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Oracle Enterprise Session Border Controller and CUCM 10.5 with Bell Canada Enterprise SIP Trunk

Technical Application Note

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Intended Audience

This document is intended for use by Oracle Systems Engineers, third party Systems Integrators, and end users of the Oracle Enterprise Session Border Controller (E-SBC). It assumes that the reader is familiar with basic operations of the Oracle Enterprise Session Border Controller.

Document Overview

Cisco Call Manager offers the ability to connect to Internet telephony service providers (ITSP) using an IP-based SIP trunk. This reduces the cost and complexity of extending an enterprise's telephony system outside its network borders. Oracle Enterprise Session Border Controllers (E-SBCs) play an important role in SIP trunking as they are used by many ITSPs and some enterprises as part of their SIP trunking infrastructure.

This application note has been prepared as a means of ensuring that SIP trunking between Cisco Call Manager, Oracle E-SBCs and Bell Canada IP Trunking services are configured in the optimal manner.

Introduction

Audience

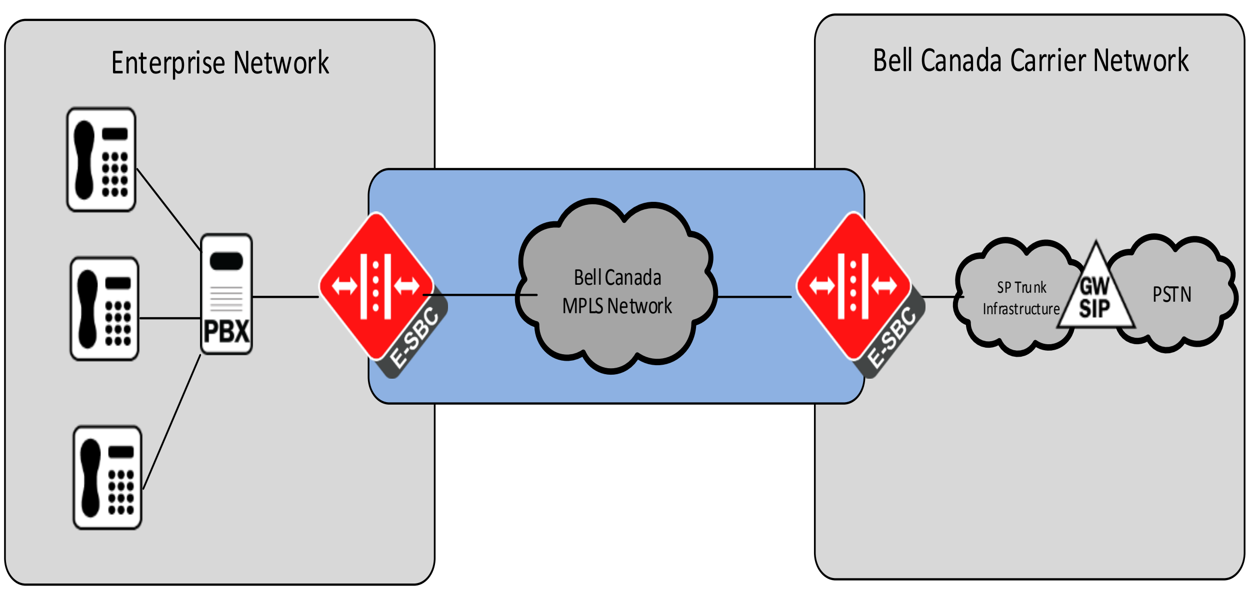
This is a technical document intended for telecommunications engineers with the purpose of configuring the Oracle Enterprise Session Border Controller and CUCM. There will be steps that require navigating the Command Line Interface (ACLI). Understanding the basic concepts of TCP/UDP, IP/Routing, SIP/RTP, TLS and SRTP are also necessary to complete the configuration and for troubleshooting, if necessary.

Requirements

- Fully installed and configured Cisco Call Manager 10.5
- Oracle Enterprise Session Border Controller is running ECZ7.3.0 Patch 2 (Build 75)
    - Note: the configuration running on the E-SBC is backward/forward compatible with any release in the 7.3.0 stream.
- Bell Canada trunk based customers with dedicated data connectivity to Bell Canada.

Architecture

The following reference architecture shows a logical view of the connectivity between CM and the E-SBC.



Phase 1: Configuring the Oracle Enterprise Session Border Controller

In this section we describe the steps for configuring an Oracle Enterprise Session Border Controller, formally known as an Acme Packet Net-Net Enterprise Session Director, for use with CUCM Server in a SIP trunking scenario.

In Scope

The following guide configuring the Oracle E-SBC assumes that this is a newly deployed device dedicated to a single customer. If a service provider currently has the E-SBC deployed then please see the ACLI Configuration Guide on http://docs.oracle.com/cd/E56581_01/index.htm for a better understanding of the Command Line Interface (CLI).

Note that Oracle offers several models of E-SBC. This document covers the setup for the E-SBC platform running ECZ7.3.0 or later. If instructions are needed for other Oracle E-SBC models, please contact your Oracle representative.

Out of Scope

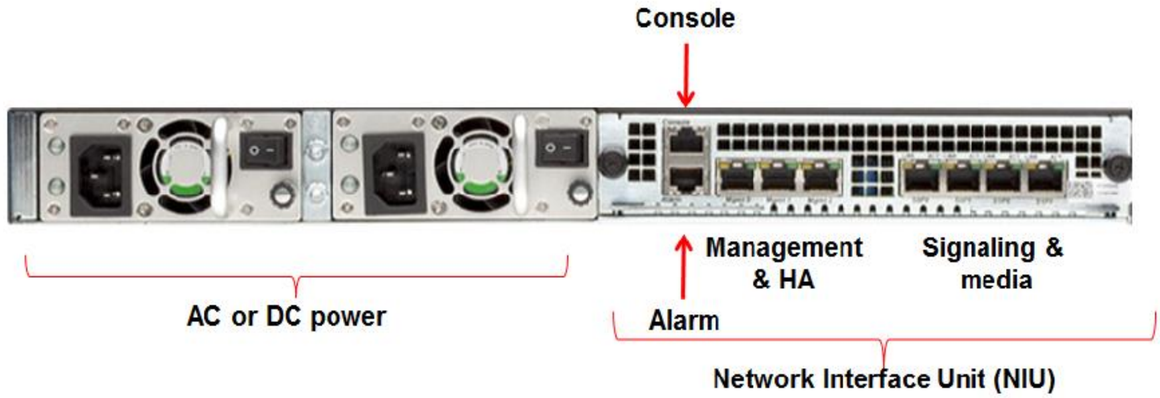
- Configuration of Network management including SNMP and RADIUS

What will you need

- Hypervisor with console connectivity through the hypervisor
- Terminal emulation application such as PuTTY or HyperTerm
- Passwords for the User and Super user modes on the Oracle E-SBC
- IP address to be assigned to management interface (Wancom0) of the E-SBC - the Wancom0 management interface must be connected and configured to a management network separate from the service interfaces. Otherwise the E-SBC is subject to ARP overlap issues, loss of system access when the network is down, and compromising DDoS protection. Oracle does not support E-SBC configurations with management and media/service interfaces on the same subnet.
- IP address of CUCM external facing NIC
- IP addresses to be used for the E-SBC internal and external facing ports (Service Interfaces)
- IP address of the next hop gateway in the service provider network

Configuring the E-SBC

Once the Oracle SBC is racked and the power cable connected, you are ready to set up physical network connectivity.



Plug the slot 0 port 0 (s0p0) interface into your outside (Bell Canada next-hop facing) network and the slot 1 port 1 (s1p1) interface into your inside (CUCM server-facing) network. Once connected, you are ready to power on and perform the following steps.

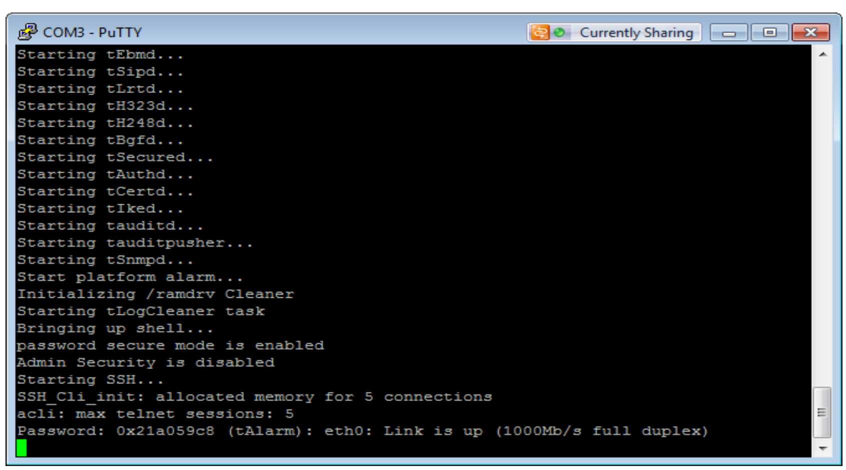
All commands are in bold, such as **configure terminal**; parameters in bold red such as SBC1 are parameters which are specific to an individual deployment. **Note:** The ACLI is case sensitive.

Establish the serial connection and logging in the SBC

Confirm the SBC is powered off and 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 SBC and confirm that you see the following output from the bootup sequence.



Enter the following commands to login to the E-SBC and move to the configuration mode. Note that the default E-SBC password is “**acme**” and the default super user password is “**packet**”.

```
Password: acme
SBC1> enable
Password: packet
SBC1# configure terminal
SBC1 (configure)#
```

You are now in the global configuration mode.

Initial Configuration – Assigning the management Interface an IP address

To assign an IP address, one has to configure the bootparams on the E-SBC by going to

```
SBC1#configure terminal --- >bootparams

Once you type “bootparam” you have to use “carriage return” key to navigate down

A reboot is required if changes are made to the existing bootparams

SBC1#(configure)bootparam
'.' = clear field;          '-' = go to previous field;          q = quit boot
device                       : eth0
processor number             : 0
host name                    : acmesystem
file name                    : /boot/nnECZ730m1p1.32.bz --- >location where the
                               software is loaded on the SBC
inet on ethernet (e)         : 192.168.1.22:ffffff80 --- > This is the ip address of the
                               management interface of the SBC, type the IP address and
                               mask in hex
inet on backplane (b)        :
host inet (h)                :
gateway inet (g)             : 192.168.1.1 -> gateway address here
user (u)                     : vxftp
ftp password (pw) (blank = use rsh): vxftp flags (f)      :
target name (tn)             : SBC1 -> ACLI prompt name & HA peer name
startup script (s)           :
other (o)                    :
```

Configuring the E-SBC

The following section walks you through configuring the Oracle E-SBC. It is outside the scope of this document to include all of the configuration elements as it will differ in every deployment.

High Availability

For additional information on High Availability please see the enterprise SBC documentation for more information (http://www.oracle.com/technetwork/indexes/documentation/oracle-comms-acme-packet-2046907.html). Interfaces wancom1 and 2 need to be added to facilitate HA communication between the two HA pairs.

```
phy-interface
    name                    wancom1
    operation-type          Control
    port                    1
    slot                    0
    virtual-mac
    admin-state             enabled
    auto-negotiation        enabled
    duplex-mode             FULL
    speed                   100
    wancom-health-score     8
    overload-protection     disabled
    mac-filtering           disabled
    last-modified-by        admin@172.18.0.139
    last-modified-date      2016-07-21 18:12:08
phy-interface
    name                    wancom2
    operation-type          Control
    port                    2
    slot                    0
    virtual-mac
    admin-state             enabled
    auto-negotiation        enabled
    duplex-mode             FULL
    speed                   100
    wancom-health-score     9
    overload-protection     disabled
    mac-filtering           disabled
    last-modified-by        admin@172.18.0.139
    last-modified-date      2016-07-21 18:12:15
network-interface
    name                    wancom1
    sub-port-id             0
    description             HA_HEARTBEAT1
```

```
        hostname
        ip-address
        pri-utility-addr              169.254.1.1
        sec-utility-addr              169.254.1.2
        netmask                       255.255.255.252
        gateway
        sec-gateway
        gw-heartbeat
            state                     disabled
            heartbeat                 0
            retry-count               0
            retry-timeout             1
            health-score              0
        dns-ip-primary
        dns-ip-backup1
        dns-ip-backup2
        dns-domain
        dns-timeout                   11
        hip-ip-list
        ftp-address
        icmp-address
        snmp-address
        telnet-address
        ssh-address
    network-interface
        name                          wancom2
        sub-port-id                   0
        description                   HA_HEARTBEAT2
        hostname
        ip-address
        pri-utility-addr              169.254.2.1
        sec-utility-addr              169.254.2.2
        netmask                       255.255.255.252
        gateway
        sec-gateway
        gw-heartbeat
            state                     disabled
            heartbeat                 0
            retry-count               0
            retry-timeout             1
            health-score              0
```

```
dns-ip-primary
dns-ip-backup1
dns-ip-backup2
dns-domain
dns-timeout                    11
hip-ip-list
ftp-address
icmp-address
snmp-address
telnet-address
ssh-address
```

```
redundancy-config
    becoming-standby-time            360000
    peer
        name                         SBC1
        type                         Primary
        destination
            address                  169.254.1.1:9090
            network-interface        wancom1:0
        destination
            address                  169.254.2.1:9090
            network-interface        wancom2:0
    peer
        name                         SBC2
        type                         Secondary
        destination
            address                  169.254.1.2:9090
            network-interface        wancom1:0
        destination
            address                  169.254.2.2:9090
            network-interface        wancom2:0
```

Bell Canada Trunk Authentication Handling

Bell Canada forces authentication challenges on INVITE's. The Oracle Communications Enterprise Session Boarder Controller supports auth challenges. The SBC will respond to any auth challenges for SIP methods that are configured. The auth configuration need to be configured on the inside realm session-agent(s).

```
session-agent
    hostname                10.232.50.89
    ip-address              10.232.50.89
```

```
        port                          5060
        state                         enabled
        app-protocol                  SIP
        app-type
        transport-method              StaticTCP
        realm-id                      cisco-inside
...
        monitoring-filters
        auth-attributes
            auth-realm                lab.ca
            username                  abc_123456_ca
            password                  ********
            in-dialog-methods         INVITE
        session-recording-server
        session-recording-required    disabled
```

Header manipulation rules required for the Bell Canada Trunk

The header rules Update_Request, Update_To, Update_From and Update_Contact update the host portion of the URI to the fqdn for Request-URI, To, From and Contact headers according to the Bell Canada Spec. Some other parameters like otg,user=phone and tgrp are also added to the URI portion of the To and From headers according to the Bell Canada trunk specification.

```
sip-manipulation
    name                          To_Bell
    description
    split-headers
    join-headers
    header-rule
        name                      Update_Request
        header-name               request-uri
        action                    manipulate
        comparison-type           case-sensitive
        msg-type                  any
        methods
        match-value
        new-value
        element-rule
            name                  Update_URI_Host
            parameter-name
            type                  uri-host
            action                replace
            match-val-type        any
            comparison-type       case-sensitive
            match-value
```

```
            new-value                    lab.ca
        element-rule
            name                         Rmv_User
            parameter-name                    user
            type                         uri-param
            action                       delete-element
            match-val-type                    any
            comparison-type                   case-sensitive
            match-value
            new-value
        element-rule
            name                         Rmv_Port
            parameter-name
            type                         uri-port
            action                       delete-element
            match-val-type                    any
            comparison-type                   case-sensitive
            match-value
            new-value
    header-rule
        name                         Update_To
        header-name                       To
        action                       manipulate
        comparison-type                   case-sensitive
        msg-type                     any
        methods
        match-value
        new-value
        element-rule
            name                         Update_URI_Host
            parameter-name
            type                         uri-host
            action                       replace
            match-val-type                    any
            comparison-type                   case-sensitive
            match-value
            new-value                    lab.ca
        element-rule
            name                         Rmv_User
            parameter-name                    user
            type                         uri-param
```

```
            action                          delete-element
            match-val-type                  any
            comparison-type                 case-sensitive
            match-value
            new-value
    header-rule
        name                        Update_From
        header-name                 from
        action                      manipulate
        comparison-type             case-sensitive
        msg-type                    any
        methods
        match-value
        new-value
        element-rule
            name                            Update_URI_Host
            parameter-name
            type                            uri-host
            action                          replace
            match-val-type                  any
            comparison-type                 case-sensitive
            match-value
            new-value                       lab.ca
        element-rule
            name                            Add_OTG_URI_Param
            parameter-name                  otg
            type                            uri-param
            action                          add
            match-val-type                  any
            comparison-type                 case-sensitive
            match-value
            new-value                       abc_ca
        element-rule
            name                            Rmv_UriParam_User
            parameter-name                  user
            type                            uri-param
            action                          add
            match-val-type                  any
            comparison-type                 case-sensitive
            match-value
            new-value                       phone
```

```
header-rule
    name                        Update_Contact
    header-name                 Contact
    action                      manipulate
    comparison-type             case-sensitive
    msg-type                    any
    methods                     INVITE
    match-value
    new-value
    element-rule
        name                    Add_tgrp
        parameter-name          tgrp
        type                    uri-user-param
        action                  add
        match-val-type          any
        comparison-type         case-sensitive
        match-value
        new-value               abc_ca
    element-rule
        name                    Add_trunk_context
        parameter-name          trunk-context
        type                    uri-user-param
        action                  add
        match-val-type          any
        comparison-type         case-sensitive
        match-value
        new-value               lab.ca
```

The header rule Max-Forwards_0 changes the Max-forwards header in the OPTIONS message to 0, and the

```
header-rule
        name                    Max_Forward_0
        header-name             Max-Forwards
        action                  manipulate
        comparison-type         pattern-rule
        msg-type                request
        methods                 OPTIONS
        match-value
        new-value               0
    header-rule
        name                    Rmv_UserAgent_Hdr
        header-name             user-agent
```

```
action                    delete
comparison-type           case-sensitive
msg-type                  any
methods
match-value
new-value
```

The below set of header rules store the Diversion header in case it is present, if not then a new one is added. This Diversion header contains the BTN/Pilot number and is the responsibility of the administrator to configure. The Update_Diversion header rule adds the uri-params otg and user to the Diversion header according to the Bell spec.

```
header-rule
    name                    save_Diversion
    header-name             Diversion
    action                  store
    comparison-type         case-sensitive
    msg-type                any
    methods
    match-value
    new-value
header-rule
    name                    Chk_Add_Diversion
    header-name             Diversion
    action                  manipulate
    comparison-type         boolean
    msg-type                any
    methods                 INVITE
    match-value             !$save_Diversion
    new-value        <sip:<613xxxxxxx>@domain-name;user=phone>
header-rule
    name                    Update_Diversion
    header-name             Diversion
    action                  manipulate
    comparison-type         case-sensitive
    msg-type                any
    methods
    match-value             !$save_Diversion
    new-value
    element-rule
        name                    Update_URI_Host
```

```
            parameter-name
            type                    uri-host
            action                  replace
            match-val-type          any
            comparison-type         case-sensitive
            match-value
            new-value               lab.ca
        element-rule
            name                    Add_OTG_URI_Param
            parameter-name          otg
            type                    uri-param
            action                  add
            match-val-type          any
            comparison-type         case-sensitive
            match-value
            new-value               abc_ca
        element-rule
            name                    Del_User_Param
            parameter-name          user
            type                    uri-param
            action                  add
            match-val-type          any
            comparison-type         case-sensitive
            match-value
            new-value
```

The below set of header rules update the host portion of the PAI header to a FQDN specified by Bell, also adding the uri-param otg and user=phone.

```
    header-rule
        name                    Update_PAI
        header-name             P-Asserted-Identity
        action                  manipulate
        comparison-type         case-sensitive
        msg-type                any
        methods
        match-value
        new-value
        element-rule
            name                    Update_URI_Host
```

```
          parameter-name
          type                   uri-host
          action                 replace
          match-val-type         any
          comparison-type        case-sensitive
          match-value
          new-value              lab.ca
     element-rule
          name                   Add_User_UriParam
          parameter-name         user
          type                   uri-param
          action                 add
          match-val-type         any
          comparison-type        case-sensitive
          match-value
          new-value              phone
     element-rule
          name                   Add_OTG_URI_Param
          parameter-name         otg
          type                   uri-param
          action                 add
          match-val-type         any
          comparison-type        case-sensitive
          match-value
          new-value              abc_ca
```

The below set of header-rules store the Referred-By header in case of call transfers using the REFER method. The Referred-By header is stored and then added back as the Diversion header on the INVITE sent out to the trunk, and then deleted so that it's not passed on to the trunk.

```
     header-rule
          name                   save_Referred_By
          header-name            Referred-by
          action                 store
          comparison-type        case-sensitive
          msg-type               request
          methods                INVITE
          match-value
          new-value
          element-rule
```

```
            name                    Fix_URI_Host
            parameter-name
            type                    uri-host
            action                  replace
            match-val-type          any
            comparison-type         case-sensitive
            match-value
            new-value               lab.ca
    header-rule
        name                    Referred_By_2_Div
        header-name             Diversion
        action                  add
        comparison-type         boolean
        msg-type                any
        methods                 INVITE
        match-value             $save_Referred_By
        new-value               $save_Referred_By.$0
        element-rule
            name                    Update_URI_Host
            parameter-name
            type                    uri-host
            action                  replace
            match-val-type          any
            comparison-type         case-sensitive
            match-value
            new-value               lab.ca
    header-rule
        name                    RmvReferredBy
        header-name             Referred-by
        action                  delete
        comparison-type         case-sensitive
        msg-type                any
        methods
        match-value
        new-value
```

The below two header rules delete the Call-Info and Cisco-GUID headers sent by CUCM which are not required on the trunk side.

```
    header-rule
        name                    Rmv_CallInfo
```

```
        header-name                     Call-Info
        action                      delete
        comparison-type                   case-sensitive
        msg-type                      any
        methods
        match-value
        new-value
    header-rule
        name                        Rmv_CiscoGUID
        header-name                     Cisco-Guid
        action                      delete
        comparison-type                   case-sensitive
        msg-type                      any
        methods
        match-value
        new-value
```

Webserver Configuration

A webserver is available on all Enterprise versions of Oracle E-SBCs. The Webserver can be used to provide tracing, configuration and dashboard info. For tracing info, 2 parts must be configured.

- The webserver must be enabled.
- Tracing filters must be applied.

```
web-server-config
    state                       enabled
    inactivity-timeout                5
    http-state                    enabled
    http-port                     80
    https-state                   disabled
    https-port                    443
    tls-profile
```

```
sip-monitoring
    match-any-filter                  disabled
    state                       enabled
    short-session-duration                0
    monitoring-filters                *
    trigger-window                  30
```

Phase 2 – Configuring the Cisco Unified Call Manager v10.5

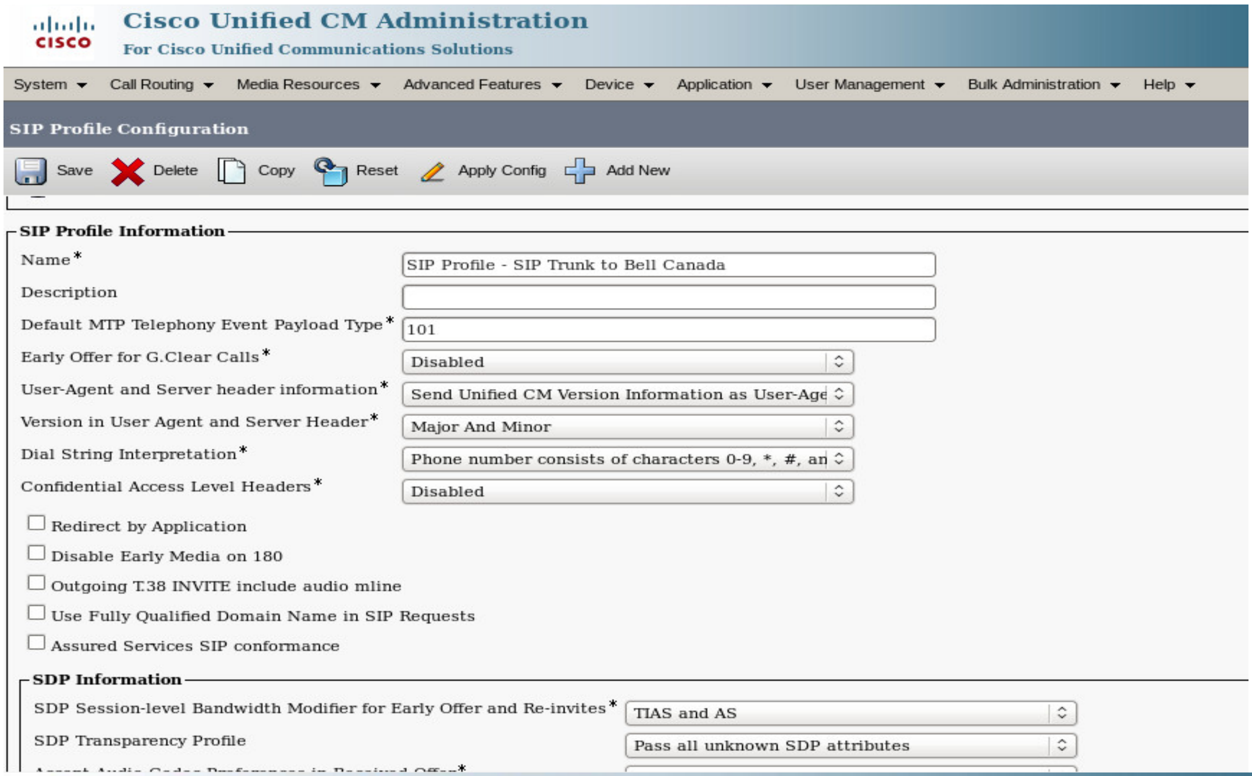
The enterprise will have a fully functioning CUCM v10.5 installed and deployed for this certification.

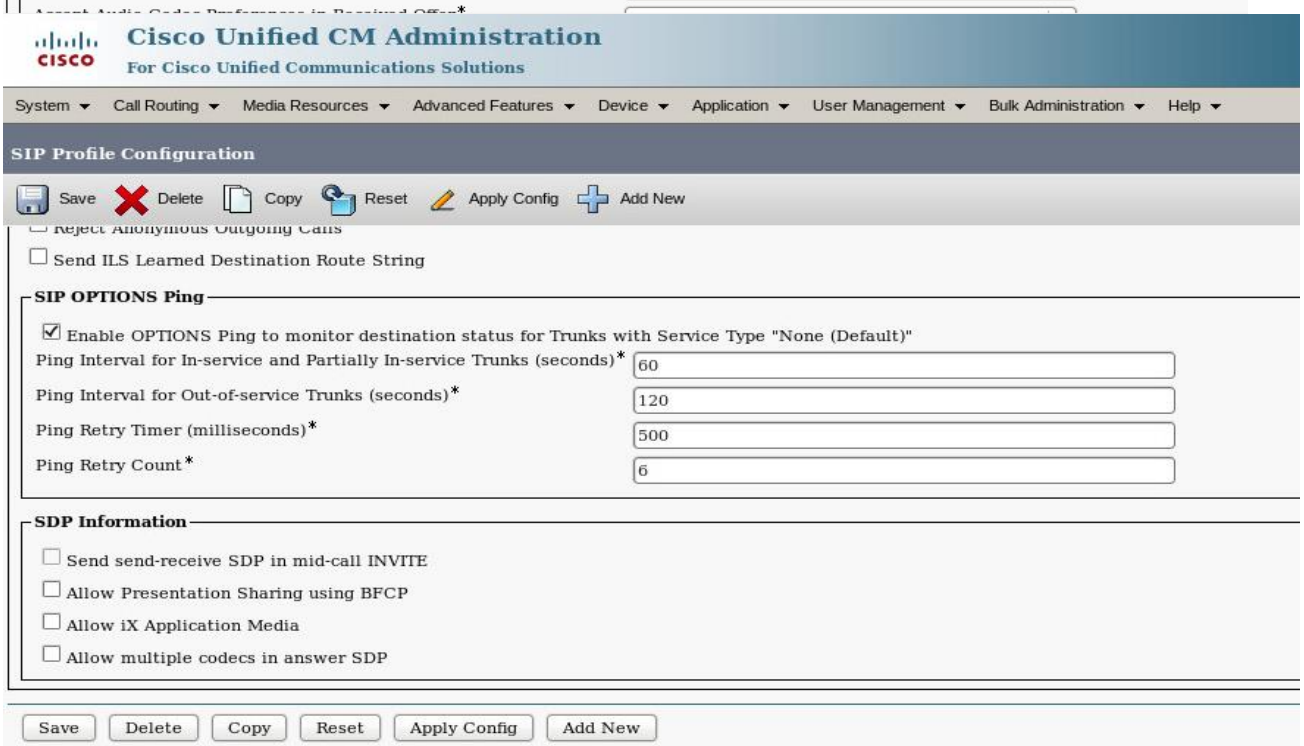
There are a few parts for configuring CUCM v10.5 to be configured and connected to operate with the Oracle E-SBC:

- Creating a SIP profile in CUCM and enabling OPTIONS ping to pro-actively monitor the SIP connectivity with the SBC
- Adding the SBC as a trunk to the CUCM infrastructure
- Creating a route pattern in the CUCM configuration to utilize the configured SBC trunk and route calls from CUCM to the SBC
- Additional configuration to add Directory Numbers, Phones to register to the CUCM and enabling a DHCP server for assigning IP addresses to Cisco phones

Creating a SIP Profile in CUCM

To add a new SIP Profile in CUCM, login into the CUCM console, use the Device --- > Device settings --- > SIP Profile menu path in CUCM. Click on Add new and following are the settings, rest can be default:

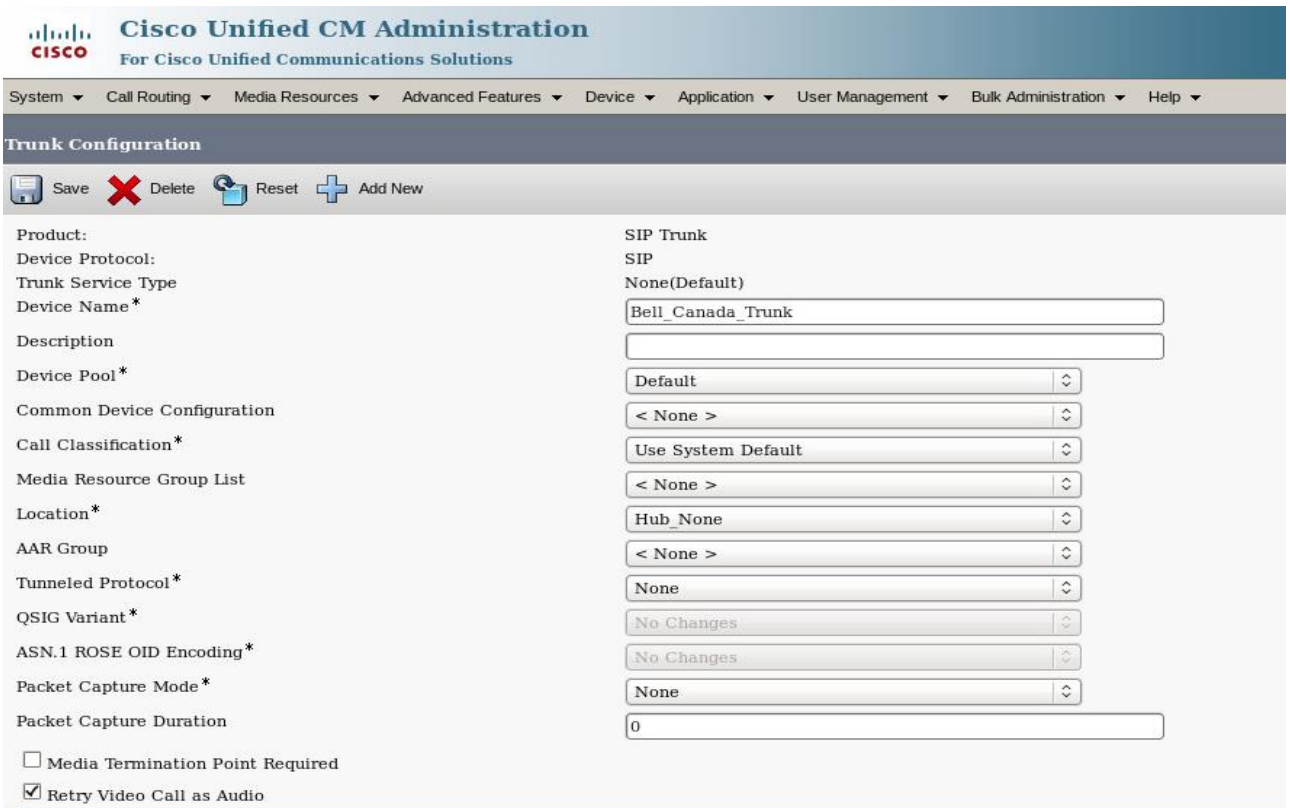


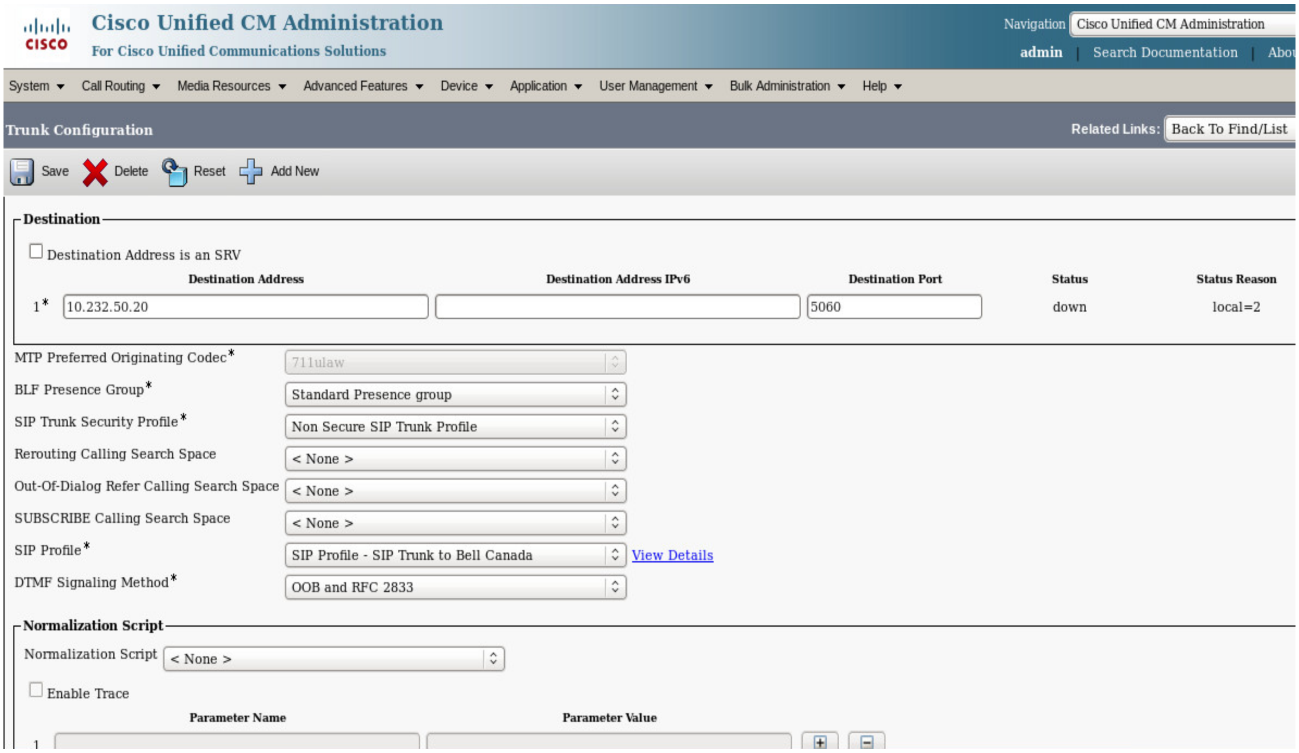


Adding the E-SBC as a trunk in CUCM

The following process details the steps to add the SBC as a trunk in CUCM Web UI

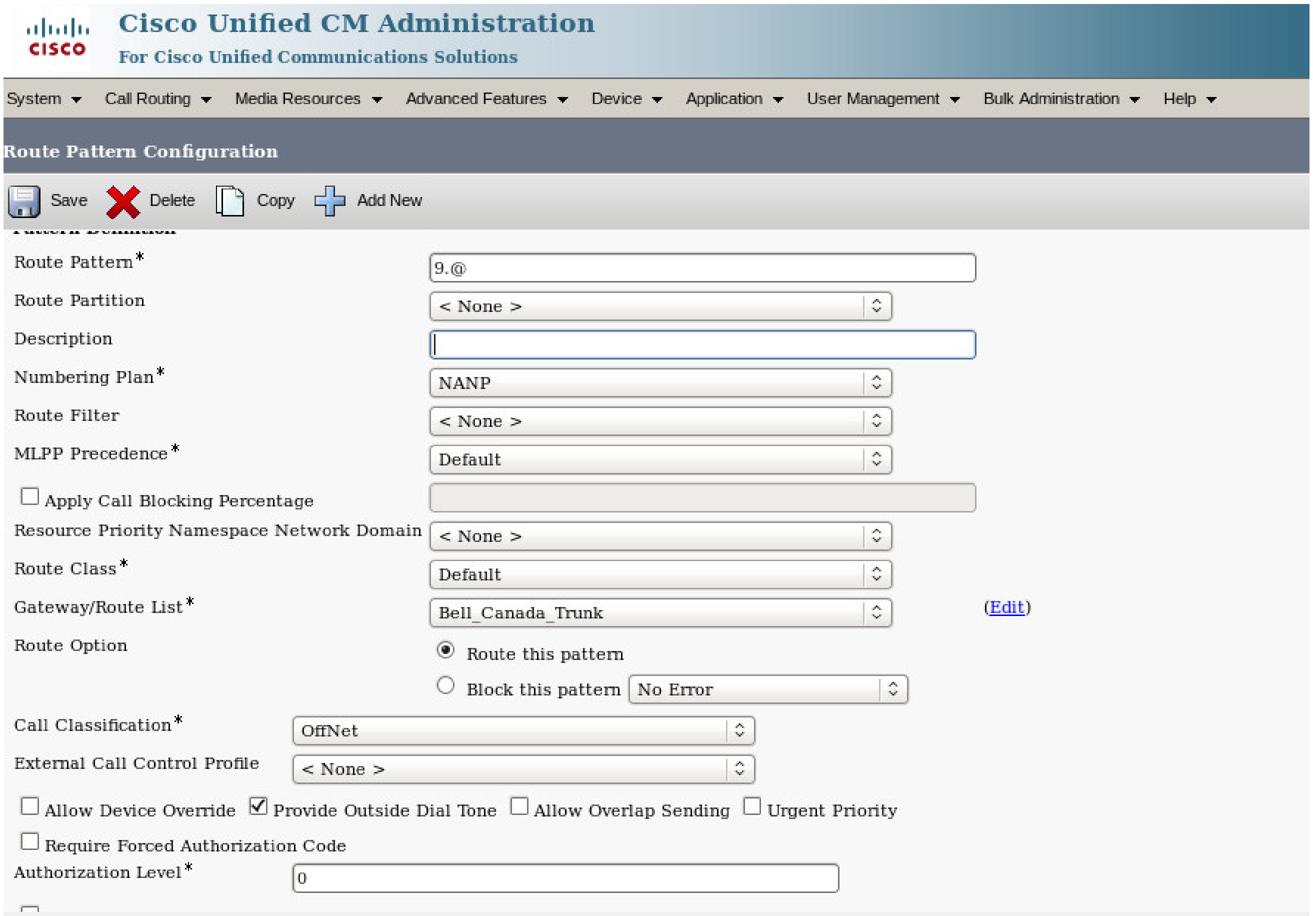
1. On the CUCM administration console (UI), maneuver to **Device --- > Trunk**. Click on New
2. Select SIP Trunk from the Trunk Type drop down menu and protocol will also be SIP
3. Let default of none be selected on the Trunk service type
4. Following 2 screenshots are the other settings to be configured on the Trunk, all other parameters set to default

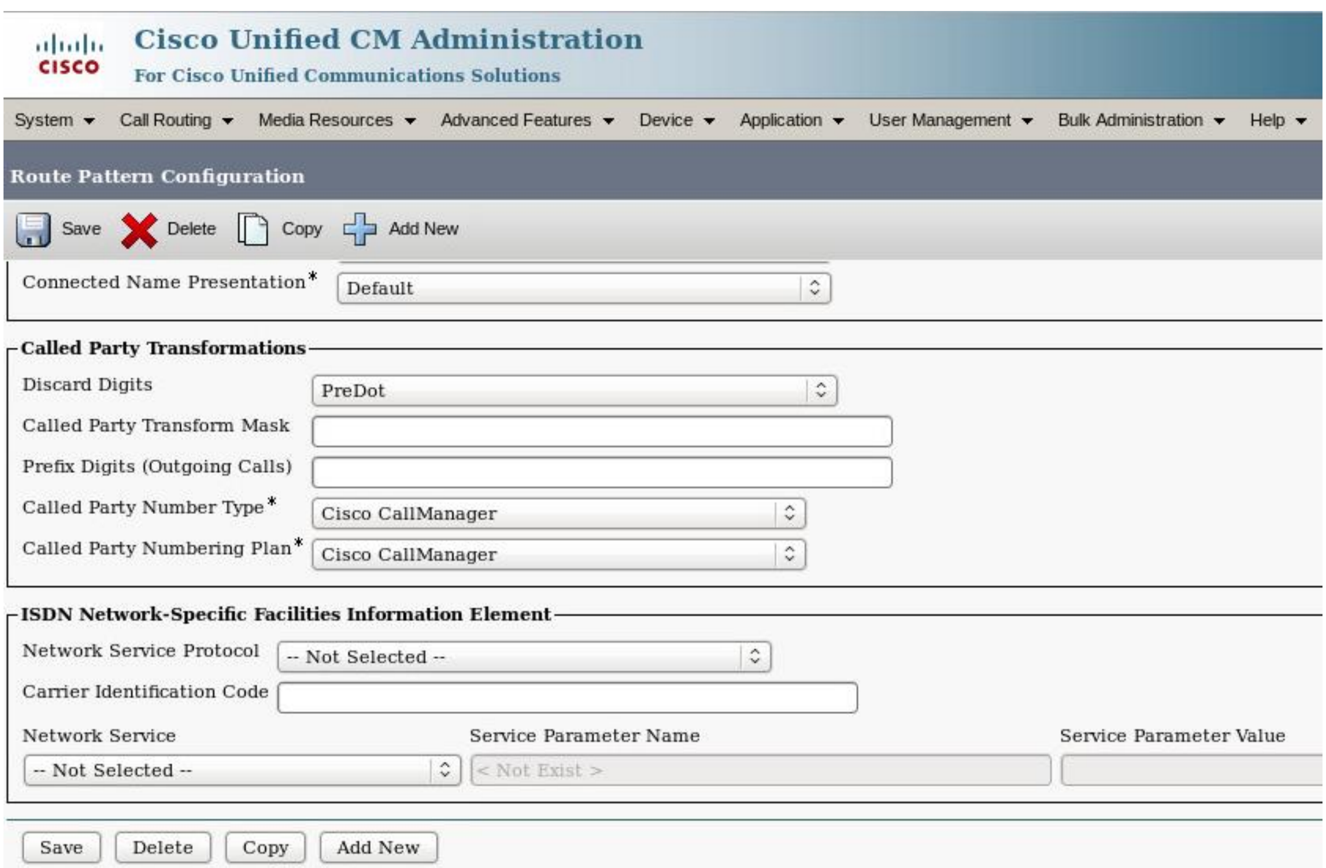




Creating a route Pattern in CUCM

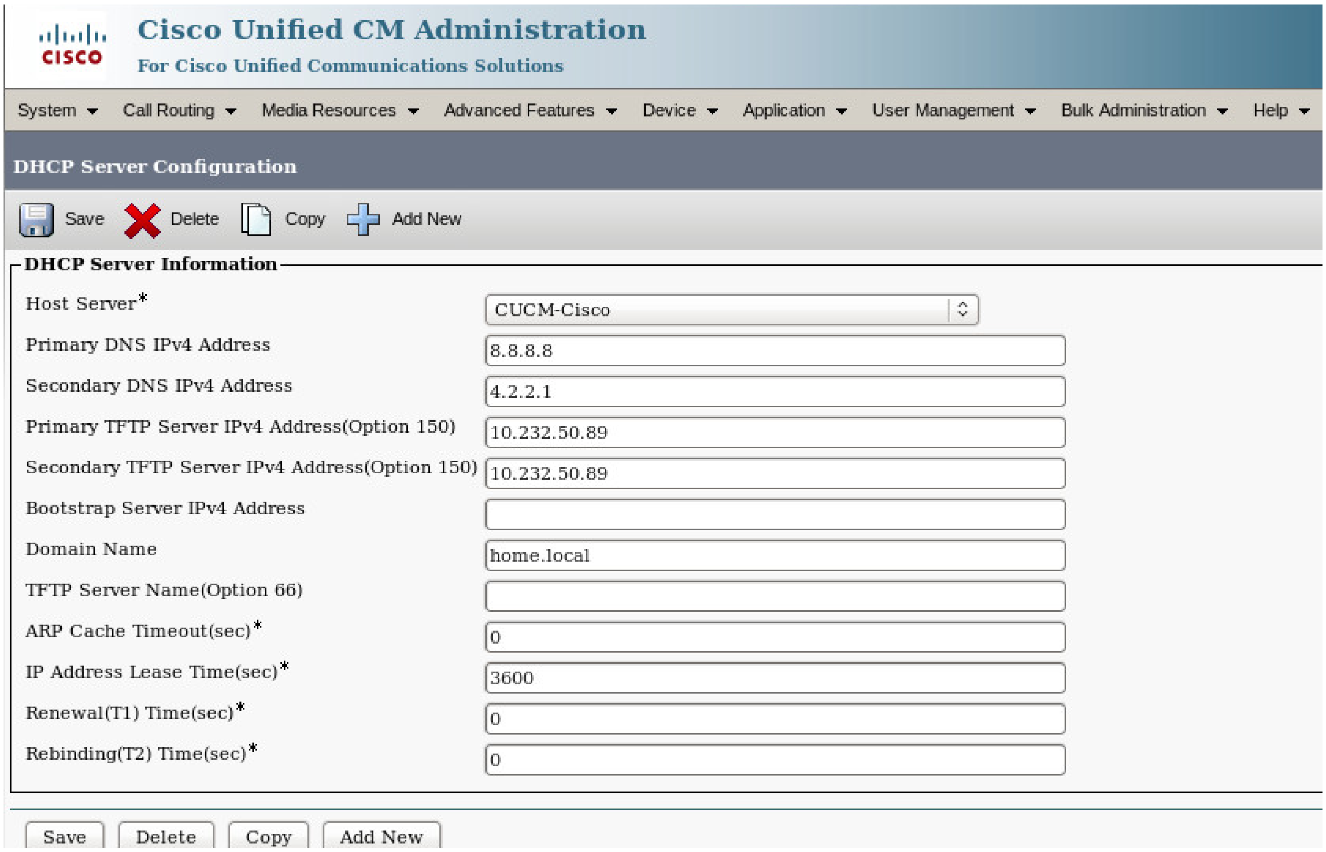
Route pattern in CUCM take the form of regular expressions to define specific routes and give flexibility in network design for dialing outbound calls from CUCM users to the PSTN via the E-SBC. A route pattern comprises a string of digits (an address) and a set of associated digit manipulations that route calls to a route list or a gateway/trunk. In CUCM administration console, use the Call Routing --- >Route/Hunt --- >Route Pattern menu path to configure route patterns. Follow the fields I the screenshots below:


Cisco Unified CM Administration
For Cisco Unified Communications Solutions
System Call Routing Media Resources Advanced Features Device Application User Management Bulk Administration Help
Route Pattern Configuration
Save Delete Copy Add New
Route Pattern* 9.@
Route Partition < None >
Description
Numbering Plan* NANP
Route Filter < None >
MLPP Precedence* Default
Apply Call Blocking Percentage
Resource Priority Namespace Network Domain < None >
Route Class* Default
Gateway/Route List* Bell_Canada_Trunk (Edit)
Route Option
Route this pattern
Block this pattern No Error
Call Classification* OffNet
External Call Control Profile < None >
Allow Device Override
Provide Outside Dial Tone
Allow Overlap Sending
Urgent Priority
Require Forced Authorization Code
Authorization Level* 0

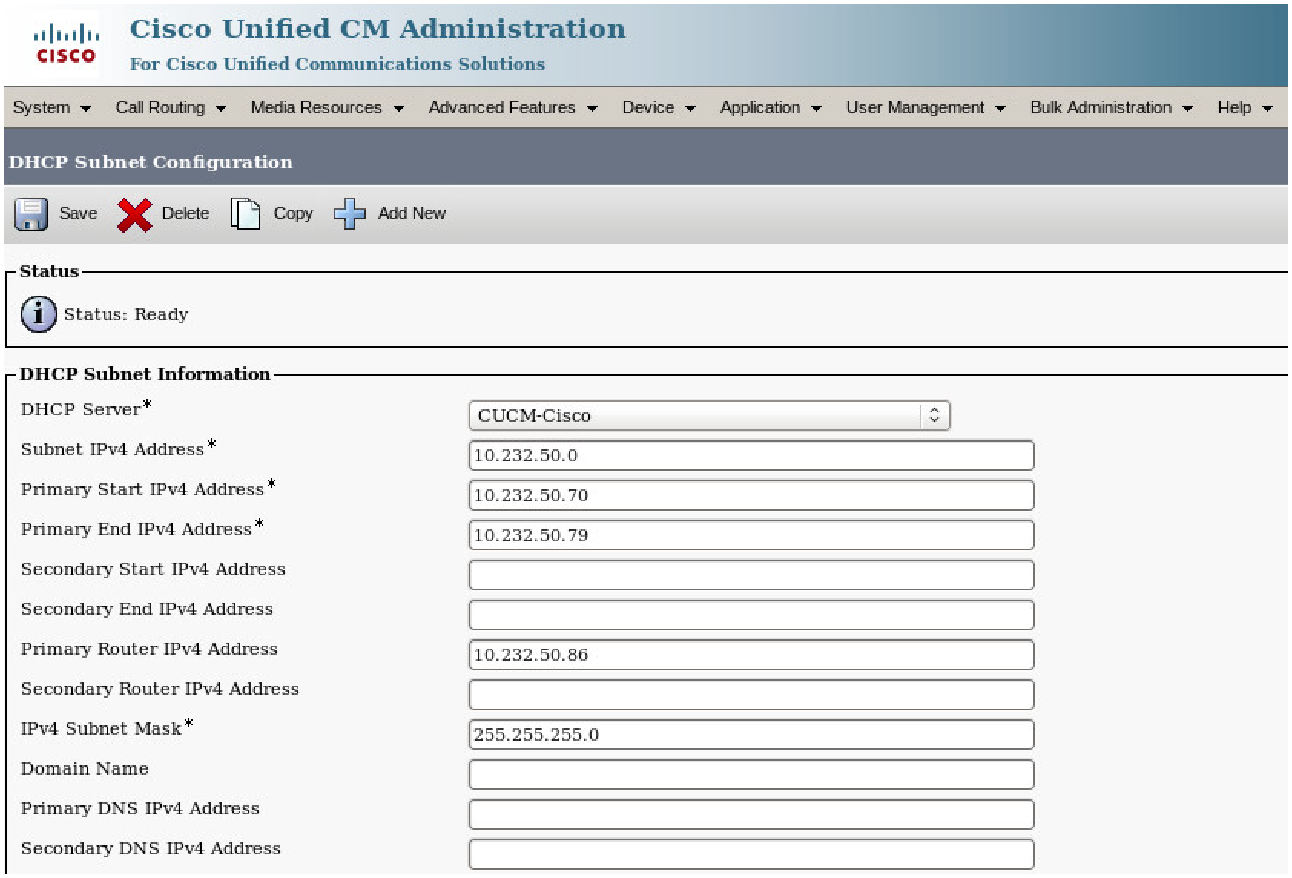

Cisco Unified CM Administration
For Cisco Unified Communications Solutions
System Call Routing Media Resources Advanced Features Device Application User Management Bulk Administration Help
Route Pattern Configuration
Save Delete Copy Add New
Connected Name Presentation* Default
Called Party Transformations
Discard Digits PreDot
Called Party Transform Mask
Prefix Digits (Outgoing Calls)
Called Party Number Type* Cisco CallManager
Called Party Numbering Plan* Cisco CallManager
ISDN Network-Specific Facilities Information Element
Network Service Protocol -- Not Selected --
Carrier Identification Code
Network Service
Service Parameter Name
Service Parameter Value
-- Not Selected --
< Not Exist >
Save Delete Copy Add New

Adding DHCP server and subnet in CUCM

In CUCM administration console, use the System --- >DHCP --- >DHCP Server menu path to define/add a new DHCP server. Use the IP address of the CUCM as the DHCP server/primary/secondary TFTP server address for the phones. Phones will use DHCP option 150 to discover the address of CUCM and request an IP address. Below is the screenshot for the same:

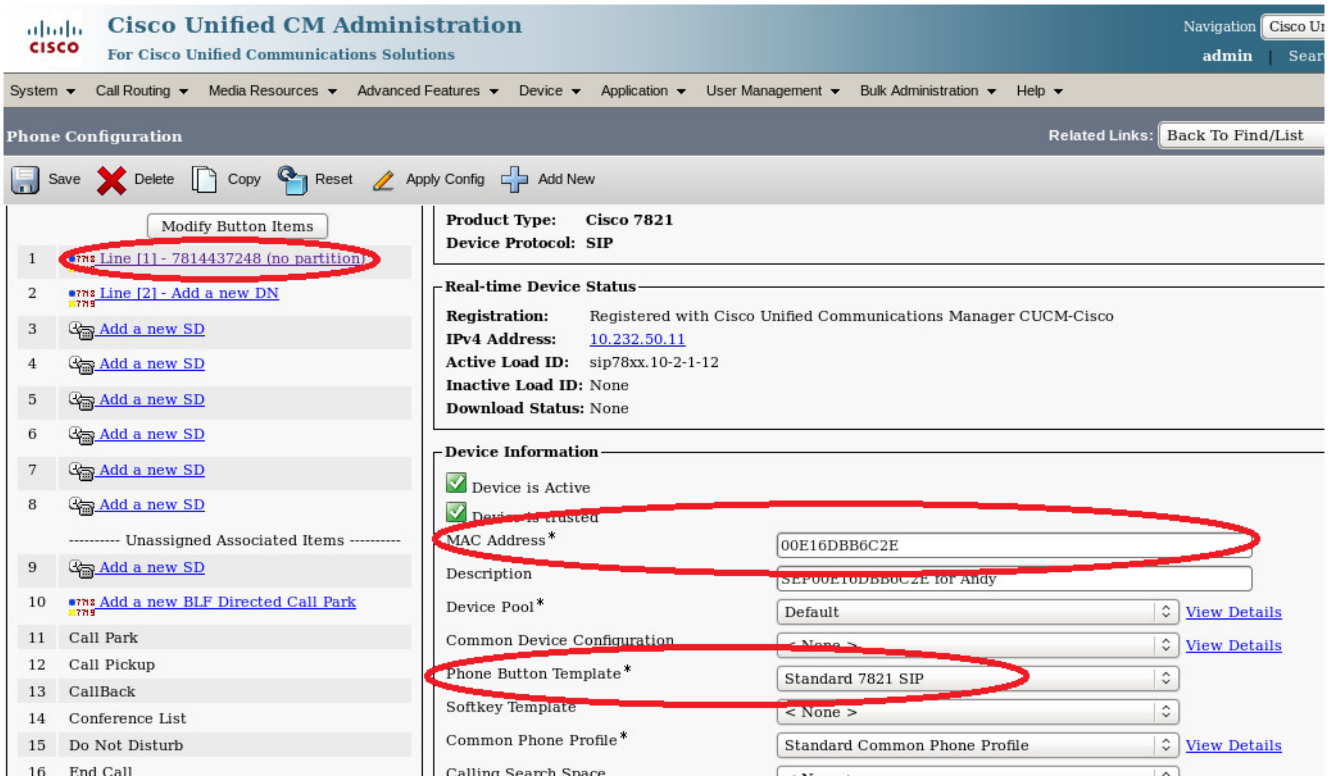


Add a DHCP subnet from the same menu path: System --- >DHCP --- > DHCP subnet



Adding Devices/Phones and configuring Directory numbers

Cisco phones need to be added in CUCM by way of their MAC address and assigned to a specific user and then when powered on, they obtain an IP address in the CUCM topology with the subnet defined in CUCM administration console. Use the Device --- > Phone menu path to add new devices. One will need to define the template based on the device being configured, for example Cisco 9971 phone template as in the screenshots below. Also, some highlights of the configuration to add a user and configure a directory number (DN) to it in CUCM are shown below:



The CUCM is now ready to send/receive calls and establish SIP connectivity with the Oracle E-SBC.

Test Plan

Caveats and out of scope items: Fax was not tested because the Lab CM did not have an analog card to test these capability there for Fax is considered out of scope for this testing.

Following is the test plan executed against this setup and results have been documented below.

ID	Test Case Title	Status
1000	Section 1	-
1100	**SIP Connectivity**	
1101	Validate syntax of OPTIONS messages sent to service provider	**p**
1102	Validate syntax of OPTIONS messages sent from service provider	**p**
1103	Validate in service reponse codes to OPTIONS messages from provider	**p**
1104	Validate in service reponse codes to OPTIONS messages to provider	**p**
1105	Validate OPTIONS messages are not sent more than once every 10 seconds to provider	**p**
2000	Section 2	-
2100	**Initial Calls To/From External Phones**	
2101	Inbound call from an external phone to an enterprise extension. Hang-up at called party (enterprise extension). Wait for calling party to disconnect. Validate proper SIP header syntax, ringback tone, two-way audio and proper call clearance	**p**
2102	Inbound call from an external phone to an enterprise extension. Hang-up at calling party (PSTN phone). Wait for called party to disconnect. Validate proper SIP header syntax, ringback tone, two-way audio and proper call clearance	**p**
2103	Outbound call from an enterprise extension to an external phone. Hang-up at called party (PSTN phone). Wait for calling party to disconnect. Make sure originating party is properly identified (Diversion/History-Info, PAI or From- in that order), using exactly 10 digits for the user part and the domain matching this TN's "PBX" (to which its TG is assigned). Also validate "tgrp/trunk-context" in Contact, if doing explicit TG selection (usually for Toll-bypass). Validate ringback tone, two-way audio and proper call clearance	**p**
2104	Outbound call from an enterprise extension to an external phone. Hang-up at calling party (enterprise extension). Wait for called party to disconnect. Make sure originating party is properly identified (Diversion/History-Info, PAI or From- in that order), using exactly 10 digits for the user part and the domain matching this TN's "PBX" (to which its TG is assigned). Also validate "tgrp/trunk-context" in Contact, if doing explicit TG selection (usually for Toll-bypass).	**p**

	Validate ringback tone, two-way audio and proper call clearance	
2105	Trunk Group Selection: test absense of explicit trunk group selection	p
2106	Trunk Group Selection: testtrunk group selection with tgrp tag	p
2107	Trunk Group Selection: testtrunk group selection with otg tag	p
3000	Section 3	-
3100	**Incomplete Call Attempts**	
3101	Inbound call from an external phone to an enterprise extension. Hang-up before far-end answers.	p
3102	Outbound call from an enterprise extension to an external phone. Hang-up before far-end answers.	p
3103	No Answer of inbound call from an external phone to an enterprise extension. (No explicit rules on CPE. Let extension ring.)	p
3104	No Answer of outbound call from an enterprise extension to an external phone.	p
3105	Inbound call from an external phone to an enterprise extension that is “Busy”.	p
3107	Inbound call from an external phone to an unassigned enterprise extension.	p
3108	Outbound call from an enterprise extension to an invalid external number (Note that this also happens to test CPE support for early media)	p
3109	Validation of explicit treatments/terminating responses to basic conditions (busy, no circuit avail, bldn etc)	p
4000	Section 4	-
4100	**Codec Support and Negotiation with Hard Phones**	
4101	Whenever the CPE sends out SDP, the Content-Type must be "application/sdp"	p
4102	Validate inbound G.729 calls	p
4103	Validate outbound G.729 calls (annexb=no is required)	p
5000	Section 5	-
5100	**Voicemail and DTMF Tone Support**	
5101	Inbound call from an external phone to an enterprise extension, transfer to voicemail. Leave a message.	p
5102	Inbound call from an external phone to an enterprise extension, let ring for close to 2 minutes, then transfer to voicemail. Leave a message.	p
5103	Login to enterprise voicemail and retrieve message from 5102.	p
5104	Outbound call to an external number, transfer to voicemail. (Ex. Call office or cell phone with voicemail). Leave a message.	p
5105	Login to external voicemail and retrieve message from 5104.	p
5108	RFC2833 DTMF sent from the CPE outbound to an external device are recognised by the recieving equipment	p

5109	RFC2833 DTMF sent from an external device inbound to the CPE are recognised by the recieving equipment	p
5111	Inband (Q.24) DTMF sent from an external device inbound to the CPE are recognised by the recieving equipment	p
6000	Section 6	-
6100	**PSTN Numbering Plans**	
6101	Inbound Call	p
6102	Outbound Toll-Free Call	p
6103	Outbound Local Call	p
6104	Outbound International Calls (011)961-865-0650	p
6105	Operator call (0)	p
6106	Operator Assisted Calls (e.g. 0+10 digits in US)	
6107	Validation of e.164 handling on DID	p
6108	Validation number plan format is correct across all headers according to interop spec	p
6109	Operator Assisted International Call (e.g. 0+1 8 to 35 digits)	p
6110	Casual Dial: 101+xxxx+NDC call (from 13 to 40 digits)	p
6111	n11 call (e.g. 211)	p
6112	911 call	p
6113	1-xxx-555-1212 call	p
6114	310-xxxx call	p
6115	1-700-xxx-xxxx call	p
6118	Operator-assisted long-distance call (00)	p
7000	Section 7 - Calling Name and Number Presentation	-
7100	**Static ONND**	
7101	Outbound call with Static ONND - using only the From header and a pre-provisioned number (with user=phone)	p
7102	Outbound call with Static ONND - using the P-Asserted-Identify header and a pre-provisioned number (with user=phone)	p
7103	Outbound call with Static ONND - using explicit trunk group selection (with user=phone)	p
7104	Outbound call with Static ONND - using the Diversion header without PAI (with user=phone)	p
7105	Outbound call with Static ONND - using the Diversion header (valid Bell number) with PAI (with user=phone)	p
7106	Outbound call with Static ONND - using the Diversion header (external number) with PAI (with user=phone and implicit trunk group selection)	p
7107	Outbound call with Static ONND - using the Diversion header (external number) with PAI (with user=phone and explicit trunk group selection)	p
7108	Validate proper syntax used in PAI, PPI, From and Diversion for CNAM/CLID display on outbound calls	p
7200	**Dynamic ONND**	

7201	Outbound call with Dynamic ONND - using the From header (without user=phone)	p
7202	Outbound call with Dynamic ONND - using the P-Asserted-Identify header (without user=phone)	p
7203	Outbound call with Dynamic ONND - using the Diversion header (with user=phone) without PAI and using a valid Bell SIP Trunking number in both the Diversion and From	p
7204	Outbound call with Dynamic ONND - using the Diversion header (with user=phone) without PAI and using an external number in either the Diversion or From	p
7205	Outbound call with Dynamic ONND - using the Diversion header (with user=phone) with PAI and using a valid Bell SIP Trunking number in both the Diversion and PAI	p
7206	Outbound call with Dynamic ONND - using the Diversion header (with user=phone) with PAI and using an external number in the Diversion	p
7207	Outbound call with Dynamic ONND to party A, transfer via tromboning to party B	p
7209	Validate proper syntax used in PAI, PPI, From and Diversion for CNAM/CLID display on outbound calls	p
7300	**Private and Unknown Calls**	
7301	Place an outbound private call. Validate privacy header syntax and interworking on outbound private call against Bell spec and document differences.	p
7302	Place an inbound private call. Validate privacy header syntax and interworking on inbound private call against Bell spec and document differences. CPE must respect the privacy header.	p
7303	Validate handling of incoming unknown calls	p
7304	Validate handling of incoming calls when not subscribed to Calling Line ID Delivery	p
8000	Section 8	
8100	**Supplementary Features – Call Hold**	
8101	Inbound Call – PBX Hold and Resume (No music) – Short Hold Duration	p
8102	Inbound Call – PBX Hold and Resume (With music) – Short Hold Duration	p
8103	Outbound Call – PBX Hold and Resume No music) – Short Hold Duration	p
8104	Outbound Call – PBX Hold and Resume (With music) – Short Hold Duration	p
8105	Inbound Call – PSTN Hold and Resume (No music) – Short Hold Duration	p
8106	Inbound Call – PSTN Hold and Resume (With music) – Short Hold Duration	p
8107	Outbound Call – PSTN Hold and Resume (No music) – Short Hold Duration	p
8108	Outbound Call – PSTN Hold and Resume (With music) – Short Hold Duration	p

8109	Inbound Call - PBX Hold and Resume (No music) – Long Hold Duration that exceeds the SIP session timers (~10 min)	p
8110	Inbound Call - PBX Hold and Resume (With music) – Long Hold Duration that exceeds the SIP session timers (~10 min)	p
8111	Outbound Call - PBX Hold and Resume (No music) – Long Hold Duration that exceeds the SIP session timers (~10 min)	p
8112	Outbound Call - PBX Hold and Resume (With music) – Long Hold Duration that exceeds the SIP session timers (~10 min)	p
8113	Inbound Call - PSTN Hold and Resume (No music) – Long Hold Duration that exceeds the SIP session timers (~10 min)	p
8114	Inbound Call - PSTN Hold and Resume (With music) – Long Hold Duration that exceeds the SIP session timers (~10 min)	p
8115	Outbound Call - PSTN Hold and Resume (No music) – Long Hold Duration that exceeds the SIP session timers (~10 min)	p
8116	Outbound Call - PSTN Hold and Resume (With music) – Long Hold Duration that exceeds the SIP session timers (~10 min)	p
8200	**Supplementary Features – Call Forward**	
8203	Call Forwarding (All) to External Number (Off-net) - Tromboning	p
8206	Call Forwarding (No Answer) to External Number (Off-net) – Tromboning	p
8209	Call Forwarding (Busy) to External Number (Off-net) – Tromboning	p
8300	**Supplementary Features – Call Transfer, Conference**	
8302	Blind Call Transfer of inbound call: Transfer to External Number (Tromboning)	p
8304	Blind Call Transfer of inbound call: Transfer to Internal Number (Tromboning)	p
8306	Blind Call Transfer of outbound call: Transfer to External Number (Tromboning)	p
8308	Blind Call Transfer of outbound call: Transfer to Internal Number (Tromboning)	p
8309	Attended Transfer of inbound call: Transfer to External Number (Tromboning)	p
8310	Attended Transfer of inbound call: Transfer to Internal Number (Tromboning)	p
8311	Attended Transfer of outbound call: Transfer to External Number (Tromboning)	p
8312	Attended Transfer of outbound call: Transfer to Internal Number (Tromboning)	p
8313	Validate call park and unpark	p
9000	Section 9	
9100	**Failover**	
9101	Validate handling of ICMP unreachable messages on a new call, by pointing CPE primary IP to unreachable IP	p
9102	Validate handling of bell SBC silently discarding packets on a new call, by pointing to 207.236.202.114:50505	p

9103	Validate handling of SIP 503 responses on a new call, by pointing to 207.236.202.114:50503	p
9104	Validate Handling of out service response codes to OPTIONS pings, out of service codes are anything other then 200 and 483 by pointing to 207.236.202.114:50504	p
9105	Validate traffic to CPE from multiple Bell IPs in order to simulate SBC failover. Requires Bell participation.	p
11000	Section 11	
11100	**Miscellaneous**	
11101	Validate handling of multiple concurrent calls for the same number	p
11102	Long Duration Calls - Inbound	p
11103	Long Duration Calls - Outbound	p
11104	Outgoing call with wrong DID number or wrong PBX domain.	p
11105	(Optional) Validate handling of outbound call to full TG (403 Forbidden)	p
11106	Validate handling of session audits every 5 or 10 min (UPDATE or re-INVITE)	p
11107	Validate handling of CPE-initiated session audits	p

Caveats: For call transfers, the INVITE sent from the CUCM to the transferred phone does not have the transferee phone number in the SIP messaging, hence the CLID on the call transfer target shows as the transferor and not the transferee.

Troubleshooting Tools

Wireshark

Wireshark is also a network protocol analyzer which is freely downloadable from www.wireshark.org.

On the Oracle E-SBC

The Oracle E-SBC provides a rich set of statistical counters available from the ACLI, as well as log file output with configurable detail. The follow sections detail enabling, adjusting and accessing those interfaces.

Resetting the statistical counters, enabling logging and restarting the log files.

At the E-SBC Console:

```
SBC1# reset sipd
SBC1# notify sipd debug
SBC1#
enabled SIP Debugging
SBC1# notify all rotate-logs
```

Examining the log files

Note: You will FTP to the management interface of the E-SBC with the username user and user mode password (the default is
"**acme**"

```
C:\Documents and Settings\user>ftp 192.168.1.22
Connected to 192.168.85.55.
220 SBC1 server (VxWorks 6.4) ready. User (192.168.1.22:(none)): user
331 Password required for user. Password: acme
230 User user logged in.
ftp> cd /opt/logs
250 CWD command successful. ftp> get sipmsg.log
200 PORT command successful.
150 Opening ASCII mode data connection for '/opt/logs/sipmsg.log' (3353 bytes).
226 Transfer complete.
ftp: 3447 bytes received in 0.00Seconds 3447000.00Kbytes/sec. ftp> get log.sipd
200 PORT command successful.
150 Opening ASCII mode data connection for '/opt/logs/log.sipd' (204681 bytes).
226 Transfer complete.
ftp: 206823 bytes received in 0.11Seconds 1897.46Kbytes/sec
```

You may now examine the log files with the text editor of your choice.

Through the Web GUI

You can also check the display results of filtered SIP session data from the Oracle Enterprise Session Border Controller, and
provides traces in a common log format for local viewing or for exporting to your PC. Please check the "Monitor and Trace" section
(page 145) of the Web GUI User Guide available at http://docs.oracle.com/cd/E56581_01/index.htm

Appendix A

Full E-SBC Configuration

```
codec-policy
    name                    prefer_729
    allow-codecs            telephone-event G729 PCMU
    order-codecs            G729 PCMU telephone-event
local-policy
    from-address            *
    to-address              *
    source-realm            cisco-inside
    policy-attribute
        next-hop            SAG:BellSIPTrunkGRP1
        realm               outside
        action              replace-uri
local-policy
    from-address            *
    to-address              *
    source-realm            outside
    policy-attribute
        next-hop            10.232.50.89
        action              replace-uri
media-manager
    initial-guard-timer     86400
    subsq-guard-timer       86400
media-profile
    name                    G729
    payload-type            18
    parameters              annexb=no
media-profile
    name                    PCMA
    payload-type            8
media-profile
    name                    PCMU
    payload-type            0
network-interface
    name                    s0p0
    description             outside
    ip-address              150.200.200.160
    netmask                 255.255.255.0
    gateway                 150.200.200.1
    hip-ip-list             150.200.200.160
    icmp-address            150.200.200.160
    ssh-address             150.200.200.160
network-interface
    name                    s1p1
    ip-address              10.232.50.20
    netmask                 255.255.255.0
    hip-ip-list             10.232.50.20
```

```
        ftp-address                         10.232.50.20
        icmp-address                        10.232.50.20
        ssh-address                         10.232.50.20
    network-interface
        name                                wancom1
        description                         HA_HEARTBEAT1
        pri-utility-addr                    169.254.1.1
        sec-utility-addr                    169.254.1.2
        netmask                             255.255.255.252
    network-interface
        name                                wancom2
        description                         HA_HEARTBEAT2
        pri-utility-addr                    169.254.2.1
        sec-utility-addr                    169.254.2.2
        netmask                             255.255.255.252
    phy-interface
        name                                s0p0
        operation-type                      Media
    phy-interface
        name                                s1p1
        operation-type                      Media
        port                                1
        slot                                1
    phy-interface
        name                                wancom1
        port                                1
        wancom-health-score                 8
    phy-interface
        name                                wancom2
        port                                2
        wancom-health-score                 9
    realm-config
        identifier                          cisco-inside
        network-interfaces                  s1p1:0
    realm-config
        identifier                          outside
        network-interfaces                  s0p0:0
        codec-policy                        prefer_729
    redundancy-config
        becoming-standby-time               360000
        peer
            name                            SBC1
            type                            Primary
            destination
                address                     169.254.1.1:9090
                network-interface           wancom1:0
            destination
                address                     169.254.2.1:9090
                network-interface           wancom2:0
```

```
    peer
        name                    SBC2
        type                    Secondary
        destination
            address                 169.254.1.2:9090
            network-interface       wancom1:0
        destination
            address                 169.254.2.2:9090
            network-interface       wancom2:0
session-agent
    hostname                10.232.50.89
    ip-address              10.232.50.89
    transport-method        StaticTCP
    realm-id                cisco-inside
    ping-method             OPTIONS
    ping-interval           90
    auth-attributes
        auth-realm              lab.ca
        username                abc_123456_ca
        password                ********
        in-dialog-methods       INVITE
    auth-attributes
        auth-realm              test
session-agent
    hostname                207.236.202.114
    ip-address              207.236.202.114
    port                    50504
    realm-id                outside
    ping-interval           30
    out-service-response-codes      503
session-agent
    hostname                200.236.200.170
    ip-address              200.236.200.170
    ping-method             OPTIONS
    ping-interval           90
    out-manipulationid      To_Bell
session-agent
    hostname                60.150.190.70
    ip-address              60.150.190.70
    realm-id                outside
    ping-interval           90
    ping-in-service-response-codes  200,483
    out-manipulationid      To_Bell
session-group
    group-name              BellSIPTrunkGRP1
    dest                    60.150.190.70
                            200.236.200.170
    sag-recursion           enabled
session-timer-profile
```

```
        name                              test
        session-expires                   400
        force-reinvite                    enabled
    session-translation
        id                                addplus1
        rules-called                      addplus1
    sip-config
        options                           max-udp-length=0
                                          session-timer-support
    sip-interface
        realm-id                          cisco-inside
        sip-port
            address                       10.232.50.20
            transport-protocol            TCP
            allow-anonymous               agents-only
        session-timer-profile             test
    sip-interface
        realm-id                          outside
        sip-port
            address                       150.200.200.160
            allow-anonymous               agents-only
        initial-inv-trans-expire          6
        add-sdp-invite                    invite
        add-sdp-profiles                  PCMU
                                          PCMA
                                          G729
        session-timer-profile             test
    sip-manipulation
        name                              To_Bell
        header-rule
            name                          Update_Request
            header-name                   request-uri
            action                        manipulate
            element-rule
                name                      Update_URI_Host
                type                      uri-host
                action                    replace
                new-value                 lab.ca
            element-rule
                name                      Rmv_User
                parameter-name            user
                type                      uri-param
                action                    delete-element
            element-rule
                name                      Rmv_Port
                type                      uri-port
                action                    delete-element
            element-rule
                name                      Update_URI_User
```

```
            type                         uri-user
            comparison-type                  pattern-rule
            match-value                   \+?(\d+)
            new-value                     \++$1
    header-rule
        name                         Update_To
        header-name                        To
        action                       manipulate
        element-rule
            name                          Update_URI_Host
            type                         uri-host
            action                       replace
            new-value                         lab.ca
        element-rule
            name                          Rmv_User
            parameter-name                      user
            type                         uri-param
            action                       delete-element
        element-rule
            name                          Update_URI_User
            type                         uri-user
            comparison-type                  pattern-rule
            match-value                   \+?(\d+)
            new-value                     \++$1
    header-rule
        name                         Update_From
        header-name                        from
        action                       manipulate
        element-rule
            name                          Update_URI_Host
            type                         uri-host
            action                       replace
            new-value                  lab.voice.ca
        element-rule
            name                          Add_OTG_URI_Param
            parameter-name                      otg
            type                         uri-param
            new-value                     abc_123456_ca
        element-rule
            name                          Rmv_UriParam_User
            parameter-name                      user
            type                         uri-param
            action                       add
            new-value                         phone
    header-rule
        name                         Update_Contact
        header-name                        Contact
        action                       manipulate
        methods                        INVITE
```

```
        element-rule
            name                        Add_User
            type                        uri-user
            new-value                   613xxxxxxx
        element-rule
            name                        Add_tgrp
            parameter-name              tgrp
            type                        uri-user-param
            new-value                   abc_123456_ca
        element-rule
            name                        Add_trunk_context
            parameter-name              trunk-context
            type                        uri-user-param
            new-value                   lab.ca
    header-rule
        name                        Max_Forward_0
        header-name                 Max-Forwards
        action                      manipulate
        comparison-type             pattern-rule
        msg-type                    request
        methods                     OPTIONS
        new-value                   0
    header-rule
        name                        Rmv_UserAgent_Hdr
        header-name                 user-agent
        action                      delete
    header-rule
        name                        save_Diversion
        header-name                 Diversion
        action                      store
    header-rule
        name                        Chk_Add_Diversion
        header-name                 Diversion
        action                      manipulate
        comparison-type             boolean
        methods                     INVITE
        match-value                 $save_Diversion
        new-value  <sip:613xxxxxxx@lab.voice.ca;user=phone>
    header-rule
        name                        Update_Diversion
        header-name                 Diversion
        match-value                 !$save_Diversion
        element-rule
            name                        Update_URI_Host
            type                        uri-host
            action                      replace
            new-value                   lab.voice.ca
        element-rule
            name                        Add_OTG_URI_Param
```

```
            parameter-name            otg
            type                      uri-param
            new-value                 abc_123456_ca
        element-rule
            name                      Chg_Tmp_UriUser
            type                      uri-user
            action                    replace
            new-value                 7207759641
        element-rule
            name                      Del_User_Param
            parameter-name            user
            type                      uri-param
    header-rule
        name                          Rmv_Priv_Hdr
        header-name                   Privacy
    header-rule
        name                          Update_PAI
        header-name                   P-Asserted-Identity
        action                        manipulate
        element-rule
            name                      Update_URI_Host
            type                      uri-host
            action                    replace
            new-value                 lab.voice.ca
        element-rule
            name                      Add_User_UriParam
            parameter-name            user
            type                      uri-param
            action                    add
            new-value                 phone
        element-rule
            name                      Add_OTG_URI_Param
            parameter-name            otg
            type                      uri-param
            new-value                 abc_123456_ca
        element-rule
            name                      Add_User
            type                      uri-user
            new-value                 7207759641
    header-rule
        name                          save_Referred_By
        header-name                   Referred-by
        action                        store
        msg-type                      request
        methods                       INVITE
        element-rule
            name                      Fix_URI_Host
            type                      uri-host
            action                    replace
```

```
                new-value                       lab.voice.ca
        header-rule
            name                            Referred_By_2_Div
            header-name                         Diversion
            action                          add
            comparison-type                     boolean
            methods                           INVITE
            match-value                         $save_Referred_By
            new-value                          $save_Referred_By.$0
            element-rule
                name                            Update_URI_Host
                type                          uri-host
                action                         replace
                new-value                       lab.voice.ca
        header-rule
            name                            RmvReferredBy
            header-name                         Referred-by
            action                          delete
        header-rule
            name                            Rmv_CallInfo
            header-name                         Call-Info
            action                          delete
        header-rule2
            name                            Rmv_CiscoGUID
            header-name                         Cisco-Guid
            action                          delete
sip-monitoring
        monitoring-filters                *
steering-pool
        ip-address                     10.232.50.20
        start-port                    40000
        end-port                      60000
        realm-id                      cisco-inside
steering-pool
        ip-address                     150.200.200.160
        start-port                    49152
        end-port                      49200
        realm-id                      outside
system-config
        process-log-level               DEBUG
        default-gateway                 172.18.0.1
translation-rules
        id                         addplus1
        type                         add
        add-string                      01
        delete-string                    +1
web-server-config
```

Appendix B

Accessing the ACLI

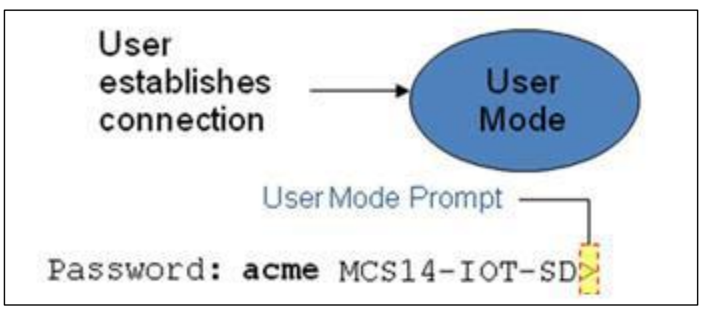
Access to the ACLI is provided by:

- The serial console connection;
- TELNET, which is enabled by default but may be disabled; and
- SSH, this must be explicitly configured.

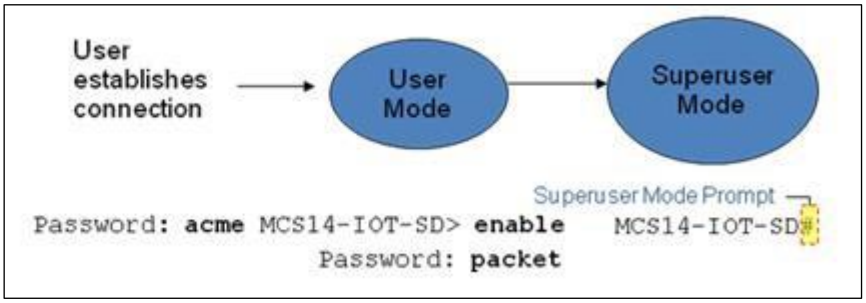
Initial connectivity will be through the serial console port. At a minimum, this is how to configure the management (eth0) interface on the E-SBC.

ACLI Basics

There are two password protected modes of operation within the ACLI, User mode and Superuser mode. When you establish a connection to the E-SBC, the prompt for the User mode password appears. The default password is acme. User mode consists of a restricted set of basic monitoring commands and is identified by the greater than sign (>) in the system prompt after the target name. You cannot perform configuration and maintenance from this mode.



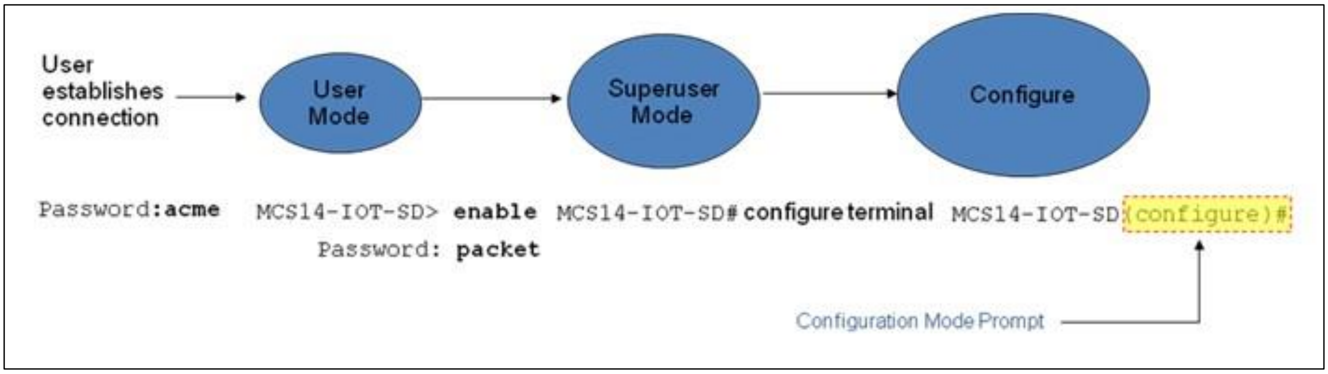
The Superuser mode allows for access to all system commands for operation, maintenance, and administration. This mode is identified by the pound sign (#) in the prompt after the target name. To enter the Superuser mode, issue the enable command in the User mode.



From the Superuser mode, you can perform monitoring and administrative tasks; however you cannot configure any elements. To return to User mode, issue the exit command.

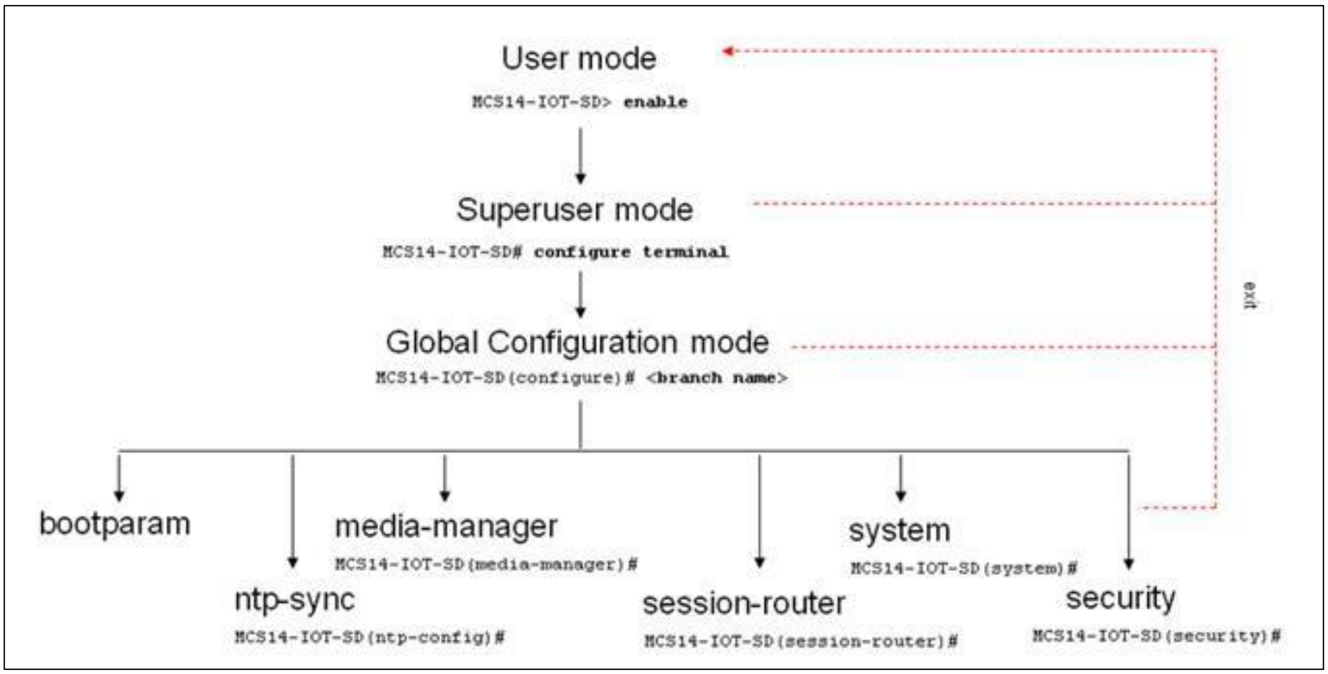
You must enter the Configuration mode to configure elements. For example, you can access the configuration branches and configuration elements for signaling and media configurations. To enter the Configuration mode, issue the **configure terminal** command in the Superuser mode.

Configuration mode is identified by the word configure in parenthesis followed by the pound sign (#) in the prompt after the target name, for example, **SBC1 (configure)#**. To return to the Superuser mode, issue the **exit**command.



In the configuration mode, there are six configuration branches:

- bootparam;
- ntp-sync;
- media-manager;
- session-router;
- system; and
- security.



The ntp-sync and bootparams branches are flat branches (i.e., they do not have elements inside the branches). The rest of the branches have several elements under each of the branches.

The bootparam branch provides access to E-SBC boot parameters. Key boot parameters include:

- boot device – The global management port, usually eth0
- file name – The boot path and the image file.
- inet on ethernet – The IP address and subnet mask (in hex) of the management port of the SD.
- host inet –The IP address of external server where image file resides.
- user and ftp password – Used to boot from the external FTP server.
- gateway inet – The gateway IP address for reaching the external server, if the server is located in a different network.

```
'.' = clear field;  '-' = go to previous field;  q = quit
boot device              : eth0
processor number         : 0
host name                :
file name                : /tffs0/nnSCX620.gz
inet on ethernet (e)     : 10.0.3.11:ffff0000
inet on backplane (b)    :
host inet (h)            : 10.0.3.100
gateway inet (g)         : 10.0.0.1
user (u)                 : anonymous
ftp password (pw) (blank = rsh)       : anonymous
flags (f)                : 0x8
target name (tn)         : MCS14-IOT-SD
startup script (s)       :
other (o)
```

The ntp-sync branch provides access to ntp server configuration commands for synchronizing the

E-SBC time and date. The security branch provides access to security configuration.

The system branch provides access to basic configuration elements as
system-config, snmp-community, redundancy, physical interfaces,
network interfaces, etc.

The session-router branch provides access to signaling and routing related elements, including
H323-config, sip-config, iwf-config, local-policy, sip-manipulation, session-agent, etc.

The media-manager branch provides access to media-related elements, including realms, steering pools, dns-config, media- manager, and so forth.

You will use media-manager, session-router, and system branches for most of your working configuration.

Configuration Elements

The configuration branches contain the configuration elements. Each configurable object is referred to as an element. Each element consists of a number of configurable parameters.

Some elements are single-instance elements, meaning that there is only one of that type of the element - for example, the global system configuration and redundancy configuration.

Some elements are multiple-instance elements. There may be one or more of the elements of any given type. For example, physical and network interfaces.

Some elements (both single and multiple instance) have sub-elements. For example:

- SIP-ports - are children of the sip-interface element
- peers – are children of the redundancy element
- destinations – are children of the peer element

Creating an Element

- To create a single-instance element, you go to the appropriate level in the ACLI path and enter its parameters. There is no need to specify a unique identifier property because a single-instance element is a global element and there is only one instance of this element.
- When creating a multiple-instance element, you must specify a unique identifier for each instance of the element.
- It is important to check the parameters of the element you are configuring before committing the changes. You do this by issuing the **show**command before issuing the **done**command. The parameters that you did not configure are filled with either default values or left empty.
- On completion, you must issue the **done**command. The done command causes the configuration to be echoed to the screen and commits the changes to the volatile memory. It is a good idea to review this output to ensure that your configurations are correct.
- Issue the **exit**command to exit the selected element.
- Note that the configurations at this point are not permanently saved yet. If the E-SBC reboots, your configurations will be lost.

Editing an Element

The procedure of editing an element is similar to creating an element, except that you must select the element that you will edit before editing it.

- Enter the element that you will edit at the correct level of the ACLI path.

- Select the element that you will edit, and view it before editing it.
- The **select**command loads the element to the volatile memory for editing. The **show**command allows you to view the element to ensure that it is the right one that you want to edit.
- Once you are sure that the element you selected is the right one for editing, edit the parameter one by one. The new value you provide will overwrite the old value.
- It is important to check the properties of the element you are configuring before committing it to the volatile memory. You do this by issuing the **show**command before issuing the **done**command.
- On completion, you must issue the **done**command.
- Issue the **exit**command to exit the selected element.

Note that the configurations at this point are not permanently saved yet. If the E-SBC reboots, your configurations will be lost.

Deleting an Element

The **no** command deletes an element from the configuration in editing. To delete a single-instance element,

- Enter the **no**command from within the path for that specific element
- Issue the **exit**command. To delete a multiple instance element,

Enter the **no**command from within the path for that particular element.
The key field prompt, such as <name>:<sub-port-id>, appears.

Use the <Enter> key to display a list of the existing configured elements.

Enter the number corresponding to the element you wish to delete.

Issue the **select**command to view the list of elements to confirm that the element was removed.

Note that the configuration changes at this point are not permanently saved yet. If the E-SBC reboots, your configurations will be lost.

Configuration Versions

At any time, three versions of the configuration can exist on the E-SBC: the edited configuration, the saved configuration, and the running configuration.

- The **edited configuration** – this is the version that you are making changes to. This version of the configuration is stored in the E-SBC's volatile memory and will be lost on a reboot.
  To view the editing configuration, issue the **show configuration**command

- The **saved configuration –** on issuing the **save-config**command, the edited configuration is copied into the non- volatile memory on the E-SBC and becomes the saved configuration. Because the saved configuration has not been activated yet, the changes in the configuration will not take effect. On reboot, the last activated configuration (i.e., the last running configuration) will be loaded, not the saved configuration.
- The **running configuration** is the saved then activated configuration. On issuing the **activate-config** command, the saved configuration is copied from the non-volatile memory to the volatile memory. The saved configuration is activated and becomes the running configuration. Although most of the configurations can take effect once being activated without reboot, some configurations require a reboot for the changes to take effect.
  To view the running configuration, issue command show **running-config**.

Saving the Configuration

The **save-config**command stores the edited configuration persistently.

Because the saved configuration has not been activated yet, changes in configuration will not take effect. On reboot, the last activated configuration (i.e., the last running configuration) will be loaded. At this stage, the saved configuration is different from the running configuration.

Because the saved configuration is stored in non-volatile memory, it can be accessed and activated at later time.

Upon issuing the **save-config**command, the E-SBC displays a reminder on screen stating that you must use the **activate- config**command if you want the configurations to be updated.

```
SBC1 # save-config
Save-Config received, processing. waiting 1200 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'.
SBC1
```

Activating the Configuration

On issuing the **activate-config**command, the saved configuration is copied from the non-volatile memory to the volatile memory. The saved configuration is activated and becomes the running configuration.

Some configuration changes are service affecting when activated. For these configurations, the E-SBC warns that the change could have an impact on service with the configuration elements that will potentially be service affecting. You may decide whether or not
to continue with applying these changes immediately or to apply them at a later time.

```
SBC1# activate-config Activate-Config received,
processing. waiting 120000 for request to finish Request
to 'ACTIVATE-CONFIG' has Finished, Activate Complete
SBC1#
```

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