Oracle SBC InterOP with PingCo TRE and Microsoft Teams Phone Mobile

Technical Application Note

COMMUNICATIONS

Disclaimer

The following is intended to outline our general product direction. It is intended for information purposes only and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

Contents

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1 Revision History

Document Version	Description	Revision Date
1.0	Initial release	09-04-2025
1.1	Added Root CA list and EKU considerations	30-01-2026

2 Intended Audience

This document outlines the integration of Oracle SBCs with the PingCo TCAP Routing Engine (TRE) for the purpose of Microsoft Teams Phone Mobile. This paper is intended for IT or telephony professionals.

3 Validated Oracle Software Versions

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

SCZ930 or above.

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 or later Only)
- AP 4600
- AP 4900 (Release SCZ9.0.0 or later 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

- https://docs.oracle.com/en/industries/communications/session-border-controller/9.2.0/aclireference/acli-reference-guide.pdf
- https://docs.oracle.com/en/industries/communications/session-border-controller/9.2.0/releasenotes/sbc-release-notes.pdf
- https://docs.oracle.com/en/industries/communications/session-border-controller/9.2.0/configuration/sbc-configuration-guide.pdf

4.2 Microsoft Teams

https://cloudpartners.transform.microsoft.com/partner-gtm/operators/teams-phone-mobile

4.3 PingCo TRE

TCAP - https://pingco.cloud/tcap
TRE - https://pingco.cloud/features/tre

5 About Teams Phone Mobile with Oracle SBC and TRE

Microsoft Teams Phone Mobile is an intuitive, mobile-first Microsoft Teams experience that allows business users to access Teams capabilities through their mobile identity on both their native dialler and any Teams endpoint. The solution delivers cellular network quality of service to Teams communications, while allowing customers to enforce business policies, reduce costs, and improve the user experience for the growing mobile workforce. Through Teams Phone Mobile, Microsoft will collaborate closely with mobile network operators (MNOs), leveraging their unique mobile assets, including 5G technologies, to build a differentiated, high-quality, connected, and immersive mobile experience that can evolve with worldwide mobility trends.

5.1 Customer Benefits

- Create a unified business communication experience. Enables an inclusive workplace for mobile, remote, hybrid, and office workers by providing a reliable communication solution to work securely from either their native dialler or from the Teams app on any device.
- Reduce costs and eliminate redundancies. Allows customers to eliminate fixed lines for their mobile and remote workers and reduce international, long-distance, and intra-company mobile costs.
- Streamline management and governance. Provisions access usage and manages telephony services for all employees from one centralized place – the Office 365 portal. Provides enterprises the ability to enforce business policies, including security, compliance, and data governance protocols, even with wireless-only, 5G users.
- Deliver a business-grade mobile communications solution. Allows mobile network operators to build on future innovation of their 5G networks through partnership with Microsoft, empowering digital transformation for enterprise customers with a high-quality and differentiated user experience.

For a list of operators participating in the Microsoft Teams Phone Mobile program and the countries or regions where their service is available, see Microsoft 365 Teams Phone Mobile.

5.2 PingCo TCAP Routing Engine

TCAP is all-in one, fully automated platform for Microsoft Teams Calling registration, provisioning, number management, billing, support and more. Built by PingCo, TCAP offers a powerful automation platform to self-manage your companies phone system. You can deploy your whole company's system in 15 minutes, and then within second stand-up new employees phone numbers. TCAP allows real-time management of your phone bill and reporting to give you power to make business decisions. With the heavy lifting covered, you can manage your own system and reduce costs with no set-up fees and low monthly costs. Enable your workforce to work from anywhere with Microsoft teams Calling providing and management with TCAP.

Note: This documents only focuses on the integration of Oracle SBC with PingCo TRE for Teams Phone Mobile calling. Provisioning of Service is out of scope.

The TCAP Routing Engine (TRE) is an advanced telecommunications solution designed to enhance the functionality of Session Border Controllers (SBCs) and optimize call routing processes.

As a powerful routing engine, TRE efficiently manages and directs incoming and outgoing calls by leveraging a range of intelligent features and extensive call analysis.

5.3 Plan for Teams Phone Mobile

Please follow below Microsoft Learn article to know more about Planning and configuring Teams Phone Mobile.

https://learn.microsoft.com/en-us/microsoftteams/operator-connect-mobile-plan

Ensure your organization has eligible Microsoft 365 services:

- Teams Phone System SKU or E5 with Teams
- Teams Phone Mobile add-on SKU

Below link provides details about configuring your Microsoft Teams Services for enabling Teams Phone Mobile.

https://learn.microsoft.com/en-us/microsoftteams/operator-connect-mobile-configure

5.4 Media Bypass vs Non-Media Bypass

Teams Phone Mobile can only work in Non-Media Bypass mode.

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 Advanced Media Termination ICE Lite on the Oracle SBC.

5.5 Teams Phone Mobile Call Scenarios utilizing Oracle SBC and TRE

- Each user is allocated with Operator's mobility number along with a SIM (Physical or eSIM). The mobile number is also used as User's Teams Identity.
- Intra Tenant (users in the same tenants Teams to Teams) calls are handled within the MS Teams network. However, Teams to Native dialler calls are routed to the mobile network operator via Oracle SBC and TRE to enable mobile default dialler ringing.
- Outbound call – Teams client to non-Teams number: Call is handed over to mobile operator by Microsoft for termination to called party. These calls also traverse Oracle SBC and TRE for necessary manipulations to the signalling.
- Inbound call – Non-Teams number to Teams client: Call is handed over to Microsoft by mobile operator for termination to called party. These calls also traverse Oracle SBC and TRE for necessary manipulations to the signalling.
- Users can initiate or receive calls from Teams Client on desktop, laptop, mobile over-the-top (OTT) or tablet. In addition, user call also uses the Mobile Native dialler to initiate or receive calls.
- International roaming users will be able to make / receive calls under standard roaming arrangements. In some countries, due to regulatory constraints, calls between Teams client and PSTN may be restricted.
- Number portability shall be applicable as per respective Geography regulatory rules.

5.6 Reference Breakdown

OC-SBC	Oracle Operator Connect SBC supporting Teams Phone Mobile Service
VoLTE	Voice over LTE- Mobile default dialler

MSFT	Microsoft
TPM	Teams Phone Mobile
Native Dialler	Default Handset Dialler of User Client
On-Net	Users calls within the same Mobile network
Off-Net	Users calls within different operators networks
Breakout	Call towards PSTN
MO	Mobile Originated Call
MT	Mobile Terminated Call
APP	Call from Teams App
TRE	PingCo TCAP Routing Engine

6 OC-SBC Interworking & Media requirements.

To integrate Teams into an Operators IMS Core, the Oracle SBC are the most valuable option as they are proven and interworks between a 3GPP defined platform (Carriers IMS Core) and non-3GPP Voice platform (Microsoft Teams).

6.1 Signalling Interworking Requirements:

- **100rel/PRACK Interworking** – Where IMS uses PRACK exclusively, Microsoft Teams does not, and this must be interworked at the IMS border. While OC-SBC is capable of performing PRACK interworking we are doing the PRACK interworking on P-CSCF in the test bed to support merge-early-dialogs.
- **Preconditions** – IMS networks MAY choose to implement Preconditions, which is not supported by Microsoft Teams. When this is used, Preconditions Interworking must be used at the border.
- **REFER termination and Replaces interworking** – Microsoft Teams has specific requirements for Call Transfers which require interworking at the border. In normal scenarios REFER will be handled by IMS Network's TAS but OC-SBC is also capable of handling REFERs. OC-SBC is also REFERs in the test bed.
- **Encryption Interworking** – Where an IMS core can be unencrypted, Microsoft Teams can optionally be encrypted to elevate security (although this is not a requirement of Operator Connect). When needed, encryption services are applied at the border. OC-SBC can perform the interoperability between an encrypted and unencrypted network for both signalling as well as Media.
- **Teams-specific Contact** – Microsoft Teams requires the Contact header be formatted with an FQDN as opposed to IP, which is not the case within 3GPP networks. OC-SBC converts the IP Address to FQDN of the Contact Header.
- **Local Media Playback** – Oracle SBC performs can perform Local Media Playback when required for generating ringback tones and during early media scenarios.
- **SBC Interworking for handling SDP offer in a-line (call hold/waiting)** – During call hold scenarios Oracle SBC performs the conversion of SDP a line from Caller towards Microsoft to convert the attribute to inactive.
- **Transcoding of unsupported codecs** – Where IMS cores use both AMR-WB and AMR, Microsoft Teams only supports AMR-WB, so calls delivered using AMR must be transcoded.
- **RTCP** – While IMS calls may support end to end RTCP, Microsoft Teams requires it, so selective RTCP Generation at the border is required to ensure service continuity.

- **Comfort Noise** – IMS does not implicitly require Comfort Noise (CN) packets, whereas Microsoft Teams prefers this. Comfort Noise generation at the border provides a smoother experience.

6.2 PingCo TRE Header Requirements:

This section outlines the call routing process of the TRE platform through the Oracle SBC (Session Border Controller). The section describes the SIP headers used for routing purposes and their respective scenarios. The headers include:

- X-TRE-CallType
- X-TRE-TrunkType (Not used for Teams Phone Mobile, Informational Only)
- X-TRE-Trunk Prefix
- X-TRE-OperatorProfile
- X-TRE-OutboundCarrier
- X=TRE-SourcePlatform

X-TRE-CallType - The X-TRE-CallType header is used to distinguish the call as either inbound or outbound. This header provides information about the direction of the call and can be utilized for various purposes within the platform. By examining the CallType header, the SBC and other components of the system can differentiate between inbound and outbound calls and perform specific actions or apply customized routing logic based on the call direction.

X-TRE-TrunkType - The X-TRE-TrunkType header is utilized to route calls to specific applications, such as Teams. The value of this header determines the target application for call routing. For instance, if the TrunkType is defined as "Direct Routing," the SBC should identify this trunk type and route the call to the Teams application. The TrunkType header is typically a GUID, for example: 9f43b6ea-facc-4766-bec0-47b3e083b1c2.

X-TRE-TrunkType - The X-TRE-TrunkType header is utilized to route calls to specific applications, such as Teams. The value of this header determines the target application for call routing. For instance, if the TrunkType is defined as "Operator Connect," the SBC should identify this trunk type and route the call to the Teams application. The TrunkType header is typically a GUID, for example: **X-TRE-TrunkType: 9bcaa351-df28-4457-32b4-08d9e15f3200**

SIP Trunk Selection :

In the case of SIP trunks, the TrunkPrefix serves as a key element for determining the appropriate trunk to select when sending a call. When the SBC analyses the TrunkType as "SIP Trunk," it further utilizes the TrunkPrefix to make routing decisions. By considering the TrunkPrefix in conjunction with the TrunkType, the SBC can determine the specific trunk through which the call should be routed.

X-TRE-OperatorProfile - The X-TRE-OperatorProfile header is used for routing calls to a specific Operator Connect instance. When the TrunkType is defined as "Operator Connect," the SBC references the Operator Profile field in the X-TRE-OperatorProfile header to determine which trunk the calls need to be routed to. This header is particularly useful in multi-tenant environments where an SBC is working with multiple operator profiles or when an operator has multiple Operator Connect instances in Teams. By considering the Operator

Profile field, the SBC can make informed routing decisions based on the specific requirements and configurations associated with each operator.

X-TRE-OutboundCarrier - The X-TRE-OutboundCarrier header is responsible for routing outgoing calls to the appropriate carrier. This header helps the SBC identify the preferred outbound carrier for the call. By utilizing the OutboundCarrier header, the SBC can ensure that the call is sent through the designated carrier that aligns with the requirements and preferences of the platform.

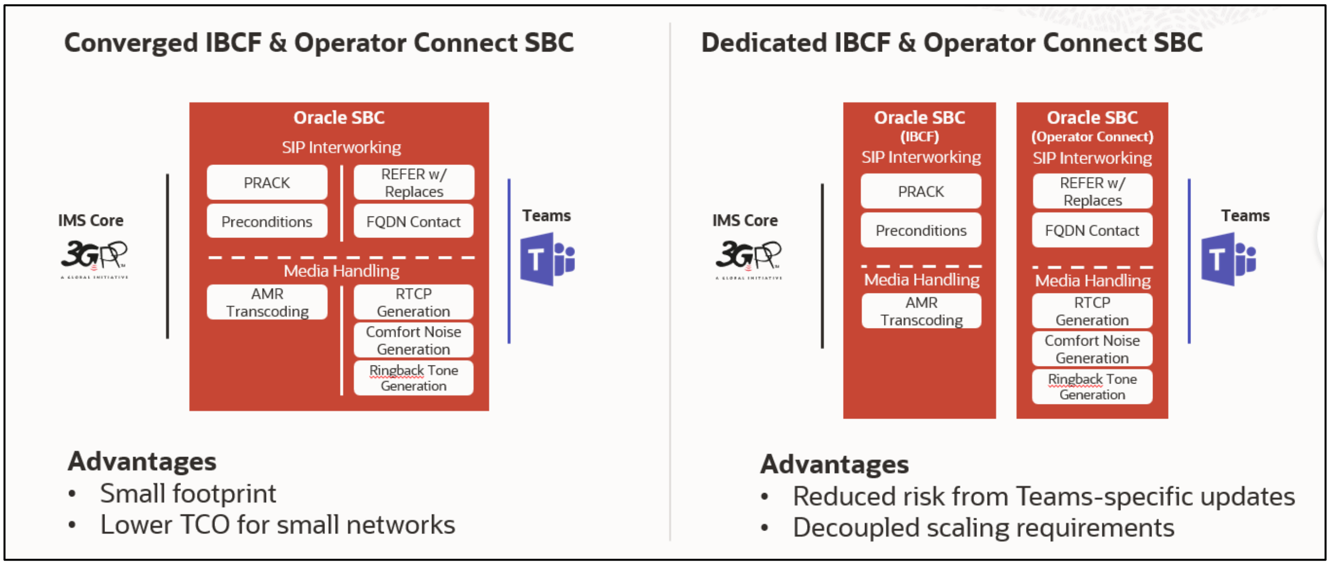
Operator Connect Routing When the TrunkType is defined as "Operator Connect," the SBC references the Operator Profile field in the X-TRE-OperatorProfile header to determine the specific trunk to which the calls should be routed. This routing mechanism is particularly useful in multi-tenant environments or when an operator has multiple Operator Connect instances in Teams. The Operator Profile field helps the SBC make routing decisions based on the specific operator requirements and configurations.

Outbound Carrier Selection The X-TRE-OutboundCarrier header plays a crucial role in routing outgoing calls. By specifying the preferred outbound carrier in this header, the SBC ensures that the call is directed through the designated carrier. The choice of carrier is based on the requirements and preferences defined within the OutboundCarrier header.

Conclusion In summary, we have outlined the SIP headers used for call routing within the TRE platform when handling calls on an SBC. The document has described the headers' purposes and how they are utilized in different scenarios. The information presented serves as a guide for implementing dynamic call routing functionality on and SBC in conjunction with TRE.

7 SBC Deployment options

7.1 Converged vs Dedicated SBC Options



Advantages
- Small footprint
- Lower TCO for small networks

Advantages
- Reduced risk from Teams-specific updates
- Decoupled scaling requirements

When integrating an Oracle SBC with your IMS core for Microsoft Teams Phone Mobile, you have two options:

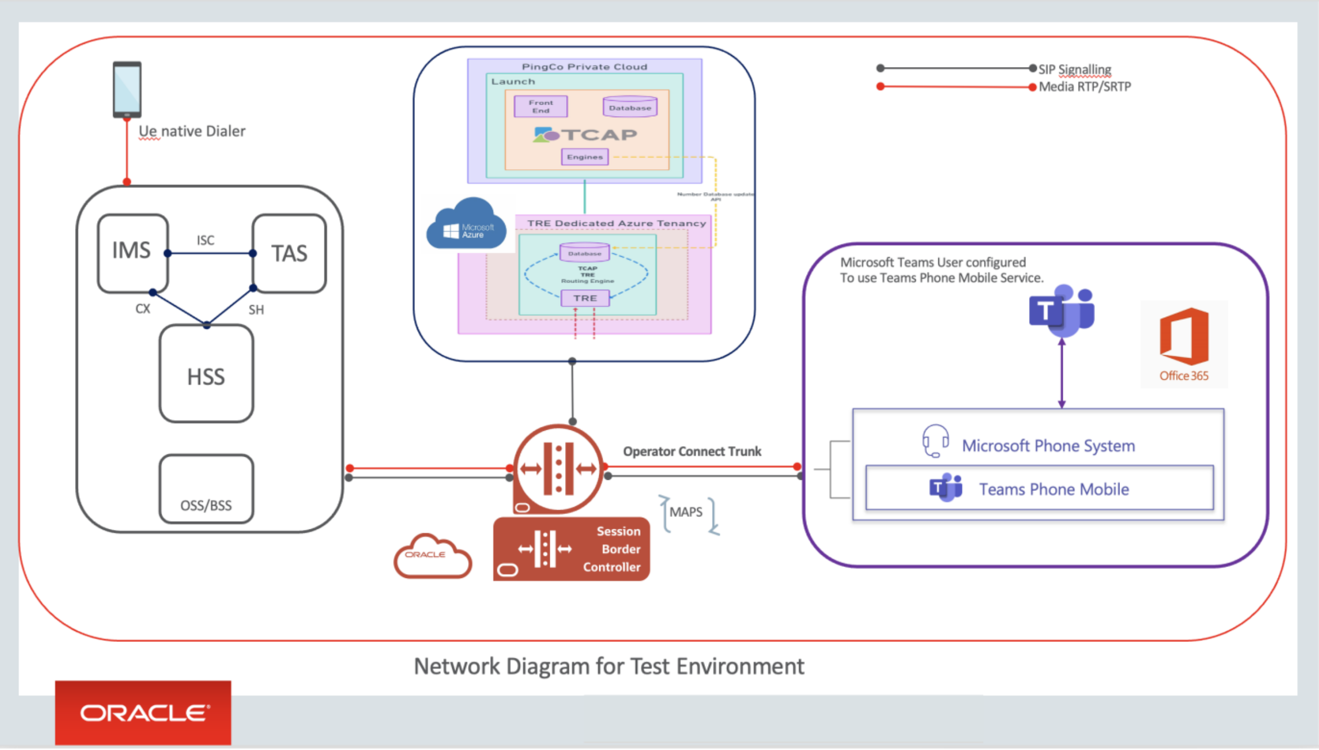
- Converged SBC: Configure your Oracle SBC to handle both IBCF and Operator Connect SBC functionalities.
- Dedicated SBC: Introduce a separate SBC dedicated to interworking with Teams Phone Mobile.

We recommend the Dedicated SBC approach for integrating an SBC with your IMS core to support Microsoft Teams Phone Mobile. This involves introducing a separate SBC to handle all required functionality. While a Converged SBC option using the Oracle SBC is also possible, we've focused on testing and documenting the Dedicated SBC approach for this application note.

8 Network topology

The following figure shows a network diagram of the test environment that is used for the Interop. Some key points to Note are –

- Oracle SBC is deployed in OCI Environment in Oracle's Development Tenant.
- Pingo TRE is hosted in Microsoft Azure and connects to Oracle SBC over UDP for the purpose of the Application Note.
- Oracle's Development Microsoft 365 Tenant is used to build the Teams Phone Mobile Service.
- All signalling traverse from Microsoft to Oracle SBC to PingCO TRE. Media from Microsoft Phone System is sent to Oracle SBC for termination to Peer Party.
- Teams Phone Mobile Trunk can also use TCP/RTP Protocol. Use of MAPS (Microsoft Azure Peering Service) Transport is a MUST for Network to Network Connection between the Oracle SBC and Operator Connect Teams Phone Mobile. Traffic sent through 3rd Part Internet is not supported. For the purpose of the Application Note we have provided TLS/SRTP method of connectivity between Oracle SBC and Microsoft Teams Phone Mobile.



Network Diagram for Test Environment

9 Oracle SBC Configuration

This chapter provides step-by-step guidance on how to configure Oracle SBC for interworking with PingCo TRE for the purpose of Microsoft Teams Phone Mobile.

Note :- In the running configuration you will find configuration related to PSTN connectivity because in the current setup PSTN breakout is also terminated onto OC-SBC.While the configuration is shown in the ACLI output and the ACLI running configuration,it is not highlighted as part of the Application Note.

This guide assumes the OC-SBC has been installed, management interface has been configured, product selected and entitlements have been assigned.
If you require more information on how to install your SBC platform, please refer to the ACLI configuration guide.

To access the ACLI on your OC-SBC, ssh to the management IP address or access via SBC console port:

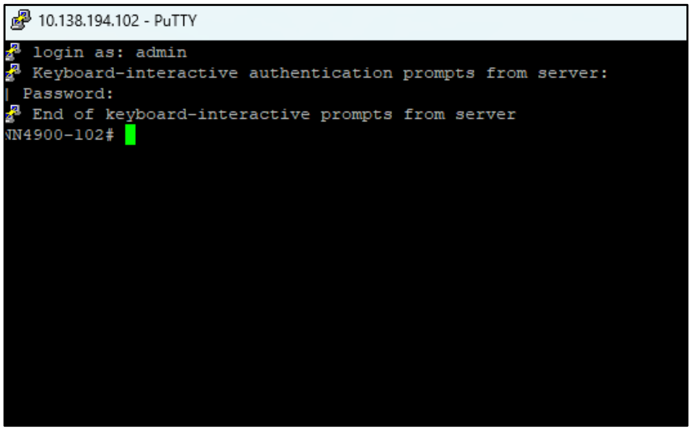
Console Settings:

- Baud Rate=115200
- Data Bits=8
- Parity=None
- Stop Bits=1
- Flow Control=None

When the login screen appears, enter the username and password to access the OC-SBC.

Any configuration parameter not specifically listed below can remain at the OC-SBC default value and does not require a change for the connection to Microsoft Teams Phone Mobile to function properly.

Note: the configuration examples below were captured from a system running the latest GA software, 9.2.0



```
 login as: admin
 Keyboard-interactive authentication prompts from server:
| Password:
 End of keyboard-interactive prompts from server
N4900-102#
```

9.1 System-Config

To enable system level functionality for the OC-SBC, you must first enable the 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)

To configure system-config from ACLI –

ACLI Path: config t→system→system-config

```
system-config
        hostname                        oraclesbc.com
        description                     SBC connecting IMS to Teams Phone Mobile
        location                      Burlington, MA
        transcoding-cores                     1
```

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.

To configure NTP from ACLI –

ACLI Path: config t→system→ntp-sync

```
ntp-config
        server                          216.239.35.0
```

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

9.2 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 Microsoft Teams Phone Mobile, the other to connect to an IMS Network.

The slots and ports used in this example may be different from your network setup.

9.2.1 Physical Interfaces

- Use the following table as a configuration example:

Config Parameter	Teams Phone Mobile	IMS	PingCo TRE
Name	s0p0	S1p0	S1p1
Operation Type	Media	Media	Media
Slot	0	1	1
Port	0	0	0

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

To configure Physical Interfaces from ACLI –

ACLI Path: config t→system→phy-interface

```
phy-interface
        name                            s0p0
        operation-type                      Media
phy-interface
        name                            s1p0
        operation-type                      Media
        slot                              1
phy-interface
        name                            s1p1
        operation-type                      Media
        port                          1
        slot                          1
```

9.2.2 Network Interfaces

- Use the following table as a configuration example:

Configuration Parameter	Teams Phone Mobile	IMS	PingCo TRE
Name	S0p0	S1p0	S1p1
IP Address	10.0.2.10	10.0.3.10	10.0.5.27
Netmask	255.255.255.0	255.255.255.0	255.255.255.0
Gateway	10.1.2.1	10.1.3.1	10.0.5.1
DNS Primary IP	8.8.8.8		
DNS Domain	cloudsbc.cgbusolutionslab.com		

To configure Network Interfaces from ACLI –

ACLI Path: config t→system→network-interface

```
network-interface
        name                        s1p0
        ip-address                   10.0.3.10
        netmask                      255.255.255.0
        gateway                      10.1.3.1
network-interface
        name                        s0p0
        ip-address                   10.0.2.10
        netmask                      255.255.255.0
        gateway                      10.1.2.1
        dns-ip-primary                  8.8.8.8
        dns-ip-backup1                   8.8.4.4
        dns-ip-backup2                   9.9.9.9
        dns-domain                     Cloudsbc.cgbusolutionslab.com
network-interface
        name                        s1p1
        ip-address                   10.0.5.27
        netmask                      255.255.255.0
        gateway                      10.0.5.1
```

Next, we'll configure the necessary elements to secure signalling and media traffic between the Oracle SBC and Microsoft Teams Phone Mobile.

9.3 Security Configuration

This section describes how to configure the SBC for both TLS and SRTP communication with Microsoft Teams Phone Mobile.For the purpose of our testing communication between Oracle SBC and PingCo TRE is UDP.TRE only handles singaling and media stays between Microsoft Network and IMS via Oracle SBC.

Note: Teams Phone Mobile Trunk can also use TCP/RTP Protocol. Use of MAPS (Microsoft Azure Peering Service) Transport is a MUST for Network to Network Connection between the Oracle SBC and Operator Connect Teams Phone Mobile. Traffic sent through 3rd Part Internet is not supported. For the purpose of the Application Note we have provided TLS/SRTP method of connectivity between Oracle SBC and Microsoft Teams Phone Mobile.

When Using TLS/SRTP Microsoft Operator Connect recommends 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.** These are same as Direct Routing Supported CAs.

9.3.1 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

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)
- Microsoft Root Certificate Authorities (Microsoft Presents the SBC a certficate signed by one of these authorites)

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.

9.3.1.1 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 and the **extended key usage list** must contain **serverAuth**. Including **clientAuth** is optional for now as Microsoft Teams Direct Routing currently permits the use of SBC client certificates even if the Client Authentication EKU is not included.

However, Microsoft has indicated that in the future, all SBC client certificates will be required to include the Client Auth EKU. When this enforcement goes into effect, a list of publicly trusted certificate authorities (CAs) that can issue such certificates will be published.

It's important to note that public CAs may stop including the Client Authentication EKU in certificates due to updated industry requirements and CA policies. You should check with your CA to determine when they plan to stop including the Client Authentication EKU by default, so you can plan accordingly.

For more information, please refer to:

https://learn.microsoft.com/en-us/microsoftteams/direct-routing-whats-new#update-on-upcoming-certificate-changes-updated-december-12-2025

and

https://www.oracle.com/a/otn/docs/microsoft-teams-ca-changes-and-eku-considerations.pdf

In this example our common name will be **cloudsbc.cgbusolutionslab.com.**You must also give it a name and we have included **clientAuth** to the **extended key usage list**.

For now, mutual TLS connections between your Oracle SBC and Microsoft Teams will continue to be established, even if the root CA removes or no longer supports the clientAuth EKU. Looking ahead, including the clientAuth EKU in your SBC's end entity certificate will be important to maintain compatibility and avoid future issues with Microsoft Teams Direct Routing. When submitting your CSR for signing, work with your CA to make sure the required EKU is maintained during the signing process.

If you generate a CSR using a certificate record that includes both serverAuth and clientAuth EKUs, but the CA removes the clientAuth EKU when signing the certificate, you can still import the resulting certificate into the SBC without any errors. The SBC will accept and present the certificate even if the clientAuth EKU is not included after signing.

All other fields are optional, and can remain at default values.

The SBC's end entity certificate is the certificate the SBC presents to Microsoft to secure the connection. The are two requirements when configuring this certificate.

1. Common name must contain the SBC's FQDN
2. extened-key-usage-list must contain both serverAuth and clientAuth.

To Configure the certificate record from ACLI:

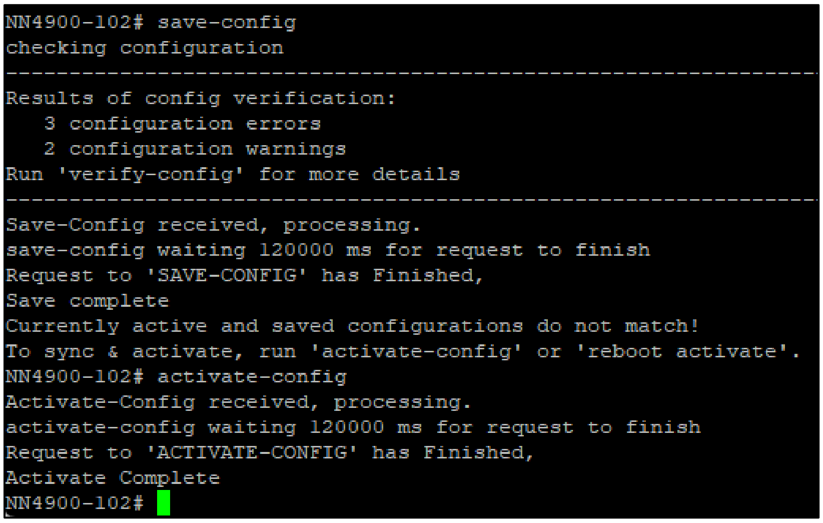
ACLI Path: config t→security→certificate-record

```
certificate-record
        name                            SBCCertificateforTPM
        state                          California
        locality                        Redwood City
        organization                       Oracle Corporation
        unit                           Oracle CGBU-LABS BOSTON
        common-name                            cloudsbc.cgbusolutionslab.com
        key-usage-list                       digitalSignature
                                             keyEncipherment
        extended-key-usage-list                   clientAuth
                                                  serverAuth
```

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

9.3.1.2 Save and Activate

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.



```
NN4900-102# save-config
checking configuration
----------------------------------------------------------------
Results of config verification:
   3 configuration errors
   2 configuration warnings
Run 'verify-config' for more details
----------------------------------------------------------------
Save-Config received, processing.
save-config waiting 120000 ms for request to finish
Request to 'SAVE-CONFIG' has Finished,
Save complete
Currently active and saved configurations do not match!
To sync & activate, run 'activate-config' or 'reboot activate'.
NN4900-102# activate-config
Activate-Config received, processing.
activate-config waiting 120000 ms for request to finish
Request to 'ACTIVATE-CONFIG' has Finished,
Activate Complete
NN4900-102#
```

9.3.1.3 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.

To perform the Steps From ACLI use the below command –

```
NN4900-102# generate-certificate-request SBCCertificateforTPM

--This Step generates a text on Screen as shown below --

-----BEGIN CERTIFICATE REQUEST-----
MIIC4zCCAcsCAQAwazELMAkGA1UEBhMCVVMxCzAJBgNVBAgTAk1BMRMwEQYDVQQH
EwpCdXJsaW5ndG9uMRQwEgYDVQQKEwtFbmdpbmVlcmluZzEkMCIGA1UEAxMbdGVs
ZWNoYXQuby10ZXN0MDYxNjE5NzcuY29tMIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8A
MIIBCgKCAQEAr3AmjF15PcIcWiB/kFExUGNHQHIbkJi28MDbcprO/KLXIHQysSnw
UWz34XLBfLQ6rS4MLyEMR8Nt8GGNSIWKiR431LsX7L+yGWvRjcBFP6DIHtH0Vuqm
ixVaUJpg5luPY6SvT1shyu26iLlBsLfem43tbKq5jz/jrvaUzyhlCvAQ23c1oS5a
D4UiF2mNOuSqxvmkx50a3/BNYbKecLNOxvKQyyTMgffNpASbZuW+eMEUKI5iB+AB
/AAoZRP4bn4qlE3wn8pJsNm8Pjxy4hbz24ySgmaN9iXpP1FdRw0TemfCsNazZRuK
DsviWJfunZYTzRfDe5pJToMH4u1zt2fK1QIDAQABoDMwMQYJKoZIhvcNAQkOMSQw
IjALBgNVHQ8EBAMCBaAwEwYDVR0lBAwwCgYIKwYBBQUHAwEwDQYJKoZIhvcNAQEL
BQADggEBADD5Y+u08LxmTMIsJ2Rjc8cgPZocTqBDXN0tp27S4FuB/01ikBBdG3YV
Ffp7/Q8ZeFHHgU/rMzeF8Gpo9Cc6JUGGux3/ws8ZkgRBxsNlG276i7pFN1vCIjEP
89AGxtryioRMc4kcdPpLJNQ10Qx1zKobHMTftGLDI6jN2pvn3zYHH8qA9V/1/yKa
3n0j33EuTrvTlQ5P4IgyVJqSBkdI29T1gXY6O8JVFLCQefTrF4TLc6teNzxXMdPw
PHoPu9hM3scGOWOHQnODXOFeq2AxBQzAa0/Cjf7Bw3l3POmMcIOawgDecZ8UjHpJ
lznX9/Gxg5X+S2QkHjNmPK+JuePqX4I=
-----END CERTIFICATE REQUEST-----
```

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.

9.3.1.4 Root CA and Intermediate Certificates

9.3.1.4.1 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.

9.3.1.4.2 Microsoft Certificates

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 one of the CA's listed in the table below. To trust this certificate, your SBC must have all the certificate listed below as a trusted CA certificate.

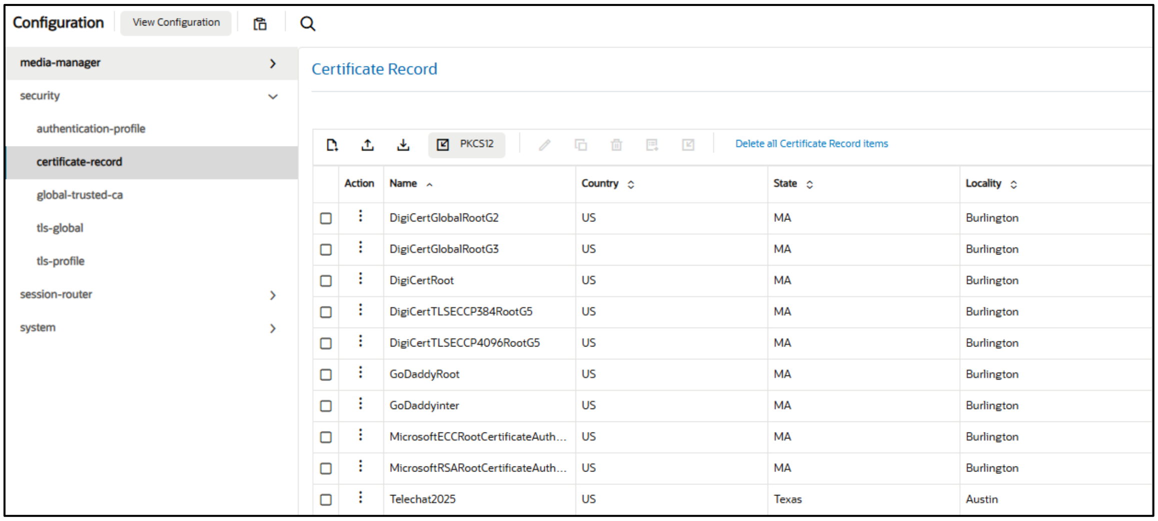
Download each certificate from the official source using the links provided below:

Certificate Authority	Download Link
DigiCert Global Root CA	DigiCert Global Root CA
DigiCert Global Root G2	DigiCert Global Root G2
DigiCert Global Root G3	DigiCert Global Root G3
DigiCert TLS ECC P384 Root G5	DigiCert TLS ECC P384 Root G5
DigiCert TLS RSA 4096 Root G5	DigiCert TLS RSA 4096 Root G5
Microsoft ECC Root Certificate Authority 2017	Microsoft ECC Root Certificate Authority 2017
Microsoft RSA Root Certificate Authority 2017	Microsoft RSA Root Certificate Authority 2017

The certificates listed in the table above can also be found at:

https://learn.microsoft.com/en-us/azure/security/fundamentals/azure-ca-details?tabs=root-and-subordinate-cas-list

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



	Action	Name	Country	State	Locality
□	⋮	DigiCertGlobalRootG2	US	MA	Burlington
□	⋮	DigiCertGlobalRootG3	US	MA	Burlington
□	⋮	DigiCertRoot	US	MA	Burlington
□	⋮	DigiCertTLSECCP384RootG5	US	MA	Burlington
□	⋮	DigiCertTLSECCP4096RootG5	US	MA	Burlington
□	⋮	GoDaddyRoot	US	MA	Burlington
□	⋮	GoDaddyinter	US	MA	Burlington
□	⋮	MicrosoftECCRootCertificateAuth…	US	MA	Burlington
□	⋮	MicrosoftRSARootCertificateAuth…	US	MA	Burlington
□	⋮	Telechat2025	US	Texas	Austin

Please note – all certificates including root and intermediate certificates are required to be imported to the SBC.

9.3.1.5 Import Certificates to SBC

Once certificate signing request has been completed – import the signed certificate to the SBC.All certificates including root and intermediate certificates are required to be imported to the SBC.
After all certificates have been imported, issue a third **save/activate** to complete the configuration of certificates on the Oracle SBC.

To import the certificate from ACLI follow below procedure -

```
NN4900-102# import-certificate try-all SBCCertificateforTeams

The System will show a prompt as below -


IMPORTANT:
        Please enter the certificate in the PEM format.
        Terminate the certificate with ";" to exit.......

Enter the Signed Certificate text as shown below-

-----BEGIN CERTIFICATE REQUEST-----
MIIC4zCCAcsCAQAwazELMAkGA1UEBhMCVVMxCzAJBgNVBAgTAk1BMRMwEQYDVQQH
EwpCdXJsaW5ndG9uMRQwEgYDVQQKEwtFbmdpbmVlcmluZzEkMCIGA1UEAxMbdGVs
ZWNoYXQuby10ZXN0MDYxNjE5NzcuY29tMIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8A
MIIBCgKCAQEAr3AmjF15PcIcWiB/kFExUGNHQHIbkJi28MDbcprO/KLXIHQysSnw
UWz34XLBfLQ6rS4MLyEMR8Nt8GGNSIWKiR431LsX7L+yGWvRjcBFP6DIHtH0Vuqm
ixVaUJpg5luPY6SvT1shyu26iLlBsLfem43tbKq5jz/jrvaUzyhlCvAQ23c1oS5a
D4UiF2mNOuSqxvmkx50a3/BNYbKecLNOxvKQyyTMgffNpASbZuW+eMEUKI5iB+AB
/AAoZRP4bn4qlE3wn8pJsNm8Pjxy4hbz24ySgmaN9iXpP1FdRw0TemfCsNazZRuK
DsviWJfunZYTzRfDe5pJToMH4u1zt2fK1QIDAQABoDMwMQYJKoZIhvcNAQkOMSQw
IjALBgNVHQ8EBAMCBaAwEwYDVR0lBAwwCgYIKwYBBQUHAwEwDQYJKoZIhvcNAQEL
```

```
BQADggEBADD5Y+u08LxmTMIsJ2Rjc8cgPZocTqBDXN0tp27S4FuB/01ikBBdG3YV
Ffp7/Q8ZeFHHgU/rMzeF8Gpo9Cc6JUGGux3/ws8ZkgRBxsNlG276i7pFN1vCIjEP
89AGxtryioRMc4kcdPpLJNQ10Qx1zKobHMTftGLDI6jN2pvn3zYHH8qA9V/1/yKa
3n0j33EuTrvTlQ5P4IgyVJqSBkdI29T1gXY6O8JVFLCQefTrF4TLc6teNzxXMdPw
PHoPu9hM3scGOWOHQnODXOFeq2AxBQzAa0/Cjf7Bw3l3POmMcIOawgDecZ8UjHpJ
lznX9/Gxg5X+S2QkHjNmPK+JuePqX4I=
-----END CERTIFICATE REQUEST-----;
```

save and activate your configuration.

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

9.3.2 TLS Profile

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

To configure system-config from ACLI –

ACLI Path: config t→security→tls-profile

```
tls-profile
        name                                TLSTeams
        end-entity-certificate                     SBCCertificateforTeams
        trusted-ca-certificates                    DigiCertRoot
                                         DigiCertGlobalRootG2
                                         DigiCertGlobalRootG3
                                         DigiCertTLSECCP384RootG5
                                         DigiCertTLSECCP4096RootG5
                                         MicrosoftECCRootCertificateAuthority2017
                                         MicrosoftRSARootCertificateAuthority2017
        mutual-authenticate                         enabled
        tls-version                          tlsv12
```

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

9.3.3 Media Security

This section outlines how to configure support for media security between the OC-SBC and Microsoft Teams Phone Mobile.

9.3.3.1 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

To configure system-config from ACLI –

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

```
sdes-profile
        name                                TeamsSRTP
        crypto-list                          AES_CM_128_HMAC_SHA1_80
        srtp-auth                           enabled
        srtp-encrypt                          enabled
        srtcp-encrypt                          enabled
        mki                                disabled
        egress-offer-format                      same-as-ingress
        use-ingress-session-params
        options
        key
        salt
        srtp-rekey-on-re-invite                  disabled
        lifetime                            31
```

9.3.3.2 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 to use to encrypt media.

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 IMS Core.

To configure media security from ACLI.

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

```
media-sec-policy
        name                                IMSNonSecure
        pass-through                          disabled
        options
        inbound
                profile
                mode                              rtp
                protocol                           none
                hide-egress-media-update                disabled
        outbound
                profile
                mode                              rtp
                protocol                           none
media-sec-policy
        name                                TeamsMediaSecurity
        pass-through                          disabled
        options
        inbound
                profile                           TeamsSRTP
                mode                              srtp
                protocol                           sdes
                hide-egress-media-update                disabled
        outbound
                profile                            TeamsSRTP
                mode                                srtp
                protocol                            sdes
```

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

9.4 Transcoding Configuration

Transcoding is the ability to convert between media streams that are based upon disparate codecs. The OC-SBC supports IP-to-IP transcoding for SIP sessions and can connect two voice streams that use different coding algorithms with one another.

9.4.1 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 Teams Phone Mobile -TPM.

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
Surname	narrowband	wideband	wideband
Payload-Type	103	104	118
Clock-rate	8000	16000	0

Besides, if the Network uses AMR the following media-profiles can be used as reference to create different media profiles for AMR-WB and AMR codec.

To configure system-config from ACLI –

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

```
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-profile
        name                                   AMR-WB
        subname                                  LOW
        payload-type                             98
        parameters                               max-red=0
                                           mode-change-capability=2
                                           mode-change-neighbor=1
                                           mode-change-period=2
                                           mode-set="0,1,2"
media-profile
        name                                   AMR-WB
        subname                                  MSFT
        payload-type                             121
        parameters                               max-red=0
                                           mode-change-capability=2
                                           mode-set="0,1,2"
media-profile
        name                                   AMR-WB
        subname                                  NMS
        payload-type                             116
        parameters                               max-red=220
                                           mode-change-capability=2
media-profile
        name                                   AMR
        subname                                  NMS96
        payload-type                             96
        parameters                               max-red=0
                                           mode-change-capability=2
                                           mode-change-neighbor=1
                                           mode-change-period=2
                                           mode-set="0,2,4,7"
media-profile
        name                                   AMR
        subname                                  NMS97
        payload-type                             97
        parameters                               max-red=0
                                           mode-set="7"
```

9.4.2 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 does not support either. Microsoft does not support AMR narrowband (AMR) but does support AMR:WB so AMR narrowband must be stripped from the IMS offer towards Microsoft.

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

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

```
codec-policy
        name                          TPMCodecPolicy
         allow-codecs                     * AMR:no
        add-codecs-on-egress                 CN
        order-codecs
        packetization-time               20
```

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:

```
codec-policy
       name                          TPMCodecPolicy
       allow-codecs                     *
       add-codecs-on-egress                 CN::wideband SILK::wideband
       order-codecs
       packetization-time               20
```

Lastly, since some IMS networks may have issues with the codecs being offered by Teams Phone Mobile, you can create another codec policy to remove unwanted or unsupported codecs from the request/responses to your Sip Trunk provider.

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

```
codec-policy
     name                         IMSCoreCodecs
     allow-codecs                     PCMU G729 telephone-event AMR
     add-codecs-on-egress                 PCMU AMR
```

The below reference codec-policy can be used to optimise and allow AMR and AMR-WB codec.

```
codec-policy
     name                          TPMIMS
```

```
        allow-codecs                            AMR-WB::NMS:no AMR-WB::LOW AMR::NMS96
AMR::NMS97 EVS AMR-WB::MSFT:no *
        add-codecs-on-egress                    AMR-WB::LOW AMR::NMS96 AMR::NMS97 EVS CN
        order-codecs                            AMR-WB::LOW AMR::NMS96 AMR::NMS97 EVS telephone-
event *
```

We have applied below codec-policy towards Teams which is specific to our Test requirements.

```
codec-policy
        name                                addCN
        allow-codecs                            *
        add-codecs-on-egress                    CN
        order-codecs                            PCMU G729 *
```

The below reference codec-policy can be used to optimise the AMR-WB usage towards Teams.

```
codec-policy
        name                                MSTPM
        allow-codecs                            *
        add-codecs-on-egress                    AMR-WB::MSFT CN
        order-codecs                            *
        packetization-time                      20
        force-ptime                           disabled
        secure-dtmf-cancellation                disabled
        dtmf-in-audio                           disabled
        tone-detect-renegotiate-timer           500
        reverse-fax-tone-detection-reinvite     disabled
        evrc-tty-baudot-transcode               disabled
```

9.4.3 RTCP Policy

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

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.

To configure system-config from ACLI –

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

```
rtcp-policy
        name                                rtcpGen
        rtcp-generate                          all-calls
        hide-cname                              disabled
```

9.5 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 signalling and media flows toward Teams and IMS Core.

9.5.1 Media Manager

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

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

- 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.

To configure system-config from ACLI –

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

```
media-manager
        state                                   enabled
options                                    audio-allow-asymmetric-pt
                                              xcode-gratuitous-rtcp-report-generation
```

9.5.2 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.
Use the following table as a configuration example for the realms. The following parameters are all required unless mentioned as optional below.

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

- Network Interface
- Media Security Policy
- Codec Policy (optional on the PSTN Realm)
- RTCP Policy

Config Parameter	Teams Phone Mobile Realm	IMS Realm	Config Parameter	Teams Phone Mobile Realm	PingCo Realm
Identifier	Teams	ims	Identifier	Teams	PingCo
Network Interface	s0p0:0	s1p0:0	Network Interface	s0p0:0	s1p1:0.4
Mm in realm	enabled	enabled	Mm in realm	enabled	
Media Sec policy	TeamsSecurityPolicy	PSTNNonSecure	Media Sec policy	TeamsSecurityPolicy	
Teams-FQDN	cloudsbc.cgbusolutionslab.com		Teams-FQDN	cloudsbc.cgbusolutionslab.com	
Teams-fqdn-in-uri	enabled		Teams-fqdn-in-uri	enabled	
Sdp-inactive-only	enabled		Sdp-inactive-only	enabled	
RTCP mux	enabled		RTCP mux	enabled	
Codec policy	TPMCodecPolicy	IMSCoreCodecs	Codec policy	TPMCodecPolicy	
RTCP policy	rtcpGen		RTCP policy	rtcpGen	
Access-control-trust-level	HIGH	HIGH	Access-control-trust-level	HIGH	
ringback-trigger		183	ringback-trigger		
ringback-file		US_Ringback_tone.raw	ringback-file		
merge-early-dialogs		enabled	merge-early-dialogs		
hide-egress-media-update		enabled	hide-egress-media-update		

- Ringback trigger,ringback-file, merge-early-dialogs and hide-egress-media-update are required on IMS Ream and are explained in Section 12.2 of the document.

To configure realm-config from ACLI –

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

```
realm-config
        identifier                              Teams
        description                          Realm Facing Teams Direct Routing
        network-interfaces                        s0p0:0.4
        mm-in-realm                             enabled
        qos-enable                            enabled
        media-sec-policy                          sdesPolicy
        rtcp-mux                             enabled
        teams-fqdn                            cloudsbc.cgbusolutionslab.com
        teams-fqdn-in-uri                         enabled
        sdp-inactive-only                         enabled
        access-control-trust-level                   high
        codec-policy                           TPMCodecPolicy
        rtcp-policy                          rtcpGen
realm-config
        identifier                          ims
        network-interfaces                        s1p0:0.4
        media-sec-policy                          RTP
        access-control-trust-level                   high
        options                             merge-early-dialogs enable
        codec-policy                           IMSCoreCodecs
        hide-egress-media-update                     enabled
        ringback-trigger                         183
        ringback-file                          US_Ringback_tone.raw
        merge-early-dialogs                         enabled
realm-config
        identifier                          PingCo
        network-interfaces                        s1p1:0.4
```

9.5.3 Steering Pools

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

- Click Add, and use the below examples to configure steering-pool.

To configure steering pool from ACLI

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

```
steering-pool
        ip-address                           10.0.2.10
        start-port                          20000
        end-port                             40000
        realm-id                             Teams
steering-pool
```

```
    ip-address                  10.0.3.10
    start-port                 20000
    end-port                    40000
    realm-id                    ims
steering-pool
    ip-address                  10.0.5.27
    start-port                 20000
    end-port                    30000
    realm-id                    PingCo
```

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

9.6 Sip Configuration

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

9.6.1 Sip-Config

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

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 sip 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).
- **inmanip-before-validate** (optional) allows the header rules in a sip-manipulation to apply before the message is parsed.
- **sip-message-len** has been increased in the setup to 65535 to allow large sip packets from the Network.
- **multiple-dialogs-enhancement** applied on the sip-config to enable multiple early dialog support. To Allows the merging of early dialogs within forking scenarios, "merge-early-dialogs" should be enabled on the caller side realm-config.
- dialog-transparency is disabled to support merge-early-dialogs feature as explained in Section 12.2.3 of the document.

To configure sip config from ACLI.

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

```
sip-config
        dialog-transparency                    disabled
        home-realm-id                          Teams
        options                          inmanip-before-validate
                                    max-udp-length=0
                                    multiple-dialogs-enhancement
        sip-message-len                        65535
        extra-method-stats                      enabled
        npli-upon-register                     disabled
```

9.6.2 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 should not send Replaces to Microsoft.

To configure support for Replaces, we configure the following:

9.6.2.1 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.

To configure sip feature from ACLI

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

```
sip-feature
        name                             replaces
        realm                            Teams
        require-mode-inbound                     Pass
       require-mode-outbound                     Pass
```

9.6.2.2 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.

To configure sip profile from ACLI

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

```
sip-profile
        name                                    forreplaces
        replace-dialogs                             enabled
```

9.6.3 Sip Manipulation

9.6.3.1 Sip-manipulation for Teams Phone Mobile call routing logic -

MS Teams uses custom header for identifying/signalling originating/terminating session case: The header name is **X-MS-FMC,** which plays a crucial role in streamlining mobile call handling within the Microsoft Teams Phone Mobile environment.

Microsoft requires that all requests from the Oracle SBC contain this header with the proper identification which are **MO** or **MT** or **App**.

PingCo TRE can handle this requirement for us.

Value	Description	Teams Generated	Teams Received	SBC to TRE
MO	Mobile Originated	YES	YES	X-TRE-Source-Platform = Mobile P-Served-User: sescase=orig
APP	Call from APP	YES	NO	X-TRE-Source-Platform = TeamsPhoneMobile
MT	Mobile Terminated	YES	No	X-TRE-Source-Platform = TeamsPhoneMobile “P-Served-User” contains “sescase=term”

- Call origin Mobile (From IMS)
  X-TRE-Source-Platform = "Mobile"
  Inserted by SBC (IMS) indicating call origin
  Route Inbound
  TRE will add X-MS-FMC: MO
  Towards MS Teams advising on call origin

- Call originated from TeamsPhoneMobile (initiated from Teams APP)
  X-TRE-Source-Platform = " TeamsPhoneMobile"
  Inserted by SBC indicating call origin
  Route Outbound

MS will add X-MS-FMC: APP
Towards SBC advising on call origin

- Mobile Terminating calls.

Microsoft adds Headers X-MS-FMC: MT which PingCo TRE uses to route the call back to Oracle SBC to terminate to Native Dialler.

Inbound Call (From PSTN)

- X-TRE-Source-Platform : PSTN
  - Oracle SBC sends this header in the INVITE to TRE for inbound calls coming from Carrier.

PingCo TRE also adds following headers as described in Section

TRE Headers

- X-TRE-CallType: Outbound
- X-TRE-OutboundCarrier: <Outbound Carrier ID>
- X-TRE-OperatorProfile: <Operator Profile ID>
- X-TRE-TrunkType: < Operator Connect Trunk Type Guid>

To configure the sip manipulation via ACLI:

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

```
sip-manipulation
        name                              TPMlogic
        header-rule
                name                              NativeDiallerlogic
                header-name                            P-Served-User
                action                            manipulate
                msg-type                            request
                methods                           INVITE
                element-rule
                        name                              matchorigval
                        parameter-name                         sescase
                        type                              header-param
                        action                            store
                        comparison-type                        boolean
                        match-value                        orig
        header-rule
                name                              addXTRESourcePlatform
                header-name                            X-TRE-Source-Platform
                action                            add
                comparison-type                        boolean
                msg-type                            request
                methods                           INVITE
                match-value                         $NativeDiallerlogic.$0
                new-value                          Mobile
        header-rule
                name                          removesupported
                header-name                      Supported
                action                       delete
                msg-type                       request
                methods                        INVITE
        header-rule
                name                          ModPAI
                header-name                      P-Asserted-Identity
                action                       manipulate
                msg-type                       request
                methods                        INVITE
                element-rule
                        name                          ModUserPAI
                        type                         uri-host
                        action                        replace
                        comparison-type                   pattern-rule
                        new-value                       $FROM_HOST.$0
        header-rule
                name                          removePVNI
                header-name                      P-Visited-Network-ID
                action                       delete
                msg-type                       request
                methods                        INVITE
        header-rule
                name                          RemoveUserAgent
                header-name                      User-Agent
                action                       delete
                msg-type                       request
                methods                        INVITE
        header-rule
                name                          StoreHost
                header-name                      request-uri
                action                       store
                comparison-type                   pattern-rule
                msg-type                       out-of-dialog
                methods                        INVITE
                element-rule
                        name                          storeurihost
                        type                         uri-host
                        action                        store
        header-rule
                name                          CopyHost
                header-name                      To
                action                       manipulate
                methods                        INVITE
                element-rule
                        name                          replacehost
                        type                         uri-host
                        action                        replace
                        comparison-type                   boolean
```

```
                match-value                          $StoreHost.$storeurihost
                new-value                           $StoreHost.$storeurihost.$0
    header-rule
            name                                addPSTNlogic
            header-name                             From
            action                             manipulate
            msg-type                              request
            methods                               INVITE
            element-rule
                name                                  matchfromhost
                type                                uri-host
                action                               store
                comparison-type                            boolean
                match-value                          pstn.com
    header-rule
            name                                AddSourcePlatformPSTN
            header-name                             X-TRE-Source-Platform
            action                             add
            comparison-type                           boolean
            msg-type                              request
            methods                               INVITE
            match-value                             $addPSTNlogic.$matchfromhost
            new-value                              PSTN
    header-rule
            name                                TeamsClientcalllogic
            header-name                             X-MS-FMC
            action                             manipulate
            msg-type                              request
            methods                               INVITE
            element-rule
                name                                  matchapp
                type                                header-value
                action                               store
                comparison-type                            boolean
                match-value                          APP
    header-rule
            name                                AddSourcePlatformTeamsPhoneMobile
            header-name                             X-TRE-Source-Platform
            action                             add
            comparison-type                           boolean
            msg-type                              request
            methods                               INVITE
            match-value                             $TeamsClientcalllogic.$matchapp.$0
            new-value                              TeamsPhoneMobile
```

Note: We have additional header rules in this sip-manipulation which may or may not be required in your implementation. The rules are provided for reference –

- NativeDiallerlogic – based on P-Served-User:orig adds X-TRE-Source-Platform:Mobile towards TRE.
- Removesupported – Removes supported header when sending the Sip Invite towards Microsoft.

- ModPAI – Modifies the P-Asserted-Identity to format it as per Microsoft requirements.
- removePVNI, RemoveUserAgent,– Remove the P-VisitedNetwork ID, User Agent when sending the Invite towards TRE.
- StoreHost – Formats the To header as per the request-URI parameters.
- addPSTNlogic -Checks Inbound calls from Carrier and adds AddSourcePlatform:PSTN towards TRE
- TeamsClientcalllogic – When calls are originated from Teams Client adds AddSourcePlatform: TeamsPhoneMobile towards TRE.

The above sip-manipulation is applied as out-manipulationid on the TRE facing sip-interface.

Sip-manipulation towards IMS

Striprouteheader – Sip-manipulation named Striprouteheader is applied as in-manipulationid on the IMS’s sip-interface.

- The header rules - striproute1, striproute0 strip the IMS added route headers towards Microsoft.
- ChangeCLine – is a requirement for the test bed and can be ignored.

```
sip-manipulation
        name                                    striprouteheader
        header-rule
                name                                    striproute1
                header-name                                 Route[1]
                action                                  delete
                msg-type                                   request
                methods                                    INVITE
        header-rule
                name                                    striproute0
                header-name                                 Route[0]
                action                                  delete
                msg-type                                   request
                methods                                    INVITE
        mime-sdp-rule
                name                                    ChangeCLine
                msg-type                                   request
                methods                                    INVITE
                action                                  manipulate
                sdp-session-rule
                        name                                    Cline
                        action                                  manipulate
                        sdp-line-rule
                                name                                    modcline
                                type                                   c
                                action                                  replace
                                comparison-type                                pattern-rule
                                match-value                                 IN IP4 129.158.200.139
                                new-value                                  "IN IP4 10.0.3.10"
```

9.6.3.2 Sip-manipulation to change error 487 to 603

- Header rule - check487 converts 487 Request terminated Error response to 603 Decline. As per Microsoft requirement When a TPM user rejects the call via their default mobile dialler with a SIP error response of 487, the operator network must send towards Teams network a 603, so that the call can be redirected to the User’s voicemail as well as stop ringing any registered Teams endpoints.

  Note: The sip-manipulation converts 480 to 603 in the test environment as the Native Dialler rejected calls with an error 480 instead of 487.

```
sip-manipulation
        name                        check480
        header-rule
                name                        check480
                header-name                     @status-line
                action                      manipulate
                msg-type                      reply
                methods                       INVITE
                element-rule
                        name                        make603
                        type                      status-code
                        action                    replace
                        match-value                   480
                        new-value                    603
                element-rule
                        name                        changeReason
                        type                      reason-phrase
                        action                    replace
                        comparison-type                  boolean
                        new-value                    "Decline"
```

9.6.3.3 Sip-Manipulation for P-Early-media header.

Sip-manipulation named E164 which is applied as out-manipulationid on the IMS sip-interface serves below purpose –

- Header-rule addPlus formats the Number to E.164 format.
- Header-rule PEMAdd calls a sip-manipulation Add_PEM_to_183 which calls another sip-manipulation Ins_PEM183 is created to add P-early Media header with a value of “send only" on the 183 Message from Microsoft towards IMS.

The requirement for this sip-manipulation is explained in Section 12.2 of the document.

```
sip-manipulation
        name                          E164
        header-rule
                name                          addPlus
                header-name                   Request-URI
                action                        manipulate
                comparison-type               pattern-rule
                msg-type                      request
                methods                       INVITE
                element-rule
                        name                          tendigits
                        type                          uri-user
                        action                        replace
                        comparison-type               pattern-rule
                        match-value                   ^[0-9]{10}$
                        new-value                     \+1+$ORIGINAL
                element-rule
                        name                          elevendigits
                        type                          uri-user
                        action                        replace
                        comparison-type               pattern-rule
                        match-value                   ^[0-9]{11}$
                        new-value                     \++$ORIGINAL
        header-rule
                name                          PEMAdd
                header-name                   FROM
                action                        sip-manip
                msg-type                      reply
                methods                       INVITE
                new-value                     Add_PEM_to_183
pri-tpm-sbc# sh ru sip-manipulation Add_PEM_to_183 short
sip-manipulation
        name                          Add_PEM_to_183
        header-rule
                name                          Detect_183
                header-name                   @status-line
                action                        manipulate
                comparison-type               pattern-rule
                element-rule
                        name                          detect183
                        type                          status-code
                        action                        sip-manip
                        comparison-type               pattern-rule
                        match-value                   183
                        new-value                     Ins_PEM183
pri-tpm-sbc# sh ru sip-manipulation Ins_PEM183 short
sip-manipulation
        name                          Ins_PEM183
        header-rule
```

```
          name                          Ins_PEM_Field
          header-name                      P-Early-Media
          action                        add
          new-value                       sendonly
```

Sip-manipulation towards Carrier.

We have created the below sip-manipulation towards Carrier to remove the custom headers by different platforms.

```
sip-manipulation
     name                               RemoveCustomHeaders
     description                          Removes specified X- headers from INVITE
     header-rule
          name                          RemoveXMSFMC
          header-name                      X-MS-FMC
          action                        delete
          msg-type                        request
          methods                         INVITE
     header-rule
          name                          RemoveXMSTenantId
          header-name                      X-MS-TenantId
          action                        delete
          msg-type                        request
          methods                         INVITE
     header-rule
          name                          RemoveXTRESourcePlatform
          header-name                      X-TRE-Source-Platform
          action                        delete
          msg-type                        request
          methods                         INVITE
     header-rule
          name                          RemoveXTRECallType
          header-name                      X-TRE-CallType
          action                        delete
          msg-type                        request
          methods                         INVITE
     header-rule
          name                          RemoveXTREChainLinkID
          header-name                      X-TRE-ChainLinkID
          action                        delete
          msg-type                        request
          methods                         INVITE
     header-rule
          name                          RemoveXTRETrunkType
          header-name                      X-TRE-TrunkType
          action                        delete
          msg-type                        request
          methods                         INVITE
```

```
    header-rule
        name                        RemoveXTRECompanyID
        header-name                     X-TRE-CompanyID
        action                      delete
        msg-type                      request
        methods                       INVITE
    header-rule
        name                        RemoveXTREOperatorProfile
        header-name                     X-TRE-OperatorProfile
        action                      delete
        msg-type                      request
        methods                       INVITE
    header-rule
        name                        RemoveXTREOutboundCarrier
        header-name                     X-TRE-OutboundCarrier
        action                      delete
        msg-type                      request
        methods                       INVITE
```

9.6.4 Sip Interface

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

Configure three sip interfaces for TRE , IMS Realm, and for Teams Phone Mobile.

Use the table below as an example to configure:

Config Parameter	IMS	Teams	PingCo TRE
Realm ID	ims	Teams	PingCo
Sip-Profile		forreplaces	
out-manipulationid	striprouteheader	check480	TPMlogic
in-manipulationid	E164		
Sip Port Config Parameter	**IMS**	**Teams**	**Teams**
Address	10.0.3.10	10.0.2.10	10.0.5.27
Port	5060	5061	5060
Transport protocol	TCP	TLS	UDP
TLS profile		TeamsTLSProfile	
Allow anonymous	agents-only	all	agents-only

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.

To configure sip interface from ACLI

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

```
  pri-tpm-sbc# sh ru sip-interface short
sip-interface
        realm-id                        Teams
        sip-port
                address                         10.0.2.10
                port                         5061
                transport-protocol                TLS
                tls-profile                     tlsteams
                allow-anonymous                         agents-only
        spl-options
HeaderNatPublicSipIfIp=129.80.211.181,HeaderNatPrivateSipIfIp=10.0.2.10
        out-manipulationid                      check480
        sip-profile                     forreplaces
sip-interface
        realm-id                        ims
        sip-port
                address                         10.0.3.10
                allow-anonymous                         agents-only
        sip-port
                address                         10.0.3.10
                transport-protocol                TCP
                allow-anonymous                         agents-only
        spl-options
HeaderNatPublicSipIfIp=129.158.200.139,HeaderNatPrivateSipIfIp=10.0.3.10
        stop-recurse                      401,407,480
        in-manipulationid                      striprouteheader
        out-manipulationid                      E164
sip-interface
        realm-id                        pingco
        sip-port
                address                         10.0.5.27
        spl-options
HeaderNatPublicSipIfIp=150.136.176.126,HeaderNatPrivateSipIfIp=10.0.5.27
        out-manipulationid                      TPMlogic
sip-interface
        realm-id                        siptrunk
        sip-port
                address                         10.0.4.10
                allow-anonymous                         agents-only
        spl-options
HeaderNatPublicSipIfIp=129.80.186.157,HeaderNatPrivateSipIfIp=10.0.4.10
        out-manipulationid                      RemoveCustomHeaders
pri-tpm-sbc#
```

9.6.5 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.

Microsoft provides four (4) regional FQDN’s for PSTN Hub (NOAM, EMEA, APAC, OCEA), These FQDNs must be configured as Session-Agents in the order of the served market. For e.g. If SBC primarily serves NOAM market(s) you MUST configure their environment to target the NOAM FQDN first.

Following 4 FQDNs must be configured as Session-Agents on Oracle SBC.

NOAM: sip-us.gcs.pstnhub.microsoft.com

EMEA: sip-eu.gcs.pstnhub.microsoft.com

APAC: sip-as.gcs.pstnhub.microsoft.com

OCEA: sip-au.gcs.pstnhub.microsoft.com

Use the table below to configure Session Agents:

Config parameter	**Session Agent 1**	**Session Agent 2**	**Session Agent 3**	**Session Agent 3**
Hostname	sip-us.gcs.pstnhub.microsoft.com	sip-eu.gcs.pstnhub.microsoft.com	sip-as.gcs.pstnhub.microsoft.com	sip-au.gcs.pstnhub.microsoft.com
Port	5061	5061	5061	5061
Transport method	StaticTLS	StaticTLS	StaticTLS	StaticTLS
Realm ID	Teams	Teams	Teams	Teams
Ping Method	OPTIONS	OPTIONS	OPTIONS	OPTIONS

Ping Interval	60	60	60	60
Refer Call Transfer	enabled	enabled	enabled	enabled
Ping Response	enabled	enabled	enabled	enabled

Note: In the test setup OC-SBC is handling REFERs for call transfers hence the Refer Call Transfer parameter is enabled on the Session-Agents. This will not be required if the REFER messages for call transfers are handled by the IMS Network.

We'll also configure a session agent for the IMS Core.

To configure session agents from ACLI

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

```
session-agent
        hostname                 sip-as.gcs.pstnhub.microsoft.com
        port                     5061
        transport-method              StaticTLS
        realm-id                    Teams
        ping-method                     OPTIONS
        ping-interval                 60
        ping-response                   enabled
        refer-call-transfer             enabled
session-agent
        hostname                 sip-au.gcs.pstnhub.microsoft.com
        port                     5061
        transport-method              StaticTLS
        realm-id                    Teams
        ping-method                     OPTIONS
        ping-interval                 60
        ping-response                   enabled
        refer-call-transfer             enabled
session-agent
        hostname                 sip-eu.gcs.pstnhub.microsoft.com
        port                     5061
        transport-method              StaticTLS
        realm-id                    Teams
        ping-method                     OPTIONS
        ping-interval                 60
        ping-response                   enabled
        refer-call-transfer                     enabled
session-agent
        hostname                                sip-us.gcs.pstnhub.microsoft.com
        port                               5061
        transport-method                          StaticTLS
        realm-id                             Teams
        ping-method                             OPTIONS
        ping-interval                          60
        ping-response                           enabled
        refer-call-transfer                     enabled
```

We have defined Session Agents SCSCF and PCSCF for IMS Core as per the requirement of the Test Environment. You may have to define additional IMS components based on your network setup and requirements.

```
session-agent
        hostname                                129.213.187.4
        transport-method                          StaticTCP
        realm-id                             ims
        ping-method                             OPTIONS
        ping-interval                          30
        ping-response                           enabled
        refer-call-transfer                     enabled

session-agent
        hostname                                volte.oraclecgbupoc.co.uk
        port                               5063
        realm-id                             ims
```

Session agent for TRE-

We have configured following session-agent for PingCo TRE.

```
session-agent
        hostname                                13.93.229.25
        realm-id                             PingCo
        ping-method                             OPTIONS
        ping-interval                          10
        ping-response                           enabled
```

9.6.6 Session Group

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

All four 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.

- Use the following as an example to configure:

To configure session group from ACLI

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

```
session-group
        group-name                          TeamsPhoneMobile
        dest                            sip-us.gcs.pstnhub.microsoft.com
                                         sip-eu.gcs.pstnhub.microsoft.com
                                         sip-as.gcs.pstnhub.microsoft.com
                                         sip-au.gcs.pstnhub.microsoft.com
```

9.7 Routing Configuration

Now that a majority of the signalling, security and media configuration is in place, we can configure the SBC to route calls from one end of the network to the other. As per the reference architecture both MO and MT leg traverse through PingCo TRE for necessary modifications to the signalling.

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 :-

- MO Teams calls Microsoft Teams to PingCo TRE
- MO native dialler calls to PingCo TRE
- MT calls from Microsoft to PingCo TRE for termination to native dialler.
- Route calls from TRE to PSTN.

To configure local policy from ACLI:

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

```
# Route calls from Carrier trunk to TRE

local-policy
        from-address                      *
        to-address                      *
        source-realm                      siptrunk
        policy-attribute
                next-hop                      13.93.229.25
                realm                       PingCo

# Routes call from TRE towards PSTN
local-policy
        from-address                      *
        to-address                      16174261400
```

```
                                17815321400
                                18004444444
                                6174261400
                                7815321400
                                800444444444
                                +16174261400
                                +17815321400
                                +18004444444
        source-realm                  PingCo
        policy-attribute
                next-hop                      138.3.226.40
                realm                         siptrunk
                action                        replace-uri

#Routes call to TPM Destination numbers from TRE originating from IMS network
local-policy
        from-address                  volte.oraclecgbupoc.co.uk
        to-address                    17812032798
                                17812032799
                                7812032798
                                7812032799
                                +17812032798
                                +17812032799
        source-realm                  PingCo
        policy-attribute
                next-hop                      sag:ocsag
                realm                         Teams
                action                        replace-uri

#Routes call from Teams to PingCo TRE for TPM users for the Native Dialler termination.
local-policy
        from-address                  *
        to-address                    17812032798
                                17812032799
                                7812032798
                                7812032799
                                +17812032798
                                +17812032799
        source-realm                  Teams
        policy-attribute
                next-hop                      13.93.229.25
                realm                         PingCo
                action                        replace-uri
```

As we are handling Transfers on OC-SBC an additional Local Policy is created for call transfers towards Microsoft TPM users which routes back the REFERs to a TPM user towards Microsoft.

```
local-policy
        from-address                  *
        to-address                      sip.gcs.pstnhub.microsoft.com
        source-realm                      Teams
        policy-attribute
                next-hop                        sag:ocsag
                realm                         Teams
                action                        replace-uri
```

9.8 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/9.2.0/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.
We also created static ACLs for TRE and IMS.

To configure access control from ACLI

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

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

```
access-control
        realm-id                        ims
        source-address                     129.213.136.120
        application-protocol                 SIP
        trust-level                     high
access-control
        realm-id                        ims
        source-address                     129.213.187.4
        application-protocol                 SIP
        trust-level                     high
access-control
```

```
        realm-id                        PingCo
        source-address                     13.93.229.25
        application-protocol                 SIP
        trust-level                     high
access-control
        realm-id                        siptrunk
        source-address                     138.3.226.40
        application-protocol                 SIP
        trust-level                     high
access-control
        realm-id                        ims
        source-address                     158.101.98.101
        application-protocol                 SIP
        trust-level                     high
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
```

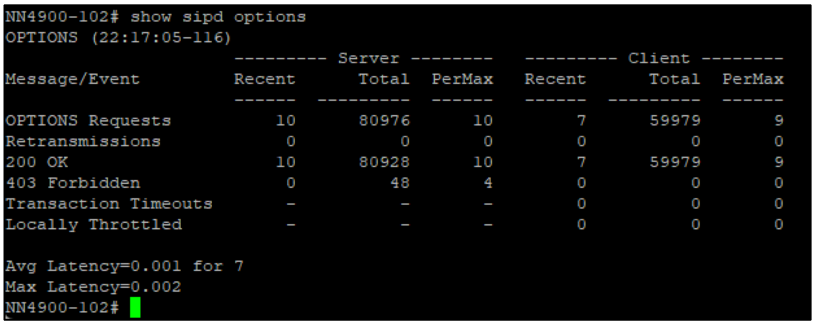
This concludes the required configuration of the SBC to properly interface with Microsoft Teams Phone Mobile.

You'll need to **save and activate** your configuration!

10 Verify Connectivity

10.1 Oracle SBC Options Pings

While in the Oracle SBC ACLI, Utilize the "show sipd options" command to check for OPTIONS to and from the SBC.



```
NN4900-102# show sipd options
OPTIONS (22:17:05-116)
                      --------- Server --------   --------- Client --------
Message/Event         Recent      Total  PerMax   Recent      Total  PerMax
                      ------  ---------  ------   ------  ---------  ------
OPTIONS Requests          10      80976      10        7      59979       9
Retransmissions            0          0       0        0          0       0
200 OK                    10      80928      10        7      59979       9
403 Forbidden              0         48       4        0          0       0
Transaction Timeouts       -          -       -        0          0       0
Locally Throttled          -          -       -        0          0       0

Avg Latency=0.001 for 7
Max Latency=0.002
NN4900-102#
```

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

11 Syntax Requirements for SIP Invite and SIP Options:

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.

Microsoft includes two customer headers **X-MS-TenantId and X-MS-FMC**: that contains the specific customer’s O365 Tenant ID and type of call which can be MO,MT or App (Call originated from Teams Client)

Note: The information is masked in the below example for security purpose.

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 and Final Responses.

Contact Header-Invite and Final Response

- Must have the FQDN sub-domain of the Oracle SBC.
- **Syntax: Contact: <phone number>@< subdomain FQDN >:<SBC Port>;<transport type>**

Picture 1 Shows the INVITE from TRE for a MO call originated from Native Dialler.

```
INVITE sip:+17812032798@13.93.229.25:5060;user=phone SIP/2.0
Via: SIP/2.0/UDP 13.93.229.25:5060;branch=z9hG4bK756b.d6784b8.0
Max-Forwards: 66
Contact: <sip:X.did.026.31e77592@13.93.229.25:5060>
To: <sip:+17812032798@13.93.229.25:5061>
From:
"+17812032799"<sip:+17812032799@volte.oraclecgbupoc.co.uk;transport=TCP>;
tag=SDk5guf01-0ad94042
Call-ID:
DLGCH_HDQOWzQ8NmN+XVAKNXBoMH0RAQ81K2dqe0MDDTB6YmUuEwMNMS9pNXxCSA9jeWRjekB
VW2M-
CSeq: 1 INVITE
Allow: INVITE, ACK, CANCEL, BYE, NOTIFY, REFER, MESSAGE, OPTIONS, INFO,
SUBSCRIBE
Content-Type: application/sdp
Allow-Events: presence, kpml, talk, as-feature-event
Content-Length: 323
P-Asserted-Identity: <sip:+17812032799@volte.oraclecgbupoc.co.uk>
P-Asserted-Identity: <tel:+17812032799>
```

```
P-Early-Media: supported
P-Served-User:
<sip:+17812032799@volte.oraclecgbupoc.co.uk>;sescase=orig;regstate=reg
X-MS-SBC: Oracle/VM/8.4.5p2
X-TRE-Source-Platform: Mobile
X-MS-FMC: MO
X-TRE-CallType: Inbound
X-TRE-InboundCarrier: 3076b66f-1690-4b4b-e04a-08da9a92b44e_tcap
X-TRE-TrunkType: 9bcaa351-df28-4457-32b4-08d9e15f3200
X-TRE-OperatorProfile: 712b6d41-adb9-4079-3424-08daa7756d02_tcap
```

Picture 2 Shows the INVITE from TRE to IMS for the MT Leg to Native Dialler.

```
INVITE sip:+17812032798@13.93.229.25:5060;user=phone SIP/2.0
Via: SIP/2.0/UDP
192.168.100.10:5060;received=13.93.229.25;branch=z9hG4bK6c88.cdf7aa44.0
FROM:
"+17812032799"<sip:+17812032799@sip.gcs.pstnhub.microsoft.com:5061;user=p
hone>;tag=SDnm3bd01-3a3a4bb83b26456d996b8e30c066c64d
TO: <sip:+17812032798@13.93.229.25:5061;user=phone>
CSEQ: 1 INVITE
CALL-ID:
DLGCH_HDQLA2ArNGN+XQFZZH81Y3ZJV1s1e2BqK0VWW2N4aGF8Q1wNY3Bia3ZBSA9jeWRjekB
VXWM-
MAX-FORWARDS: 68
CONTACT: <sip:X.did.f88.aff80e55@192.168.100.10>
CONTENT-LENGTH: 347
CONTENT-TYPE: application/sdp
ALLOW: INVITE,ACK,OPTIONS,CANCEL,BYE,NOTIFY
PRIVACY: id
X-MS-FMC: MT
X-MS-TenantId: d8d754c2-108b-4816-9f4b-79fb12d5ca28
X-TRE-Source-Platform: TeamsPhoneMobile
X-TRE-OutboundCarrier: 3076b66f-1690-4b4b-e04a-08da9a92b44e
X-TRE-CallType: Outbound
```

11.3 Requirements for SIP Options.

Below are the Microsoft requirements for SIP Options Message.

- The SBC MUST support the SIP OPTIONS method and respond to an incoming SIP OPTIONS request based on RFC 3261.
- The SBC MUST NOT respond with SIP/2.0 405 Method Not Supported or 215 SIP/2.0 501 Not Implemented.

- The OPTIONS pings from SBC MUST NOT exceed a frequency of one transaction every 60 seconds for each configured trunk and MUST NOT be more less frequent than one 229 transaction every 180 seconds for each configured trunk.
- Microsoft will not initiate OPTIONS pings to SBC until it receives OPTIONS pings from the SBC.
- The CONTACT header MUST contain the FQDN of the trunk and MUST specify both the port and protocol (e.g., 5061 and TLS)
- **Syntax: Contact: <phone number>@< subdomain FQDN >:<SBC Port>;<transport type>**
- Microsoft will not include the ACCEPT header and will ignore any body text in the response.

Picture 3 - Example of SIP OPTIONS message from Oracle SBC to Microsoft.

```
OPTIONS sip:sip-us.gcs.pstnhub.microsoft.com:5061;transport=tls SIP/2.0
Via: SIP/2.0/TLS 20.65.42.129:5061;branch=z9hG4bKdik4l8206025aqb9v510
Call-ID: c75cbb319998591b44c2c7e20e8f717b0000g30@10.1.4.4
To: sip:ping@sip-us.gcs.pstnhub.microsoft.com
From:
sip:ping@cloudsbc.cgbusolutionslab.com;tag=bba52bd57d6bd688fde828d05f2a71
830000g30
Max-Forwards: 70
CSeq: 7 OPTIONS
Contact: sip:ping@
cloudsbc.cgbusolutionslab.com:5061;transport=tls;sip.ice
Expires: 60
Route: sip:52.115.54.0:5061;transport=tls;lr
X-MS-SBC: Oracle/VM/9.2.0p2
Content-Length: 0
```

Picture 4 - Example of SIP OPTIONS message from Microsoft to Oracle SBC.

```
OPTIONS sip:ping@cloudsbc.cgbusolutionslab.com:5061;transport=tls SIP/2.0
FROM: <sip:sip-us.gcs.pstnhub.microsoft.com:5061>;tag=89a53e30-276b-4596-
a761-0ac7c919a859
TO: <sip:ping@cloudsbc.cgbusolutionslab.com>
CSEQ: 1 OPTIONS
CALL-ID: 92542534-cad5-4501-a418-b9f6304bf45b
MAX-FORWARDS: 70
VIA: SIP/2.0/TLS 52.115.54.0:5061;branch=z9hG4bK728aa3f0
CONTACT: <sip:sip-us.gcs.pstnhub.microsoft.com:5061>
CONTENT-LENGTH: 0
USER-AGENT: Microsoft.PSTNHub.SIPProxy v.2022.2.14.2 i.USEA.3
ALLOW: INVITE,ACK,OPTIONS,CANCEL,BYE,NOTIFY
```

12 Appendix A

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.

HeaderNatPublicSipIfIp= 129.80.211.18,HeaderNatPrivateSipIfIp=10.0.2.10

HeaderNatPublicSipIfIp is the public interface ip

HeaderNatPrivateSipIfIp is the private ip.

To configure header NAT SPL from ACLI

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

Choose the sip interface on which the header NAT SPL needs to be applied. Under spl-options add the entry as per example shared below.

```
spl-options                     HeaderNatPublicSipIfIp=129.80.211.18,HeaderNatPrivateSipIfIp=10.0.2.10
```

- Perform a **save and activate** configuration for changes to take effect.

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

12.2   Early Media handling, Local Media Playback and Merge Dialogs -

For certain call flows with early Media Microsoft expects OC-SBC to merge early dialogs sent by Teams and generates a PEM header towards the IMS Core and play Ringback Tone Locally. Microsoft also requires OC-SBC to merge multiple 183 Session Progress Messages from Teams backend and make it a single fork.

We have achieved this by configuring some additional parameters onto the SBC and through sip-manipulations.

12.2.1   Early Media handling

For the requirement of OC-SBC generates a PEM header towards the IMS Core and play Ring back Tone Locally. We have created the sip-manipulation explained in section 9.6.3

The HMR works as below on the 183 Session progress Message from Microsoft.

Inbound 183 Session Progress from Microsoft towards Oracle SBC.

```
SIP/2.0 183 Session Progress
FROM:
<sip:+918130313388@cloudsbc.cgbusolutionslab.com;user=phone>;tag=SD4dthf0
2-861130111-1706516226676-
TO: "ORACLESOLLAB ."<sip:+17812032798@sip-
us.gcs.pstnhub.microsoft.com:5061;user=phone>;tag=1c370fd74fa848f180e1cdb
5e1b03172
CSEQ: 707105083 INVITE
CALL-ID: SD4dthf02-66926c0021824938f6f2de24181dbaf4-a004050
VIA: SIP/2.0/TLS 10.0.2.10:5061;branch=z9hG4bKijge4u00c81tudqgtau0.1
RECORD-ROUTE: <sip:sip-
us.gcs.pstnhub.microsoft.com:5061;transport=tls;lr>
CONTACT: <sip:api-du-b-usea.pstnhub.microsoft.com:443;x-i=38d12233-f46d-
4215-adb9-c5d52b97b0f5;x-
c=b6721950dcf157ae9168ba217afeb25a/s/1/bbef7d3473084ab6b4d4687af54d063b>
CONTENT-LENGTH: 465
CONTENT-TYPE: application/sdp
ALLOW: INVITE,ACK,OPTIONS,CANCEL,BYE,NOTIFY
SERVER: Microsoft.PSTNHub.SIPProxy v.2024.1.22.1 i.USEA.1
X-MS-TenantId: XXXXXXXXXX
```

Outbound 183 Session progress from SBC towards IMS

```
SIP/2.0 183 Session Progress
Via: SIP/2.0/TCP
10.0.17.20:5060;received=129.213.187.4;branch=z9hG4bK9pi2kq20e8fli11lqan0
.1
Via: SIP/2.0/UDP 10.0.17.22:5060;branch=z9hG4bKjva37b20agt0hpru2910.1
Via: SIP/2.0/UDP
129.158.200.139:5060;branch=z9hG4bKh3ad2l00cok0vf8848r0.1
From: <sip:+918130313388@63.77.76.250;user=phone>;tag=SD4dthf01-
861130111-1706516226676-
To: "ORACLESOLLAB
."<sip:+17812032798@141.146.36.101:5061;user=phone>;tag=SD4dthf99-
1c370fd74fa848f180e1cdb5e1b03172
Call-ID: SD4dthf01-66926c0021824938f6f2de24181dbaf4-a004050
CSeq: 707105083 INVITE
Record-Route: <sip:SDgdc09+fpebnfmuvif67u3p5p8fr1ubf-
gl5p7bvvoeuctgh5p7b10ocud5@129.213.187.4:5060;lr;transport=udp>
Contact: <sip:129.158.200.139:5060;x-i=38d12233-f46d-4215-adb9-
c5d52b97b0f5;x-
c=b6721950dcf157ae9168ba217afeb25a/s/1/bbef7d3473084ab6b4d4687af54d063b;t
ransport=tcp>
CONTENT-LENGTH: 345
CONTENT-TYPE: application/sdp
ALLOW: INVITE,ACK,OPTIONS,CANCEL,BYE,NOTIFY
SERVER: Microsoft.PSTNHub.SIPProxy v.2024.1.22.1 i.USEA.1
X-MS-TenantId: XXXXXXXXXX
P-Early-Media: sendonly
```

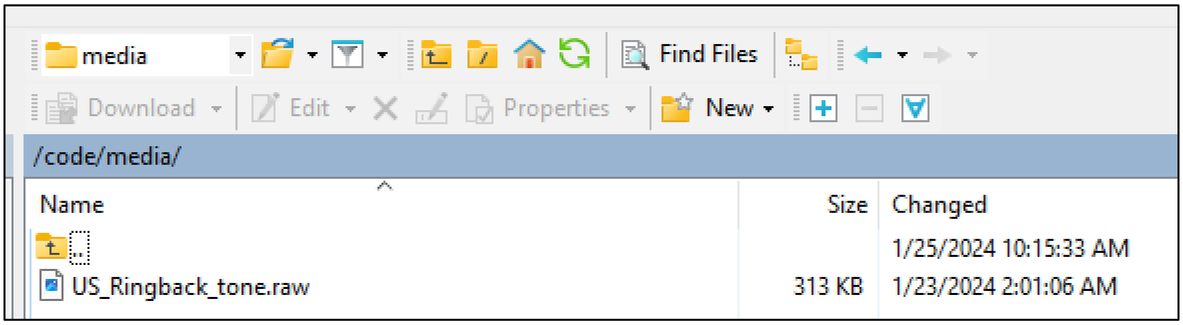
12.2.2 Oracle SBC Local Media Playback

Oracle SBC has the capability of playing local media on certain triggers. For this case we are playing the Local Media on the 183 Session progress from the Microsoft towards the Caller.

12.2.2.1 Media Files

Media files of ring back 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, load the file to the /code/media directory on the Oracle SBC. SFTP to the SBC management IP address to securely transfer the file into this directory. In this example, we're using a common SFTP client, WinSCP.



/code/media/

Name	Size	Changed
..		1/25/2024 10:15:33 AM
US_Ringback_tone.raw	313 KB	1/23/2024 2:01:06 AM

Lastly, we'll assign this file to the realm facing the IMS Core and set the trigger for the SBC to generate local ring back.

12.2.2.2 Local Media Playback Config

To assign the ring back file on the realm through ACLI, navigate to below path and provide the name of the ring back file at the ringback-file config object.

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

```
realm-config
        identifier                              ims
        network-interfaces                              s1p0:0.4
        media-sec-policy                              RTP
        access-control-trust-level                  high
        ringback-trigger                         183
        ringback-file                         US_Ringback_tone.raw
```

- Perform a **save and activate** configuration for changes to take effect.

12.2.3 Merge Early Dialogs

Microsoft requires OC-SBC to merge multiple 183 Session Progress Messages from Teams backend and make it a single fork. To handle this requirement, we are creating below configuration on the SBC.

```
sip-config
        dialog-transparency                    disabled
        home-realm-id                          Teams
        registrar-domain                       *
        registrar-host                        *
        registrar-port                        5060
        options                              inmanip-before-validate
                                             max-udp-length=0
                                             multiple-dialogs-enhancement
realm-config
        identifier                           ims
        network-interfaces                      s1p0:0.4
        media-sec-policy                        RTP
        access-control-trust-level                high
        options                              merge-early-dialogs enable
        hide-egress-media-update                  enabled
        ringback-trigger                        183
        ringback-file                         US_Ringback_tone.raw
        merge-early-dialogs                      enabled
```

Please follow Oracle SBC documentation Section Merge Function within Early Dialog Support on Page 647 for detailed understanding on Merge-early-dialogs feature.

Note Merge-early-dialogs does not work with –

- Offerless call
- Preconditions interworking
- SRVCC • multiple audio or video m-line
- p-early-media-header with 'add' and 'modify' options.

- You should configure HMU to maintain RTP consistency. •
- Dialog transparency should be disabled.

13 Appendix B

13.1 Test Cases

This version of Application Note is created as per below conducted tests-

S no.	**Case**	**Status**
1	Intra Tenant Call	PASSED

3	TPM Origination Call to Non-Teams user	PASSED
4	MT Call to TPM User	PASSED
5	SBC Sip and Media Interworking towards Teams User	PASSED
6	SBC Interworking Offer in a-line	PASSED
7	Cold Transfer to TPM Enabled User	PASSED
8	Call Transfer to External PSTN	PASSED
10	Consultative Transfer to TPM Enabled User	PASSED
11	Call Uplift via Teams App for the Teams Native Dialler in Call	PASSED
13	User not Assigned in TPM	PASSED
14	Call Forking and Local Reject (Orig PSTN or Volte User)	PASSED
15	Local User Rejects incoming call needs to route to TPM VM (global reject SIP Error)	PASSED
16	Call Forking and Cancel	PASSED

14 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 and may also include other configuration that may be relevant to the purpose of 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.

```
pri-tpm-sbc#
pri-tpm-sbc# sh ru short
access-control
        realm-id                        ims
        source-address                     129.213.136.120
        application-protocol               SIP
        trust-level                     high
access-control
        realm-id                        ims
        source-address                     129.213.187.4
        application-protocol               SIP
        trust-level                     high
access-control
        realm-id                        pingco
        source-address                     13.93.229.25
        application-protocol               SIP
        trust-level                     high
access-control
        realm-id                        siptrunk
        source-address                     138.3.226.40
        application-protocol               SIP
        trust-level                     high
access-control
        realm-id                        ims
        source-address                  158.101.98.101
        application-protocol              SIP
        trust-level                   high
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
access-control
        realm-id                      Teams
        source-address                  52.121.0.0/14
        application-protocol              SIP
        trust-level                   high
certificate-record
        name                          DigiCertGlobalRootCA
        common-name                          DigiCert Global Root CA
certificate-record
        name                          DigiCertGlobalRootG2
        common-name                          DigiCert Global Root G2
certificate-record
        name                          DigiCertGlobalRootG3
        common-name                          DigiCert Global Root G3
certificate-record
        name                          DigiCertTLSRSA4096RootG5
        common-name                          DigiCert TLS RSA4096 Root G5
certificate-record
        name                          MicrosoftECCRootCertificateAuthority2017
        common-name                          Microsoft ECC Root Certificate Authority 2017
certificate-record
        name                          MicrosoftRSARootCertificateAuthority2017
        common-name                          Microsoft RSA Root Certificate Authority 2017
certificate-record
        name                          SBCCertificateforTPM
        common-name                          cloudsbc.cgbusolutionslab.com
certificate-record
        name                          gd_bundle-g2-g1
        common-name                          gd_bundle-g2-g1
codec-policy
        name                          addCN
        allow-codecs                     *
        add-codecs-on-egress                CN
        order-codecs                    PCMU G729 *
codec-policy
        name                          TPMCodecPolicy
        allow-codecs                     *
```

```
                add-codecs-on-egress            CN::wideband SILK::wideband
     order-codecs
     packetization-time                20
codec-policy
     name                            IMSCoreCodecs
     allow-codecs                       PCMU G729 telephone-event AMR
     add-codecs-on-egress                  PCMU AMR
codec-policy
     name                             TPMIMS
     allow-codecs                       AMR-WB::NMS:no AMR-WB::LOW AMR::NMS96 AMR::NMS97
EVS AMR-WB::MSFT:no *
     add-codecs-on-egress                  AMR-WB::LOW AMR::NMS96 AMR::NMS97 EVS CN
     order-codecs                       AMR-WB::LOW AMR::NMS96 AMR::NMS97 EVS telephone-event *
codec-policy
     name                             MSTPM
     allow-codecs                          *
     add-codecs-on-egress                  AMR-WB::MSFT CN
     order-codecs                          *
http-server
     name                             web
ice-profile
     name                             ice
     stun-conn-timeout                     0
     stun-keep-alive-interval               0
local-policy
     from-address                          *
     to-address                         16174261400
                              17815321400
                              18004444444
                              6174261400
                              7815321400
                              800444444444
                              +16174261400
                              +17815321400
                              +18004444444
     source-realm                       pingco
     policy-attribute
          next-hop                          138.3.226.40
          realm                          siptrunk
          action                         replace-uri
local-policy
     from-address                       volte.oraclecgbupoc.co.uk
     to-address                         17812032798
                              17812032799
                              7812032798
                              7812032799
                              +17812032798
                              +17812032799
     source-realm                       pingco
     policy-attribute
```

```
          next-hop                     sag:ocsag
          realm                       Teams
          action                      replace-uri
local-policy
     from-address                   *
     to-address                    17812032798
                              17812032799
                              7812032798
                              7812032799
                              +17812032798
                              +17812032799
     source-realm                   Teams
     policy-attribute
          next-hop                     13.93.229.25
          realm                       pingco
          action                      replace-uri
local-policy
     from-address                   *
     to-address                    *
     source-realm                   Teams
     policy-attribute
          next-hop                     13.93.229.25
          realm                       pingco
local-policy
     from-address                   *
     to-address                    sip.gcs.pstnhub.microsoft.com
     source-realm                   Teams
     policy-attribute
          next-hop                     sag:ocsag
          realm                       Teams
          action                      replace-uri
local-policy
     from-address                   *
     to-address                    *
     source-realm                   ims
     policy-attribute
          next-hop                     13.93.229.25
          realm                       pingco
          action                      replace-uri
local-policy
     from-address                   *
     to-address                    pstn.com
     source-realm                   ims
     policy-attribute
          next-hop                     13.93.229.25
          realm                       pingco
          action                      replace-uri
local-policy
     from-address                   sip.gcs.pstnhub.microsoft.com
     to-address                    *
```

```
    source-realm                pingco
    policy-attribute
        next-hop                    129.213.187.4
        realm                       ims
        action                      replace-uri
local-policy
    from-address                *
    to-address                  *
    source-realm                pingco
    policy-attribute
        next-hop                    sag:ocsag
        realm                       Teams
        action                      replace-uri
local-policy
    from-address                *
    to-address                  *
    source-realm                siptrunk
    policy-attribute
        next-hop                    13.93.229.25
        realm                       pingco
media-manager
    options                     dtls-trace
                                webrtc-trace
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-profile
    name                        AMR-WB
    subname                     LOW
    payload-type                98
    parameters                  max-red=0
                                mode-change-capability=2
                                mode-change-neighbor=1
                                mode-change-period=2
                                mode-set="0,1,2"
media-profile
    name                        AMR-WB
    subname                     MSFT
```

```
        payload-type                    121
        parameters                      max-red=0
                                    mode-change-capability=2
                                    mode-set="0,1,2"
media-profile
        name                          AMR-WB
        subname                         NMS
        payload-type                    116
        parameters                      max-red=220
                                    mode-change-capability=2
media-profile
        name                          AMR
        subname                         NMS96
        payload-type                    96
        parameters                      max-red=0
                                    mode-change-capability=2
                                    mode-change-neighbor=1
                                    mode-change-period=2
                                    mode-set="0,2,4,7"
media-profile
        name                          AMR
        subname                         NMS97
        payload-type                    97
        parameters                      max-red=0
                                    mode-set="7"
media-sec-policy
        name                          RTP
media-sec-policy
        name                          sdesPolicy
        inbound
                profile                     SDES
                mode                         srtp
                protocol                     sdes
        outbound
                profile                     SDES
                mode                         srtp
                protocol                     sdes
network-interface
        name                          s0p0
        hostname                        cloudsbc.cgbusolutionslab.com
        ip-address                     10.0.2.10
        netmask                        255.255.255.0
        gateway                        10.0.2.1
        dns-ip-primary                    8.8.8.8
        dns-domain                       cloudsbc.cgbusolutionslab.com
network-interface
        name                          s0p1
        ip-address                     10.0.4.10
        netmask                        255.255.255.0
        gateway                        10.0.4.1
```

```
network-interface
        name                          s1p0
        ip-address                     10.0.3.10
        netmask                        255.255.255.0
        gateway                        10.0.3.1
network-interface
        name                          s1p1
        ip-address                     10.0.5.27
        netmask                        255.255.255.0
        gateway                        10.0.5.1
phy-interface
        name                          s0p0
        operation-type                    Media
phy-interface
        name                          s0p1
        operation-type                    Media
        port                        1
phy-interface
        name                          s1p0
        operation-type                    Media
        slot                        1
phy-interface
        name                          s1p1
        operation-type                    Media
        port                        1
        slot                        1
realm-config
        identifier                    Teams
        description                     Realm Facing Teams Direct Routing
        network-interfaces                   s0p0:0.4
        mm-in-realm                        enabled
        qos-enable                       enabled
        media-sec-policy                     sdesPolicy
        rtcp-mux                        enabled
        teams-fqdn                       cloudsbc.cgbusolutionslab.com
        teams-fqdn-in-uri                   enabled
        sdp-inactive-only                   enabled
        access-control-trust-level              high
        codec-policy                      addCN
        rtcp-policy                     rtcpGen
realm-config
        identifier                    ims
        network-interfaces                   s1p0:0.4
        media-sec-policy                     RTP
        access-control-trust-level              high
        ringback-trigger                   183
        ringback-file                     US_Ringback_tone.raw
realm-config
        identifier                    pingco
        network-interfaces                   s1p1:0.4
        media-sec-policy                RTP
realm-config
        identifier                      siptrunk
        network-interfaces              s0p1:0.4
        media-sec-policy                RTP
        options                         merge-early-dialogs enable
        hide-egress-media-update        enabled
        merge-early-dialogs             enabled
rtcp-policy
        name                            rtcpGen
        rtcp-generate                   all-calls
sdes-profile
        name                            SDES
        lifetime                        31
session-agent
        hostname                        129.213.187.4
        transport-method                StaticTCP
        realm-id                        ims
        ping-method                     OPTIONS
        ping-interval                   30
        ping-response                   enabled
        refer-call-transfer             enabled
session-agent
        hostname                        13.93.229.25
        realm-id                        pingco
        ping-method                     OPTIONS
        ping-interval                   10
        ping-response                   enabled
session-agent
        hostname                        138.3.226.40
        ip-address                      138.3.226.40
        realm-id                        siptrunk
        ping-method                     OPTIONS
        ping-interval                   30
        ping-response                   enabled
session-agent
        hostname                        158.101.98.101
        ip-address                      158.101.98.101
        realm-id                        ims
        refer-call-transfer             enabled
session-agent
        hostname                        sip-as.gcs.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                        sip-au.gcs.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                        sip-eu.gcs.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                        sip-us.gcs.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                        sip.gcs.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                        volte.oraclecgbupoc.co.uk
        port                       5063
        realm-id                      ims
session-group
        group-name                        ocsag
        dest                       sip-us.gcs.pstnhub.microsoft.com
                                  sip-eu.gcs.pstnhub.microsoft.com
                                  sip-au.gcs.pstnhub.microsoft.com
                                  sip-as.gcs.pstnhub.microsoft.com
session-timer-profile
        name                         ToTeams
        force-reinvite                  enabled
        request-refresher                 uas
session-translation
```

```
        id                                  toPSTN
sip-config
        dialog-transparency                     disabled
        home-realm-id                           Teams
        registrar-domain                        *
        registrar-host                          *
        registrar-port                          5060
        options                                 inmanip-before-validate
                                            max-udp-length=0
                                            multiple-dialogs-enhancement
        sip-message-len                         65535
        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                                Teams
        sip-port
                address                                 10.0.2.10
                port                                    5061
                transport-protocol                      TLS
                tls-profile                             tlsteams
                allow-anonymous                         agents-only
        spl-options
HeaderNatPublicSipIfIp=129.80.211.181,HeaderNatPrivateSipIfIp=10.0.2.10
        out-manipulationid                      check480
        sip-profile                             forreplaces
sip-interface
        realm-id                                ims
        sip-port
                address                                 10.0.3.10
                allow-anonymous                         agents-only
        sip-port
                address                                 10.0.3.10
                transport-protocol                      TCP
                allow-anonymous                         agents-only
        spl-options
HeaderNatPublicSipIfIp=129.158.200.139,HeaderNatPrivateSipIfIp=10.0.3.10
        stop-recurse                            401,407,480
        in-manipulationid                       striprouteheader
        out-manipulationid                      E164
sip-interface
        realm-id                                pingco
        sip-port
                address                                 10.0.5.27
        spl-options
HeaderNatPublicSipIfIp=150.136.176.126,HeaderNatPrivateSipIfIp=10.0.5.27
        out-manipulationid                      TPMlogic
sip-interface
        realm-id                                siptrunk
        sip-port
                address                                 10.0.4.10
                allow-anonymous                         agents-only
        spl-options
HeaderNatPublicSipIfIp=129.80.186.157,HeaderNatPrivateSipIfIp=10.0.4.10
        out-manipulationid                      RemoveCustomHeaders

sip-manipulation
        name                                    AddPAcmePlayback
        header-rule
                name                                    CheckForSDPInactive
                header-name                             Content-Type
                action                                  store
                comparison-type                         pattern-rule
                methods                                 INVITE
                element-rule
                        name                                    Inactive
                        parameter-name                          application/SDP
                        type                                    mime
                        action                                  store
                        match-value                             a=inactive
        header-rule
                name                                    StartMoH
                header-name                             P-Acme-Playback
                action                                  add
                comparison-type                         boolean
                methods                                 INVITE
                match-value                             $CheckForSDPInactive.$Inactive
                new-value                               "start;duration=continuous;direction=both;stop-on-final-resp=false"
sip-manipulation
        name                                    AddRefertoAllow
        header-rule
                name                                    AllowRefer
                header-name                             Allow
                action                                  manipulate
                methods                                 Invite
                new-value                               $ORIGINAL+",REFER"
sip-manipulation
        name                                    Add_PEM_to_183
        header-rule
                name                                    Detect_183
                header-name                             @status-line
                action                                  manipulate
                comparison-type                         pattern-rule
                element-rule
```

```
            name                        detect183
            type                        status-code
            action                      sip-manip
            comparison-type                 pattern-rule
            match-value                     183
            new-value                       Ins_PEM183
sip-manipulation
    name                        DeleteSDP
    header-rule
        name                        Store180
        header-name                     @status-line
        action                      store
        msg-type                      reply
        methods                       Invite
        element-rule
            name                        store180
            type                        status-code
            action                      store
            match-value                     180
    mime-sdp-rule
        name                        sdpStrip
        msg-type                      reply
        methods                       Invite
        action                      delete
        comparison-type                 boolean
        match-value                     $Store180.$store180
sip-manipulation
    name                        E164
    header-rule
        name                        addPlus
        header-name                     Request-URI
        action                      manipulate
        comparison-type                 pattern-rule
        msg-type                      request
        methods                       INVITE
        element-rule
            name                        tendigits
            type                        uri-user
            action                      replace
            comparison-type                 pattern-rule
            match-value                     ^[0-9]{10}$
            new-value                       \+1+$ORIGINAL
        element-rule
            name                        elevendigits
            type                        uri-user
            action                      replace
            comparison-type                 pattern-rule
            match-value                     ^[0-9]{11}$
            new-value                       \++$ORIGINAL
    header-rule
```

```
            name                             PEMAdd
            header-name                         FROM
            action                          sip-manip
            msg-type                           reply
            methods                            INVITE
            new-value                           Add_PEM_to_183
sip-manipulation
        name                            Ins_PEM183
        header-rule
            name                             Ins_PEM_Field
            header-name                         P-Early-Media
            action                          add
            new-value                           sendonly
sip-manipulation
        name                            RemoveCustomHeaders
        description                       Removes specified X- headers from INVITE
        header-rule
            name                             RemoveXMSFMC
            header-name                         X-MS-FMC
            action                          delete
            msg-type                           request
            methods                            INVITE
        header-rule
            name                             RemoveXMSTenantId
            header-name                         X-MS-TenantId
            action                          delete
            msg-type                           request
            methods                            INVITE
        header-rule
            name                             RemoveXTRESourcePlatform
            header-name                         X-TRE-Source-Platform
            action                          delete
            msg-type                           request
            methods                            INVITE
        header-rule
            name                             RemoveXTRECallType
            header-name                         X-TRE-CallType
            action                          delete
            msg-type                           request
            methods                            INVITE
        header-rule
            name                             RemoveXTREChainLinkID
            header-name                         X-TRE-ChainLinkID
            action                          delete
            msg-type                           request
            methods                            INVITE
        header-rule
            name                             RemoveXTRETrunkType
            header-name                         X-TRE-TrunkType
            action                          delete
```

```
          msg-type                      request
          methods                       INVITE
      header-rule
          name                         RemoveXTRECompanyID
          header-name                      X-TRE-CompanyID
          action                       delete
          msg-type                      request
          methods                       INVITE
      header-rule
          name                         RemoveXTREOperatorProfile
          header-name                      X-TRE-OperatorProfile
          action                       delete
          msg-type                      request
          methods                       INVITE
      header-rule
          name                         RemoveXTREOutboundCarrier
          header-name                      X-TRE-OutboundCarrier
          action                       delete
          msg-type                      request
          methods                       INVITE
sip-manipulation
      name                         TPMlogic
      header-rule
          name                         NativeDialerlogic
          header-name                      P-Served-User
          action                       manipulate
          msg-type                      request
          methods                       INVITE
          element-rule
              name                         matchorigval
              parameter-name                   sescase
              type                         header-param
              action                       store
              comparison-type                  boolean
              match-value                    orig
      header-rule
          name                         addXTRESourcePlatform
          header-name                      X-TRE-Source-Platform
          action                       add
          comparison-type                  boolean
          msg-type                      request
          methods                       INVITE
          match-value                     $NativeDialerlogic.$0
          new-value                      Mobile
      header-rule
          name                         removesupported
          header-name                      Supported
          action                       delete
          msg-type                      request
          methods                       INVITE
```

```
header-rule
     name                        ModPAI
     header-name                    P-Asserted-Identity
     action                      manipulate
     msg-type                      request
     methods                      INVITE
     element-rule
          name                        ModUserPAI
          type                       uri-host
          action                      replace
          comparison-type                  pattern-rule
          new-value                    $FROM_HOST.$0
header-rule
     name                        removePVNI
     header-name                    P-Visited-Network-ID
     action                      delete
     msg-type                      request
     methods                      INVITE
header-rule
     name                        RemoveUserAgent
     header-name                    User-Agent
     action                      delete
     msg-type                      request
     methods                      INVITE
header-rule
     name                        StoreHost
     header-name                    request-uri
     action                      store
     comparison-type                  pattern-rule
     msg-type                      out-of-dialog
     methods                      INVITE
     element-rule
          name                        storeurihost
          type                       uri-host
          action                      store
header-rule
     name                        CopyHost
     header-name                    To
     action                      manipulate
     methods                      INVITE
     element-rule
          name                        replacehost
          type                       uri-host
          action                      replace
          comparison-type                  boolean
          match-value                    $StoreHost.$storeurihost
          new-value                    $StoreHost.$storeurihost.$0
header-rule
     name                        addPSTNlogic
     header-name                    From
```

```
        action                        manipulate
        msg-type                        request
        methods                         INVITE
        element-rule
            name                            matchfromhost
            type                          uri-host
            action                        store
            comparison-type                   boolean
            match-value                     pstn.com
    header-rule
        name                           AddSourcePlatformPSTN
        header-name                       X-TRE-Source-Platform
        action                        add
        comparison-type                   boolean
        msg-type                        request
        methods                         INVITE
        match-value                       $addPSTNlogic.$matchfromhost
        new-value                        PSTN
    header-rule
        name                           TeamsClientcalllogic
        header-name                       X-MS-FMC
        action                        manipulate
        msg-type                        request
        methods                         INVITE
        element-rule
            name                            matchapp
            type                          header-value
            action                        store
            comparison-type                   boolean
            match-value                     APP
    header-rule
        name                           AddSourcePlatformTeamsPhoneMobile
        header-name                       X-TRE-Source-Platform
        action                        add
        comparison-type                   boolean
        msg-type                        request
        methods                         INVITE
        match-value                       $TeamsClientcalllogic.$matchapp.$0
        new-value                        TeamsPhoneMobile
sip-manipulation
    name                           add100reltosupported
    header-rule
        name                           add100rel
        header-name                       Supported
        action                        manipulate
        comparison-type                   pattern-rule
        msg-type                        request
        methods                         INVITE
        new-value                        100rel
sip-manipulation
```

```
    name                       check480
    header-rule
         name                      check480
         header-name                  @status-line
         action                    manipulate
         msg-type                    reply
         methods                     INVITE
         element-rule
              name                      make603
              type                     status-code
              action                    replace
              match-value                  480
              new-value                   603
         element-rule
              name                      changeReason
              type                     reason-phrase
              action                    replace
              comparison-type               boolean
              new-value                   "Decline"
sip-manipulation
    name                       striprouteheader
    header-rule
         name                      striproute1
         header-name                  Route[1]
         action                    delete
         msg-type                    request
         methods                     INVITE
    header-rule
         name                      striproute0
         header-name                  Route[0]
         action                    delete
         msg-type                    request
         methods                     INVITE
    mime-sdp-rule
         name                      ChangeCLine
         msg-type                    request
         methods                     INVITE
         action                    manipulate
         sdp-session-rule
              name                      Cline
              action                    manipulate
              sdp-line-rule
                   name                      modcline
                   type                     c
                   action                   replace
                   comparison-type               pattern-rule
                   match-value                 IN IP4 129.158.200.139
                   new-value                   "IN IP4 10.0.3.10"
sip-monitoring
    match-any-filter             enabled
```

```
        monitoring-filters                   *
sip-profile
        name                                forreplaces
        replace-dialogs                          enabled
ssh-key
        name                                admin
        type                               authorized-key
        size                               2048
steering-pool
        ip-address                           10.0.2.10
        start-port                          20000
        end-port                             40000
        realm-id                             Teams
steering-pool
        ip-address                           10.0.3.10
        start-port                          20000
        end-port                             40000
        realm-id                             ims
steering-pool
        ip-address                           10.0.4.10
        start-port                          20000
        end-port                             40000
        realm-id                             siptrunk
steering-pool
        ip-address                           10.0.5.27
        start-port                          20000
        end-port                             30000
        realm-id                             pingco
system-config
        hostname                              cloudsbc.cgbusolutionslab.com
        dos-cores                            1
        transcoding-cores                         1
tls-global
        session-caching                         enabled
        diffie-hellman-key-size                    DH_KeySize_2048
tls-profile
        name                                TLSTeams
        end-entity-certificate                   SBCCertificateforTeams
        trusted-ca-certificates                  DigiCertRoot
                                   DigiCertGlobalRootG2
                                   DigiCertGlobalRootG3
                                   DigiCertTLSECCP384RootG5
                                   DigiCertTLSECCP4096RootG5
                                   MicrosoftECCRootCertificateAuthority2017
                                   MicrosoftRSARootCertificateAuthority2017
        mutual-authenticate                       enabled
        tls-version                          tlsv12
pri-tpm-sbc#
```

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