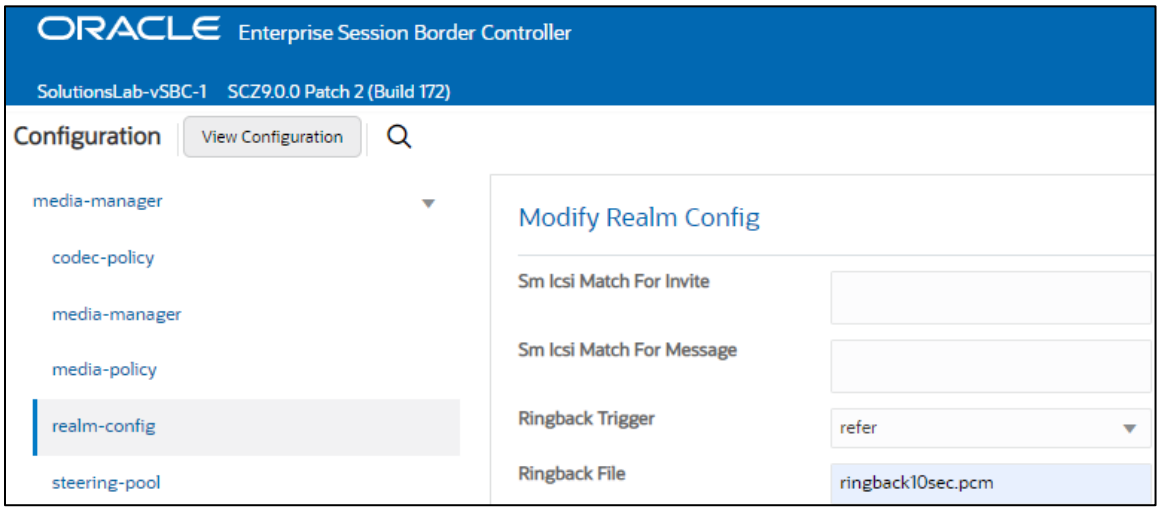




Lastly, we'll assign this file to the realm facing PSTN, and set the trigger for the SBC to generate local ringback toward PSTN:

GUI Path: media manager/realm-config

ACLI Path: config t→media-manager→realm-config



- Select OK at the bottom, and save and activate your configuration.

14 Appendix D

14.1 Configuration for Emergency Calling

As part of Oracle's continued partnership with Microsoft, the Oracle Communications Session Border Controller is fully certified with Microsoft Teams Direct Routing for E911 compatibility as well as an Elin Capable Gateway.

https://docs.microsoft.com/en-us/microsoftteams/direct-routing-border-controllers

For more information on how to configure emergency services in your Microsoft Teams Tenant, please refer to the documentation at the link below.

https://docs.microsoft.com/en-us/microsoftteams/what-are-emergency-locations-addresses-and-call-routing

https://docs.microsoft.com/en-us/microsoftteams/configure-dynamic-emergency-calling

https://docs.microsoft.com/en-us/microsoftteams/direct-routing-configure#configure-voice-routing

The following will outline how to configure your Oracle SBC to handle E911 from Microsoft Teams, as well as setting up Oracle SBC Elin Gateway configuration.

14.1.1 E911

14.1.2 Emergency Session Handling

The Oracle® Enterprise Session Border Controller provides a mechanism to handle emergency sessions from non-allowed endpoints/agents. An endpoint is designated as non-allowed if it fails the admission control criteria specified by the allow-anonymous parameter in the Sip Inerface/SIP Ports configuration element. To enable this feature, you will need to configure the following:

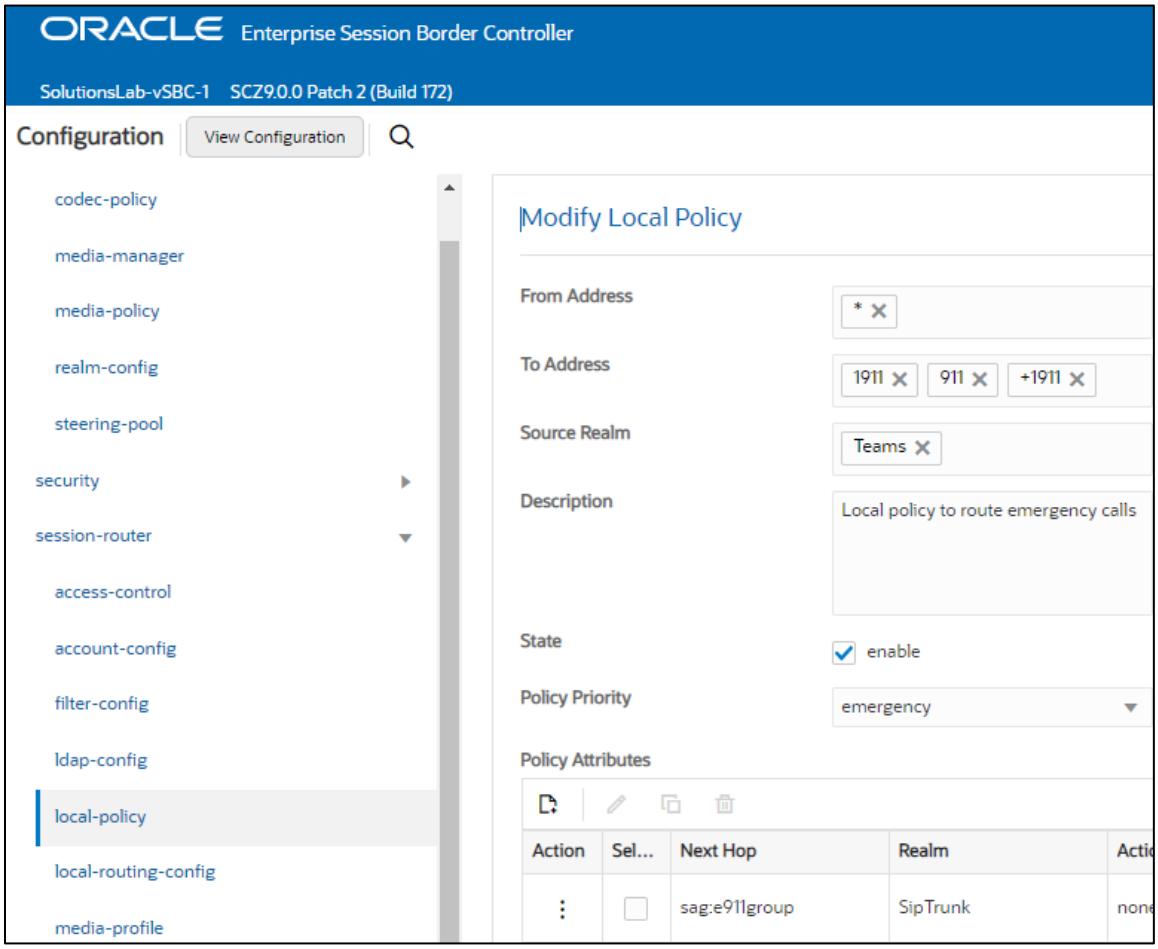
- Local Policy to Match and Route emergency calls to correct destination with policy priority set to emergency
- Enable anonymous-priority on Ingress Sip Interface

Note: This is just a configuration example. This note assumes any session agents or session group for PSAP has already been configured:

14.1.2.1 Local Policy Route for Emergency Calls

GUI Path: session-router/local-policy

ACLI Path: config t→session-router—local-policy



You would also configure a policy attribute to route emergency calls to their proper destination. In this example, we have created a SAG called e911 as the destination for all emergency calls. For instructions on how to configure Session Agents or Session Groups, please click the links for examples.

Next, we'll enable anonymous-priority field in Sip-Interface: For more information on how this feature works, please see the SBC Configuration Guide, Chapter 4.

GUI Path: Not available in the SBC GUI at this time

ACLI Path: config t→session-router→sip-interface

```
sip-interface
      realm-id                    Teams
      sip-port
            address                   10.1.3.4
            port                    5061
            transport-protocol          TLS
            tls-profile             TeamsTLSProfile
            allow-anonymous               agents-only
      in-manipulationid             Checkfor183
      anonymous-priority              emergency
      sip-profile                 forreplaces
```

14.1.2.2 Net-Management Control

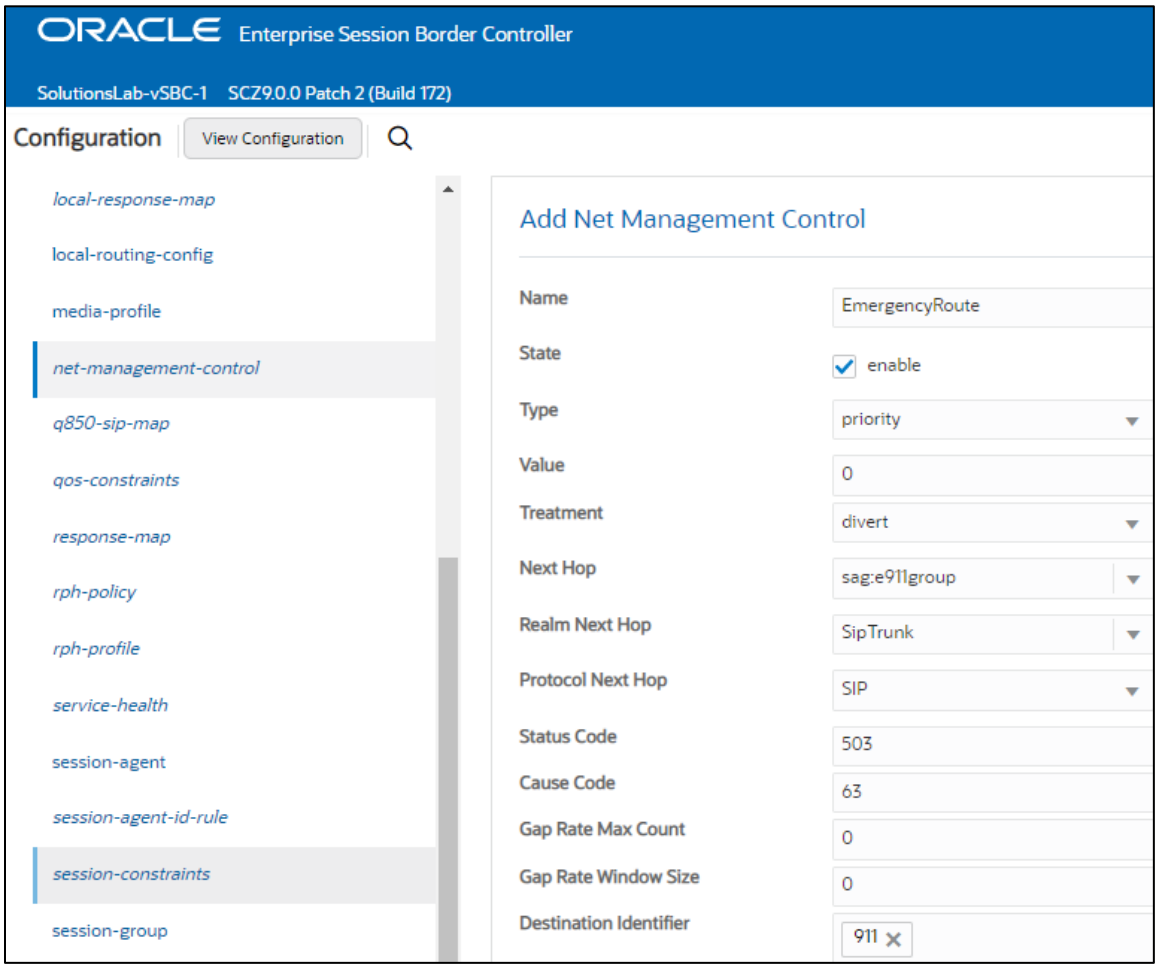
The Oracle Communications Session Border Controller supports network management controls for multimedia traffic specifically for static call gapping and 911 exemption handling. These controls limit the volume or rate of traffic for a specific set of dialed numbers or dialed number prefixes (destination codes).

To enable network management controls on your Oracle Communications Session Border Controller, you set up the net-management-control configuration and then enable the application of those rules on a per-realm basis. Each network management control rule has a unique name, in addition to information about the destination (IP address, FQDN, or destination number or prefix), how to perform network management (control type), whether to reject or divert the call, the next hop for routing, and information about status/cause codes. For more information about Network Management Controls, please refer to the Configuration Guide, Chapter 11.

GUI Path: session-router/net-management-control

ACLI Path: config t→session-router→net-management-control

Use the below example to configure net-management-control and assign it to the Teams realm. Please note, net-management-control Realm parameter is not available through the GUI, so it must be enabled via ACLI to the appropriate realm.



Note: Net-Management-Controls do not adhere to any constraints configured on your SBC due to the emergency nature of the call flows handled by this element.

```
realm-config
        identifier                      Teams
        description                       Realm facing Teams
        network-interfaces                  s1p0:0.4
        mm-in-realm                       enabled
        media-sec-policy                    TeamsMediaSecurity
        rtcp-mux                        enabled
        ice-profile                     ice
        teams-fqdn                        telechat.o-test06161977.com
        teams-fqdn-in-uri                   enabled
        sdp-inactive-only                   enabled
        in-translationid                  911removeplus
        access-control-trust-level              high
        net-management-control                      enabled
        codec-policy                      addCN
        rtcp-policy                     rtcpGen
```

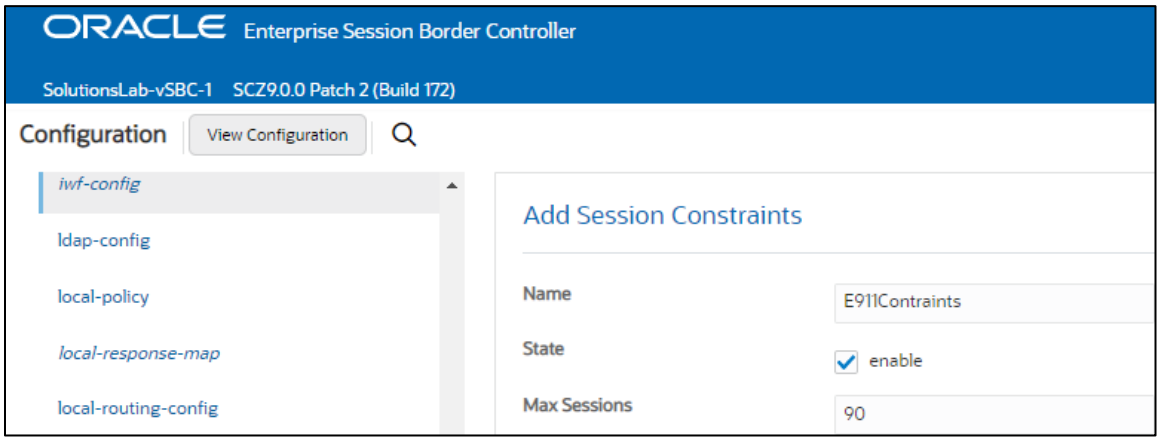
14.1.2.3 Session Constraints for E911

In order for the SBC to have the ability to handle emergency calls in high volume environment, we recommend configuring and applying session constraints for each realm on your SBC to allow a small portion of your licensed sessions to be allocated to emergency calls.

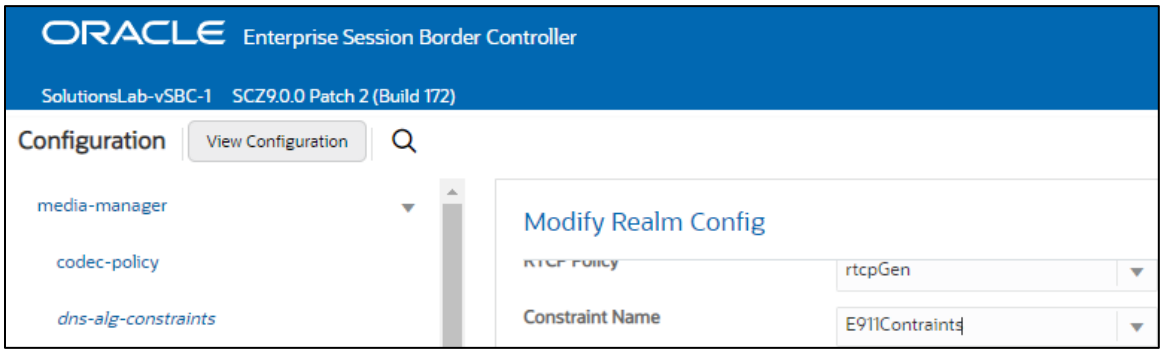
The below example is a very basic constraint setup limiting the number of calls allowed to traverse a realm. For the purposes of this example, we assume there are 100 licensed sessions on the SBC, so we'll limit the number of calls on the realms to 90, leaving 10 licensed session for emergency calls. Again, as noted above, when net management controls are configured to handle emergency traffic, constraints do not apply to those calls.

GUI Path: session-router/session-constraints

ACLI Path: config t→session-router→session-constraints



And now we'll assign this constraint to a realm:



- Select OK at the bottom of each element when finished

14.2 Elin Gateway

The Oracle® Enterprise Session Border Controller supports E911 ELIN for Teams-enabled Enterprises using the ELIN Gateway SPL option. Enable this option in the global SPL configuration. The Oracle® Enterprise Session Border Controller supports up to 300 ELIN numbers simultaneously and it can reuse numbers allowing a greater number of emergency calls

For more information about the SBC's Emergency Location Identification Number (ELIN) Gateway Support, please refer to the 9.0.0 Configuration Guide, Starting on Page 20-29

GUI Path: system/spl-config

ACLI Path: config t→system→spl-config

The only entry required to enable support for Elin Gateway is:

Elin-Gateway=<value>

Valid Values are either 30 or 60. This determines how long (minutes) the SBC will retain the mapping in memory. Default value is 30. For the purposes of testing, we increased that value to 60 minutes, as shown in the example below.

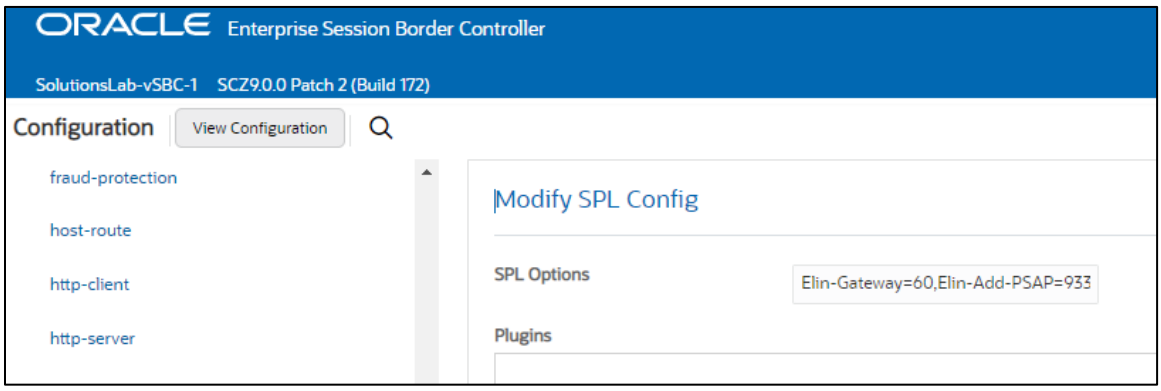
An optional configuration parameter:

Elin-Add-PSAP=<value>

Where <value> is one or more PSAP numbers. For multiple numbers, place the numbers within quotes, separate the numbers with a comma, and use no spaces. A single number does not require enclosure in quotes.

Examples: Elin-Add-PSAP=999 and Elin-AddPSAP="999,000,114"

By Default, Oracle delivers the SBC preconfigured with the 911 and 112 Public Safety Answering Point (PSAP) callback numbers



- Select OK at the bottom of the page when finished adding the options

14.2.1 Sip-Manipulation for Teams ELIN

By Default, the Oracle SBC with Elin SPL enabled, looks at the <NAM> field in the metadata of an Invite to extract the ELIN numbers and the FROM User uri for mapping. Since Microsoft Teams sends the ELIN information in an <Elin> field, and to avoid any issues due to ani masking on the Teams side, we have created the following sip-manipulation rule to move the information in the <Elin> field to the <Nam> field, and we replace the User part of the FROM header with the user part of the PAI. The manipulation gets assigned to either the Teams Realm or Sip Interface, and assures proper Elin mapping in the SBC.

Note: If there is an existing Sip Manipulation rule already assigned as the in-manipulation-id on either the realm or sip interface, these rules would need to be added to that existing manipulation.

GUI Path: session-router/sip-manipulation

ALCI Path: config t→session-router→sip-manipulation

While this can be configured via the GUI, we are using the ACLI output to provide an example config for ease of viewing.

```
sip-manipulation
        name                            ELIN_Support
        header-rule
                name                            StoreElin
                header-name                         Content-Type
                action                          store
                msg-type                        request
                methods                         Invite
                element-rule
                        name                            storeelin
                        parameter-name                      application/pidf+xml
                        type                            mime
                        action                          store
                        comparison-type                     pattern-rule
                        match-value                     (<ELIN>)(.*)(</ELIN>)
        header-rule
                name                            ReplaceNam
                header-name                         Content-Type
                action                          manipulate
                msg-type                        request
                methods                         Invite
                element-rule
                        name                            changenam
                        parameter-name                      application/pidf+xml
                        type                            mime
                        action                          find-replace-all
                        comparison-type                     pattern-rule
                        match-value                     (<NAM>)(.*)(</NAM>)
                        new-value                       $1+$StoreElin.$storeelin.$2+$3
        header-rule
                name                            PAItoFrom
                header-name                         From
                action                          manipulate
                msg-type                        request
                methods                         Invite
                element-rule
                        name                            changeuser
                        type                            uri-user
                        comparison-type                     pattern-rule
                        new-value                       $PAI_USER.$0
```

15 ACLI Running Configuration

Below is a complete output of the running configuration used to create this application note. This output includes all of the configuration elements used in our examples, including some of the optional configuration features outlined throughout this document. Be aware that not all parameters may be applicable to every Oracle SBC setup, so please take this into consideration if planning to copy and paste this output into your SBC.

```
access-control
        realm-id                        Teams
        source-address                      52.112.0.0/14
        application-protocol                SIP
        trust-level                     high
access-control
        realm-id                        Teams
        source-address                      52.120.0.0/14
        application-protocol                SIP
        trust-level                     high
certificate-record
        name                            BaltimoreRoot
        common-name                         Baltimore CyberTrust Root
certificate-record
        name                            DigiCertRoot
        common-name                         DigiCert Global Root CA
certificate-record
        name                            SBCCertificateforTeams
        state                           California
        locality                        Redwood City
        organization                      Oracle Corporation
        unit                            Oracle CGBU-LABS BOSTON
        common-name                         telechat.o-test06161977.com
certificate-record
        name                            WebServerInstance
        state                           California
        locality                        Redwood City
        organization                      Oracle Corporation
        unit                            Oracle CGBU-LABS BOSTON
        common-name                         telechat.o-test06161977.com
codec-policy
        name                            SipTrunkCodecs
        allow-codecs                      * SILK:NO G722:NO PCMA:NO
        add-codecs-on-egress                PCMU
codec-policy
        name                            addCN
        allow-codecs                      *
        add-codecs-on-egress                CN
http-server
        name                            webServerInstance
        http-state                      disabled
        https-state                     enabled
        tls-profile                     WebServerInstance
ice-profile
        name                            ice
local-policy
        from-address                      *
```

```
        to-address                  1911
                                    911
                                    +1911
        source-realm                Teams
        description                 Local policy to route emergency calls
        policy-priority             emergency
        policy-attribute
            next-hop                sag:e911group
            realm                   SipTrunk
local-policy
        from-address                *
        to-address                  *
        source-realm                SipTrunk
        description                 Route calls from PSTN to Microsoft Teams Phone
                                    System Direct Routing
        policy-attribute
            next-hop                sag:TeamsGrp
            realm                   Teams
            action                  replace-uri
local-policy
        from-address                *
        to-address                  *
        source-realm                Teams
        description                 Route Calls from Teams Phone System Direct
                                    Routing to PSTN
        policy-attribute
            next-hop                10.1.2.30
            realm                   SipTrunk
media-manager
        options                     audio-allow-asymmetric-pt
                                    xcode-gratuitous-rtcp-report-generation
media-profile
        name                        CN
        subname                     wideband
        payload-type                118
media-profile
        name                        SILK
        subname                     narrowband
        payload-type                103
        clock-rate                  8000
media-profile
        name                        SILK
        subname                     wideband
        payload-type                104
        clock-rate                  16000
media-sec-policy
        name                        PSTNNonSecure
media-sec-policy
        name                        TeamsMediaSecurity
        inbound
            profile                 TeamsSRTP
            mode                    srtp
            protocol                sdes
        outbound
            profile                 TeamsSRTP
            mode                    srtp
```

```
            protocol                    sdes
net-management-control
        name                        EmergencyRoute
        type                       priority
        treatment                    divert
        next-hop                     sag:e911group
        realm-next-hop                  SipTrunk
        protocol-next-hop                SIP
        destination-identifier           911
network-interface
        name                        s0p0
        ip-address                   10.1.2.4
        netmask                      255.255.255.0
        gateway                      10.1.2.1
network-interface
        name                        s1p0
        ip-address                   10.1.3.4
        netmask                      255.255.255.0
        gateway                      10.1.3.1
ntp-config
        server                      216.239.35.0
phy-interface
        name                        s0p0
        operation-type                  Media
phy-interface
        name                        s1p0
        operation-type                  Media
        slot                       1
realm-config
        identifier                  SipTrunk
        description                    Realm facing PSTN
        network-interfaces                s0p0:0.4
        mm-in-realm                      enabled
        media-sec-policy                  PSTNNonSecure
        access-control-trust-level           high
        codec-policy                    SipTrunkCodecs
        ringback-trigger                 refer
        ringback-file                   ringback10sec.pcm
realm-config
        identifier                  Teams
        description                    Realm facing Teams
        network-interfaces                s1p0:0.4
        mm-in-realm                      enabled
        media-sec-policy                  TeamsMediaSecurity
        rtcp-mux                       enabled
        ice-profile                    ice
        teams-fqdn                      telechat.o-test06161977.com
        teams-fqdn-in-uri                enabled
        sdp-inactive-only                enabled
        access-control-trust-level          high
        net-management-control                enabled
        codec-policy                    addCN
        rtcp-policy                    rtcpGen
rtcp-policy
        name                        rtcpGen
        rtcp-generate                   all-calls
```

```
sdes-profile
        name                    TeamsSRTP
        lifetime                31
session-agent
        hostname                10.1.2.30
        ip-address              10.1.2.30
        realm-id                SipTrunk
        ping-method             OPTIONS
        ping-interval           30
        ping-response           enabled
session-agent
        hostname                e911.com
        ip-address              10.1.2.10
        realm-id                SipTrunk
        description             Route emergency calls to this destination.
session-agent
        hostname                sip.pstnhub.microsoft.com
        port                    5061
        transport-method        StaticTLS
        realm-id                Teams
        ping-method             OPTIONS
        ping-interval           30
        ping-response           enabled
        refer-call-transfer     enabled
session-agent
        hostname                sip2.pstnhub.microsoft.com
        port                    5061
        transport-method        StaticTLS
        realm-id                Teams
        ping-method             OPTIONS
        ping-interval           30
        ping-response           enabled
        refer-call-transfer     enabled
session-agent
        hostname                sip3.pstnhub.microsoft.com
        port                    5061
        transport-method        StaticTLS
        realm-id                Teams
        ping-method             OPTIONS
        ping-interval           30
        ping-response           enabled
        refer-call-transfer     enabled
session-group
        group-name              TeamsGrp
        dest                    sip.pstnhub.microsoft.com
                                sip2.pstnhub.microsoft.com
                                sip3.pstnhub.microsoft.com
        sag-recursion           enabled
        stop-sag-recurse        401,407,480
session-group
        group-name              e911group
        description             Session Group for emergency calls
        dest                    e911.com
        sag-recursion           enabled
sip-config
        home-realm-id           Teams
```

```
        options                         max-udp-length=0
        allow-pani-for-trusted-only             disabled
        add-ue-location-in-pani             disabled
        npli-upon-register                  disabled
sip-feature
        name                            replaces
        realm                           Teams
        require-mode-inbound                    Pass
        require-mode-outbound                   Pass
sip-interface
        realm-id                        SipTrunk
        sip-port
                address                         10.1.2.4
                allow-anonymous                         agents-only
sip-interface
        realm-id                        Teams
        sip-port
                address                         10.1.3.4
                port                            5061
                transport-protocol                      TLS
                tls-profile                     TeamsTLSProfile
                allow-anonymous                         agents-only
        in-manipulationid               Checkfor183
        anonymous-priority                  emergency
        sip-profile                     forreplaces
sip-manipulation
        name                            Checkfor183
        header-rule
                name                            check183
                header-name                         @status-line
                action                          manipulate
                msg-type                        reply
                methods                         Invite
                element-rule
                        name                            is183
                        type                            status-code
                        action                          store
                        comparison-type                         pattern-rule
                        match-value                         183
        mime-sdp-rule
                name                            if183
                msg-type                        reply
                methods                         Invite
                action                          manipulate
                comparison-type                         boolean
                match-value                         $check183.$is183
                sdp-session-rule
                        name                            au
                        action                          manipulate
                        sdp-line-rule
                                name                                checkclineforsbcip
                                type                            c
                                action                          store
                                comparison-type                         pattern-rule
                                match-value                         ^(.(?!(10.1.3.4))).*$
        mime-sdp-rule
```

```
            name                    delete183SDP
            msg-type                  reply
            methods                   Invite
            action                  delete
            comparison-type             boolean
            match-value              $if183.$au.$checkclineforsbcip
        header-rule
            name                    change183to180
            header-name                @status-line
            action                  manipulate
            comparison-type             boolean
            match-value              $if183.$au.$checkclineforsbcip
            element-rule
                name                      changestatus
                type                    status-code
                action                    replace
                match-value                183
                new-value                  180
            element-rule
                name                      changereasonphrase
                type                    reason-phrase
                action                    replace
                match-value                Session Progress
                new-value                  Ringing
sip-manipulation
        name                        ELIN_Support
        header-rule
            name                    StoreElin
            header-name                Content-Type
            action                  store
            msg-type                  request
            methods                   Invite
            element-rule
                name                      storeelin
                parameter-name                application/pidf+xml
                type                    mime
                action                    store
                comparison-type               pattern-rule
                match-value              (<ELIN>)(.*)(</ELIN>)
        header-rule
            name                    ReplaceNam
            header-name                Content-Type
            action                  manipulate
            msg-type                  request
            methods                   Invite
            element-rule
                name                      changenam
                parameter-name                application/pidf+xml
                type                    mime
                action                    find-replace-all
                comparison-type               pattern-rule
                match-value              (<NAM>)(.*)(</NAM>)
                new-value                $1+$StoreElin.$storeelin.$2+$3
        header-rule
            name                    PAItoFrom
            header-name                From
```

```
            action                  manipulate
            msg-type                  request
            methods                   Invite
            element-rule
                name                      changeuser
                type                    uri-user
                comparison-type             pattern-rule
                new-value                 $PAI_USER.$0
sip-profile
      name                      forreplaces
      replace-dialogs             enabled
spl-config
      spl-options                Elin-Gateway=60,Elin-Add-PSAP=933
steering-pool
      ip-address                 10.1.2.4
      start-port                10000
      end-port                  10999
      realm-id                  SipTrunk
steering-pool
      ip-address                 10.1.3.4
      start-port                10000
      end-port                  10999
      realm-id                  Teams
system-config
      hostname                   oraclesbc.com
      description                SBC connecting PSTN Sip Trunk to Microsoft
                                 Teams Phone System Direct Routing
      location                  Burlington, MA
      transcoding-cores           1
tls-profile
      name                      TeamsTLSProfile
      end-entity-certificate      SBCCertificateforTeams
      trusted-ca-certificates     BaltimoreRoot
      mutual-authenticate         enabled
tls-profile
      name                      WebServerInstance
      end-entity-certificate      WebServerInstance
      trusted-ca-certificates     BaltimoreRoot
                                DigiCertInter
                                DigiCertRoot
```

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