Cisco Unified Communications Manager 12.5 to Verizon Business SIP Trunk via Cisco Unified Border Element 12.5 [CSR 1000V, IOS - 16.10.01b]

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Introduction

Service Providers today, such as Verizon, are offering alternative methods to connect to the PSTN via their IP networks. Most of these services utilize SIP as the primary signaling method and centralized IP to TDM POP gateways to provide on-net and off-net services.

A demarcation device between these services and customer owned services is recommended. As an intermediary device between Cisco Unified Communications Manager and Verizon network, Virtual Cisco Unified Border Element (VCUBE) CSR 1000V running IOS 16.10.01b can be used. The Virtual Cisco Unified Border Element v12.5 [IOS-XE16.10.01b] provides demarcation, security, interworking and session control services for Cisco Unified Communications Manager 12.5 connected to Verizon network.

This document assumes the reader is knowledgeable with the terminology and configuration of Cisco UCM (Cisco Unified Communications Manager). Only configuration settings specifically required for Verizon interoperability are presented. Feature configuration and most importantly the dial plan are customer specific and need individual approach.

- This application note describes how to configure a Cisco Unified Communications Manager (Cisco UCM) 12.5 and Virtual Cisco Unified Border Element (VCUBE) on CSR 1000V [IOS-XE - 16.10.01b] for connectivity to Verizon SIP Trunking service. The deployment model covered in this application note is (Cisco UCM 12.5) to PSTN (Verizon) via Virtual cisco unified border element (VCUBE) 12.5.

- Testing was performed in accordance to Verizon generic SIP Trunking test methodology and among features verified were – basic calls, DTMF transport, Music on Hold (MOH), attended and semi-attended transfers, call forward, conferences and interoperability with Cisco Unity Connection (CUC).

- The Cisco UCM configuration detailed in this document is based on a lab environment with a simple dial-plan used to ensure proper interoperability between Verizon SIP network and Cisco Unified Communications. The configuration described in this document details the important configuration settings to have enabled for interoperability to be successful and care must be taken by the network administrator deploying Cisco UCM to interoperate to Verizon SIP Trunking network.
Figure 1: Network Topology
System Components

Hardware Requirements

- Cisco UCSC-C240-M3S VMWare host running ESXi 5.5 or later
- Cisco CSR1000V as Virtual CUBE.
- Cisco CSR1000V (VXE) processor (revision VXE) with 2171998K/3075K bytes of memory with 3 Gigabit Ethernet interfaces.
- Processor board ID 9ZYSQ04GQX
- Cisco 2851 Fax Gateway
- IP phones 7841 (SIP) and 8945 (SIP)

Software Requirements

- Cisco Unified Communications Manager 12.5.1.10000-22
- Cisco Unity Connection 12.5.1.10000-23
- IOS 16.10.01b for CSR 1000V Virtual Cisco Unified Border Element
- Cisco IOS Software [Gibraltar], Virtual XE Software (X86_64_LINUX_IOSD-UNIVERSALK9M), Version 16.10.1b, RELEASE SOFTWARE (fc1)
- Cisco IOS XE Software, Version 16.10.01b
- IOS 15.0(1)XA3 for Cisco 2851 Fax Gateway
Features

Features Supported

- Incoming and outgoing off-net calls using G711ULaw & G729 voice codecs
- Call hold
- Call transfer (semi-attended and attended)
- Call conference
- Call forward (all, busy and no answer)
- Calling Line (number) Identification Presentation (CLIP)
- Calling Line (number) Identification Restriction (CLIR)
- DTMF (RFC2833)
- Media flow-through on Virtual Cisco UBE
- T.38 Fax

Features Not Supported

- Cisco IP phones used in this test do not support blind transfer

Caveats

- CLID is not updated on PSTN phones for transfer (attended and semi-attended). Cisco UBE sends PAI/PPI header to the Verizon network however once the transfer is completed the CLID does not updated on the PSTN.
- G711 fax pass-through calls are failing because the FAX CNG tone is not send by the Verizon.
Configuration

Configuring Cisco Unified Border Element

Network Interface

Configure Ethernet IP address and sub interface. The IP address and VLAN encapsulation used are for illustration only, the actual IP address can vary. For SIP trunks two IP addresses must be configured - for LAN and WAN.

Figure 2 High Availability topology
CUBE 1:

interface GigabitEthernet1
  description cube LAN
  ip address 10.64.3.135 255.255.0.0
  negotiation auto
  no mop enabled
  no mop sysid
  redundancy rii 1
  redundancy group 1 ip 10.64.3.80 exclusive

interface GigabitEthernet2
  description CUBE WAN
  ip address 10.250.1.xx 255.255.255.0
  negotiation auto
  no mop enabled
  no mop sysid
  redundancy rii 2
  redundancy group 1 ip 10.250.1.xx exclusive
CUBE 2:

interface GigabitEthernet1
  description cube LAN
  ip address 10.64.3.136 255.255.0.0
  negotiation auto
  no mop enabled
  no mop sysid
  redundancy rii 1
  redundancy group 1 ip 10.64.3.80 exclusive

interface GigabitEthernet2
  description CUBE WAN
  ip address 10.250.1.XX 255.255.255.0
  negotiation auto
  no mop enabled
  no mop sysid
  redundancy rii 2
  redundancy group 1 ip 10.250.1.XX exclusive
Global Cisco UBE Settings

In order to enable Cisco UBE IP2IP gateway functionality, enter the following:

```
voice service voip
   no ip address trusted authenticate
   address-hiding
   mode border-element license capacity 20
   allow-connections sip to sip
   redundancy-group 1
   fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
   sip
      session refresh
      early-offer forced
      midcall-signaling passthru
      privacy-policy passthru
```

**Explanation**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>allow-connections sip to sip</td>
<td>Allow IP2IP connections between two SIP call legs</td>
</tr>
<tr>
<td>fax protocol</td>
<td>Specifies the fax protocol</td>
</tr>
<tr>
<td>early-offer forced</td>
<td>Enables SIP Delayed-Off to Early-Off globally</td>
</tr>
<tr>
<td>midcall-signaling passthru</td>
<td>Passes SIP messages from one IP leg to another IP leg</td>
</tr>
</tbody>
</table>

**Codecs**

G711ulaw and G729 voice codecs are used for this testing. Codec preferences used to change according to the test plan description

```
voice class codec 1
   codec preference 1 g711ulaw
   codec preference 2 g711alaw
   codec preference 3 g729r8
```
Dial Peer

Dial-peer to Verizon using UDP:

dial-peer voice 1 voip
description CUCM to PSTN - LAN Interface
session protocol sipv2
session transport udp
incoming called-number .T
voice-class codec 1
voice-class sip bind control source-interface GigabitEthernet1
voice-class sip bind media source-interface GigabitEthernet1
dtmf-relay rtp-nte
fax-relay ecm disable
fax rate 14400
fax nsf 000000
fax protocol t38 version 0 hs REDUNDANCY 0
no vad
!
dial-peer voice 2 voip
description CUCM to PSTN - WAN Interface
destination-pattern .T
session protocol sipv2
session target ipv4:172.31.156.XX:5060
session transport udp
voice-class codec 1
voice-class sip bind control source-interface GigabitEthernet2
voice-class sip bind media source-interface GigabitEthernet2
dtmf-relay rtp-nte
fax-relay ecm disable
fax rate 14400
fax nsf 000000
fax protocol t38 version 0 hs REDUNDANCY 0
no vad
!
dial-peer voice 3 voip
description PSTN to CUCM - WAN Interface
session protocol sipv2
session transport udp
incoming called-number 984465....
voice-class codec 1
voice-class sip bind control source-interface GigabitEthernet2
voice-class sip bind media source-interface GigabitEthernet2
dtmf-relay rtp-nte
fax-relay ecm disable
fax rate 14400
fax nsf 000000
fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
no vad

dial-peer voice 4 voip
description PSTN to CUCM - LAN Interface
destination-pattern 984465....
session protocol sipv2
session target ipv4:10.80.12.2:5060
session transport udp
voice-class codec 1
voice-class sip bind control source-interface GigabitEthernet1
voice-class sip bind media source-interface GigabitEthernet1
dtmf-relay rtp-nte
fax-relay ecm disable
fax rate 14400
fax nsf 000000
fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
no vad
Configuration Example

The following configuration snippet contains a sample configuration of Cisco UBE with all parameters mentioned previously.

*Active Cisco UBE:*

```
version 16.10
service timestamps debug datetime msec
service timestamps log datetime msec
service call-home
platform qfp utilization monitor load 80
no platform punt-keepalive disable-kernel-core
platform console virtual
!
hostname Router
!
boot-start-marker
boot-end-marker
!
!
no logging queue-limit
logging buffered 10000000
no logging rate-limit
no logging console
no logging monitor
!
no aaa new-model
call-home
  ! If contact email address in call-home is configured as sch-smart-licensing@cisco.com

! the email address configured in Cisco Smart License Portal will be used as contact email address to send SCH notifications.
```
contact-email-addr sch-smart-licensing@cisco.com
profile "CiscoTAC-1"
active
destination transport-method http
no destination transport-method email
!
login on-success log
subscriber templating
multilink bundle-name authenticated
!
!
voice service voip
no ip address trusted authenticate
address-hiding
mode border-element license capacity 20
allow-connections sip to sip
redundancy-group 1
fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
sip
    session refresh
    early-offer forced
    midcall-signaling passthru
    privacy-policy passthru
!
voice class codec 1
    codec preference 1 g711ulaw
    codec preference 2 g711alaw
    codec preference 3 g729r8
!
crypto pki trustpoint SLA-TrustPoint
    enrollment pkcs12
    revocation-check crl
!
crypto pki trustpoint TP-self-signed-180560139
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-180560139
revocation-check none
rsakeypair TP-self-signed-180560139
!
!
crypto pki certificate chain SLA-TrustPoint
certificate ca 01

30820321 30820209 A0030201 02020101 300D0609 2A864886 F70D0101 0B050030
32310E30 0C060355 040A1305 43697363 6F312030 1E060355 04031317 43697363
6F204C69 63656E73 69666963 6F4C6561 62204C69 636E7369 6E6730 30820321 30820209 A0030201 02020101 300D0609 2A864886 F70D0101 0B050030
32310E30 0C060355 040A1305 43697363 6F312030 1E060355 04031317 43697363
6F204C69 63656E73 69666963 6F4C6561 62204C69 636E7369 6E6730
526F6F74 20434130 8012230 0D06092A 864886F7 0D010010 05000382 010F0030
8010A02 8020100 A68CB9D6 131E05F7 145E72C2 CD6E68E6 17222EA1 F1EFF64D
CBB4C798 212AA147 C655D8D7 9471380D 8711441E 1A6F071A 9CAE6388 8A38E520
1C394D78 462EF239 C659F715 B98C0A59 5BB85CB8 0CFEBEA3 700A8BF7 D8F256EE
4AA4E80D DB6FD1C9 60B1F1D8 FFC69C96 6FA68957 A2617DE7 104FDC5F EA2956AC
7390A3EB 2B5436AD C847A2C5 DAB553EB 69A9A535 58E9F3E3 COBD23CF 58BD7188
68E69491 20F320E7 948E71D7 AE3BCC84 F10684C7 4BC8E00F 539BA42B 42C68BB7
C7479096 B4CB2D62 EA2F505D CB062A48 6811D95B E8250FC4 5D55FB88 8F27D191
C55F0D7E 61F9A4CD 3D992327 A8BB03BD 4E6D7069 7CBA7F8B DF5F4368 95135E44
DFC7C6CF 04DD7F1 02030100 01A34230 403000E0 03551D0F 0F01FF04 04030201
06300F06 03551D13 011FF04 05300301 01FF301D 0603551D 0E041604 1449DC85
4B3D31E5 1B36E6A7 606AF333 3D3B4C73 E8300D06 092A8648 86F70D01 010B0050
03820101 00507F24 D3932AE6 680259DF E838AE5C 6D4DF6B0 49631C7C 240DA905
604EDCDE FF4FED2B 77FC460E CD636FDB DD44684E 3A5693AB 9093DB31 6C9E3D88
D98987BF E40CB9D9 19ECA0C2 2189BB5C 8F6A5F86 CD98B646 55751B14 8DFC66A8
467A3DF4 4D565700 6ADF0F3D CF835015 3C04FF7C 21E878AC 11BA9CD2 55A9232C
7CA7B7E6 C1AF74F6 152E9B7B B1FCEF9B E973DE7F 5BDDE8B6 C71E3B49 1765308B
5FB0DA06 B92AEE7F 494E8A9E 07B85737 F3A58BE1 1A48A229 C37C1E69 39F08678
80DDCD16 D6BACECA EEBC7CF9 8428787B 35202C6C 60E4616A B623CDBD 230E3AFB
418616A9 4093E049 4D10AB75 27E86F73 932E35B5 8862FDAE 0275156F 719BB2F0
D697DF7F 28

quit

crypto pki certificate chain TP-self-signed-180560139

certificate self-signed 01

3082032E 30820216 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
30312E30 2C060355 04031325 49F4F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 33383033 36303313 33906E17 0D313930 34313330 31333030
375A170D 33303031 30303030 5A303031 2E302C06 03550043 1325494F
532D5365 6C662D53 69666965 642D4635 72746966 69636174 652D3133 30353530
31333930 82012230 0D06092A 864886EF 0D010101 05000382 010F0030 82010A02
82010100 B7B59234 1162DE8C 14B4FAC7 744648E8C 9C8AF1D6 9195AAAC 9589F303
7DAA8AC B903F529 2270E932 F2624C10 F4E7FC45 0E6794DD 1F2444DB
D823808D 77F4AAEB 32343445 93802B1E 6FA14C4E C423F3BC E083BFE2 CA1E7B4D
4AEFB337 92ECC029 A3B07859 3184B00F 6E100248 735D2227 223B12E1 FC1EDAB6
F6134811 8DB31C01 74764C82 38E57C51 ED9C871D 7E529FF8 F1BD8913 8A698A09
D50563E5 F913997C 94F74F9BF D4CA2028 A466C02A 4E600389 92AF25C5 6E13AA0F
8179FC7F C5A11B85 0F007C0 05E348A9 DA2674A4 0D5D025F 27269F3E C0015FEE
3FE760F6 B5632A3D 4DD32FDE C7862F70 B3D01622 FF872F3E F70A62ED A63230C5
A4B183CF 02030100 01A35330 51300F0F 03551D13 0101FF04 05300301 01FF301F
0603551D 23041830 168014FB 7A485637 82C2C895 A7A0FE9F 06284EC4 9AEB7303
1D060355 1D0E0416 0414FB7A 48563782 C2C895A7 A0FE9F06 284EC49A E2B7300D
6092A86 4886F70D 01010505 00038201 0100570D E26CAB76 0BE8725D B3E9B32F
A897419B A986C419 1ADE6C61 B2F01289 A65CD638 4E81B512 B8A2FD4 4FE5D336
3AC309CA 6B3514BB 3BB6128B 505CE013 0C01B404 A5A28A7B A670F468 17AB221F
49E56FF0 09475C91 79842A87 CA55C431 1F441FF 52D1F3FF 399DFC0F 28433BB0
F8DB1AC5 6056947B EBD51B27 B79383F0 ECB23E10 C13054D3 37FABD66 1EB689C7
B459139 894E13C6 B0E50076 6A5D5726E 254BAE30 389E52FC 1BB73169 B7F5BEC
C283929C D62E20A3 B6296670 197F6764 39129A69 614306CB 7BA6COE3 D5371342
EB2E2235 EEFACBB1 A45F6975 281F828B A5C1EF48 F0CCEA07 1BC320C2 C152257D
9B8E217B D9E3683B 11DB61F4 9AA667F7 412C

quit

license udi pid CSR1000V sn 9ABCSEQ04GQX
diagnostic bootup level minimal
!
spanning-tree extend system-id
!
redundancy
  application redundancy
    group 1
      priority 100 failover threshold 75
      timers delay 30 reload 60
      control GigabitEthernet3 protocol 1
      data GigabitEthernet3
      track 1 shutdown
      track 2 shutdown
!
track 1 interface GigabitEthernet1 line-protocol
track 2 interface GigabitEthernet2 line-protocol
!
interface GigabitEthernet1
  description CUBE LAN
  ip address 10.64.3.135 255.255.0.0
  negotiation auto
  no mop enabled
  no mop sysid
  redundancy rii 1
  redundancy group 1 ip 10.64.3.80 exclusive
!
interface GigabitEthernet2
  description cube wan
  ip address 10.250.1.XX 255.255.255.0
  negotiation auto
  no mop enabled
  no mop sysid
  redundancy rii 2
  redundancy group 1 ip 10.250.1.XX exclusive
interface GigabitEthernet3
    description CUBE HA
    ip address 192.168.14.2 255.255.255.0
    negotiation auto
    no mop enabled
    no mop sysid

ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip http client source-interface GigabitEthernet1
ip route 0.0.0.0 0.0.0.0 10.250.1.xx
ip route 10.64.0.0 255.255.0.0 10.64.1.1
ip route 10.80.12.0 255.255.255.0 10.64.1.1
ip route 172.16.31.0 255.255.255.0 10.64.1.1
!
control-plane
!
dial-peer voice 1 voip
    description CUCM to PSTN - LAN Interface
    session protocol sipv2
    session transport udp
    incoming called-number .T
    voice-class codec 1
    voice-class sip bind control source-interface GigabitEthernet1
    voice-class sip bind media source-interface GigabitEthernet1
dtmf-relay rtp-nte
    fax-relay ecm disable
    fax rate 14400
    fax nsf 000000
    fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
    no vad
dial-peer voice 2 voip
description CUCM to PSTN - WAN Interface
destination-pattern .T
session protocol sipv2
session target ipv4:172.31.156.108:5060
session transport udp
voice-class codec 1
voice-class sip bind control source-interface GigabitEthernet2
voice-class sip bind media source-interface GigabitEthernet2
dtmf-relay rtp-nte
fax-relay ecm disable
fax rate 14400
fax nsf 000000
fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
no vad
!
dial-peer voice 3 voip
description PSTN to CUCM - WAN Interface
session protocol sipv2
session transport udp
incoming called-number 984465....
voice-class codec 1
voice-class sip bind control source-interface GigabitEthernet2
voice-class sip bind media source-interface GigabitEthernet2
dtmf-relay rtp-nte
fax-relay ecm disable
fax rate 14400
fax nsf 000000
fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
no vad
!
dial-peer voice 4 voip
description PSTN to CUCM - LAN Interface
destination-pattern 984465....
session protocol sipv2
session target ipv4:10.80.12.2:5060
session transport udp
voice-class codec 1
voice-class sip bind control source-interface GigabitEthernet1
voice-class sip bind media source-interface GigabitEthernet1
dtmf-relay rtp-npe
fax-relay ecm disable
fax rate 14400
fax nsf 000000
fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
no vad
!
!
!
line con 0
  exec-timeout 60 0
  password xxxxxxxx
  login
  stopbits 1
line vty 0 4
  password xxxxxxxx
  login
  transport input telnet
!
ppp profile pnp_cco_profile

  transport https host devicehelper.cisco.com. port 443 remotecert
  RXC_Trustpool

end
Standby Cisco UBE:

version 16.10
service timestamps debug datetime msec
service timestamps log datetime msec
service call-home
platform qfp utilization monitor load 80
no platform punt-keepalive disable-kernel-core
platform console virtual
!
hostname vcube
!
boot-start-marker
boot-end-marker
!
!
no logging queue-limit
logging buffered 10000000
no logging rate-limit
no logging console
no logging monitor
!
no aaa new-model
!
call-home

  ! If contact email address in call-host is configured as sch-smart-licensing@cisco.com

  ! the email address configured in Cisco Smart License Portal will be used as contact email address to send SCH notifications.
  contact-email-addr sch-smart-licensing@cisco.com

profile "CiscoTAC-1"
  active
  destination transport-method http
  no destination transport-method email
! login on-success log
subscriber templating
multilink bundle-name authenticated
!
voice service voip
no ip address trusted authenticate
address-hiding
mode border-element license capacity 20
allow-connections sip to sip
redundancy-group 1
fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
sip
  session refresh
  early-offer forced
  midcall-signaling passthru
  privacy-policy passthru
!
voice class codec 1
  codec preference 1 g711ulaw
  codec preference 2 g711alaw
  codec preference 3 g729r8
!
crypto pki trustpoint SLA-TrustPoint
  enrollment pkcs12
  revocation-check crl
!
crypto pki trustpoint TP-self-signed-487064547
  enrollment selfsigned
  subject-name cn=IOS-Self-Signed-Certificate-487064547
  revocation-check none
  rsakeypair TP-self-signed-487064547
!
!
crypto pki certificate chain SLA-TrustPoint

certificate ca 01

30820321 30820209 A0030201 02020101 300D0609 2A864886 F70D0101 0B050030
32310E30 0C060355 040A1305 43697363 6F312030 1E060355 04031317 43697363
6F204C69 63656E73 696E6720 526F6F74 20434130 0E060355 04031317 43697363
3834375A 170D3338 30353330 31393438 34375A30 32310E30 0C060355 040A1305
43697363 6F312030 0E060355 04031317 43697363 6F204C69 63656E73 696E6720
526F6F74 20434130 0E060355 04031317 43697363 6F204C69 63656E73 696E6720
82012230 0D0609A2 864886F7 0D010101 05000382 010F0030
82010100 A6BCBD96 131E05F7 145EA72C 2CD686E6 17222E21 F1EFF64D
CBB4C798 212AA147 C655D07D 97138030 8711414E 1AAFF071A 9CAE6388 8A38E520
1C394D78 462EF239 C659F715 B98C0A59 5BB5C8BD 0CFFBE3A 700A8BF7 D8F256EE
4AA4E80D DB6FD1C9 60B1FD18 FFC69C96 6FA68957 A2617DE7 104FDC5F EA2956AC
7390A3EB 2B5436AD C847A2C5 DAB553EB 69A9A535 58E9F3E3 C0BD23CF 58BD7188
68E69491 20F320E7 948E71D7 AE3BCC84 F10684C7 4BC8EE0F 539BA42B 42C688BB
C7479096 B4CB2D62 EA2F505D C7B062A4 6811D95B E8250FC4 5D5D5F88 8F27D191
C55F0D76 61F9A4CD 3D992327 A8BB03B3 4E6D7069 7CBADF8B DF5F4368 95135E44
DFC7C6CF 04DDFD11 02030100 01A34230 40300E06 03551D0F 0101FF04 04030201
06300F06 03551D13 0101FF04 05300301 01FF301D 06300F06 03551D13 0101FF04
48706454 7A66025D 9F32A66 86025DF9 E838AE5C 6D4DF6B0 49631C78 240DA905
604EDCDE FF4FED2B 77FC460E CD636FD8 D44681E 3A5673AB 9093D3B1 6C9E3D8B
D98987BF E40C8D9E 1AEAC02C 2189BB5C 8FA856B6 CD9B8646 5575B146 8DFC66A8
467A3DF4 4D565700 6ADFOFO0 CF835015 3C04FF7C 21E878AC 11B9A9CD 55A9232C
7CA7B7E6 C1A7F46F 152E99B7 B1FCF9BB E973DE7F 5BDDEB86 C717E3B49 1765308B
5FB0DA06 B92A69E7 494E8A9E 07B85737 F3A58BE1 1A48A229 C37C1E69 39F08678
80DDCD16 D6BACECA EEE5C7CF 8428787B 35202CD6 0E4616A B623C8BD 230E3AFB
418616A9 4093E049 4D10AB75 27E867F3 932E35B5 8862FDAE 0275156F 719BB2F0
D697DF7F 28

quit

crypto pki certificate chain TP-self-signed-487064547

certificate self-signed 01

3082032E 30820216 A0030201 02020101 300D0609 2A864886 F70D0101 0B050030
30312E30 2C060355 04031325 494F532D 53656C66 2D536967 6E65642D 43657274
69666963 6174652D 34383730 36343534 37301E17 0D313930 32323630 36313031
quit

license udi pid CSR1000V sn 9I14XTQTGNR
license boot level ax
license smart transport callhome
diagnostic bootup level minimal
!
spanning-tree extend system-id
!
!

redundancy

application redundancy
group 1
  name vCUBEHA
  priority 100 failover threshold 75
timers delay 30 reload 60
  control GigabitEthernet3 protocol 1
data GigabitEthernet3
  track 1 shutdown
  track 2 shutdown

track 1 interface GigabitEthernet1 line-protocol
track 2 interface GigabitEthernet2 line-protocol

interface GigabitEthernet1
  description cube LAN
  ip address 10.64.3.136 255.255.0.0
  negotiation auto
  no mop enabled
  no mop sysid
  redundancy rii 1
  redundancy group 1 ip 10.64.3.80 exclusive

interface GigabitEthernet2
  description cube WAN
  ip address 10.250.1.XX 255.255.255.0
  negotiation auto
  no mop enabled
  no mop sysid
  redundancy rii 2
  redundancy group 1 ip 10.250.1.XX exclusive

!
interface GigabitEthernet3
    description CUBE HA
    ip address 192.168.14.3 255.255.0.0
    negotiation auto
    no mop enabled
    no mop sysid
    
    ip forward-protocol nd
    ip http server
    ip http authentication local
    ip http secure-server
    ip http client source-interface GigabitEthernet1
    ip route 0.0.0.0 0.0.0.0 10.250.1.xx
    ip route 10.64.0.0 255.255.0.0 10.64.1.1
    ip route 10.80.12.0 255.255.0.0 10.64.1.1
    ip route 172.16.31.0 255.255.255.0 10.64.1.1
    
    control-plane
    
    dial-peer voice 1 voip
        description CUCM to PSTN - LAN Interface
        session protocol sipv2
        session transport udp
        incoming called-number .T
        voice-class codec 1
        voice-class sip bind control source-interface GigabitEthernet1
        voice-class sip bind media source-interface GigabitEthernet1
        dtmf-relay rtp-nte
        fax-relay ecm disable
        fax rate 14400
        fax nsf 000000
        fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
        no vad
        !
dial-peer voice 2 voip

  description CUCM to PSTN - WAN Interface
  destination-pattern .T
  session protocol sipv2
  session target ipv4:172.31.156.108:5060
  session transport udp
  voice-class codec 1
  voice-class sip bind control source-interface GigabitEthernet2
  voice-class sip bind media source-interface GigabitEthernet2
  dtmf-relay rtp-nate
  fax-relay ecm disable
  fax rate 14400
  fax nsf 000000
  fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
  no vad

!
dial-peer voice 3 voip

  description PSTN to CUCM - WAN Interface
  session protocol sipv2
  session transport udp
  incoming called-number 984465....
  voice-class codec 1
  voice-class sip bind control source-interface GigabitEthernet2
  voice-class sip bind media source-interface GigabitEthernet2
  dtmf-relay rtp-nate
  fax-relay ecm disable
  fax rate 14400
  fax nsf 000000
  fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
  no vad

!
! dial-peer voice 4 voip
description PSTN to CUCM - LAN Interface
destination-pattern 984465....
session protocol sipv2
session target ipv4:10.80.12.2:5060
session transport udp
voice-class codec 1
voice-class sip bind control source-interface GigabitEthernet1
voice-class sip bind media source-interface GigabitEthernet1
dtmf-relay rtp-nte
fax-relay ecm disable
fax rate 14400
fax nsf 000000
fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
no vad
!
line con 0
exec-timeout 60 0
password xxxxxxx
login
stopbits 1
line vty 0 4
password xxxxxxx
login
transport input telnet
!
pnp profile pnp_cco_profile
transport https host devicehelper.cisco.com. port 443 remotecert
RXC_Trustpool
end
Configuring Cisco Unified Communications Manager

Cisco UCM Version

Figure 3 cisco UCM Version
Cisco Call Manager Service Parameters

Navigation: System → Service Parameters

1. Select Server*: Clus22ub1--CUCM Voice/Video (Active)
2. Select Service*: Cisco CallManager (Active)
3. All other fields are set to default values

![Select Server and Service](image)

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code Yellow Entry Latency</td>
<td>20</td>
</tr>
<tr>
<td>Code Yellow Exit Latency</td>
<td>40</td>
</tr>
<tr>
<td>Code Yellow Duration</td>
<td>5</td>
</tr>
<tr>
<td>Max Events Allowed</td>
<td>2000</td>
</tr>
<tr>
<td>System Throttle Sample Size</td>
<td>10</td>
</tr>
</tbody>
</table>

Figure 4: Service Parameters
Offnet Calls via Verizon SIP Trunk

Off-net calls are served by SIP trunks configured between Cisco UCM and the Verizon network and calls are routed via Cisco UBE.

SIP Trunk Security Profile

Navigation: System → Security → SIP Trunk Security Profile

1. Name*: Non Secure SIP Trunk Profile_verizon
2. Description: Non Secure SIP Trunk Profile authenticated by null String

<table>
<thead>
<tr>
<th>SIP Trunk Security Profile Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name*</td>
</tr>
<tr>
<td>Non Secure SIP Trunk Profile_verizon</td>
</tr>
<tr>
<td>Description</td>
</tr>
<tr>
<td>Non Secure SIP Trunk Profile authenticated by null String</td>
</tr>
<tr>
<td>Device Security Mode</td>
</tr>
<tr>
<td>Non Secure</td>
</tr>
<tr>
<td>Incoming Transport Type</td>
</tr>
<tr>
<td>TCP+UDP</td>
</tr>
<tr>
<td>Outgoing Transport Type</td>
</tr>
<tr>
<td>UDP</td>
</tr>
<tr>
<td>Enable Digest Authentication</td>
</tr>
<tr>
<td>Nonce Validity Time (mins)*</td>
</tr>
<tr>
<td>Secure Certificate Subject or Subject Alternate Name</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Incoming Port</td>
</tr>
<tr>
<td>5060</td>
</tr>
<tr>
<td>Enable Application level authorization</td>
</tr>
<tr>
<td>Accept presence subscription</td>
</tr>
<tr>
<td>Accept out-of-dialog refer**</td>
</tr>
<tr>
<td>Accept unsolicited notification</td>
</tr>
<tr>
<td>Accept replaces header</td>
</tr>
<tr>
<td>Transmit security status</td>
</tr>
<tr>
<td>Allow changing header</td>
</tr>
<tr>
<td>SIP V150 Outbound SDP Offer Filtering*</td>
</tr>
<tr>
<td>Use Default Filter</td>
</tr>
</tbody>
</table>

Figure 5: SIP Trunk Security Profile
**Explanation**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incoming Transport Type</td>
<td>TCP + UDP</td>
<td></td>
</tr>
<tr>
<td>Outgoing Transport Type</td>
<td>UDP</td>
<td>SIP trunks to VCUBE should use UDP as a transport protocol for SIP. This is configured using SIP Trunk Security profile, which is later assigned to the SIP trunk itself.</td>
</tr>
</tbody>
</table>

**SIP Profile Configuration**

SIP Profile will be later associated with the SIP trunk

Navigation: Device → Device Settings → SIP Profile

1. Name*: Verizon SIP Profile, for example
2. Description: Verizon SIP Profile, for example
### SIP Profile Information

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Verizon SIP Profile</td>
</tr>
<tr>
<td>Description</td>
<td>Verizon SIP Profile</td>
</tr>
<tr>
<td>Default MTP Telephony Event Payload Type</td>
<td>101</td>
</tr>
<tr>
<td>Early Offer for G.729 Calls</td>
<td>Disabled</td>
</tr>
<tr>
<td>User-Agent and Server Header information</td>
<td>Send Unified CM Version Information as User-Agent</td>
</tr>
<tr>
<td>Version in User Agent and Server Header</td>
<td>Major And Minor</td>
</tr>
<tr>
<td>Dial String Interpretation</td>
<td>Phone number consists of characters 0-9, *, #, and +</td>
</tr>
<tr>
<td>Confidential Access Level Headers</td>
<td>Disabled</td>
</tr>
</tbody>
</table>

#### SDP Information

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDP Session-level Bandwidth Modifier for Early Offer and Re-invites</td>
<td>TIAE and AS</td>
</tr>
<tr>
<td>SDP Transparency Profile</td>
<td>Pass all unknown SDP attributes</td>
</tr>
<tr>
<td>Accept Audio Codec Preferences in Received Offer</td>
<td>Default</td>
</tr>
<tr>
<td>Require SDP Inactive Exchange for Mid-Call Media Change</td>
<td></td>
</tr>
<tr>
<td>Allow RR/RS bandwidth modifier (RFC 3556)</td>
<td></td>
</tr>
</tbody>
</table>

#### Parameters used in Phone

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timer Invite Expires (seconds)</td>
<td>180</td>
</tr>
<tr>
<td>Timer Register Delta (seconds)</td>
<td>5</td>
</tr>
<tr>
<td>Timer Register Expires (seconds)</td>
<td>3600</td>
</tr>
<tr>
<td>Timer T1 (msec)</td>
<td>500</td>
</tr>
<tr>
<td>Timer T2 (msec)</td>
<td>4000</td>
</tr>
<tr>
<td>Retry INVITE</td>
<td>6</td>
</tr>
<tr>
<td>Retry Non-INVITE</td>
<td>10</td>
</tr>
<tr>
<td>Media Port Ranges</td>
<td></td>
</tr>
<tr>
<td>Common Port Range for Audio and Video</td>
<td></td>
</tr>
<tr>
<td>Separate Port Range for Audio and Video</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 6: SIP Profile**
Figure 6: SIP Profile (Cont.)
### Explanation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default MTP Telephony Event Payload Type</td>
<td>101</td>
<td>RFC2833 DTMF payload type</td>
</tr>
<tr>
<td>SIP Rel1XX Options</td>
<td>Send PRACK for 1xx Messages</td>
<td>Enable Provisional Acknowledgements</td>
</tr>
<tr>
<td>Ping Interval for In-service and Partially In-service Trunks (seconds)</td>
<td>60</td>
<td>OPTIONS message parameters- interval time</td>
</tr>
<tr>
<td>Ping Interval for Out-of-service Trunks (seconds)</td>
<td>120</td>
<td>OPTIONS message parameters- interval time</td>
</tr>
</tbody>
</table>
SIP Trunk Configuration

Create SIP trunks to Cisco UBE

Navigation: Device → Trunk

Figure 7: SIP Trunks List

Figure 8: SIP Trunk to Cisco UBE
Figure 8: SIP Trunk to Cisco UBE (Cont.)
Figure 8: SIP Trunk to Cisco UBE (Cont.)
## Explanation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Name</td>
<td>Verizon_Trunk</td>
<td>Name for the trunk</td>
</tr>
<tr>
<td>Device Pool</td>
<td>G711pool</td>
<td>Default Device Pool is used for this trunk</td>
</tr>
<tr>
<td>Media Resource Group List</td>
<td>MRGL_MTP</td>
<td>MRG with resources: ANN, CFB, MOH and MTP</td>
</tr>
<tr>
<td>Significant Digits</td>
<td>4</td>
<td>4 digits Extension for all CPE phones</td>
</tr>
<tr>
<td>Destination Address</td>
<td>10.64.3.80</td>
<td>IP address of the Cisco UBE Virtual LAN</td>
</tr>
<tr>
<td>SIP Trunk Security Profile</td>
<td>Non Secure SIP Trunk Profile</td>
<td>SIP Trunk Security Profile configured earlier</td>
</tr>
<tr>
<td>SIP Profile</td>
<td>Verizon SIP Profile</td>
<td>SIP Profile configured earlier</td>
</tr>
</tbody>
</table>
Dial Plan
Route Pattern Configuration

Navigation: Call Routing → Route/Hunt → Route Pattern

Route patterns are configured as below:

- Cisco IP phone dial “8”+10 digits number to access PSTN via Cisco UBE
  - “8” is removed before sending to Cisco UBE
- For FAX call, Access Code “8”+10 digits number is used at Cisco Fax gateway
  - “8” is removed at Cisco UCM
  - The rest of the number is sent to Cisco UBE to Verizon network
- Incoming fax call to 8000 will be sent to Cisco Fax gateway

Figure 9: Route Patterns List
Figure 10: Route Pattern for Voice

Figure 10: Route Pattern for Voice (cont..)
**Figure 11: Route Pattern for Fax**

- **Pattern Definition**
  - **Route Pattern**: 884465XXXX
  - **Route Partition**: Not selected
  - **Description**: Verizon
  - **Numbering Plan**: Not selected
  - **Route Filter**: Not selected
  - **MLPP Precedence**: Default
  - **Apply Call Blocking Percentage**: Not selected
  - **Resource Priority Namespace Network Domain**: Not selected
  - **Route Class**: Default
  - **Gateway/Route List**: Trunk to FAXGW
  - **Call Classification**: Offnet
  - **External Call Control Profile**: Not selected
  - **Allow Device Override**: Not selected
  - **Provide Outside Dial Tone**: Not selected
  - **Allow Overlap Sending**: Not selected
  - **Urgent Priority**: Not selected
  - **Require Forced Authorization Code**: Not selected
  - **Authorization Level**: 0
  - **Require Client Matter Code**: Not selected

- **Calling Party Transformations**
  - **Use Calling Party's External Phone Number Mask**: Not selected
  - **Calling Party Transform Mask**: Not selected
  - **Prefix Digits (Outgoing Calls)**: Not selected
  - **Calling Line ID Presentation**: Default
  - **Calling Name Presentation**: Default
  - **Calling Party Number Type**: Cisco CallManager
  - **Calling Party Numbering Plan**: Cisco CallManager

- **Connected Party Transformations**
  - **Connected Line ID Presentation**: Default
  - **Connected Name Presentation**: Default

- **Called Party Transformations**
  - **Dialled Digits**: Not selected
  - **Called Party Transform Mask**: Not selected
  - **Prefix Digits (Outgoing Calls)**: Not selected
  - **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**: Not selected
  - **Network Service**: Not selected
  - **Service Parameter Name**: Not selected
  - **Service Parameter Value**: Not selected

**Figure 11: Route Pattern for Fax (Cont...)**
### Explanation

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route Pattern</td>
<td>8.@ for Voice &amp; International Calls and 884465XXXXX for Fax Call</td>
<td>Specify appropriate Route Pattern</td>
</tr>
<tr>
<td>Gateway/Route List</td>
<td>Verizon_trunk for Route Pattern 8.@ and Trunk_to_FAXGW for Route Pattern 884465XXXXX</td>
<td>SIP Trunk name configured earlier</td>
</tr>
<tr>
<td>Numbering Plan</td>
<td>NANP for Route Pattern 8.@</td>
<td>North American Numbering Plan</td>
</tr>
<tr>
<td>Call Classification</td>
<td>OffNet for Route Pattern 8.@ and 884465XXXXX</td>
<td>Restrict the transferring of an external call to an external device</td>
</tr>
<tr>
<td>Discard Digits</td>
<td>PreDot for Route Pattern 8.@</td>
<td>Specifies how to modify digit before they are sent to Verizon network</td>
</tr>
</tbody>
</table>

### Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPE</td>
<td>Customer Premise Equipment</td>
</tr>
<tr>
<td>Cisco UBE</td>
<td>Cisco Unified Border Element</td>
</tr>
<tr>
<td>Cisco UCM</td>
<td>Cisco Unified Communications Manager</td>
</tr>
<tr>
<td>MTP</td>
<td>Media Termination Point</td>
</tr>
<tr>
<td>POP</td>
<td>Point of Presence</td>
</tr>
<tr>
<td>PSTN</td>
<td>Public Switched Telephone Network</td>
</tr>
<tr>
<td>ESBC</td>
<td>Enterprise Session Border Controller</td>
</tr>
<tr>
<td>SCCP</td>
<td>Skinny Client Control Protocol</td>
</tr>
<tr>
<td>SIP</td>
<td>Session Initiation Protocol</td>
</tr>
</tbody>
</table>
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<th>Americas Headquarters</th>
<th>Asia Pacific Headquarters</th>
</tr>
</thead>
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<tr>
<td>170 West Tasman Drive</td>
<td>Haarlerbergpark</td>
<td>170 West Tasman Drive</td>
<td>Capital Tower</td>
</tr>
<tr>
<td>San Jose, CA 95134-1706</td>
<td>Haarlerbergweg 13-19</td>
<td>San Jose, CA 95134-1706</td>
<td>168 Robinson Road</td>
</tr>
<tr>
<td>USA</td>
<td>1101 CH Amsterdam</td>
<td>USA</td>
<td>#22-01 to #29-01</td>
</tr>
<tr>
<td><a href="http://www.cisco.com">www.cisco.com</a></td>
<td>The Netherlands</td>
<td><a href="http://www.cisco.com">www.cisco.com</a></td>
<td>Singapore 068912</td>
</tr>
<tr>
<td>Tel: 408 526-4000</td>
<td>www-europe.cisco.com</td>
<td>Tel: 408 526-7660</td>
<td>Tel: +65 317 7777</td>
</tr>
<tr>
<td>800 553-NETS (6387)</td>
<td></td>
<td>Fax: 408 527-0883</td>
<td>Fax: +65 317 7799</td>
</tr>
<tr>
<td>Fax: 408 526-4100</td>
<td></td>
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<tr>
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<td></td>
</tr>
</tbody>
</table>

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