



# ORACLE

## Configuring the Oracle SBC with Microsoft Teams Direct Routing Carrier Hosting Model

**Technical Application Note**

**ORACLE**  

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**COMMUNICATIONS**



## Disclaimer

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## 2 Related Documentation

### 2.1 Oracle SBC

- [Oracle® Enterprise Session Border Controller ESBC Configuration Guide](#)
- [Oracle® Enterprise Session Border Controller ACLI Reference Guide](#)
- [Oracle® Enterprise Session Border Controller Release Notes](#)
- [https://docs.oracle.com/cd/F12246\\_01/doc/sbc\\_scz900\\_security.pdf](https://docs.oracle.com/cd/F12246_01/doc/sbc_scz900_security.pdf)

### 2.2 Microsoft Teams

- <https://docs.microsoft.com/en-us/microsoftteams/direct-routing-configure>
- <https://docs.microsoft.com/en-us/microsoftteams/direct-routing-sbc-multiple-tenants#create-a-trunk-and-provision-users>
- <https://docs.microsoft.com/en-us/microsoftteams/direct-routing-plan#public-trusted-certificate-for-the-sbc>

### 3 Revision History

Version	Date Revised	Description of Changes
1.0	04/17/2019	Initial publication
1.1	10/09/2019	<ul style="list-style-type: none"><li>• Added GUI Configuration</li><li>• Firmware Version 8.3</li><li>• Modified Due to changes in MSFT Concept of Hosting Model</li></ul>
1.2	03/26/2020	<ul style="list-style-type: none"><li>• Modified TLS Profile Config</li><li>• Change LRT example</li><li>• Added additional customer domain information</li></ul>
1.3	04/29/2020	<ul style="list-style-type: none"><li>• Added Alert</li><li>• Add Important Information Section</li></ul>
1.4	06/08/2020	<ul style="list-style-type: none"><li>• Changed Running Config Output</li><li>• Added Appendix C with Notes</li><li>• Added notes regarding Sip Manipulation and new release</li></ul>
1.5	01/07/2022	<ul style="list-style-type: none"><li>• Removed Reference to sip-all fqdn</li></ul>
1.6	03/31/2022	<ul style="list-style-type: none"><li>• 9.0 Refresh</li><li>• Removed sip manip</li><li>• Added ACLs for new Teams subnets</li></ul>

## 4 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 +.*

## 5 Validated Oracle Versions

Microsoft has successfully conducted testing with the Oracle Communications SBC versions:

SCZ830/SCZ840/SCZ900

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

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

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

## 6 About Teams Direct Routing

Microsoft Teams Direct Routing allows a customer provided SBC to connect to Microsoft Phone System. The customer provided SBC can be connected to almost any telephony trunk or interconnect 3rd party PSTN equipment. The scenario allows:

- Use virtually any PSTN trunk with Microsoft Phone System.
- Configure interoperability between customer-owned telephony equipment, such as 3rd party PBXs, analog devices, and Microsoft Phone System

## 7 Infrastructure Requirements

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

Infrastructure Prerequisite	Details
Certified Session Border Controller (SBC)	<b>See Microsoft's <a href="#">Plan Direct Routing</a> document and <a href="#">Microsoft Trusted Root Program</a> with Included <a href="#">CA Certificate List</a></b>
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	

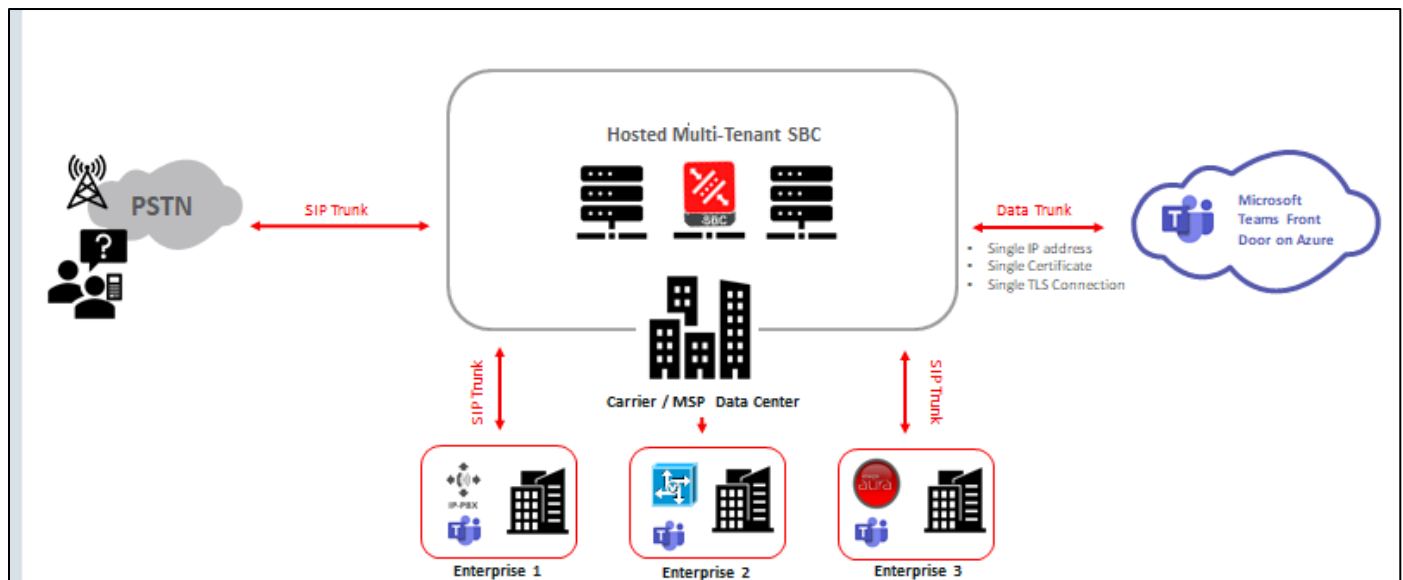


## 8 Configuration

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

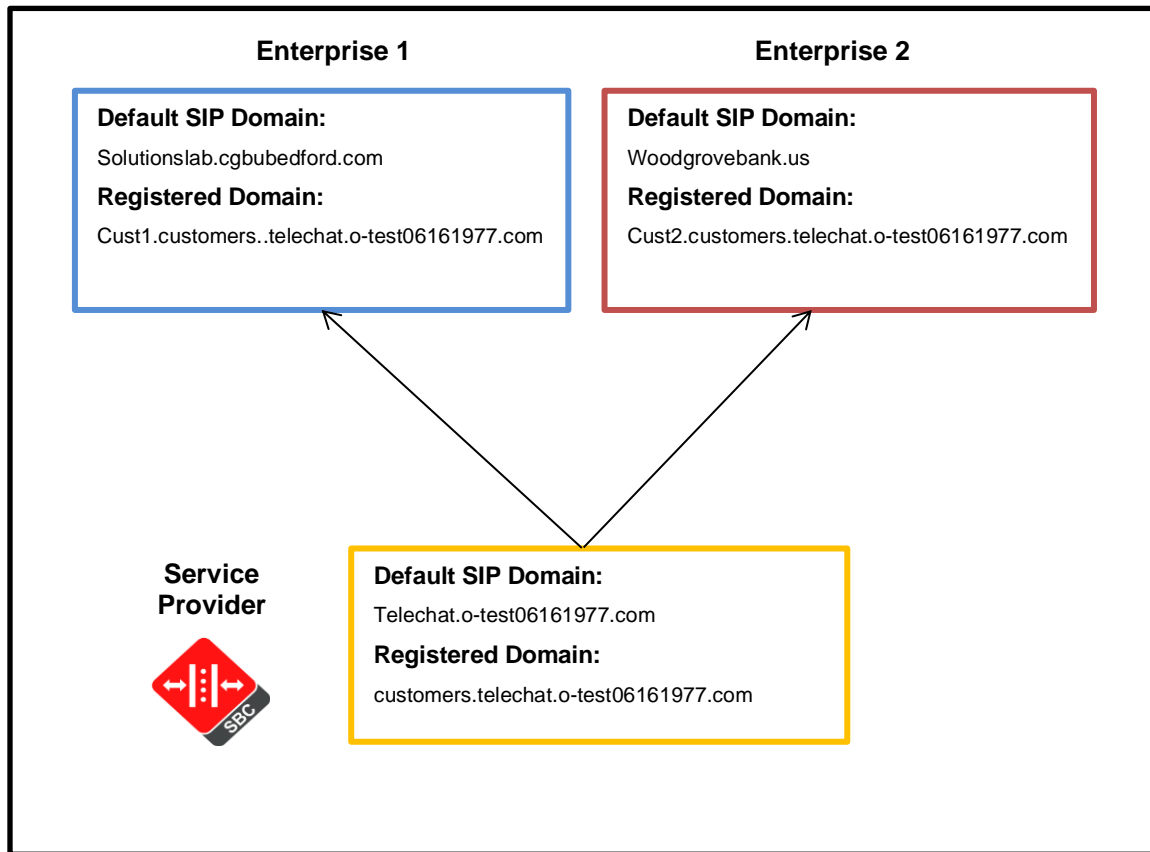
Below shows the connection topology example for MSFT Teams Carrier Model. There are multiple connections shown:

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



*These instructions cover configuration steps between the Oracle SBC and Microsoft Teams Direct Routing Interface. The interconnection of other entities, such as connection of the SIP trunk, 3rd Party PBX and/or analog devices are not covered in this instruction. The details of such connection are available in other instructions produced by the vendors of retrospective components.*

The below illustration and table are the Tenant Domain Structure used for this Application Note.



New Domain Name	Type	Registered Tenant	Certificate SAN for SBC	Tenant Default Domain	FQDN presented in Contact header when sending Calls
Customers.telechat.0-test06161977.com	Base	Carrier	*.cusotmers.telechat.o-test06161977.com	Telechat.o-test06161977.com	NA, this is a service tenant, no users
Sbc1.Customers.telechat.0-test06161977.com	Subdomain	Customer	*.cusotmers.telechat.o-test06161977.com	Solutionslab.cgbubedford.com	Sbc1.Customers.telechat.0-test06161977.com
Sbc2.Customers.telechat.0-test06161977.com	Subdomain	Customer	*.cusotmers.telechat.o-test06161977.com	Woodgrovebank.us	Sbc2.Customers.telechat.0-test06161977.co

### 8.1.1 Prerequisites

Before you begin, make sure that you have the following per every SBC you want to pair:

- Public IP address
- FQDN name for each registered subdomain representing individual tenants using the multitenant Direct Routing Trunk. Each FQDN must resolve to the Public IP address
- Public certificate, issued by one of the supported CAs (refer to [Related Documentation](#) for details about supported Certification Authorities).

### 8.1.2 About SBC Domain Name

The SBC domain name must be from one of the names registered in “Domains” of the tenant. You cannot use the **\*.onmicrosoft.com** tenant for the domain name. For example, on the picture below, the administrator registered the following DNS names for the tenant:

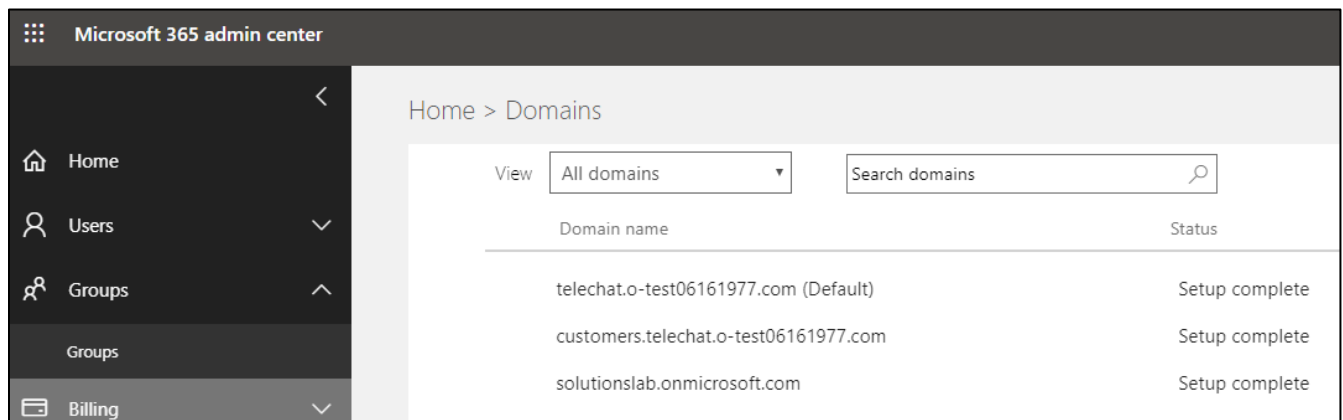
DNS Name	Can Be Used For SBC	Example of FQDN names
*.customers.adatum.biz	YES	<b>Valid FQDN:</b> <ul style="list-style-type: none"><li>• Sbc50.customers.adatum.biz</li><li>• Sbc51.customer.adatum.biz</li><li>• Ussbcsl5.customers.adatum.biz</li><li>• Europe.customers.adatum.biz</li></ul> <b>Invalid FQDN:</b> <ul style="list-style-type: none"><li>• Sbc1.customers.europe.adatum.biz (this would require registering domain name “Europe.adatum.biz”)</li></ul>
adatumbiz.onmicrosoft.com	NO	Using *.onmicrosoft.com domains is not supported for SBC names

### 8.1.3 SBC Domain Name in Carrier Tenant

Below is an example of registered DNS names in the Carrier Tenant:

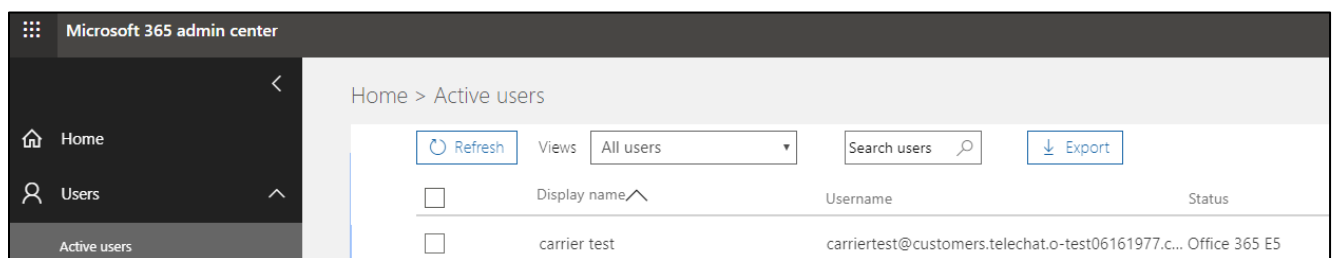
- Carrier Default Domain: **telechat.o-test06161977.com**
- Carrier Subdomain: **customers.telechat.o-test06161977.com**

*Note: The above FQDN's are examples only and not to be used outside of this document. Please use FQDN's that are applicable to your environment.*



After you have registered a domain name, you need to activate it by adding at least one licensed user with the SIP address matching the created base domain.

In the below example we have created the user [carriertest@customers.telechat.o-test06161977.com](mailto:carriertest@customers.telechat.o-test06161977.com) in the carrier tenant to activate the carrier base domain:



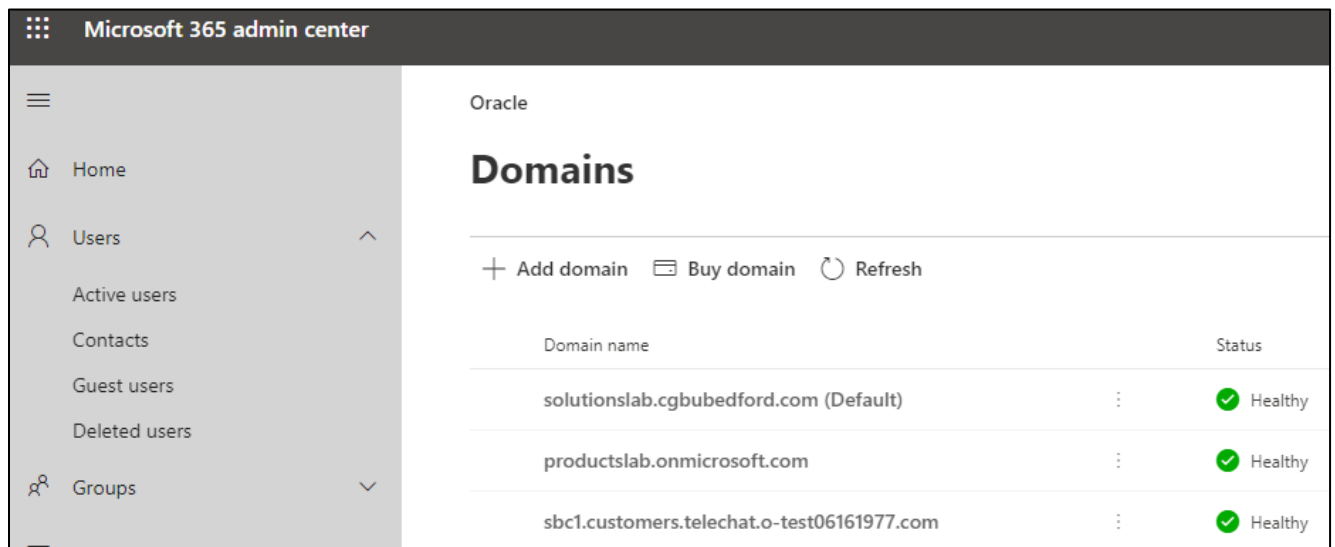
### 8.1.4 SBC Domain in Customer Tenant

For each customer tenant, you must register a subdomain that belongs to a carrier that points to a customer tenant.

In the below example:

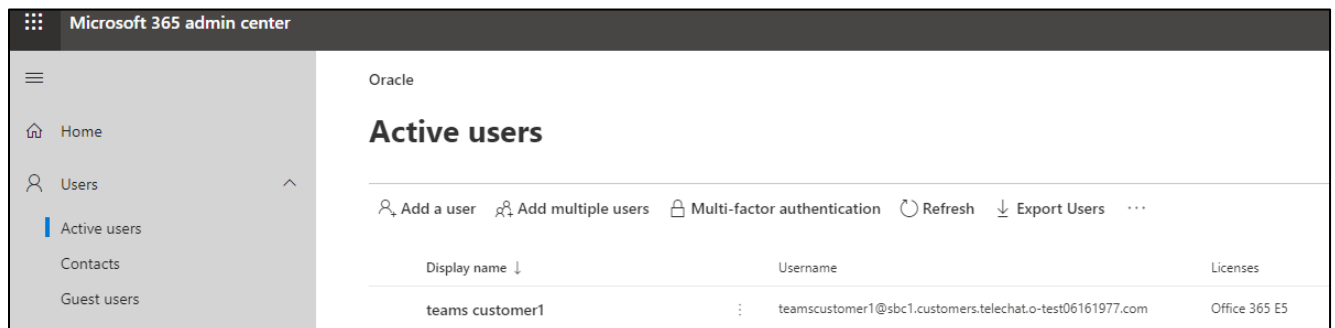
- Customer Tenant Default Domain: **solutionslab.cgbubedford.com**
- Carrier subdomain: **sbc1.customers.telechat.o-test06161977.com**

*Note: The above FQDN's are examples only and not to be used outside of this document. Please use FQDN's that are applicable to your environment.*



Same as the carrier tenant above, once you register the domain, you must activate it by adding at least one licensed user with the SIP address matching the carrier subdomain in the customer tenant.

Below, we have added the user [teamscustomer1@sbc1.customers.telechat.o-test06161977.com](mailto:teamscustomer1@sbc1.customers.telechat.o-test06161977.com) to activate the carrier subdomain in the customer tenant.



For the purposes of this example, the following IP address and FQDN's are used:

*Note: all fqdn's listed below resolve to the same public IP address*

FQDN Names	Public IP Address
customers.telechat.o-test06161977.com	141.146.36.68
sbc1.customers.telechat.o-test06161977.com	
sbc2.customers.telechat.o-test06161977.com	

## 9 Oracle SBC Configuration

There are two methods for configuring 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.

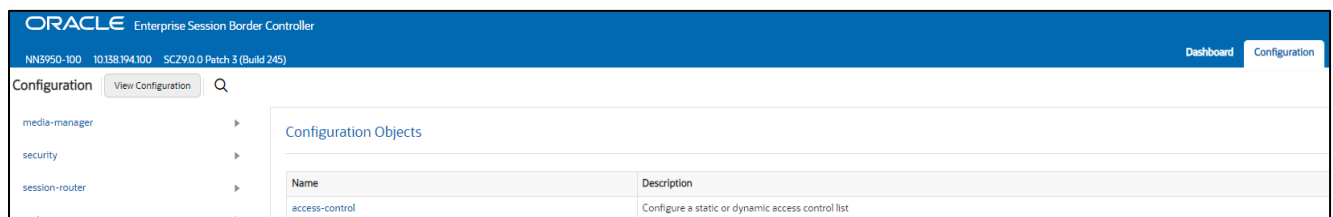
This guide assumes the OCSBC has been installed, management interface has been configured, product selected and entitlements have been assigned. Also, web-server-config has been enabled for GUI access. If you require more information on how to install your SBC platform, please refer to the [ACLI configuration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

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

Once you have accessed the OCSBC, 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 connection to MSFT Teams Direct routing to function properly.**

Please note, the below configuration example assumes Media Bypass is enabled on the MSFT Teams Tenant. For differences in the OCSBC configuration for Non Media Bypass, please see Appendix A



### 9.1 System-Config

To configure 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)

**ORACLE** Enterprise Session Border Controller

NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)

**Configuration** View Configuration 🔍

- media-manager ▶
- security ▶
- session-router ▶
- system ▼
- fraud-protection**
- host-route
- http-client
- http-server
- network-interface
- ntp-config
- phy-interface

### Modify System Config

Hostname	customers.telechat.o-test06161977.cor
Description	Carrier SBC for Teams Carrier Hosting Mode
Location	Burlington, MA
Mib System Contact	
Mib System Name	
Mib System Location	
Acp TLS Profile	
SNMP Enabled	<input checked="" type="checkbox"/> enable

- Click the OK at the bottom of the screen

### 9.1.1 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

**ORACLE** Enterprise Session Border Controller

NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)

**Configuration** View Configuration 🔍

- media-manager ▶
- security ▶
- session-router ▶
- system ▼
- fraud-protection

### Add NTP Config

This object has not been created. Start editing and click OK to add.

Server	216.239.35.0 ✕
--------	----------------

- Select OK at the bottom

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

### 9.1.2 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.

### 9.1.3 Physical Interfaces

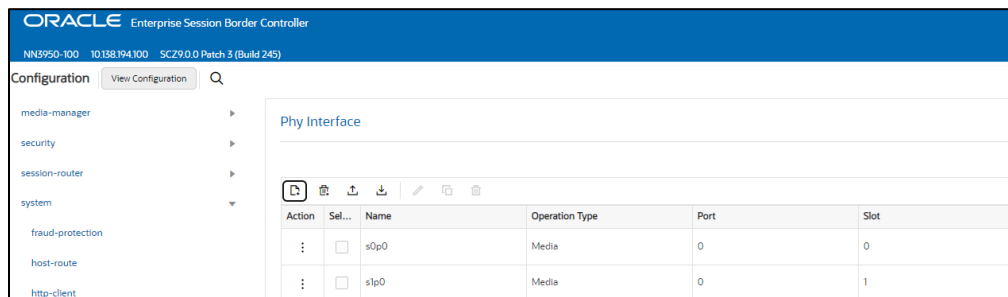
GUI Path: system/phy-interface

ACL 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*



### 9.1.4 Network Interfaces

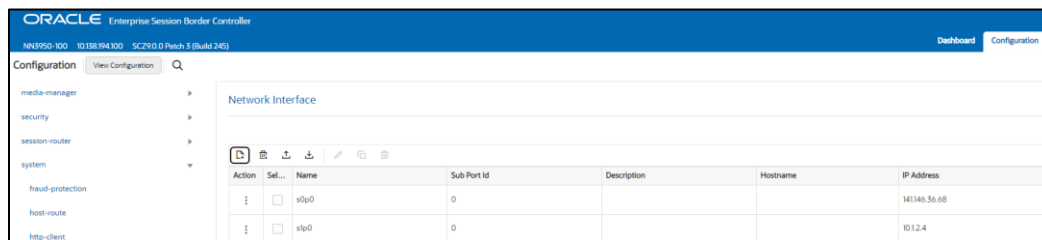
GUI Path: system/network-interface

ACL Path: config t→system→network-interface

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

Configuration Parameter	Teams	PSTN
Name	S0p0	S1p0
IP Address	141.146.36.68	10.1.2.4
Netmask	255.255.255.192	255.255.255.0
Gateway	141.146.36.65	10.1.2.1
DNS Primary IP	8.8.8.8	
DNS Domain	telechat.o-test06161977.com	





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

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

## 9.2 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 Authorities can be found at:

### [Public trusted certificate for the SBC](#)

#### 9.2.1 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

ACL 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 wildcard certificate)
- DigiCert RootCA Cert (Root CA used to sign the SBC's end entity certificate)
- BaltimoreRoot CA Cert (Microsoft Presents the SBC a certificate 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.*

##### 9.2.1.1 SBC End Entity Certificate

The SBC's end entity certificate is based on the Carrier Model domain structure outlined in the [Configuration](#) section of this document. This certificate record must include the following:

- Common name: Carrier Base Domain (**customers.telechat.o-test06161977.com**)
- Alternate Name: \*.Carrier Base Domain (**\*.customers.telechat.o-test06161977.com**)

To Configure the certificate record:

- Click Add, and configure the SBC certificate as shown below:

The screenshot displays the Oracle Enterprise Session Border Controller configuration interface. The top header shows the Oracle logo and the product name 'Enterprise Session Border Controller'. Below the header, the configuration path is shown: 'Configuration' > 'View Configuration' > 'Q'. The left sidebar lists the configuration hierarchy: 'media-manager', 'security', 'authentication-profile', 'certificate-record' (selected), 'tls-global', 'tls-profile', 'session-router', and 'system'. The main content area is titled 'Modify Certificate Record' and contains the following fields:

Name	TeamsCarrierCert
Country	US
State	California
Locality	Redwood City
Organization	Oracle Corporation
Unit	
Common Name	customers.telechat.o-test06161977.co
Key Size	2048
Alternate Name	*.customers.telechat.o-test06161977.c
Trusted	<input checked="" type="checkbox"/> enable
Key Usage List	<input type="checkbox"/> digitalSignature <input type="checkbox"/> keyEncipherment

- Click OK at the bottom

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

### 9.2.1.2 Root CA and Intermediate Certificates

#### 9.2.1.2.1 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.

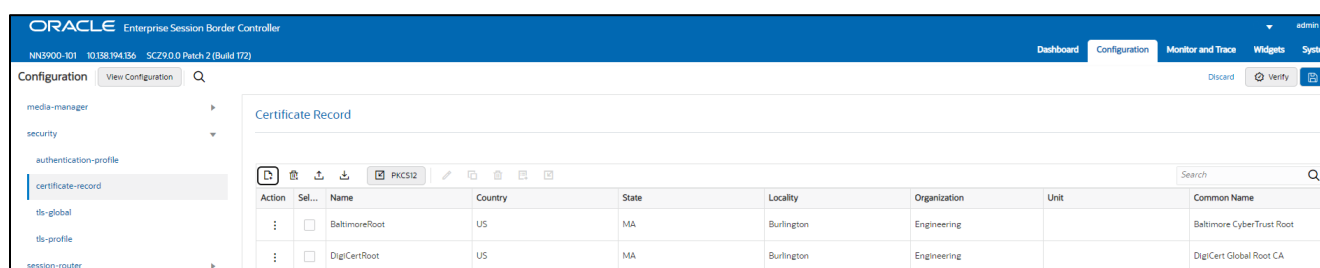
#### 9.2.1.2.2 Baltimore Root

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.

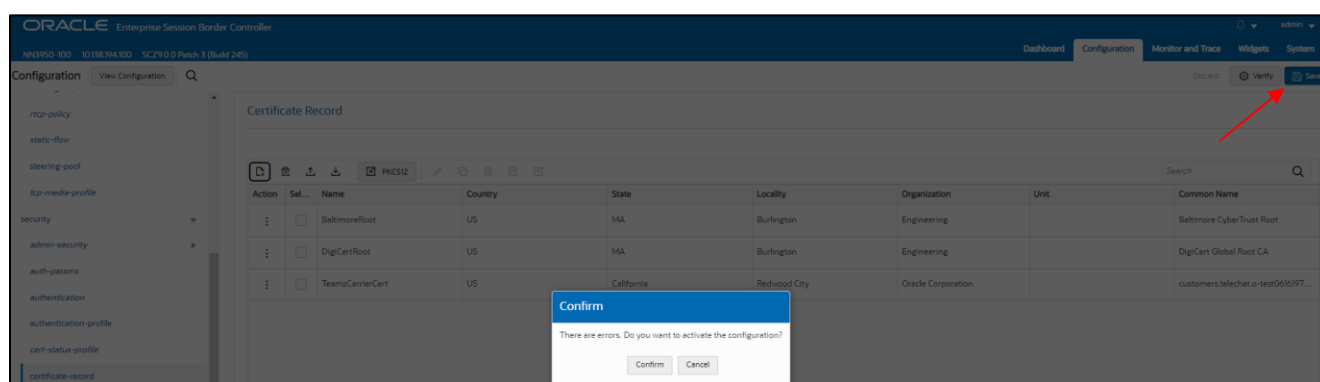
You can download this certificate here: <https://cacerts.digicert.com/BaltimoreCyberTrustRoot.crt.pem>

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.

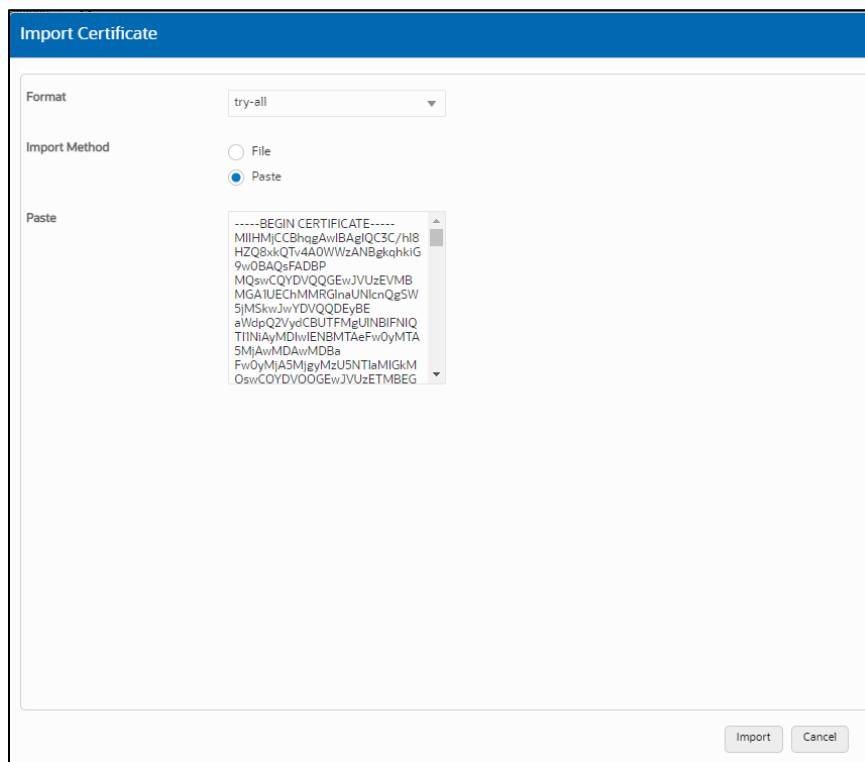
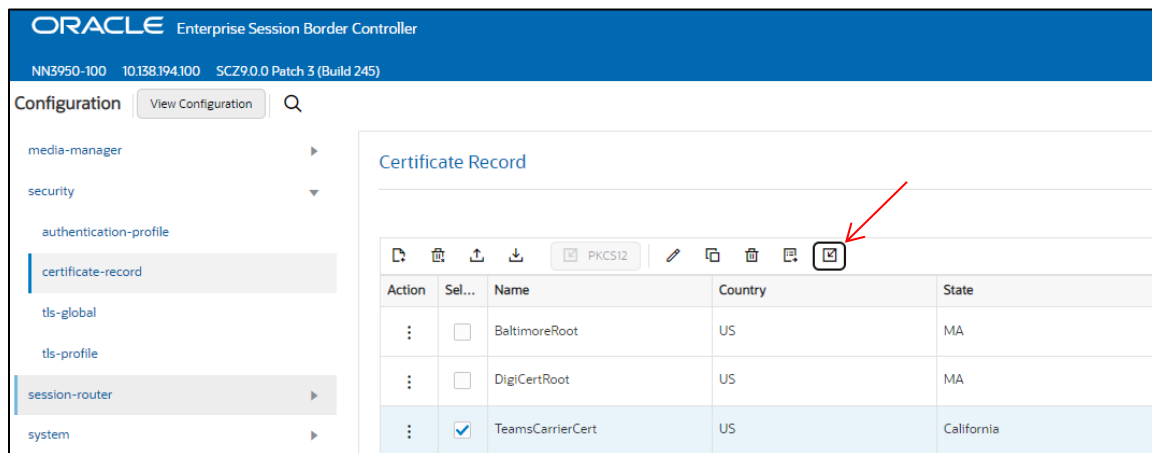


### 9.2.1.3 Generate Certificate Signing Request

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





- Paste the signed certificate in the text box, then select Import at the bottom. Next, as mentioned above, **save and activate** your configuration.

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

## 9.2.2 TLS Profile

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

GUI Path: security/tls-profile

ACL 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.

### 9.2.3 Media Security

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

#### 9.2.3.1 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

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

- Click Add, and use the example below to configure

*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

### 9.2.3.2 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

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

- Click Add, use the examples below to configure

**ORACLE** Enterprise Session Border Controller

NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)

**Configuration** View Configuration 🔍

- auth-params
- authentication**
- authentication-profile
- cert-status-profile
- certificate-record
- factory-accounts
- ike ▶
- ipsec ▶
- local-accounts
- media-security ▼
  - dtls-srtp-profile
  - media-sec-policy**
  - sdes-profile

### Modify Media Sec Policy

Name: TeamsSRTP

Pass Through: ☐ enable

Options:

**Inbound**

Profile: SDES ▼

Mode: srtp ▼

Protocol: sdes ▼

Hide Egress Media Update: ☐ enable

**Outbound**

Profile: SDES ▼

Mode: srtp ▼

Protocol: sdes ▼

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**Configuration** View Configuration 🔍

- auth-params
- authentication
- authentication-profile
- cert-status-profile
- certificate-record
- factory-accounts
- ike** ▶
- ipsec ▶
- local-accounts
- media-security ▼
  - dtls-srtp-profile
  - media-sec-policy**
  - sdes-profile

### Modify Media Sec Policy

Name: PSTNNonSecure

Pass Through: ☐ enable

Options:

**Inbound**

Profile: ▼

Mode: rtp ▼

Protocol: none ▼

Hide Egress Media Update: ☐ enable

**Outbound**

Profile: ▼

Mode: rtp ▼

Protocol: none ▼

- 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 advanced media termination features and transcoding.



## 9.3 Transcoding Configuration

Transcoding is the ability to 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 algorithms with one another

### 9.3.1 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. 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

Action	Sel...	Name	Subname	Media Type	Payload Type	Transport	Clock Rate
+	<input type="checkbox"/>	CN	wideband	audio	118	RTP/AVP	16000
+	<input type="checkbox"/>	SILK	narrowband	audio	103	RTP/AVP	8000
+	<input type="checkbox"/>	SILK	wideband	audio	104	RTP/AVP	16000

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

### 9.3.2 Codec Policies

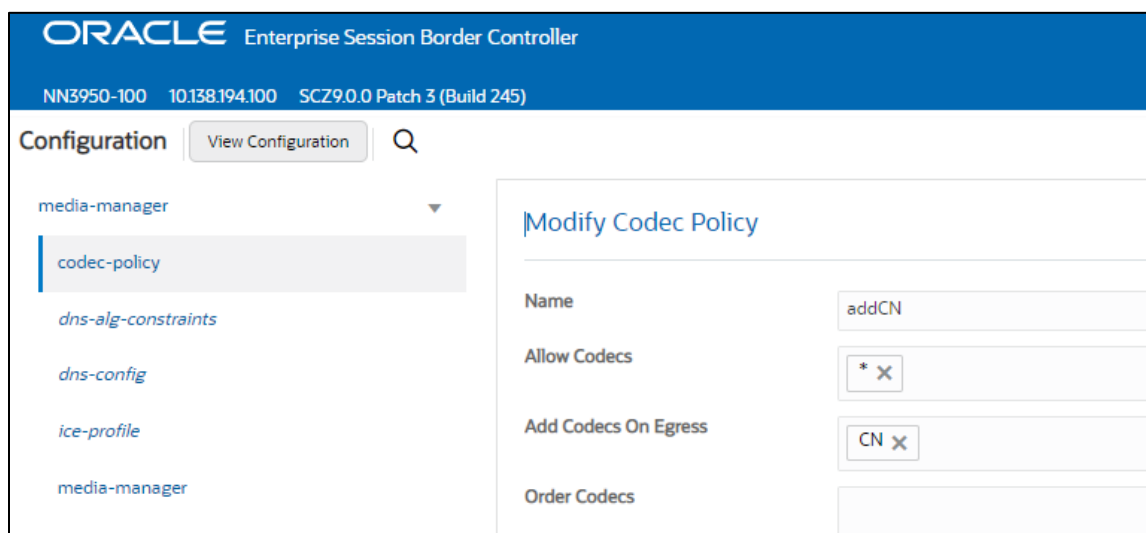
Codec policies are sets of rules that specify the manipulations to be performed on SDP offers allowing the Oracle SBC the ability to add, strip, and reorder codecs for SIP sessions.

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. To satisfy this requirement, the SBC uses transcoding resources to generate those packets, which does require a codec policy be configured and assigned.

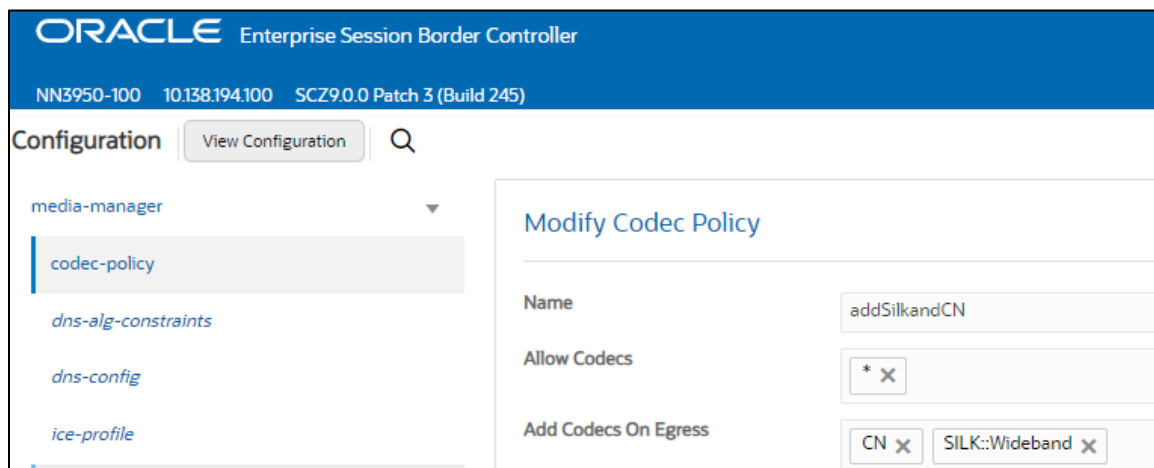
GUI Path: media-manager/codec-policy

ACL 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 offered by Microsoft Teams, you can create another codec policy to remove unwanted or unsupported codecs from the request/responses to your Sip Trunk provider.

The screenshot shows the Oracle Enterprise Session Border Controller configuration interface. The top header is blue with the Oracle logo and 'Enterprise Session Border Controller'. Below the header, system information is displayed: 'NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)'. The main navigation area on the left is titled 'Configuration' and includes a 'View Configuration' button and a search icon. A sidebar menu lists configuration items: 'media-manager', 'codec-policy' (highlighted), 'dns-alg-constraints', 'dns-config', 'ice-profile', and 'media-manager'. The main content area is titled 'Modify Codec Policy'. It contains three sections: 'Name' with a text field containing 'SipTrunkCodecs'; 'Allow Codecs' with a list of codec buttons: '\*' (with an 'x'), 'PCMA:no' (with an 'x'), 'SILK:no' (with an 'x'), and 'G722:no' (with an 'x'); and 'Add Codecs On Egress' with a button 'PCMU' (with an 'x').

- Select OK at the bottom

### 9.3.3 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

The screenshot shows the Oracle Enterprise Session Border Controller configuration interface for 'Modify RTCP Policy'. The top header is blue with the Oracle logo and 'Enterprise Session Border Controller'. Below the header, system information is displayed: 'NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)'. The main navigation area on the left is titled 'Configuration' and includes a 'View Configuration' button and a search icon. A sidebar menu lists configuration items: 'media-manager', 'codec-policy', 'dns-alg-constraints', and 'dns-config'. The main content area is titled 'Modify RTCP Policy'. It contains two sections: 'Name' with a text field containing 'rtcpGen', and 'RTCP Generate' with a dropdown menu currently showing 'all-calls'.

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

### 9.3.4 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

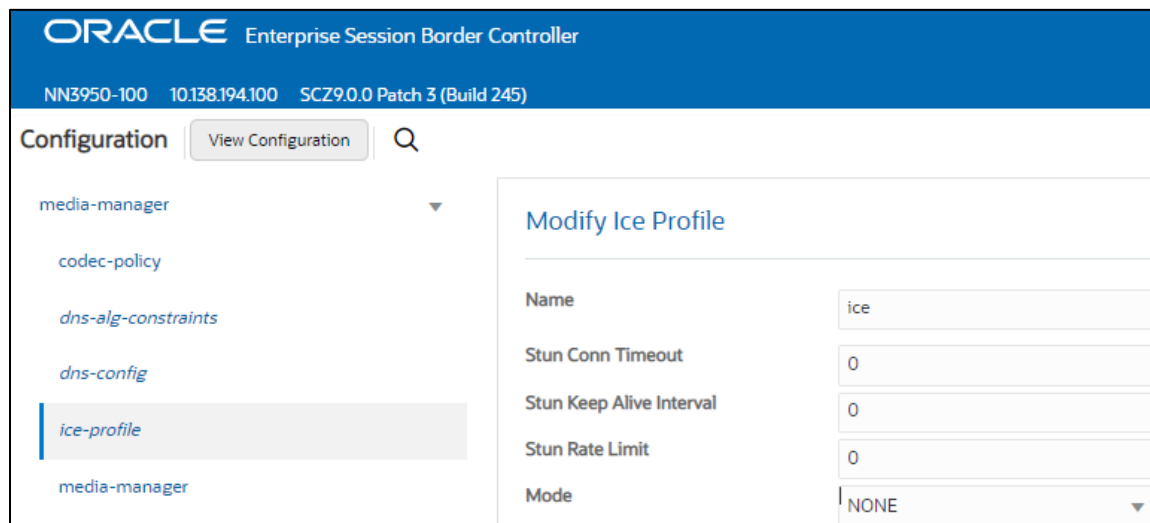
The use of ICE is required only if using Teams with Media Bypass enabled.

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

GUI Path: media-manager/ice-profile

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

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



The screenshot shows the Oracle Enterprise Session Border Controller web interface. The top header includes the Oracle logo and version information: NN3950-100, 10.138.194.100, SCZ9.0.0 Patch 3 (Build 245). The left sidebar is titled 'Configuration' and lists several menu items: media-manager, codec-policy, dns-alg-constraints, dns-config, ice-profile (which is highlighted with a blue bar), and media-manager. The main content area is titled 'Modify Ice Profile' and contains a form with the following fields: Name (set to 'ice'), Stun Conn Timeout (set to '0'), Stun Keep Alive Interval (set to '0'), Stun Rate Limit (set to '0'), and Mode (set to 'NONE').

*When deploying the Oracle SBC with Microsoft Teams, we recommend changing the default values for Stun Conn Timeout, Stun Keep Alive Interval, and Stun Rate Limit to a value of 0 (zero) from their default values.*

- 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.

## 9.4 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.

### 9.4.1 Media Manager

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

GUI Path: media-manager/media-manager

ACL 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.

The screenshot shows the Oracle Enterprise Session Border Controller configuration page. The top header includes the Oracle logo and the text 'Enterprise Session Border Controller'. Below the header, the system information is displayed: 'NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)'. The main navigation pane on the left lists various configuration sections: 'media-manager', 'codec-policy', 'dns-alg-constraints', 'dns-config', 'ice-profile', 'media-manager' (selected), 'media-policy', 'msrp-config', 'playback-config', 'realm-config', 'realm-group', and 'rtcp-policy'. The 'media-manager' section is expanded, showing a list of configuration items: 'Subsq Guard Timer', 'TCP Flow Time Limit', 'TCP Initial Guard Timer', 'TCP Subsq Guard Timer', 'Hnt Rtcp', 'Algd Log Level', 'Mbcd Log Level', and 'Options'. The 'Options' section is expanded, showing two options: 'audio-allow-asymmetric-pt' and 'xcode-gratuitous-rtcp-report-generation', both with 'X' icons next to them.

- Click OK at the bottom

## 9.4.2 Realm Config

### Nested Realm for Teams

Nested Realms is an OCSBC feature that supports hierarchical realm groups. One or more realms may be nested within a higher order realm. This allows the OCSBC to separate each tenant the Carrier Model SBC is servicing.

In this example we will create two realms facing MSFT Teams.

A parent realm for Teams and a child realm for a customer tenant. The parent realm will contain the carrier base domain, and the Tenant realm will contain the customer's carrier subdomain.

We'll also be creating a third, standalone realm facing PSTN.

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 three realms used in this configuration example

Config Parameter	Teams Realm	Tenant Realm	PSTN Realm
Identifier	Teams	Teams_Cust1	SipTrunk
Network Interface	s0p0:0	s0p0:0	s1p0:0
Mm in realm	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Media Sec policy	TeamsSRTP	TeamsSRTP	PSTNNonSecure
Teams-FQDN	Customers.telechat.o-test06161977.com	Sbc1.customers.telechat.o-test06161977.com	
Teams-fqdn-in-uri	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Sdp-inactive-only	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
RTCP mux	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
ice profile	Ice (required for media bypass only)	Ice (required for media bypass only)	
Codec policy	addCN	addCN	SipTrunkCodecs
RTCP policy	rtcpGen	rtcpGen	
Access-control-trust-level	HIGH	HIGH	HIGH
Parent Realm		Teams	

Additional Realms can be added, one for each customer tenant the Oracle SBC is servicing. The carrier subdomain registered in each tenant needs to be added under the “Teams-FQDN” parameter in the realm.

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

Action	Sel...	Identifier	Description	Addr Prefix	Network Interfaces
⋮	<input type="checkbox"/>	SIPTrunk	Realm Facing PSTN	0.0.0.0	s1p0:0
⋮	<input type="checkbox"/>	Teams	Carrier Tenant Facing Teams Direct Routing Inte...	0.0.0.0	s0p0:0
⋮	<input type="checkbox"/>	Teams_Cust1	Realm to service Customer, woodgrovebank.us. ...	0.0.0.0	s0p0:0

- Select OK at the bottom of each

### 9.4.3 Steering Pools

Steering pools define sets of ports that are used for steering media flows through the OCSBC.

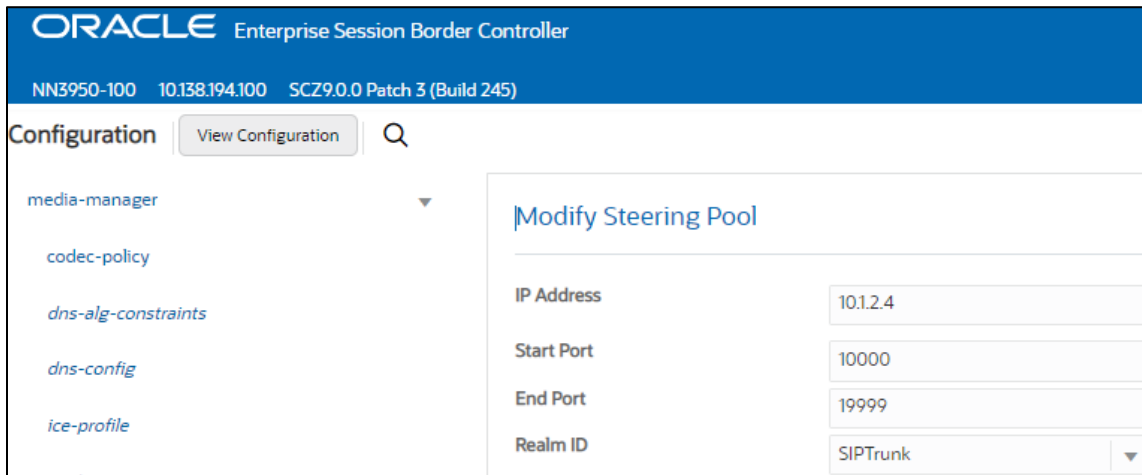
These selected ports are used to modify the SDP to cause receiving session agents to direct their media toward this system.

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



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Configuration View Configuration Q

media-manger

codec-policy

dns-alg-constraints

dns-config

ice-profile

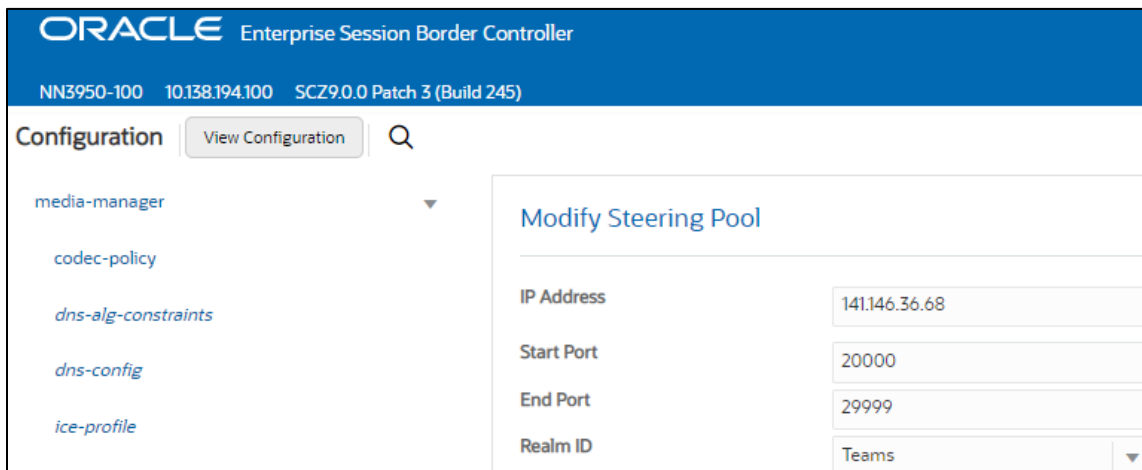
Modify Steering Pool

IP Address 10.1.2.4

Start Port 10000

End Port 19999

Realm ID SIPTrunk



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Configuration View Configuration Q

media-manger

codec-policy

dns-alg-constraints

dns-config

ice-profile

Modify Steering Pool

IP Address 141.146.36.68

Start Port 20000

End Port 29999

Realm ID Teams

- Select OK at the bottom

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

## 9.5 Sip Configuration

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

## 9.5.1 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).

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Configuration View Configuration

session-router

access-control

account-config

filter-config

ldap-config

local-policy

local-routing-config

media-profile

session-agent

session-group

session-recording-group

session-recording-server

session-translation

**sip-config**

sip-feature

sip-interface

sip-manipulation

### Modify SIP Config

State	<input checked="" type="checkbox"/> enable
Dialog Transparency	<input checked="" type="checkbox"/> enable
Home Realm ID	Teams
Egress Realm ID	
Nat Mode	None
Registrar Domain	*
Registrar Host	*
Registrar Port	5060
Init Timer	500
Max Timer	4000
Trans Expire	32
Initial Inv Trans Expire	0
Invite Expire	180
Session Max Life Limit	0
Enforcement Profile	
Red Max Trans	10000
Options	max-udp-length=0 x

- Select OK at the bottom



## 9.5.2 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:

### 9.5.2.1 Sip Feature

The sip feature configuration element allows 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:

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Configuration View Configuration

security  
session-router  
access-control  
account-config  
filter-config  
ldap-config  
local-policy  
local-routing-config  
media-profile  
session-agent

### Modify SIP Feature

Name	replaces
Realm	Teams
Support Mode Inbound	Pass
Require Mode Inbound	Pass
Proxy Require Mode Inbound	Pass
Support Mode Outbound	Pass
Require Mode Outbound	Pass
Proxy Require Mode Outbound	Pass

- Click OK at the bottom

### 9.5.2.2 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

### 9.5.3 Sip Interface

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

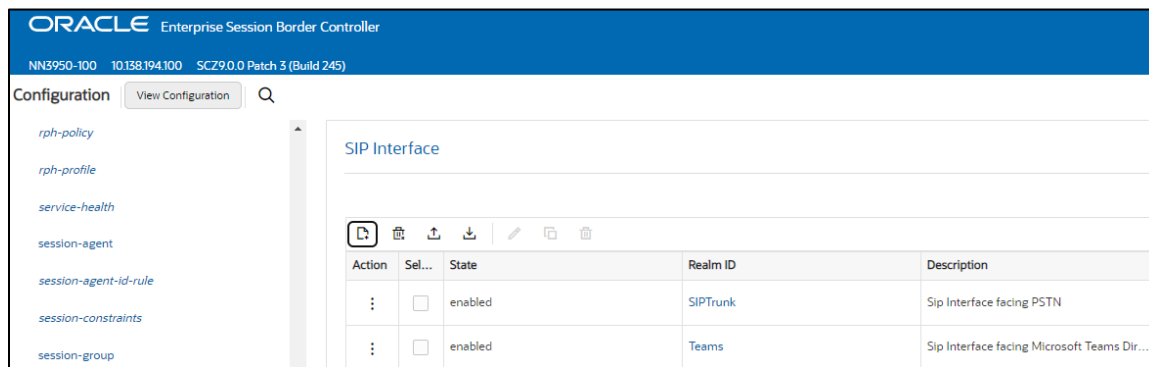
Configure two sip interfaces, one associated with PSTN Realm, and the other for Teams. You only need to configure a single sip interface facing Microsoft Teams Direct Routing. All realms for customers tenants inherit the sip interface from the Teams parent realm

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	141.146.36.68
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

## 9.5.4 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.

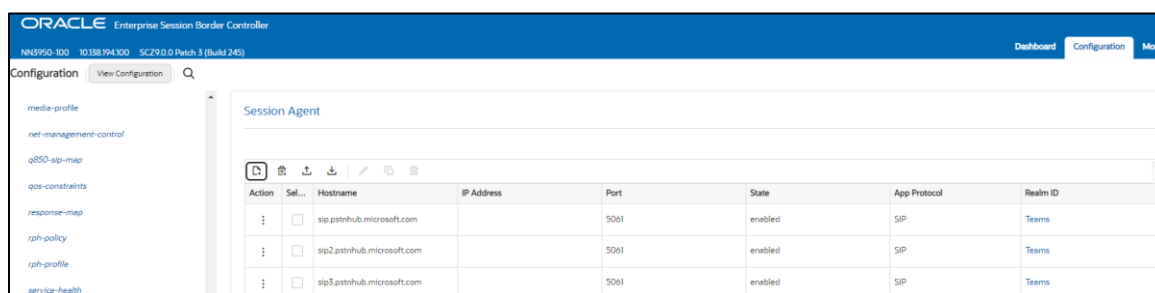
GUI Path: session-router/session-agent

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

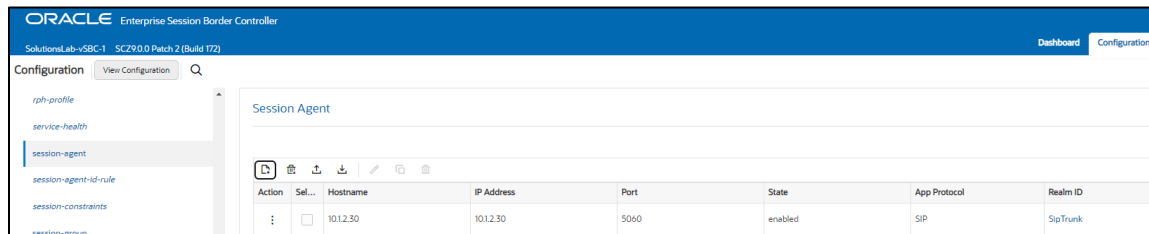
You will need to configure three Session Agents for the Microsoft Direct Routing Interface

- 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	10	10	10
Refer Call Transfer	enabled	enabled	enabled
Ping Response	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>



Next, we'll configure a session agent for PSTN



- Select OK at the bottom

## 9.5.5 Session Group

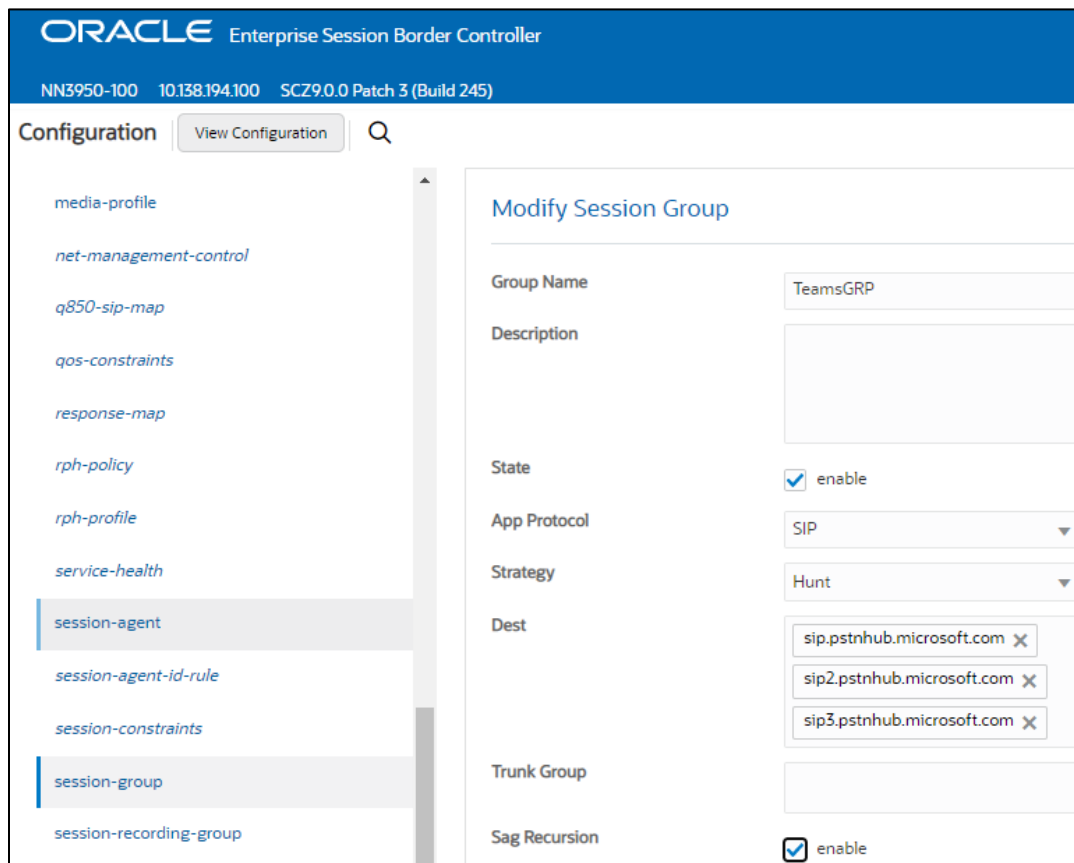
A session agent group allows the SBC to create a load balancing model:

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

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

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



- Click OK at the bottom

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

## 9.6 Routing Configuration

This section outlines how to configure the OCSBC to route Sip traffic to and from Microsoft Teams Direct Routing Interface.

The OCSBC has multiple routing options that can be configured based on environment. For this example configuration, we are utilizing the OCSBC's multistage local policy routing feature along with DID separation via local route table.

A routing stage signifies a re-evaluation of local policy based on the results of a local policy lookup. In the simplest, single stage case, the Session Border Controller performs a local policy lookup on a SIP message's Request URI. The result of that local policy lookup is a next hop FQDN, IP address, ENUM lookup, or LRT lookup; that result is where the Session Border Controller forwards the message. In the multistage routing model, that resultant next hop is used as the lookup key for a second local policy lookup

### 9.6.1 LRT

The OCSBC supports LRT, an XML document that contains either E164 telephone numbers or strings-to-SIP-URI mappings. An iLRT is configured and transferred from the development environment to the OCSBC /code/lrt directory. After installation and configuration, the LRT is available for SIP Request routing. For more information on creating and configuring LRT, please see the [OCSBC 9.0 Configuration Guide](#), Chapter 8.

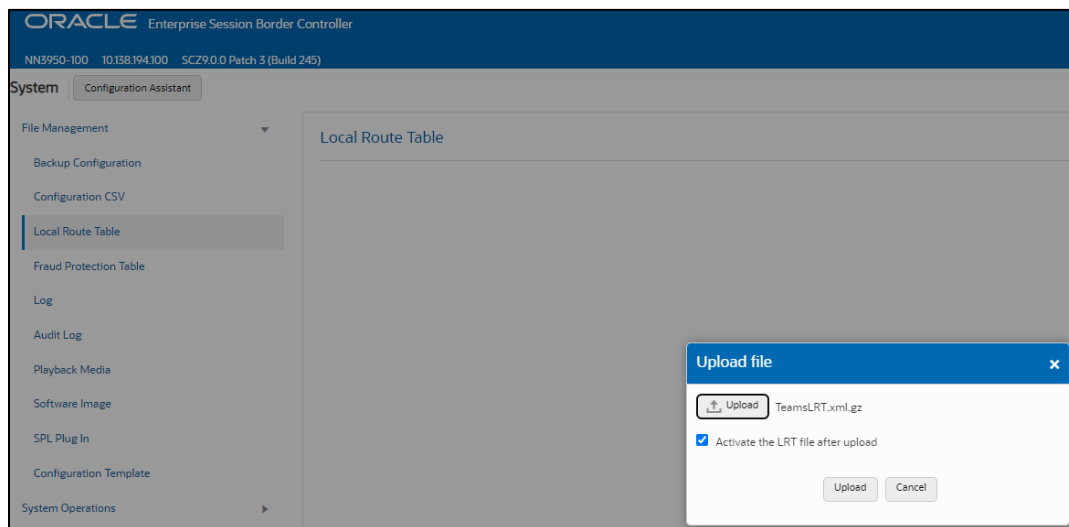
The following is an example Lrt file, once created, will be placed in the /code/lrt directory on the OCSBC

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<localRoutes xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <!-- Customer 1 Tenant: solutionslab.cgbubedford.com/sbc1.customers.telechat.o-test06161977.com -->
    <route>
      <user type="E164">17814437242</user>
      <next type="regex">!^.*!sip:\0@sbc1.customers.telechat.o-test06161977.com!</next>
    </route>
    <route>
      <user type="E164">17814437247</user>
      <next type="regex">!^.*!sip:\0@sbc1.customers.telechat.o-test06161977.com!</next>
    </route>
    <route>
      <user type="E164">17814437245</user>
      <next type="regex">!^.*!sip:\0@sbc1.customers.telechat.o-test06161977.com!</next>
    </route>
  <!-- Customer 2 Tenant – woodgrovebank.us/sbc2.customers.telechat.o-test06161977.com -->
    <route>
      <user type="E164">17814437243</user>
      <next type="regex">!^.*!sip:\0@sbc2.customers.telechat.o-test06161977.com!</next>
    </route>
    <route>
      <user type="E164">17814437244</user>
      <next type="regex">!^.*!sip:\0@sbc2.customers.telechat.o-test06161977.com!</next>
    </route>
    <route>
      <user type="E164">17814437388</user>
      <next type="regex">!^.*!sip:\0@sbc2.customers.telechat.o-test06161977.com!</next>
    </route>
</localRoutes>
```

The LRT file, once created, can be copied to the /code/lrt directory of the SBC via SFTP to the management IP, or uploaded through the GUI:

### 9.6.1.1 GUI Upload of LRT File

- At the top, click on the System Tab
- Left Hand side, expand File Management and select Local Route Table
- Click Upload
- Browse to select file to upload to SBC
- Check box “Activate LRT file after upload”
- Click Upload



### 9.6.2 Local Routing Config

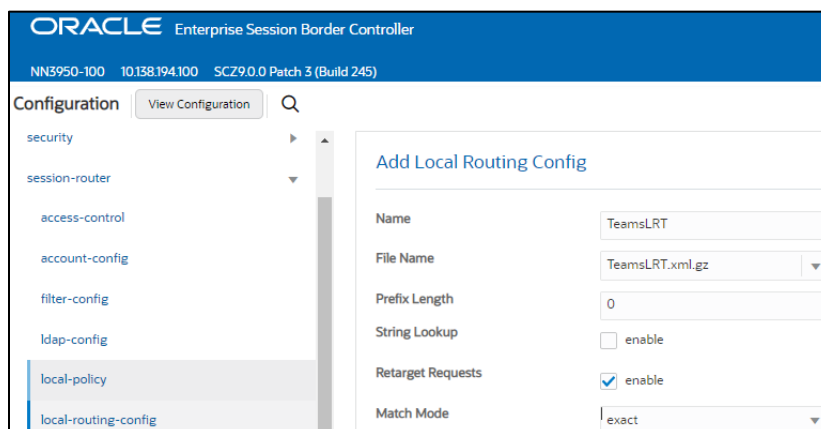
After moving the DID-range-based LRT to the /code/lrt directory on the OCSBC, use the following procedure to specify the file's location, and the lookup method.

GUI Path: session-router/local-routing-config

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

Click Add, use the following as an example to configure

*Note: the file name field below is the full name of the LRT file that has been placed in the /code/lrt directory on the OCSBC*



### 9.6.3 Session Router Config

Session router config allows for the SBC to perform multistage routing.

GUI Path: session-router/session-router

ACL Path: config t→session-router→session-router

Use the following example to configure session router config:

The screenshot shows the Oracle Enterprise Session Border Controller GUI. The top header includes the Oracle logo and version information: NN3950-100, 10.138.194.100, SCZ9.0.0 Patch 3 (Build 245). The left sidebar lists various configuration items: local-response-map, local-routing-config, media-profile, net-management-control, q850-sip-map, qos-constraints, response-map, rph-policy, and rph-profile. The main content area is titled 'Add Session Router' and contains the following configuration options:

State	<input checked="" type="checkbox"/> enable
System Number Type	Pots
Match Lp Src Parent Realm	<input type="checkbox"/> enable
Nested Realm Stats	<input type="checkbox"/> enable
Reject Message Threshold	0
Reject Message Window	10
Force Report Trunk Info	<input type="checkbox"/> enable
Additional Lp Lookups	1 (Range: 0.5)
Max Routes Per Lookup	0 (Range: 0.999999999)
Total Lp Routes	0 (Range: 0.999999999)
Multi Stage Src Realm Override	<input checked="" type="checkbox"/> enable

- Click OK at the bottom

### 9.6.4 Local Policy Configuration

Local Policy config allows for the SBC to route calls from one end of the network to the other based on routing criteria.

GUI Path: session-router/local-policy

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

To route Sip traffic to and from Microsoft Teams Direct Routing Interface, the following local policies will need to be configured.

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

**ORACLE** Enterprise Session Border Controller  
 NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)

**Configuration** View Configuration Q

- account-group
- allowed-elements-profile
- class-profile ▶
- enforcement-profile
- enum-config
- filter-config
- h323 ▶
- http-alg
- ivf-config
- ldap-config
- local-policy**
- local-response-map
- local-routing-config
- media-profile

### Modify Local Policy

From Address \* X

To Address \* X

Source Realm SIPTrunk X

Description

State ☒ enable

Policy Priority none ▼

Policy Attributes

Action	Sel...	Next Hop	Realm	Action
:	<input type="checkbox"/>	Irt:TeamsLRT	SIPTrunk	none

Policy Attribute:

**ORACLE** Enterprise Session Border Controller  
 NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)

**Configuration** View Configuration Q

- account-group
- allowed-elements-profile
- class-profile ▶
- enforcement-profile
- enum-config
- filter-config
- h323 ▶
- http-alg
- ivf-config
- ldap-config

### Modify Local policy / policy attribute

Next Hop Irt:TeamsLRT ▼

Realm SIPTrunk ▼

Action none ▼

Terminate Recursion ☐ enable

Cost 0

State ☒ enable

App Protocol ▼

Lookup multi ▼

The above local policy utilizes the [Irt /local-routing-config](#)- outlined previously in this document. This is a way to identify the terminating tenant/subdomain when the core network ie..SIPTrunk, does not identify the target in the Request-Uri host. When the target subdomain/tenant is identified in the Request-Uri host, the following local policies will route directly to Teams Group by to-address match.

- Call from Sip Trunk to Customer 1 Tenant:



**ORACLE** Enterprise Session Border Controller  
 NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)

**Configuration** View Configuration 🔍

- media-manager
- security
- session-router
  - access-control
  - account-config
  - filter-config
  - ldap-config
  - local-policy**
  - local-routing-config
  - media-profile
  - session-agent
  - session-group
  - session-recording-group
  - session-recording-server
  - session-translation
  - sip-config

### Modify Local Policy

From Address: \*

To Address: sbc1.customers.telechat.o-test06161977.com

Source Realm: SIPTrunk

Description:

State: ☒ enable

Policy Priority: none

Policy Attributes

Action	Sel...	Next Hop	Realm	Action
:	<input type="checkbox"/>	sag:TeamsGRP	Teams_Cust1	replace-uri

Policy Attribute:

**ORACLE** Enterprise Session Border Controller  
 NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)

**Configuration** View Configuration 🔍

- media-manager
- security
- session-router
  - access-control
  - account-config
  - filter-config
  - ldap-config
  - local-policy**
  - local-routing-config
  - media-profile

### Modify Local policy / policy attribute

Next Hop: sag:TeamsGRP

Realm: Teams\_Cust1

Action: replace-uri

Terminate Recursion: ☐ enable

Cost: 0

State: ☒ enable

App Protocol:

Lookup: single

- Click OK at the bottom

Using the above example, continue for each customer tenant being hosted by this OCSBC.

Next, we'll configure a local policy to route all traffic from Teams Direct Routing to Sip Trunk

**ORACLE** Enterprise Session Border Controller

NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)

**Configuration** View Configuration 🔍

- account-group
- allowed-elements-profile
- class-profile ▶
- enforcement-profile
- enum-config
- filter-config
- h323 ▶
- http-alg
- ivf-config
- ldap-config
- local-policy**
- local-response-map
- local-routing-config
- media-profile

### Modify Local Policy

From Address

To Address

Source Realm

Description

State ☒ enable

Policy Priority

Policy Attributes

Action	Sel...	Next Hop	Realm	Action
:	<input type="checkbox"/>	10.1.2.30	SIPTrunk	none

Policy Attribute:

**ORACLE** Enterprise Session Border Controller

NN3950-100 10.138.194.100 SCZ9.0.0 Patch 3 (Build 245)

**Configuration** View Configuration 🔍

- account-group
- allowed-elements-profile
- class-profile ▶
- enforcement-profile**
- enum-config
- filter-config
- h323 ▶
- http-alg
- ivf-config
- ldap-config

### Modify Local policy / policy attribute

Next Hop

Realm

Action

Terminate Recursion ☐ enable

Cost

State ☒ enable

App Protocol

Lookup

- Click OK at the bottom of each when applicable:

## 9.7 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 only from trusted IP's with a trust level of high
2. Set the access control trust level on public facing [realms](#) to HIGH

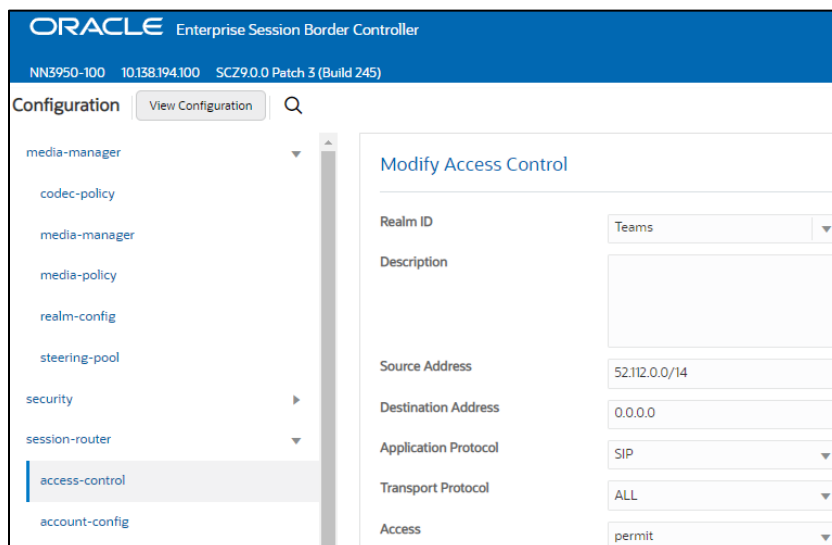
Microsoft Teams has two subnets, 52.112.0.0/14 and 52.120.0.0/14 that must be allowed to send traffic to the SBC. Both must be configured as an access control on the Oracle SBC and associated with the Teams realm.

Use this example to create ACL's for both 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.



- Click OK at the bottom

The SBC configuration is now complete. Move to verify the connection with Microsoft Direct Routing Interface.

## 10 Verify Connectivity

### 10.1 OCSBC Options Ping

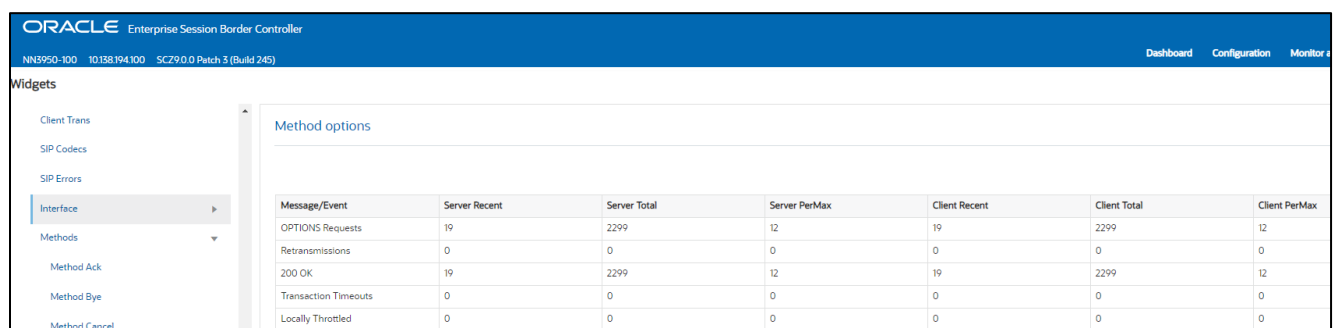
After you've paired the OCSBC with Direct Routing using the New-CsOnlinePSTNGateway PowerShell command, validate that the SBC can successfully exchange SIP Options with Microsoft Direct Routing.

While in the OCSBC GUI, utilize “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/Methods/Method OPTIONS



The screenshot shows the Oracle Enterprise Session Border Controller GUI. The top navigation bar includes 'Dashboard', 'Configuration', and 'Monitor'. The left sidebar shows a 'Widgets' menu with options like 'Client Trans', 'SIP Codescs', 'SIP Errors', 'Interface', 'Methods', 'Method Ack', 'Method Bye', and 'Method Cancel'. The main content area displays a table titled 'Method options' with the following data:

Message/Event	Server Recent	Server Total	Server PerMax	Client Recent	Client Total	Client PerMax
OPTIONS Requests	19	2299	12	19	2299	12
Retransmissions	0	0	0	0	0	0
200 OK	19	2299	12	19	2299	12
Transaction Timeouts	0	0	0	0	0	0
Locally Throttled	0	0	0	0	0	0

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

### 10.2 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](#)

## 11 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.

### 11.1 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

### 11.2 Requirements for Invite Messages

Picture 1 Example of INVITE message

```
INVITE sip:17814437383@sbcl1.customers.telechat.o-test06161977.com;transport=tls SIP/2.0
Via: SIP/2.0/TLS 155.212.214.173:5061;branch=z9hG4bK3rfq6u10d8f8fonro0k0.1
From: sip:9785551212@ sbcl1.customers.telechat.o-test06161977.com;transport=tls:5061;tag=0A7C0BFE
To: <sip: 17814437383@sip.pstnhub.microsoft.com:5061>
Call-ID: F3154A1E-F3AE-4257-94EA-7F01356AEB55-268289@192.168.4.180
CSeq: 1 INVITE
Content-Length: 245
Content-Type: application/sdp
Contact: <sip:9785551212@ sbcl1.customers.telechat.o-test06161977.com:5061;user=phone;transport=tls>
Allow: ACK, BYE, CANCEL, INFO, INVITE, MESSAGE, NOTIFY, OPTIONS, PRACK, REFER, UPDATE
User-Agent: Oracle SBC
```

#### 11.2.1 Contact.Header Invite:

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

### 11.3 Requirements for OPTIONS Messages

Picture 2 Example of OPTIONS message

```
OPTIONS sip:sip.pstnhub.microsoft.com:5061;transport=tls SIP/2.0
Via: SIP/2.0/TLS 155.212.214.173:5061;branch=z9hG4bKumatcr30fod0o13gi060
Call-ID: 4cf0181d4d07a995bcc46b8cd42f9240020000sg52@155.212.214.173
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@ customers.telechat.o-test06161977.com:5061;transport=tls>
Record-Route: <sip: customers.telechat.o-test06161977.com >
```

### 11.3.1 Contact Header OPTIONS:

- When sending OPTIONS to the Direct Routing Interface, the “Contact” header should have SBC FQDN in URI. This will be the FQDN registered in the carrier tenant.
- 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 back to the SBC

### 11.4 Microsoft Teams Direct Routing Interface characteristics

Table 1 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 Name	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	<a href="https://tools.ietf.org/html/rfc5763">https://tools.ietf.org/html/rfc5763</a>
	Crypto Suite	AES_CM_128_HMAC_SHA1_80, non-MKI	
	Control protocol for media transport	SRTP (SRTP-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	
	Audio codecs	· G711 · Silk (Teams clients) · Opus (WebRTC clients) - Only if Media Bypass is used; · G729 · G722	
Codecs	Other codecs	· CN · Required narrowband and wideband · RED – Not required · DTMF – Required · Events 0-16 · Silence Suppression – Not required	

## 12 Appendix A

### 12.1 SBC Behind NAT SPL configuration

This configuration is needed when your SBC is behind a NAT device. This is configured to avoid loss in voice path and SIP signaling.

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.

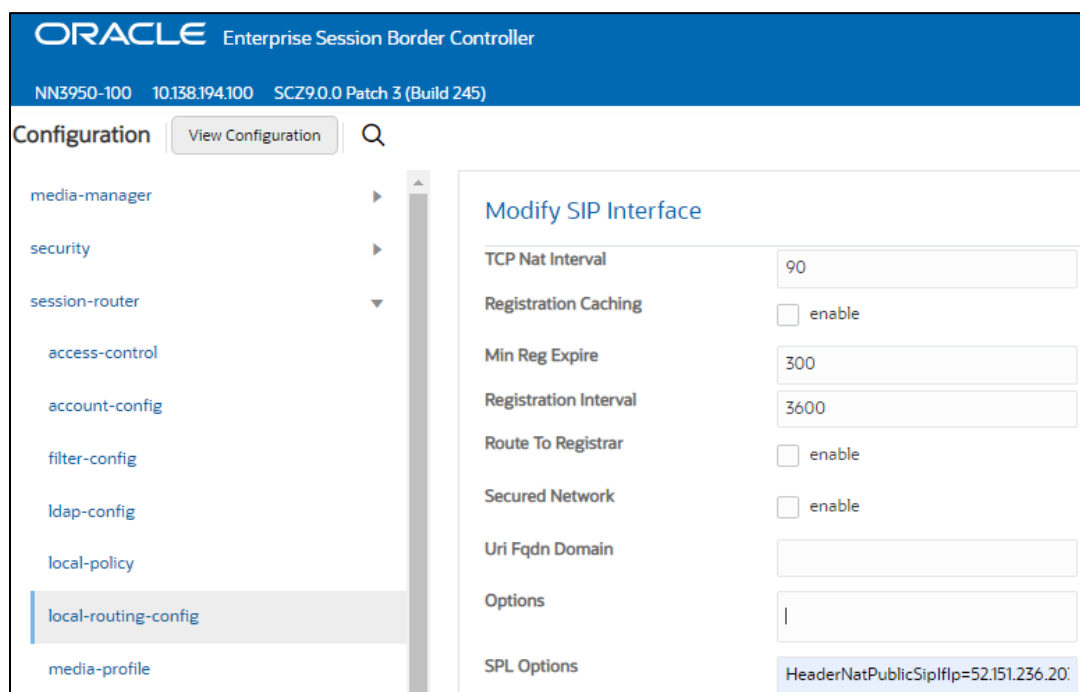
- The private IP address must be the same as the SIP Interface and steering pool IP address, both of which must match
- The public IP address must be the public IP address of the NAT device

Here is an example configuration with SBC Behind NAT SPL config. The SPL is applied to the Teams side SIP interface.

To configure SBC Behind NAT SPL Plug in, Go to session-router->sip-interface->spl-options and input the following value, save and activate.

HeaderNatPublicSipIfIp=52.151.236.203,HeaderNatPrivateSipIfIp=10.0.4.4

Here HeaderNatPublicSipIfIp is the public interface ip and HeaderNatPrivateSipIfIp is the private ip configured on the OCSBC.



- This configuration needs to be applied to each Sip Interface in the OCSBC configuration that is deployed behind a Nat Device



## 13 Appendix B

### 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 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.

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
  header-rule
    name
    header-name
    action
    msg-type
    methods
    element-rule
      name
      type
      action
      comparison-type
      match-value
  mime-sdp-rule
    name
    msg-type
    methods
    action
    comparison-type
    match-value
    sdp-session-rule
      name
      action
      sdp-line-rule
        name
        type
        action
        comparison-type
        match-value
  mime-sdp-rule
    name
    msg-type
    methods
    action
    comparison-type
    match-value
  header-rule
    name
    header-name
    action
    comparison-type
    match-value
    element-rule
      name
      type
      action
      match-value
      new-value
    element-rule
      name
      type
      action
      match-value
      new-value

Checkfor183
  check183
    @status-line
  manipulate
    reply
    Invite
  is183
    status-code
    store
    pattern-rule
    183
  if183
    reply
    Invite
  manipulate
    boolean
    $check183.$is183
  au
    manipulate
    checkclineforsbcip
    c
    store
    pattern-rule
    ^.(?!(141.146.36.68))).*$
  delete183SDP
    reply
    Invite
    delete
    boolean
    $if183.$au.$checkclineforsbcip
  change183to180
    @status-line
  manipulate
    boolean
    $if183.$au.$checkclineforsbcip
  changestatus
    status-code
    replace
    183
    180
  changereasonphrase
    reason-phrase
    replace
    Session Progress
    Ringing

```

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

GUI Path: Session Router/Sip Interface

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

**ORACLE** Enterprise Session Border Controller  
SolutionsLab-vSBC-1 SCZ9.0.0 Patch 2 (Build 172)

**Configuration** View Configuration

security  
session-router  
access-control  
account-config  
filter-config  
ldap-config  
local-policy  
local-routing-config  
media-profile  
session-agent  
session-group  
session-recording-group  
session-recording-server  
session-translation

**Modify SIP Interface**

Registration Interval	3600
Route To Registrar	<input type="checkbox"/> enable
Secured Network	<input type="checkbox"/> enable
Uri Fqdn Domain	
Options	
SPL Options	
Trust Mode	all
Max Nat Interval	3600
Stop Recurse	401,407
Port Map Start	0
Port Map End	0
In Manipulationid	Checkfor183
Out Manipulationid	Checkfor183

## 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 can generate ringback upon receipt of the sip REFER from Microsoft.

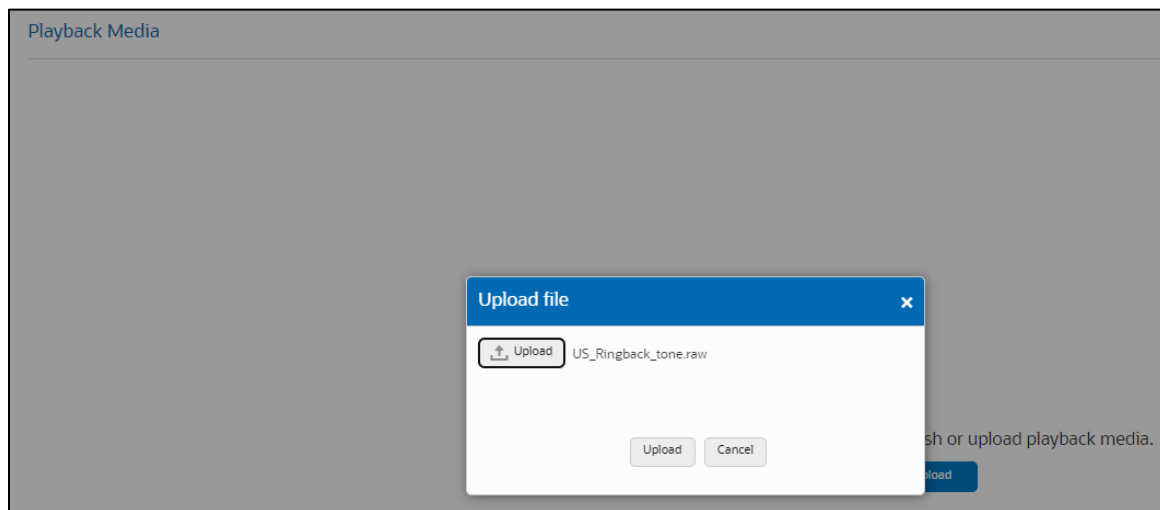
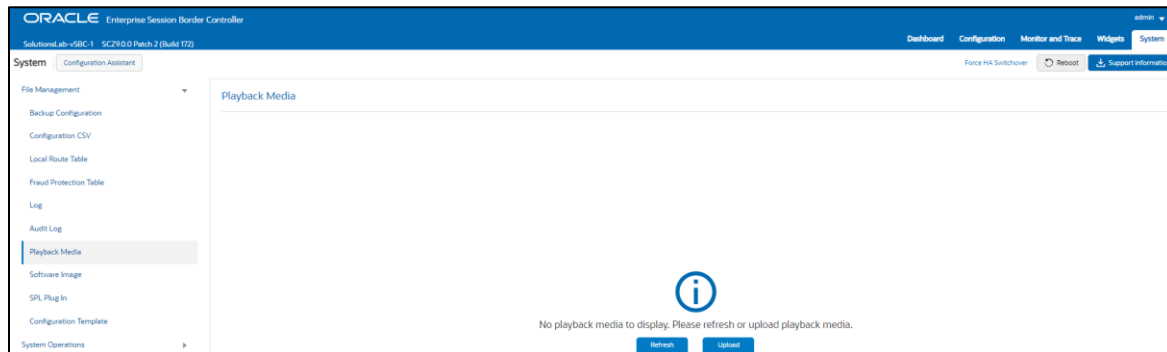
First, you must create a media file.

## 13.2.2 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 ACLI Running Configuration

Below is a complete output of the running configuration used to create this application note. This output includes all 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              TeamsCarrierCert
  state             California
  locality          Redwood City
  organization      Oracle Corporation
  common-name       customers.telechat.o-test06161977.com
  alternate-name    *.customers.telechat.o-test06161977.com
codec-policy
  name              OptimizeCodecs
  allow-codecs      * SILK:NO G722:NO

```

add-codecs-on-egress	PCMU
codec-policy	
name	addCN
allow-codecs	*
add-codecs-on-egress	CN
http-server	
name	webServerInstance
ice-profile	
name	ice
stun-conn-timeout	0
stun-keep-alive-interval	0
local-policy	
from-address	*
to-address	*
source-realm	SIPTrunk
policy-attribute	
next-hop	Irt:TeamsLRT
realm	SIPTrunk
lookup	multi
local-policy	
from-address	*
to-address	sbc1.customers.telechat.o-test06161977.com
source-realm	SIPTrunk
policy-attribute	
next-hop	sag:TeamsGRP
realm	Teams_Cust1
action	replace-uri
local-policy	
from-address	*
to-address	*
source-realm	Teams
policy-attribute	
next-hop	10.1.2.30
realm	SIPTrunk
local-routing-config	
name	TeamsLRT
file-name	TeamsLRT.xml.gz
media-manager	
media-profile	
name	CN
subname	wideband
payload-type	118
clock-rate	16000
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	RTP
media-sec-policy	
name	TeamsSRTP

```

inbound
  profile      SDES
  mode         srtp
  protocol     sdes
outbound
  profile      SDES
  mode         srtp
  protocol     sdes
network-interface
  name         s0p0
  ip-address   141.146.36.68
  netmask      255.255.255.192
  gateway      141.146.36.65
  dns-ip-primary 8.8.8.8
  dns-ip-backup1 8.8.4.4
  dns-domain   customers.telechat.o-test06161977.com
network-interface
  name         s1p0
  ip-address   10.1.2.4
  netmask      255.255.255.0
  gateway      10.1.2.1
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 s1p0:0
  mm-in-realm   enabled
  media-sec-policy RTP
  access-control-trust-level high
  codec-policy  OptimizeCodecs
  ringback-trigger refer
  ringback-file US_Ringback_tone.raw
realm-config
  identifier    Teams
  description   Carrier Tenant Facing Teams Direct Routing Interface
  network-interfaces s0p0:0
  mm-in-realm   enabled
  qos-enable    enabled
  media-sec-policy TeamsSRTTP
  rtcp-mux      enabled
  ice-profile    ice
  teams-fqdn     customers.telechat.o-test06161977.com
  teams-fqdn-in-uri enabled
  sdp-inactive-only enabled
  access-control-trust-level high
  codec-policy   addCN
  rtcp-policy    rtcpGen
realm-config
  identifier    Teams_Cust1

```

description	Realm to service Customer, woodgrovebank.us.
network-interfaces	s0p0:0
mm-in-realm	enabled
media-sec-policy	TeamsSRTP
rtcp-mux	enabled
ice-profile	ice
teams-fqdn	sbc1.customers.telechat.o-test06161977.com
teams-fqdn-in-uri	enabled
sdp-inactive-only	enabled
access-control-trust-level	high
codec-policy	addCN
rtcp-policy	rtcpGen
rtcp-policy	
name	rtcpGen
rtcp-generate	all-calls
sdes-profile	
name	SDES
crypto-list	AES_CM_128_HMAC_SHA1_32
	AES_CM_128_HMAC_SHA1_80
lifetime	31
session-agent	
hostname	10.1.2.30
ip-address	10.1.2.30
realm-id	SIPTrunk
session-agent	
hostname	sip.pstnhub.microsoft.com
port	5061
transport-method	StaticTLS
realm-id	Teams
ping-method	OPTIONS
ping-interval	10
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	10
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	10
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
session-router	



```

additional-ip-lookups          1
multi-stage-src-realm-override enabled
sip-config
  home-realm-id                Teams
  registrar-domain             *
  registrar-host               *
  registrar-port               5060
  options                      max-udp-length=0
  sip-message-len              0
  extra-method-stats           enabled
  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
  description                   Sip Interface facing PSTN
  sip-port
    address                    10.1.2.4
    allow-anonymous            agents-only
sip-interface
  realm-id                     Teams
  description                   Sip Interface facing Microsoft Teams Direct Routing
  sip-port
    address                    141.146.36.68
    port                       5061
    transport-protocol         TLS
    tls-profile                 TLSTeamsCarrier
  in-manipulationid            Checkfor183
  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	^(.?!(141.146.36.68))).*\$
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
new-value	Ringing
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
sip-monitoring	
match-any-filter	enabled
monitoring-filters	*
sip-profile	
name	forreplaces
replace-dialogs	enabled
steering-pool	
ip-address	10.1.2.4
start-port	10000
end-port	19999
realm-id	SIPTrunk
steering-pool	
ip-address	141.146.36.68
start-port	20000
end-port	29999
realm-id	Teams
system-config	
hostname	customers.telechat.o-test06161977.com
description	Carrier SBC for Teams Carrier Hosting Model
location	Burlington,MA
system-log-level	NOTICE
snmp-agent-mode	v1v2
tls-global	
session-caching	enabled

tls-profile

name

end-entity-certificate

trusted-ca-certificates

mutual-authenticate

TLSTeamsCarrier

TeamsCarrierCert

BaltimoreRoot

enabled

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