Deployment Of Oracle Enterprise Session Router (Oracle Session Stateful ESR) as a SIP proxy with Cisco Voice Platform

Technical Application Note

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Revision History

Version	Description of Changes	Date Revision Completed
1.0	Deployment Of Oracle Enterprise Session Router (Oracle Session Stateful ESR) as a SIP proxy with Cisco voice platform.	20th December 2024

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1. Intended Audience

This document is intended for use by Oracle Systems Engineers, third party Systems Integrators, Oracle Enterprise customers and partners and end users of the Oracle Enterprise Session Router (ESR) and Session Border Controller (SBC). It is assumed that the reader is familiar with basic operations of the Oracle Enterprise Session Border Controller platform along with Cisco Voice Platform.

2. Document Overview

This Oracle technical application note outlines how to configure the Oracle ESR as a load balancer (sip-proxy) to interwork between Oracle ESBC and Cisco Voice Platform. The solution contained within this document has been tested using Oracle Enterprise Session Router with **OS920p7**

2.1. Oracle Enterprise Session Router

The main objective of this document is to explain the configuration of the Oracle Enterprise Session Router as a sip proxy instead of Cisco CUSP (Cisco Unified SIP Proxy) which is also recommended by the Cisco. In some areas, the PSTN does not provide multiple SIP trunks to a single site. In that case, you can connect the SIP trunk to an Oracle Enterprise Session Router SIP Proxy and connect multiple SBCs (either Oracle SBCs or it be Cisco CUBE) to the SIP Proxy to provide some redundancy. **Oracle ESR mainly works in 4 different modes out of which we will be configuring only the Session Stateful ESR mode which will be discussed in the below section.**

The ESR here primarily works as load balancer and this application note focusses on the Oracle ESR configuration which will be in CLI mode as ESR does not have a GUI as of now.

Please note that topics related to licenses (like software TLS etc.) are not covered in this Application note document. Please contact your Oracle Account Team or your Oracle representative with any questions pertaining to this topic for more information.

Please note that the IP Addresses, FQDN and configuration names and details given in this document are used for reference purposes only. These same details cannot be used in customer configurations. End users of this document can use the configuration details according to their network requirements. There may be some some public facing IPs (externally routable IPs) that we use for our testing are masked in this document for security reasons. The customers can configure any publicly routable IPs for these sections as per their network architecture needs.

2.2. Explaining Session Stateful ESR mode

Oracle Communications Session Router supports four modes, providing multiple levels of session statefulness that balance interoperability, security, and accounting features with performance. The four working modes are given in the below table with the difference in each mode.

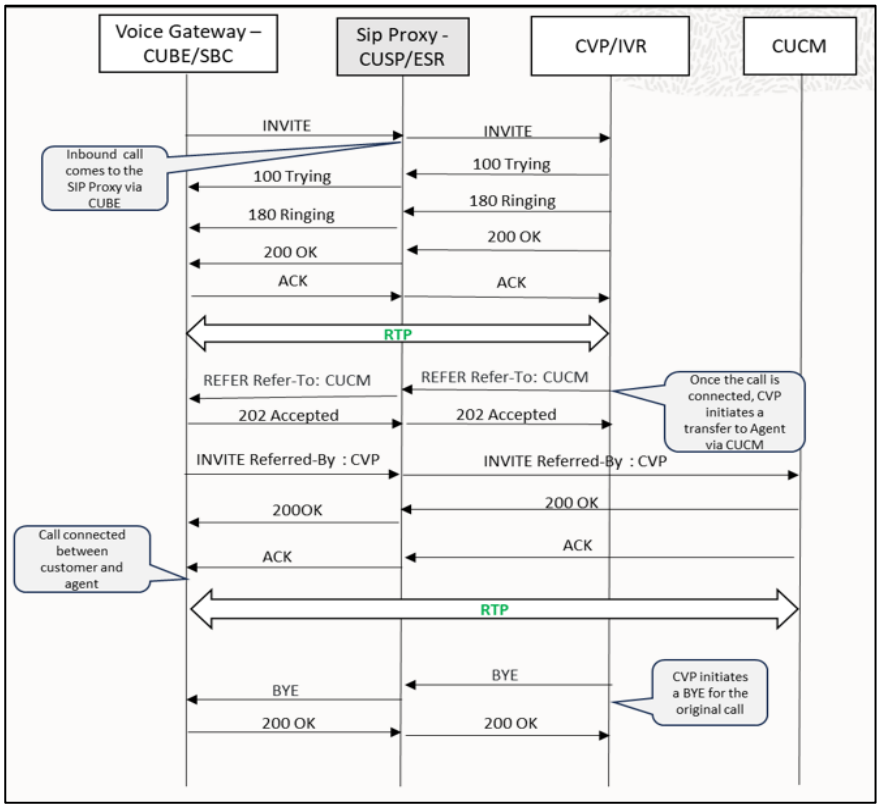
Mode	Performance	Signaling State	Topology Hiding	Overload Control	Load Balancing	Sip Interworking	Accounting
Stateless	Highest	Initial invite only	No	No	No	No	No
Transaction Stateful	Higher	Through initial setup	No	CPS only	Hunt, lowest sustained rate	Yes	No
Session Stateful	High	Through session termination	No	CPS and sessions	Hunt, round robin, and proportional, least busy, lowest sustained rate	Yes	Yes
Dialog Stateful	High	Through session termination	Yes	CPS and sessions	Hunt, round robin, and proportional, least busy, lowest sustained rate	Yes	Yes

Out of the above 4 modes, we will be covering the Session Stateful ESR mode in this document.

1. **Session Stateful ESR server**

- Mode of Operation: Session Stateful
- Behaviour: All messages pass through proxy during the duration of call.

Below is the figure which represents a standard Inbound SIP proxy call flow through CUSP/ESR



3. Introduction

This is a technical document intended for telecommunications engineers with the purpose of configuring. Oracle Enterprise Session Router. There will be steps that require navigating Oracle ESR CLI interface, understanding the basic concepts of TCP/UDP, TLS, IP/Routing, DNS server and SIP/RTP are also necessary to complete the configuration and for troubleshooting, if necessary.

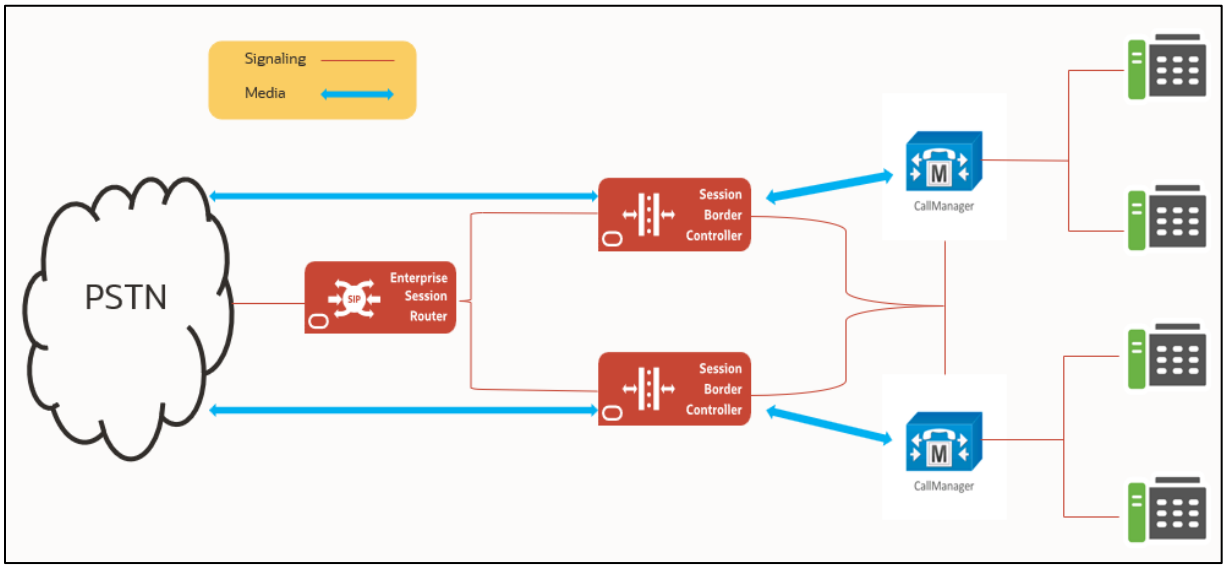
3.1. Requirements

- Oracle Enterprise Session Router (hereafter Oracle ESR) running 9.2.0 version or later.

The below revision table explains the versions of the software used for each component:
This table is Revision 1 as of now:

Software Used	ESR Version
Revision 1	9.2.0

3.2. Architecture



This document mainly focuses on configuring the Oracle ESR and below are the IP details.

ESR SIP Interface IP towards PSTN side: 10.232.50.86
ESR SIP Interface IP towards SBC side: 10.232.50.83
ESR Session Agent IP towards PSTN side: 10.232.50.173

ESR Session Agent IP towards SBC side: Session Agent Group: SBCgroup
(which has SA IP 10.232.50.81 and 10.232.50.87)

The above ESR IP address information is explained in detail in the below ESR configuration section.

4. Configuring the ESR

This chapter provides step-by-step guidance on how to configure Oracle ESR as SIP proxy for the SBCs **(which can be either Oracle SBCs as shown in above diagram or third-party SBCs like Cisco CUBE etc.)** which will then connect to the Cisco voice platform (In this app note, we have selected Cisco Call Manager (Cisco CUCM) as Cisco voice platform).

4.1. Validated Oracle ESR version.

Oracle conducted tests with Oracle ESR 9.2 software – this software with the configuration listed below can run on any of the following products:

- AP 1100
- AP 3900
- AP 4600
- AP 6300
- AP 6350
- AP 3950
- AP 4900
- VME

5. New ESR configuration

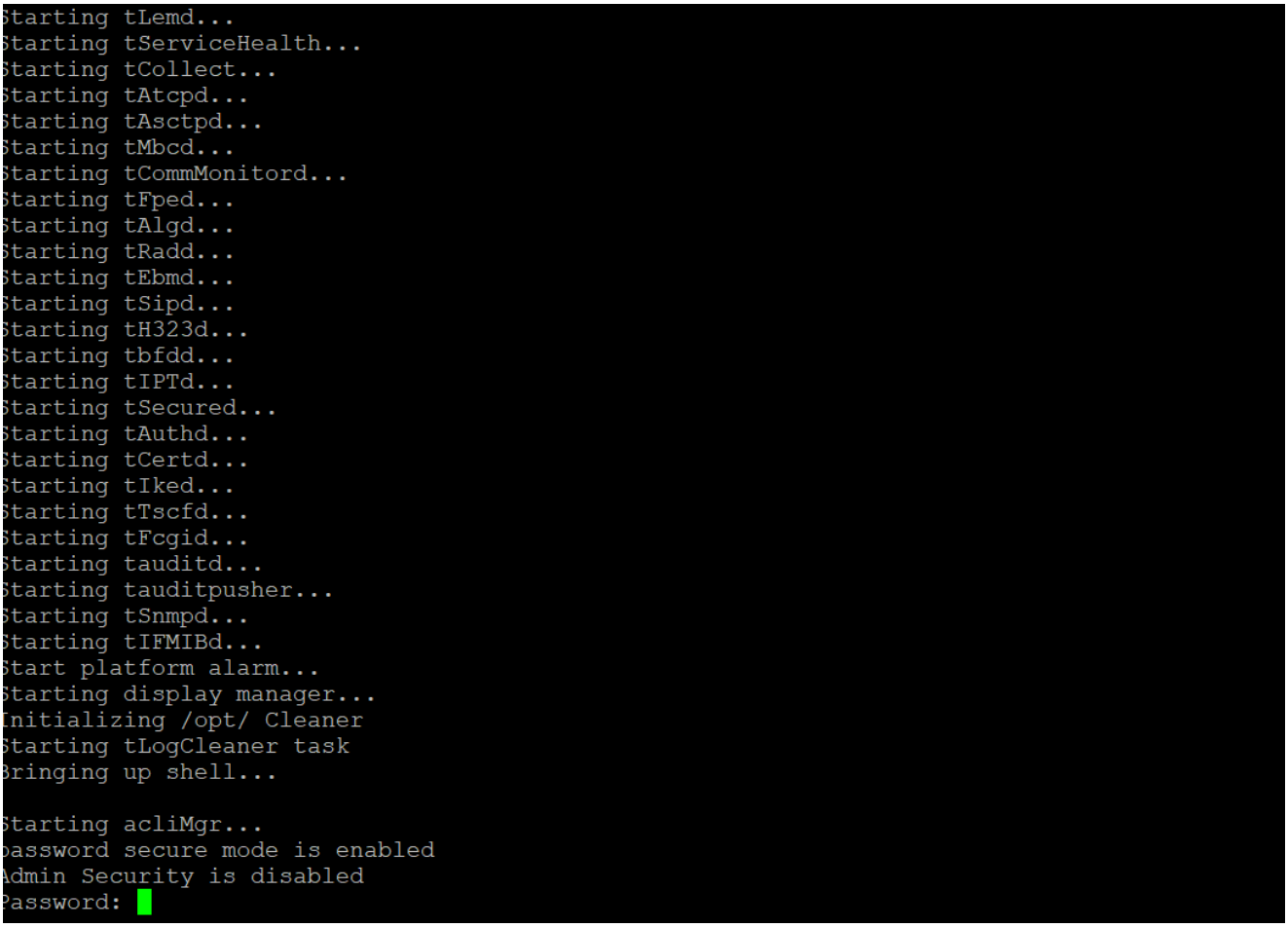
If the customer is looking to setup a new ESR from scratch, please follow the section below.

5.1. Establishing a serial connection to the ESR

Connect one end of a straight-through Ethernet cable to the front console port (which is active by default) on the SBC and the other end to console adapter that ships with the SBC, connect the console adapter (a DB-9 adapter) to the DB-9 port on a workstation, running a terminal emulator application such as Putty. Start the terminal emulation application using the following settings:

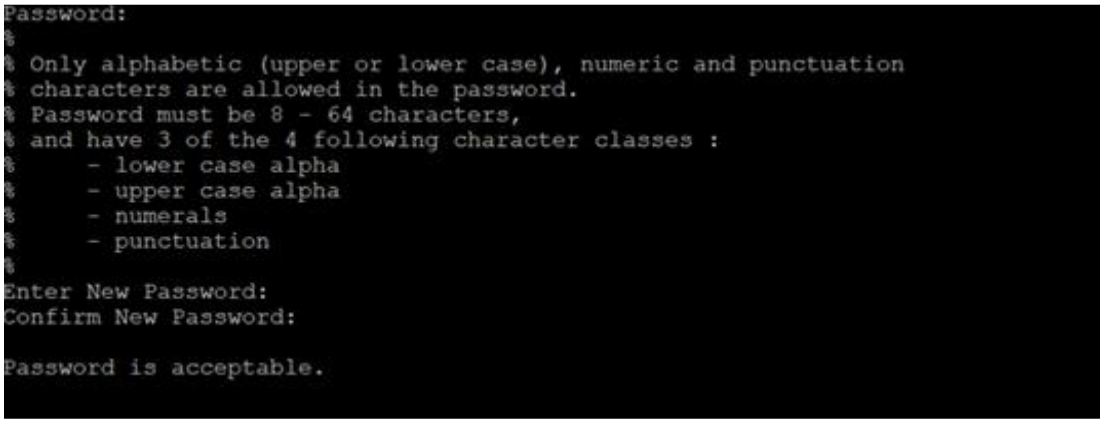
- Baud Rate=115200
- Data Bits=8
- Parity=None
- Stop Bits=1
- Flow Control=None

Power on the ESR and confirm that you see the following output from the boot-up sequence.



Enter the default password to log in to the ESR. Note that the default ESR password is “acme” and the default super user password is “packet”.

Both passwords have to be changed according to the rules shown below.



Now set the management IP of the ESR by setting the IP address in bootparam.

To access bootparam. Go to Configure terminal->bootparam.

```
CUCMESR(configure)# bootparam

'.' = clear field;  '-' = go to previous field;  q = quit

Boot File               : /boot/bzImage
IP Address              : 10.138.194.186
VLAN                    :
Netmask                 : 255.255.255.192
Gateway                 : 10.138.194.129
IPv6 Address            :
IPv6 Gateway            :
Host IP                 :
FTP username            :
FTP password            :
Flags                   :
Target Name             : CUCMESR
Console Device          : VGA
Console Baudrate        : 115200
Other                   :

NOTE: These changed parameters will not go into effect until reboot.
Also, be aware that some boot parameters may also be changed through
PHY and Network Interface Configurations.
```

Note: There is no management IP configured by default.

To configure product type, type setup product in the terminal as shown below.

Select option 2 for configuring Session Router – Session Stateful and perform a save(s) after that.

```
CUCMESR# setup product

------------------------------------------------------------
WARNING:
Alteration of product alone or in conjunction with entitlement
changes will not be complete until system reboot

Last Modified 2024-09-09 11:06:22
------------------------------------------------------------
 1 : Product       : Session Router - Transaction Stateful

Enter 1 to modify, d' to display, 's' to save, 'q' to exit. [s]: 1

  Product
    1 - Session Border Controller
    2 - Session Router - Session Stateful
    3 - Session Router - Transaction Stateful
    4 - Subscriber-Aware Load Balancer
    5 - Enterprise Session Border Controller
    6 - Peering Session Border Controller
  Enter choice     : 2
```

Enable the features for the ESR based on the above choice using the setup entitlements command as shown below and perform a save(s) after that.

Below are the entitlements for Session stateful ESR.

The minimum requirements (Entitlements) needed for Session Stateful ESR are Session Capacity and Load Balancing option as shown below.

```
CUCMESR# setup entitlements

------------------------------------------------------------
Entitlements for Session Router - Session Stateful
Last Modified: Never
------------------------------------------------------------
 1 : Session Capacity                : 0
 2 :   Accounting                    :
 3 :   Load Balancing                :
 4 :   Policy Server                 :
 5 :   STIR/SHAKEN Client            :
 6 : Admin Security                  :
 7 : ANSSI R226 Compliance           :

Enter 1 - 7 to modify, d' to display, 's' to save, 'q' to exit. [s]: 1

  Session Capacity (0-512000)          : 1000

Enter 1 - 7 to modify, d' to display, 's' to save, 'q' to exit. [s]: 3

    Load Balancing (enabled/disabled)  : enabled

Enter 1 - 7 to modify, d' to display, 's' to save, 'q' to exit. [s]: s
SAVE SUCCEEDED
CUCMESR# show entitlements
Provisioned Entitlements:
-------------------------
Session Router - Session Stateful Base    : enabled
Session Capacity                          : 1000
  Accounting                              :
  Load Balancing                          : enabled
  Policy Server                           :
  STIR/SHAKEN Client                      :
Admin Security                            :
ANSSI R226 Compliance                     :

Keyed (Licensed) Entitlements
-----------------------------

CUCMESR#
```

Please reboot the ESR after selecting the above option to take effect.

The ESR comes up after reboot and is now ready for further configuration**.**

5.2. Configure system-config

ACLI Path: config t->system->system-config

The system configuration element must be enabled, although there are no necessary changes required. It's enabled by selecting it, and then issuing a "done".

```
system-config
        hostname                                ESR-SBC
        description
        location
        mib-system-contact
        mib-system-name
        mib-system-location
        acp-tls-profile
        snmp-enabled                            enabled
        enable-snmp-auth-traps                  disabled
        enable-snmp-syslog-notify               disabled
        enable-snmp-monitor-traps               disabled
        enable-snmp-tls-srtp-traps              disabled
        enable-env-monitor-traps                disabled
        enable-mblk_tracking                    disabled
        enable-12-miss-report                   enabled
        snmp-syslog-his-table-length            1
        snmp-syslog-level                       WARNING
        system-log-level                        WARNING
        process-log-level                       NOTICE
```

5.3. Configure sip-config

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

Similar to the system config above, this must be enabled by selecting it, and issuing the “done” command. Only change that is needed in sip-config is that you can set the **operation mode parameter to session** if the ESR is Session Stateful.

operation-mode session

We do however recommend assigning a value to the home realm ID, so if you have pre planned your realm identifiers, you can enter at this time. If not, you can enter a value in this parameter at any time in the future. The home realm ID will be the realm the SBC uses to source a packet if there are no other options available through other configuration elements.

5.4. Configure Physical Interface values.

To configure physical Interface values with the parameters given below.

ACLI Path: config t->system->phy-interface

- Name
- Operation Type
- Slot
- Port

Please configure s1p1 for SBC side and s0p0 for PSTN Trunk side.

Parameter Name	SBC side (s1p1)	PSTN side (s0p0)
Slot	1	0
Port	1	0
Operation Mode	Media	Media

Please configure s0p0interface as below.

```
phy-interface
        name                            s0p0
        operation-type                  Media
        port                            0
        slot                            0
        virtual-mac
        admin-state                     enabled
        auto-negotiation                enabled
        duplex-mode                     FULL
        speed                           100
        wancom-health-score             50
        overload-protection             disabled
```

Please configure s1p1 interface as below

```
phy-interface
        name                            s1p1
        operation-type                  Media
        port                            1
        slot                            1
        virtual-mac
        admin-state                     enabled
        auto-negotiation                enabled
        duplex-mode                     FULL
        speed                           100
        wancom-health-score             50
        overload-protection             disabled
```

5.5. Configure Network Interface values

Configure network interface with the parameters given below, associated with a physical interface already configured.

ACLI Path: config t->system->network-interface

- Name
- Sub-port-id
- IP-address
- netmask
- gateway

Please configure network interface s0p0 as below

```
network-interface
        name                                    s0p0
        sub-port-id                             0
        description
        hostname                                10.232.50.86
        ip-address
        pri-utility-addr
        sec-utility-addr
        netmask                                 255.255.255.0
        gateway                                 10.232.50.1
        sec-gateway
        gw-heartbeat
                state                                   disabled
                heartbeat                               0
                retry-count                             0
                retry-timeout                           1
                health-score                            0
        bfd-config
                state                                   disabled
                health-score                            0
```

Please configure network interface s1p1 as below

```
network-interface
       name                            s1p1
       sub-port-id                     0
       description
       hostname
       ip-address                      10.232.50.83
       pri-utility-addr
       sec-utility-addr
       netmask                         255.255.255.0
       gateway                         10.232.50.1
       sec-gateway
       gw-heartbeat
               state                           disabled
               heartbeat                       0
               retry-count                     0
               retry-timeout                   1
               health-score                    0
       bfd-config
               state                           disabled
               health-score                    0
               options
       dns-ip-primary
       dns-ip-backup1
       dns-ip-backup2
       dns-domain
       dns-timeout                     11
```

5.6. Configure Realms

Configure two realms, PSTN and CUCMSBC, both assigned to the same network interfaces configured in prior step with the parameters given below.

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

In the below example case, Realm name is given as PSTN & CUCMSBC. Please set the Access Control Trust Level as high for these realms. **The End User can choose the Realm names according to their choice and network configuration.**

Use the following table as a configuration example for the two realms used in this configuration:

Config Parameter	SBC Side	PSTN side
Identifier	CUCMSBC	PSTN
Network Interface	s1p1	s0p0
Mm in realm	☑	☑
Access Control Trust Level	High	High

```
realm-config
        identifier                              PSTN
        description
        addr-prefix                             0.0.0.0
        network-interfaces                      s0p0:0.4
        media-realm-list
        mm-in-realm                             enabled
        mm-in-network                           enabled
        mm-same-ip                              enabled
        mm-in-system                            enabled
        bw-cac-non-mm                           disabled
        msm-release                             disabled
        max-bandwidth                           0
        fallback-bandwidth                      0
        max-priority-bandwidth                  0
        max-latency                             0
        max-jitter                              0
        max-packet-loss                         0
        observ-window-size                      0
        parent-realm
        dns-realm
        media-policy
```

```
realm-config
        identifier                              CUCMSBC
        description
        addr-prefix                             0.0.0.0
        network-interfaces                      s1p1:0.4
        media-realm-list
        mm-in-realm                             enabled
        mm-in-network                           enabled
        mm-same-ip                              enabled
        mm-in-system                            enabled
        bw-cac-non-mm                           disabled
        msm-release                             disabled
        max-bandwidth                           0
        fallback-bandwidth                      0
        max-priority-bandwidth                  0
        max-latency                             0
        max-jitter                              0
        max-packet-loss                         0
        observ-window-size                      0
        parent-realm
        dns-realm
        media-policy
        nsep-media-policy
```

For more information on Access Control Trust Level, please refer to SBC Security guide link given below:

https://docs.oracle.com/en/industries/communications/session-border-controller/9.2.0/security/security-guide.pdf

5.7. Configure SIP Interfaces

Navigate to sip-interface under session-router and configure the sip-interface as shown below.
Please configure the below settings under the sip-interface.

Set allow-anonymous to agents-only along with the other parameters given below, to ensure traffic to this sip-interface only comes from the particular session agents added to the ESR.

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

- Realm ID
- Sip-port
- Address
- Next-hop
- Port
- Transport protocol
- Allow-anonymous

PSTN side sip-interface

```
sip-interface
        state                                   enabled
        realm-id                                PSTN
        description
        sip-port
                address                                 10.232.50.86
                port                                    5060
                transport-protocol                      UDP
                allow-anonymous                         agents-only
                multi-home-addrs
                ims-aka-profile
        sip-port
                address                                 10.232.50.86
                port                                    5060
                transport-protocol                      TCP
                allow-anonymous                         agents-only
                multi-home-addrs
                ims-aka-profile
        carriers
        trans-expire                            0
        initial-inv-trans-expire                0
        invite-expire                           0
        session-max-life-limit                  0
        max-redirect-contacts                   0
        proxy-mode
```

SBC side sip-interface

```
sip-interface
        state                                   enabled
        realm-id                                CUCMSBC
        description
        sip-port
                address                                 10.232.50.83
                port                                    5060
                transport-protocol                      UDP
                allow-anonymous                         agents-only
                multi-home-addrs
                ims-aka-profile
        sip-port
                address                                 10.232.50.83
                port                                    5060
                transport-protocol                      TCP
                allow-anonymous                         agents-only
                multi-home-addrs
                ims-aka-profile
        carriers
        trans-expire                            0
        initial-inv-trans-expire                0
        invite-expire                           0
        session-max-life-limit                  0
        max-redirect-contacts                   0
        proxy-mode
```

Once sip-interface is configured – the SBC is ready to accept traffic on the allocated IP address.

5.8. Configure session-agent

Session-agents are config elements which are trusted agents who can send/receive traffic from the ESR with direct access to trusted data path. Session-agents are config elements which are trusted agents who can send/receive traffic from the ESR with direct access to trusted data path.

In this application note example, we configure 3 session agents out of which 1 is for PSTN side and 2 is for SBC side which can be Oracle SBC or Cisco CUBE and ESR connects to 2 SBCs so that it can act as sip-proxy or load balancer.

Configure session-agents with the parameters given below.

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

- Hostname
- IP address
- Realm ID
- Port
- Transport-protocol
- Ping-method
- Ping-interval

PSTN side session-agent

```
session-agent
       hostname                                10.232.50.173
       ip-address                              10.232.50.173
       port                                    5060
       state                                   enabled
       app-protocol                            SIP
       app-type
       transport-method                        UDP
       realm-id                                PSTN
       egress-realm-id
       description
       carriers
       allow-next-hop-lp                       enabled
       associated-agents
       constraints                             disabled
    ping-method                                OPTIONS
    ping-interval                              30
    ping-send-mode                             keep-alive
    ping-all-addresses                         disabled
    ping-in-service-response-codes
```

SBC side first session-agent

```
session-agent
       hostname                                10.232.50.81
       ip-address                              10.232.50.81
       port                                    5060
       state                                   enabled
       app-protocol                            SIP
       app-type
       transport-method                        UDP
       realm-id                                CUCMSBC
       egress-realm-id
       description
       carriers
       allow-next-hop-lp                       enabled
       associated-agents
    ping-method                                OPTIONS
    ping-interval                              30
    ping-send-mode                             keep-alive
    ping-all-addresses                         disabled
    ping-in-service-response-codes
```

SBC side second session-agent

```
session-agent
        hostname                                10.232.50.87
        ip-address                              10.232.50.87
        port                                    5060
        state                                   enabled
        app-protocol                            SIP
        app-type
        transport-method                        UDP
        realm-id                                CUCMSBC
        egress-realm-id
        description
        carriers
        allow-next-hop-lp                       enabled
        associated-agents
        constraints                             disabled
```

```
    ping-method                                 OPTIONS
    ping-interval                               30
    ping-send-mode                              keep-alive
    ping-all-addresses                          disabled
    ping-in-service-response-codes
```

5.9. Configure session-group

Configure session group on OCSR with the below parameters. This is the load balancing functionality that allows traffic to be distributed evenly to each of the session agents (OCSBC's) configured in group. This also allows the SR to recurse if there is no response from the next hop.

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

- Group-name
- Strategy (options include Hunt, RoundRobin, LeastBusy, LowSusRate and PropDist) We have selected the option RoundRobin in our example as shown below.
- Dest (for multiple destinations, surround the entries with ", with a space in between… i.e "10.232.50.81 10.232.50.87"

```
session-group
        group-name                              SBCgroup
        description
        state                                   enabled
        app-protocol                            SIP
        strategy                                RoundRobin
        dest                                    10.232.50.87
                                                10.232.50.81
        trunk-group
        sag-recursion                           disabled
        stop-sag-recurse                        401,407
        sip-recursion-policy
```

5.10. Configure local-policy

Local policy config allows for the SBC to route calls from one end of the network to the other based on routing criteria. Configure the local-policy with the parameters given below.

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

- From-address
- To-address
- Source-realm

Policy-attribute

- Next-hop
- realm

To route the calls from PSTN side to SBC side, Use the below local–policy.

```
local-policy
        from-address                            *
        to-address                              *
        source-realm                            PSTN
        description
        activate-time
        deactivate-time
        state                                   enabled
        parallel-forking                        disabled
        policy-priority                         none
        policy-attribute
                next-hop                                sag:SBCgroup
                realm                                   CUCMSBC
                action                                  replace-uri
                terminate-recursion                     disabled
```

To route the calls from SBC side to PSTN side, Use the below local–policy.

```
local-policy
        from-address                            *
        to-address                              *
        source-realm                            CUCMSBC
        description
        activate-time
        deactivate-time
        state                                   enabled
        parallel-forking                        disabled
        policy-priority                         none
        policy-attribute
                next-hop                                10.232.50.173
                realm                                   PSTN
                action                                  replace-uri
                terminate-recursion                     disabled
                carrier
```

5.11. Save and Activate

At this point, the OCSR configuration is completed. Back out of configuration mode, and perform a save/activate.

```
CUCMESR# save-config
checking configuration
--------------------------------------------------------------------------------
Results of config verification:
   1 configuration warning
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'.
CUCMESR# activate-config
Activate-Config received, processing.
activate-config waiting 120000 ms for request to finish
Request to 'ACTIVATE-CONFIG' has Finished,
Activate Complete
CUCMESR#
```

6. Security Configuration

This section describes how to configure the ESR for both TLS communication with SBC platform instead of normal UDP/TCP traffic that we have configured in the previous section in case the customer is looking for secure communication. Oracle ESR allows TLS connections for SIP traffic. This setup requires a certificate signed by one of the trusted Certificate Authorities.

Please follow the below steps in section 6 and section 7 for the TLS communication of Oracle ESR with SBC side.

6.1. Certificate Records

"Certificate-records" are configuration elements on Oracle ESR which captures 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 ESR configuration.

ACLI Path: config t→security→certificate-record

We need to create 2 certificate records. They are as follows:

- ESR Certificate (end-entity certificate)
- Any authorized Root certificate (Ex. GoDaddy, DigiCert etc)

6.2. ESR End Entity Certificate

The ESR end entity certificate is what is presented to ESR platform after signed by your CA authority. The certificate must include a common name.

For this, we are using an fqdn as the common name.
• Common name: (Solutionslab.CGBUlabs.com)

To Configure the certificate record:
• Go to the ACLI path given above and configure the SBC certificate as shown below:

```
CUCMESR(certificate-record)# show
certificate-record
        name                                Testing
        country                             US
        state                               california
        locality                            RedwoodCity
        organization                        Orcalecorp
        unit                                OracleCGBU-LABS
        common-name                         Solutionslab.CGBUlabs.com
        key-size                            2048
        alternate-name
        trusted                             enabled
        key-usage-list                      digitalSignature
                                            keyEncipherment
        extended-key-usage-list             serverAuth
        key-algor                           rsa
        digest-algor                        sha256
        ecdsa-key-size                      p256
        cert-status-profile-list
        options
        last-modified-by                    admin@10.191.241.38
        last-modified-date                  2024-09-18 05:09:34

CUCMESR(certificate-record)#
```

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

Save and activate is required to save the created certificate records.

6.3. Generate Certificate Signing Request

Now that the ESR's certificate has been configured, create a certificate signing request for the ESR's end entity only.

This is not required for any of the Root CA certificates that have been created.

Type the below command in ESR CLI to generate a certificate signing request.

Generate-certificate-request <certificate-record-name>

```
CUCMESR# generate-certificate-request Testing
This certificate record already has a certificate-request
Do you want to re-generate certificate request [y/n]?: y
Generating Certificate Signing Request. This can take several minutes....

-----BEGIN CERTIFICATE REQUEST-----
MIIDBDCCAewCAQAwgYsxCzAJBgNVBAYTAlVTMRMwEQYDVQQIEwpjYWxpZm9ybmlh
MRQwEgYDVQQHEwtSZWR3b29kQ2l0eTETMBEGA1UEChMKT3JjYWxlY29ycDEYMBYG
A1UECxMPT3JhY2xlQ0dCVS1MQUJTMSIwIAYDVQQDExlTb2x1dGlvbnNsYWIuQ0dC
VWxhYnMuY29tMIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEA2pNr3sR4
TTSbtoNVw0UPgH4z66CD6+AbetXSeDIT2fqJ39sOw8PexLi+byFOIgXoy6fkKycE
hyEqXODj6gqWwATu9KMY5ay/Me2vnLr8Ws3Xeq9ZbBNO3tIlMidEhQJZjG0fOVsP
gvPJNWSN1HFjIXyIeKxlDzRhpNXOACLuIovLzhIMK4FgCAjjty8rW0NZ11zRTee0
CVgm0sLSY3RD+WU2AYa3QVg6j8FXYPpkBEfaWZnH5pg2qq7fv+q/Q0UD5t4lwuBz
KXYof4hOESIuY3NV2WS9ohAGH0J89+MtEOI7emNKrI8Rswf34F0jnH6VprOtiVB6
8oBk0+Sk6+w79QIDAQABoDMwMQYJKoZIhvcNAQkOMSQwIjALBgNVHQ8EBAMCBaAw
EwYDVR0lBAwwCgYIKwYBBQUHAwEwDQYJKoZIhvcNAQELBQADggEBAKcg6Uwo87/u
eQiM253So75YSheo216f3R1MaWFGkUmBOZrL2ww8Z6z3cmFOfyh19HZsTVLxGodQ
lcypAH/yIlseEIQOt8nhYVCpFC4Yitgj47YnIMqezXvrvUmmil7aVrUbzn10OGVf
OZcaAa2+gPzpdHHkADnnFq6MVjYVPwcDsGE5CFawllisYyZ5+6irSenymzo5pFQW
RGYZ1Q3LUQOQda2h+6FS/j4VebK96+rljI79gc0GvCNPoOI6B1viLWNiSwcLsgJH
tJiIK6QbPLAzcVtYvJTIQiKIR6Tq2+dGaKpwrKBHk/ZudmPAhajvmGw72tuA/ySv
GnCXllEyzrs=
-----END CERTIFICATE REQUEST-----

WARNING: Configuration changed, run "save-config" command.
CUCMESR#
```

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

6.4. Import Certificates to ESR

- Once certificate signing request has been completed – import the signed certificate to the ESR.
- Please note – all certificates including root certificates are required to be imported to the ESR.

  Import command is given below for reference.

  import-certificate [try-all|pkcs7|x509] [certificate-record file-name]

- Repeat these steps to import all the certificates into the ESR.
- **Once all certificates have been imported, issue save/activate.**

6.5. TLS Profile

TLS profile configuration on the ESR allows for specific certificates to be assigned and create the tls-profile as shown below.

ACLI Path: config t→security→tls-profile

```
tls-profile
        name                                ESRTLS
        end-entity-certificate              Testing
        trusted-ca-certificates             DigicertCA
        cipher-list                         ALL
        verify-depth                        10
        mutual-authenticate                 disabled
        tls-version                         tlsv12
        options                             ignore-root-ca=yes
        cert-status-check                   disabled
        cert-status-profile-list
        ignore-dead-responder               disabled
        allow-self-signed-cert              enabled
        last-modified-by                    admin@10.191.241.38
        last-modified-date                  2024-09-18 06:35:52
CUCMESR#
```

Assign this tls-profile to the sip-interface connecting to the SBC side as shown in the previous section (In our example, CUCMSBC side sip interface which has 10.232.50.83 IP) and change the following parameters.

ACLI Path: config t->session-router->sip-interface->sip-ports

- Port to 5061
- Transport protocol to TLS
- tls-profile as ESRTLS (as created above)

```
sip-interface
        state                                   enabled
        realm-id                                CUCMSBC
        description
        sip-port
                address                                 10.232.50.83
                port                                    5061
                transport-protocol                      TLS
                tls-profile                             ESRTLS
                allow-anonymous                         agents-only
                multi-home-addrs
                ims-aka-profile
```

7. SBC Side Configuration

As this application note mainly focusses on ESR configuration, the SBC configuration is out of scope of this document as the SBCs used may be different based on customer requirements. If the SBC side is Oracle SBC, the customer can use any of the latest application note in the Oracle Application Note website as a reference to configure the SBC side configuration.

https://www.oracle.com/technical-resources/documentation/acme-packet.html

We have tested this solution with Oracle ESR and Oracle SBC as our SBC side connecting to Cisco CUCM. We have made inbound calls from PSTN side to Cisco CUCM side, and we observed that the calls are routed from Oracle ESR to appropriate Oracle SBC based on session group configuration. The outbound calls from CUCM are also successful to PSTN side via Oracle SBC and Oracle ESR.

Appendix A

Below are the INVITE and 200 OK messages which are captured in Session Stateful ESR for both outgoing calls as well as for incoming calls.

Outgoing Call captured in ESR for Session Stateful with operation mode = session (FROM CUCM TO PSTN)

INVITE message received from SBC side to ESR

```
---------------------------------------------------------------------------
Oct 11 04:25:06.442 On [257:0]10.232.50.83:5060 received from 10.232.50.91:5060
INVITE sip:918449165202@10.232.50.83:5060 SIP/2.0
Via: SIP/2.0/UDP 10.232.50.91:5060;branch=z9hG4bK48nf5v3040ourjth4260.1
From: <sip:17812032807@10.232.50.72>;tag=47357~a3dc97f3-9718-4f95-b19c-b0b976fa7dc0-16798126
To: <sip:918449165202@10.232.50.140>
Date: Fri, 11 Oct 2024 04:25:06 GMT
Call-ID: c99c8280-1f01a58b-3fd7-4832e80a@10.232.50.72
Supported: timer,resource-priority,replaces
Supported: X-cisco-srtp-fallback,X-cisco-original-called
Min-SE: 1800
User-Agent: Cisco-CUCM14.0
Allow: INVITE, OPTIONS, INFO, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY
CSeq: 101 INVITE
Expires: 180
Allow-Events: presence
Call-Info: <urn:x-cisco-remotecc:callinfo>;x-cisco-video-traffic-class=DESKTOP
Session-ID: a3451c5fb455f6bc9c404d55faa47356;remote=00000000000000000000000000000000
Session-Expires: 1800
P-Asserted-Identity: <sip:17812032807@10.232.50.72>
Contact: <sip:17812032807@10.232.50.91:5060;transport=udp>
Max-Forwards: 68
Content-Length: 0

-----------------------------------------
```

INVITE message sent from ESR side to PSTN side

```
---------------------------------------------------------------------------
Oct 11 04:25:06.447 On 10.232.50.86:8194 sent to 10.232.50.173:5060
INVITE sip:918449165202@10.232.50.173:5060 SIP/2.0
Via: SIP/2.0/TCP 10.232.50.86:5060;branch=z9hG4bKuhkhu0101g64lpiordr0.1
Via: SIP/2.0/UDP 10.232.50.91:5060;branch=z9hG4bK48nf5v3040ourjth4260.1
From: <sip:17812032807@10.232.50.72>;tag=47357~a3dc97f3-9718-4f95-b19c-b0b976fa7dc0-16798126
```

To: <sip:918449165202@10.232.50.140>
Date: Fri, 11 Oct 2024 04:25:06 GMT
Call-ID: c99c8280-1f01a58b-3fd7-4832e80a@10.232.50.72
Supported: timer,resource-priority,replaces
Supported: X-cisco-srtp-fallback,X-cisco-original-called
Min-SE: 1800
User-Agent: Cisco-CUCM14.0
Allow: INVITE, OPTIONS, INFO, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY
CSeq: 101 INVITE
Expires: 180
Allow-Events: presence
Call-Info: <urn:x-cisco-remotecc:callinfo>;x-cisco-video-traffic-class=DESKTOP
Session-ID: a3451c5fb455f6bc9c404d55faa47356;remote=00000000000000000000000000000000
Session-Expires: 1800
P-Asserted-Identity: <sip:17812032807@10.232.50.72>
Contact: <sip:17812032807@10.232.50.91:5060;transport=udp>
Max-Forwards: 67
Content-Length: 0
Record-Route: <sip:SDpmfs1+ogna4jnpemnvufqu5lnmh616a-
vfoeed9t6nfn60006061@10.232.50.86:5060;lr;transport=tcp>
Record-Route: <sip:SDi8254+ogna4jnpemnvufqu5lnmh616a-
t0net67vf5v7ddccbl61@10.232.50.83:5060;lr;transport=udp>

---

200 OK message received from PSTN side to ESR

Oct 11 04:25:15.957 On 10.232.50.86:8194 received from 10.232.50.173:5060
SIP/2.0 200 OK
Via: SIP/2.0/TCP 10.232.50.86:5060;branch=z9hG4bKuhkhu0101g64lpiordr0.1
Via: SIP/2.0/UDP 10.232.50.91:5060;branch=z9hG4bK48nf5v3040ourjth4260.1
From: <sip:17812032807@10.232.50.72>;tag=47357~a3dc97f3-9718-4f95-b19c-b0b976fa7dc0-16798126
To: <sip:918449165202@10.232.50.140>;tag=1976812062-1728620822513
Call-ID: c99c8280-1f01a58b-3fd7-4832e80a@10.232.50.72
CSeq: 101 INVITE
Record-Route: <sip:SDpmfs1+ogna4jnpemnvufqu5lnmh616a-
vfoeed9t6nfn60006061@10.232.50.86:5060;lr;transport=tcp>
Record-Route: <sip:SDi8254+ogna4jnpemnvufqu5lnmh616a-
t0net67vf5v7ddccbl61@10.232.50.83:5060;lr;transport=udp>
Supported:
Contact: <sip:10.232.50.173:5060;transport=tcp>
Allow: ACK,BYE,CANCEL,INFO,INVITE,OPTIONS,PRACK,REFER,NOTIFY
Accept: application/media_control+xml,application/sdp
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 285

v=0
o=BroadWorks 21179170 1 IN IP4 10.232.50.173
s=-
c=IN IP4 10.232.50.173
t=0 0
m=audio 10104 RTP/AVP 18 0 8 101

a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
a=sendrecv
a=ptime:20
---

200 OK message sent from ESR to SBC side

Oct 11 04:25:15.958 On [257:0]10.232.50.83:5060 sent to 10.232.50.91:5060
SIP/2.0 200 OK
Via: SIP/2.0/UDP 10.232.50.91:5060;branch=z9hG4bK48nf5v3040ourjth4260.1
From: <sip:17812032807@10.232.50.72>;tag=47357~a3dc97f3-9718-4f95-b19c-b0b976fa7dc0-16798126
To: <sip:918449165202@10.232.50.140>;tag=1976812062-1728620822513
Call-ID: c99c8280-1f01a58b-3fd7-4832e80a@10.232.50.72
CSeq: 101 INVITE
Record-Route: <sip:SDpmfs1+ogna4jnpemnvufqu5lnmh616a-
vfoeed9t6nfn60006061@10.232.50.86:5060;lr;transport=tcp>
Record-Route: <sip:SDi8254+ogna4jnpemnvufqu5lnmh616a-
t0net67vf5v7ddccbl61@10.232.50.83:5060;lr;transport=udp>
Supported:
Contact: <sip:10.232.50.173:5060;transport=tcp>
Allow: ACK,BYE,CANCEL,INFO,INVITE,OPTIONS,PRACK,REFER,NOTIFY
Accept: application/media_control+xml,application/sdp
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 285

v=0
o=BroadWorks 21179170 1 IN IP4 10.232.50.173
s=-
c=IN IP4 10.232.50.173
t=0 0
m=audio 10104 RTP/AVP 18 0 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
a=sendrecv
a=ptime:20

Incoming Call captured in ESR for Session Stateful with operation mode = session (FROM PSTN to CUCM)

INVITE message received from PSTN side to ESR

Oct 11 05:04:27.148 On [257:0]10.232.50.86:5060 received from 10.232.50.173:5060
INVITE sip:17812032807@10.232.50.86:5060;user=phone SIP/2.0
Via: SIP/2.0/UDP 10.232.50.173:5060;branch=z9hG4bKp1negj00a00c6pecqr60.1
From: <sip:918449165202@63.77.76.250;user=phone>;tag=1511938313-1728623180561-
To: "ORACLESOLLAB ."<sip:17812032807@138.3.226.61;user=phone>
Call-ID: BW050620561111024-619422369@63.77.76.250
CSeq: 1023163785 INVITE
Contact: <sip:10.232.50.173:5060;transport=udp>
Allow: ACK,BYE,CANCEL,INFO,INVITE,OPTIONS,PRACK,REFER,NOTIFY
Recv-Info: x-broadworks-client-session-info
Accept: application/media_control+xml,application/sdp,multipart/mixed
Supported:
Max-Forwards: 68
Content-Type: application/sdp
Content-Length: 309

v=0
o=BroadWorks 21183271 1 IN IP4 10.232.50.173
s=-
c=IN IP4 10.232.50.173
t=0 0
m=audio 10106 RTP/AVP 18 0 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
a=ptime:20
a=sqn: 0
a=cdsc:1 image udptl t38

INVITE message sent from ESR to SBC side

Oct 11 05:04:27.150 On 10.232.50.83:8196 sent to 10.232.50.81:5060
INVITE sip:17812032807@10.232.50.81:5060;user=phone SIP/2.0
Via: SIP/2.0/TCP 10.232.50.83:5060;branch=z9hG4bKeud3t310b8oh58enjpc0.1
Via: SIP/2.0/UDP 10.232.50.173:5060;branch=z9hG4bKp1negj00a00c6pecqr60.1
From: <sip:918449165202@63.77.76.250;user=phone>;tag=1511938313-1728623180561-
To: "ORACLESOLLAB ."<sip:17812032807@138.3.226.61;user=phone>
Call-ID: BW050620561111024-619422369@63.77.76.250
CSeq: 1023163785 INVITE
Contact: <sip:10.232.50.173:5060;transport=udp>
Allow: ACK,BYE,CANCEL,INFO,INVITE,OPTIONS,PRACK,REFER,NOTIFY
Recv-Info: x-broadworks-client-session-info
Accept: application/media_control+xml,application/sdp,multipart/mixed
Supported:
Max-Forwards: 67

Content-Type: application/sdp
Content-Length: 309
Record-Route: <sip:SD3tkm6+ogna4jnpemnvufqu5lnmh616a-t0net6ftf2v7d000c0f0@10.232.50.83:5060;lr;transport=tcp>
Record-Route: <sip:SDgjok0+ogna4jnpemnvufqu5lnmh616a-vfoeedd0fge6d@10.232.50.86:5060;lr;transport=udp>

v=0
o=BroadWorks 21183271 1 IN IP4 10.232.50.173
s=-
c=IN IP4 10.232.50.173
t=0 0
m=audio 10106 RTP/AVP 18 0 8 101
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15
a=ptime:20
a=sqn: 0
a=cdsc:1 image udptl t38
---

200 OK message received from SBC side to ESR

Oct 11 05:04:30.490 On 10.232.50.83:8196 received from 10.232.50.81:5060
SIP/2.0 200 OK
Via: SIP/2.0/TCP 10.232.50.83:5060;branch=z9hG4bKeud3t310b8oh58enjpc0.1
Via: SIP/2.0/UDP 10.232.50.173:5060;branch=z9hG4bKp1negj00a00c6pecqr60.1
From: <sip:918449165202@63.77.76.250;user=phone>;tag=1511938313-1728623180561-
To: "ORACLESOLLAB ."<sip:17812032807@138.3.226.61;user=phone>;tag=47771~a3dc97f3-9718-4f95-b19c-b0b976fa7dc0-16798127
Call-ID: BW050620561111024-619422369@63.77.76.250
CSeq: 1023163785 INVITE
Record-Route: <sip:SD3tkm6+ogna4jnpemnvufqu5lnmh616a-t0net6ftf2v7d000c0f0@10.232.50.83:5060;lr;transport=tcp>
Record-Route: <sip:SDgjok0+ogna4jnpemnvufqu5lnmh616a-vfoeedd0fge6d@10.232.50.86:5060;lr;transport=udp>
Date: Fri, 11 Oct 2024 05:04:27 GMT
Allow: INVITE, OPTIONS, INFO, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY
Allow-Events: presence
Supported: replaces
Supported: X-cisco-srtp-fallback
Supported: Geolocation
Server: Cisco-CUCM14.0
Call-Info: <urn:x-cisco-remotecc:callinfo>;x-cisco-video-traffic-class=DESKTOP
Session-ID: a3451c5fb455f6bc9c404d55faa47772;remote=4428bbeea630816fd1135aa21ab47771
P-Preferred-Identity: <sip:17812032807@10.232.50.72>
Contact: <sip:17812032807@10.232.50.81:5060;transport=tcp>
Content-Type: application/sdp
Content-Length: 224

v=0
o=CiscoSystemsCCM-SIP 47771 1 IN IP4 10.232.50.81
s=SIP Call
c=IN IP4 10.232.50.81
b=TIAS:64000
b=AS:80
t=0 0
m=audio 10052 RTP/AVP 0 101
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event
a=fmtp:101 0-15
---

200 OK message sent from ESR to PSTN side

Oct 11 05:04:30.491 On [257:0]10.232.50.86:5060 sent to 10.232.50.173:5060
SIP/2.0 200 OK
Via: SIP/2.0/UDP 10.232.50.173:5060;branch=z9hG4bKp1negj00a00c6pecqr60.1
From: <sip:918449165202@63.77.76.250;user=phone>;tag=1511938313-1728623180561-
To: "ORACLESOLLAB ."<sip:17812032807@138.3.226.61;user=phone>;tag=47771~a3dc97f3-9718-4f95-b19c-b0b976fa7dc0-16798127
Call-ID: BW050620561111024-619422369@63.77.76.250
CSeq: 1023163785 INVITE
Record-Route: <sip:SD3tkm6+ogna4jnpemnvufqu5lnmh616a-t0net6ftf2v7d000c0f0@10.232.50.83:5060;lr;transport=tcp>
Record-Route: <sip:SDgjok0+ogna4jnpemnvufqu5lnmh616a-vfoeedd0fge6d@10.232.50.86:5060;lr;transport=udp>
Date: Fri, 11 Oct 2024 05:04:27 GMT
Allow: INVITE, OPTIONS, INFO, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY
Allow-Events: presence
Supported: replaces
Supported: X-cisco-srtp-fallback
Supported: Geolocation
Server: Cisco-CUCM14.0
Call-Info: <urn:x-cisco-remotecc:callinfo>;x-cisco-video-traffic-class=DESKTOP
Session-ID: a3451c5fb455f6bc9c404d55faa47772;remote=4428bbeea630816fd1135aa21ab47771
P-Preferred-Identity: <sip:17812032807@10.232.50.72>
Contact: <sip:17812032807@10.232.50.81:5060;transport=tcp>
Content-Type: application/sdp
Content-Length: 224

v=0
o=CiscoSystemsCCM-SIP 47771 1 IN IP4 10.232.50.81
s=SIP Call
c=IN IP4 10.232.50.81
b=TIAS:64000
b=AS:80
t=0 0
m=audio 10052 RTP/AVP 0 101
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-15

Oracle Corporation, World Headquarters
2300 Oracle Way
Austin, TX 78741, USA

Worldwide Inquiries
Phone: +1.650.506.7000 or
Phone: +1.800.392.2999

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