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Troubleshooting Webex Calling Premises-based PSTN

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BRKCOL-2812

Agenda

- Webex Calling PSTN Architecture
- CUBE SIP Registration
- Call Routing
- SIP Troubleshooting
- Voice Quality

Webex Calling PSTN Architecture

Webex Calling PSTN Options

Connection Type

Choose the connection type for all phone numbers associated with Cisco Live Test.

Cisco PSTN

Cisco-provided PSTN provides a bundled Cisco solution that simplifies your cloud calling experience with easy PSTN ordering and full support from Cisco and our Partners.

Cloud Connected PSTN

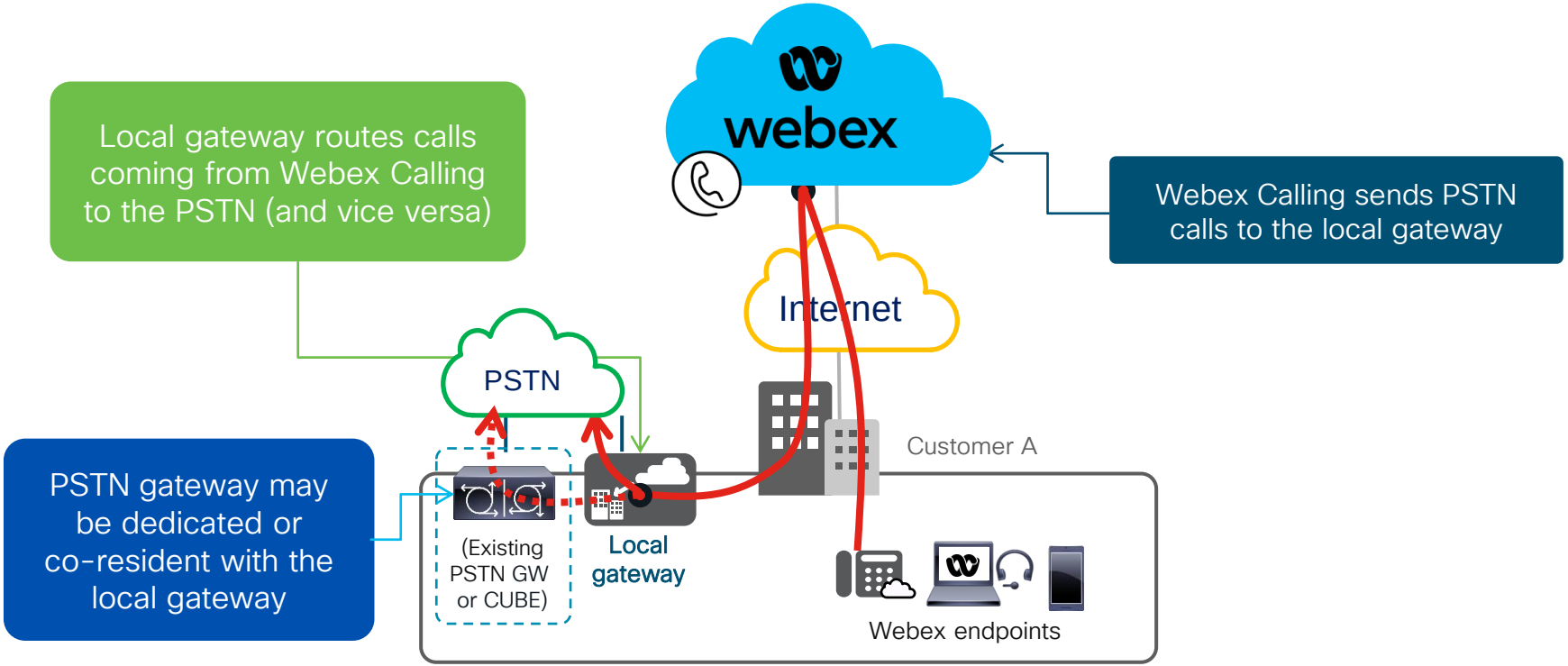
Select Cisco Cloud Connected PSTN partners that provide flexible global PSTN solutions fully integrated with Cisco's Webex Calling cloud.

Premises-based PSTN

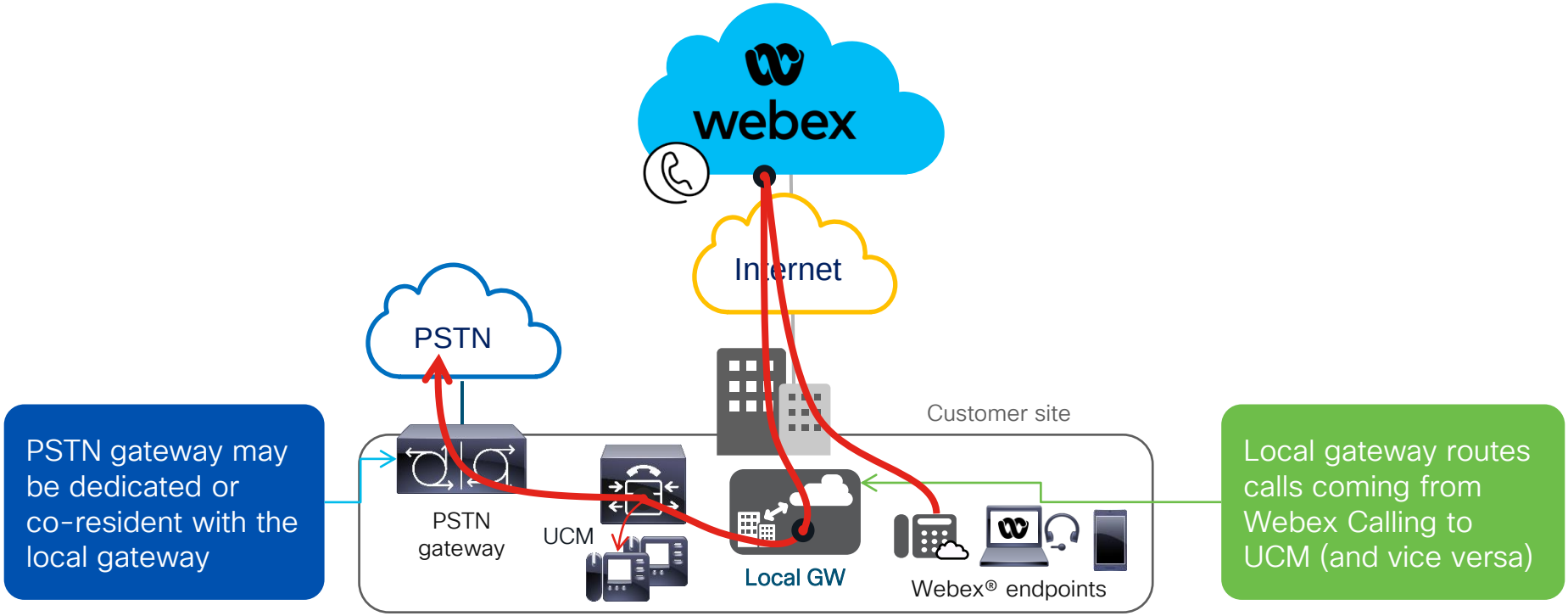
(formerly local gateway)

Bring Your Own Carrier by interconnecting any Service Provider's PSTN with a premises-based local gateway that tightly integrates to Cisco's Webex Calling cloud.

Premises-based PSTN Deployment Models
Single Site with and without separate PSTN gateway

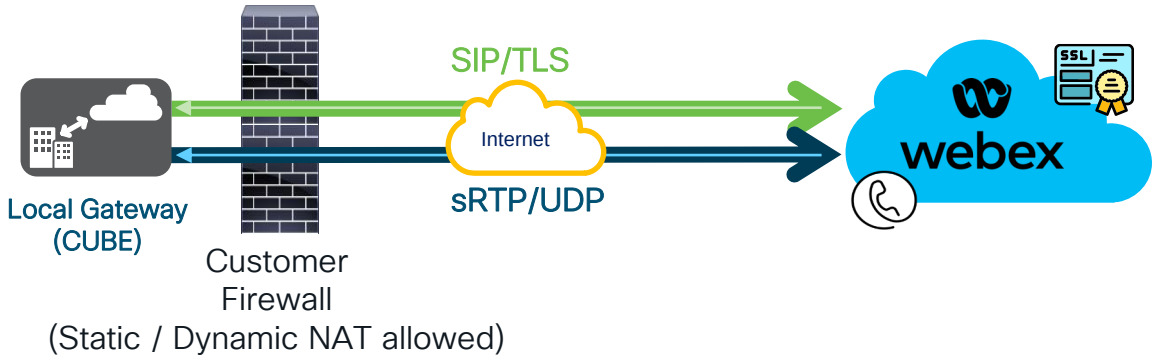


Premises-based PSTN Deployment Models
Single Site with UCM Integration

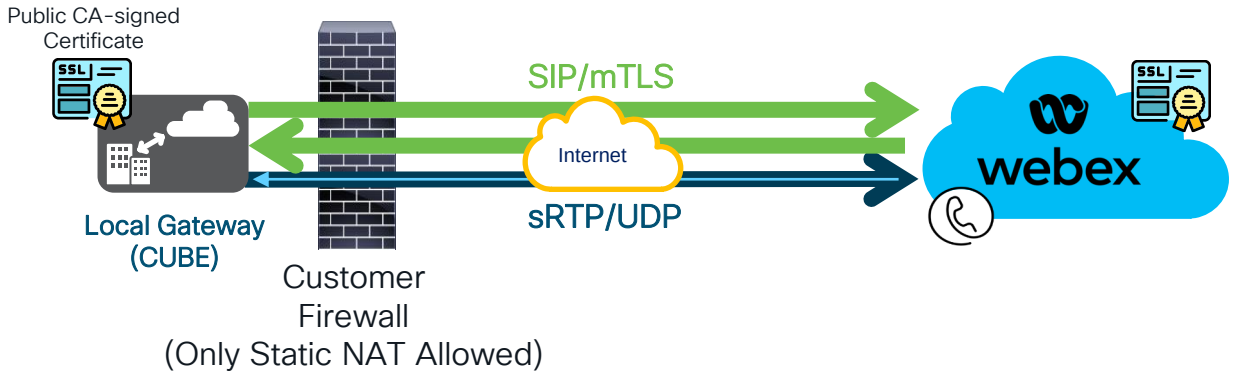


Local Gateway Connection Options

Registration-Based

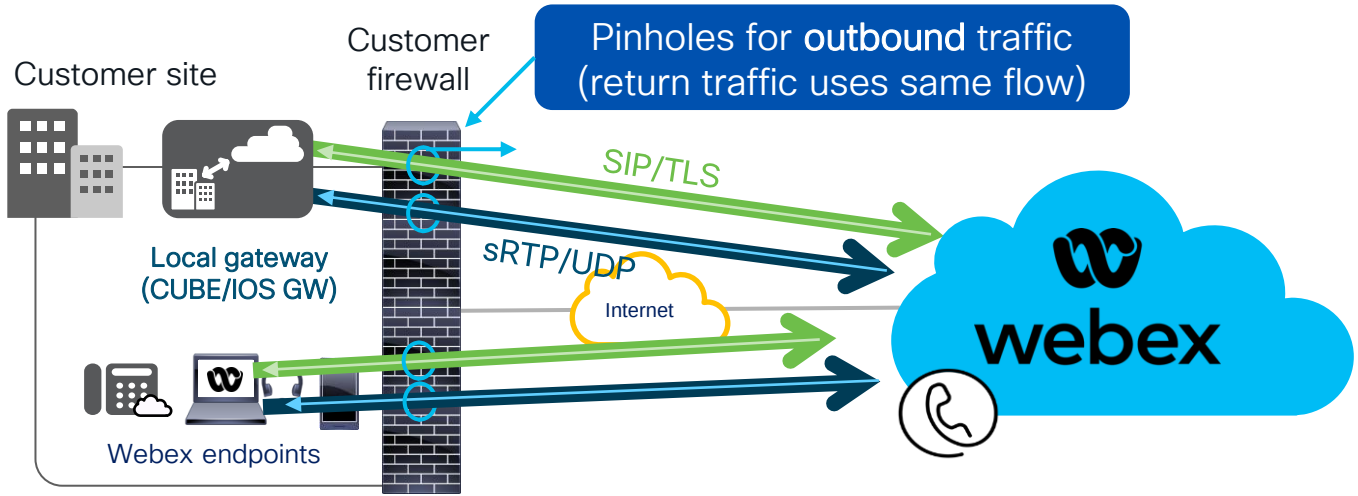


Certificate-Based



Registration-Based Local Gateway: CUBE SIP Registration

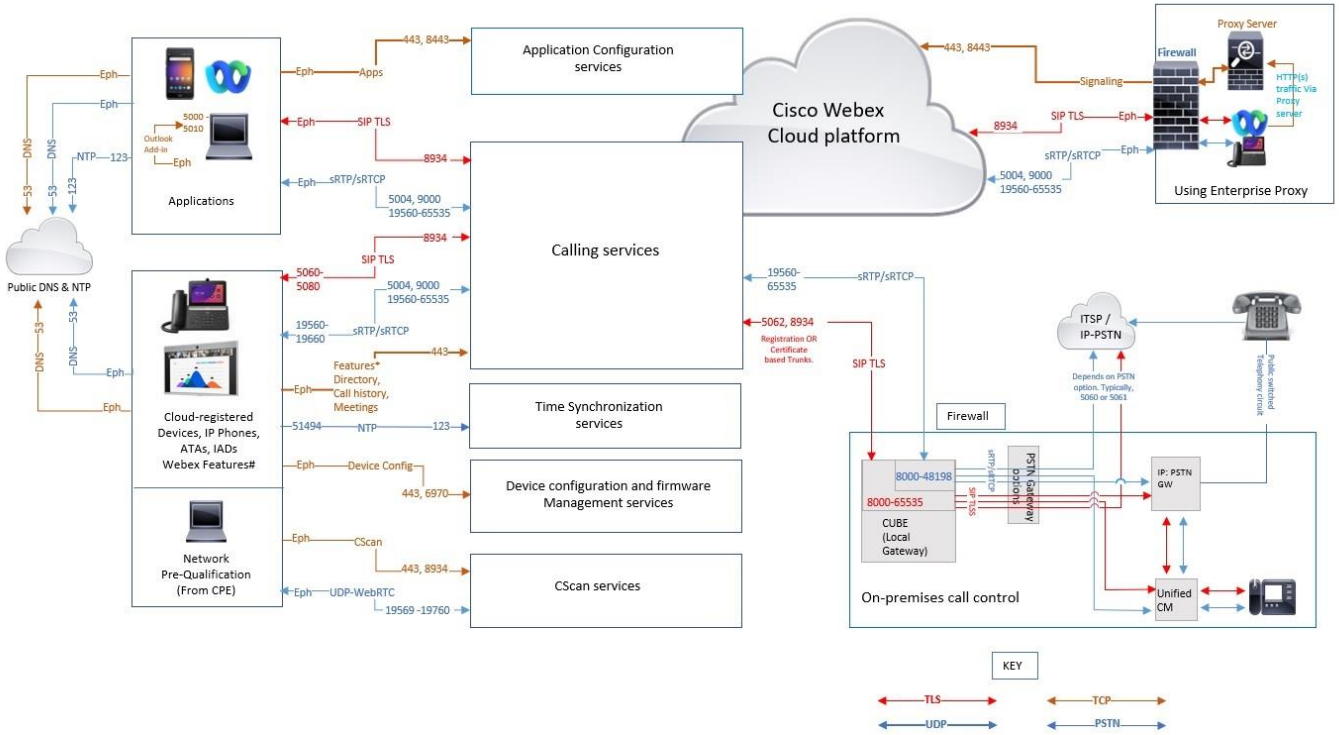
CUBE as a local gateway
Firewall and NAT traversal



- In most cases, the local gateway and endpoints can sit on the internal customer network using private IP addresses (with NAT and PAT)
- Firewall needs to allow outbound traffic (SIP, RTP/UDP, HTTP) to specific IP addresses/ports (see updated Webex Calling port reference guide)

CUBE as a local gateway
Firewall and NAT traversal

https://help.webex.com/en-us/article/b2exve/Port-Reference-Information-for-Cisco-Webex-Calling



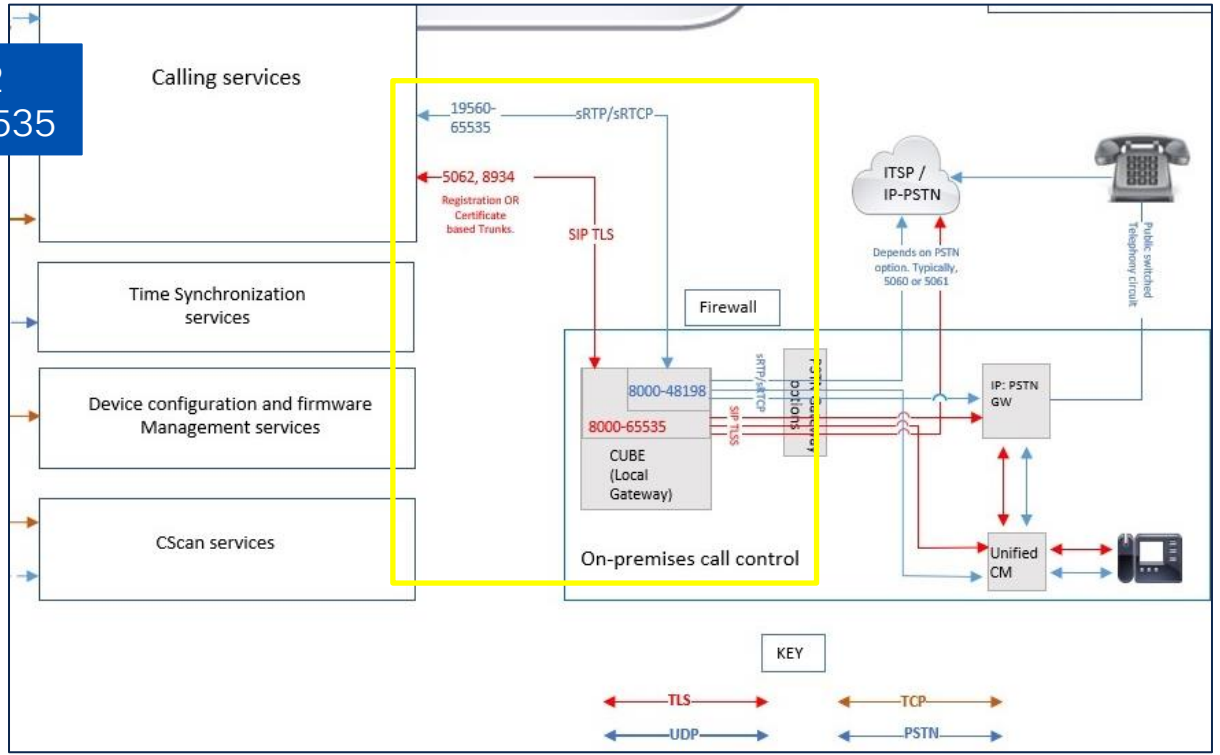
CUBE as a local gateway Firewall and NAT traversal

https://help.webex.com/en-us/article/b2exve/Port-Reference-Information-for-Cisco-Webex-Calling

- Permit TCP port 8934 or 5062
- Permit UDP ports 19560 – 65535

- Access to DNS

- Access to NTP

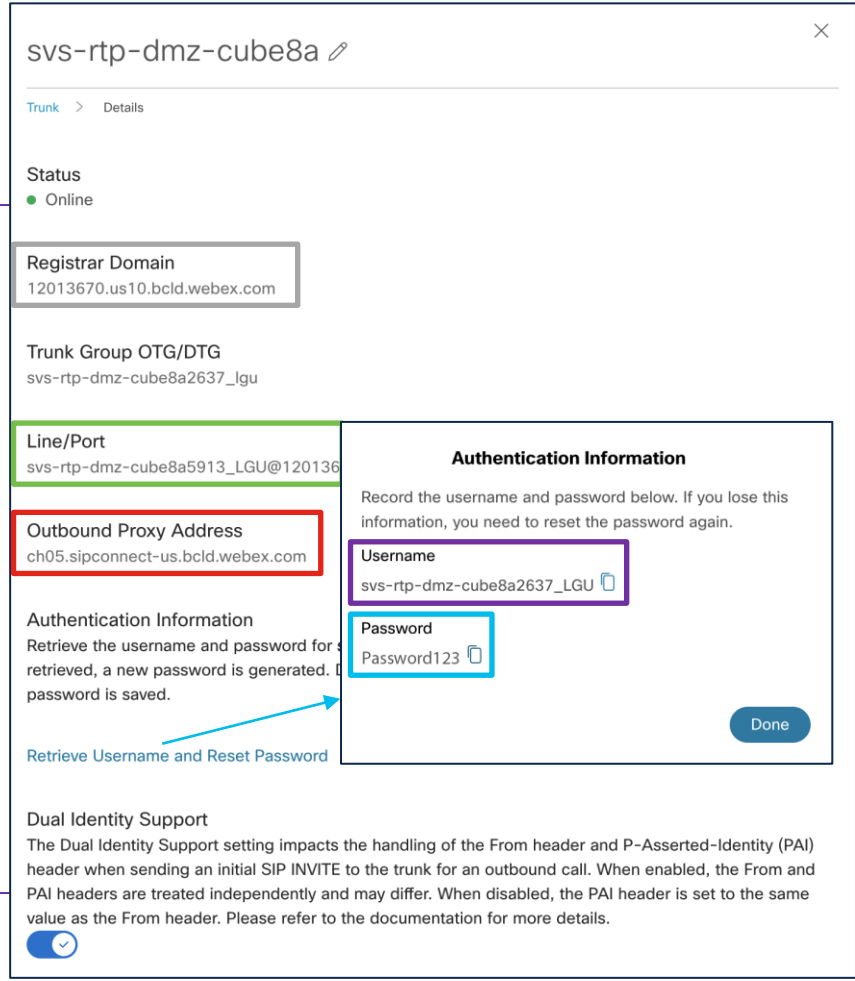


CUBE Configuration Guide

https://help.webex.com/en-us/article/jr1i3r/Configure-Local-Gateway-on-IOS-XE-for-Webex-Calling

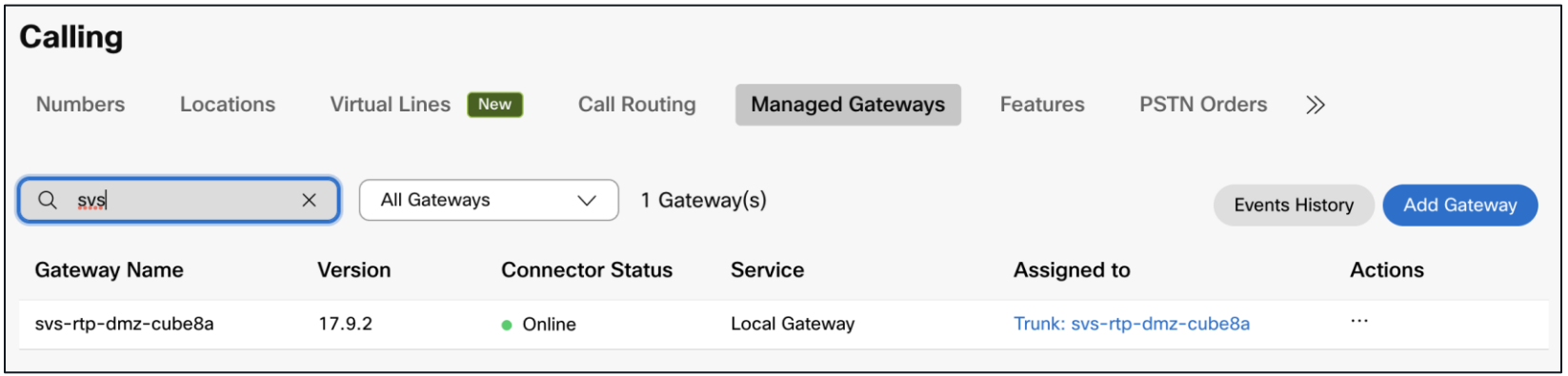
CUBE Configuration

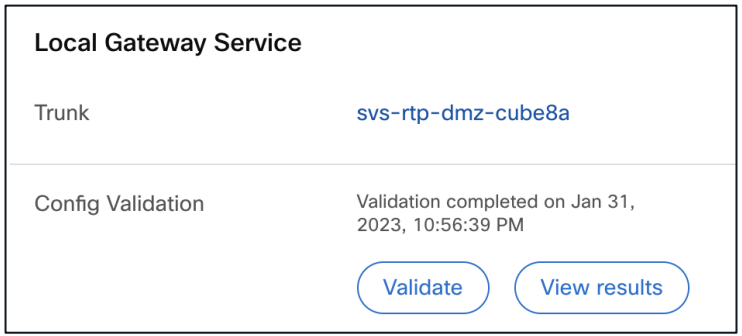
```
voice class tenant 200
 registrar dns:12013670.us10.bcld.webex.com scheme sips expires 240
    refresh-ratio 50 tcp tls
 credentials number svs-rtp-dmz-cube8a5913_LGU username
    svs-rtp-dmz-cube8a2637_LGU password 0 Password123 realm BroadWorks
 authentication username svs-rtp-dmz-cube8a2637_LGU password 0
    Password123 realm BroadWorks
 authentication username svs-rtp-dmz-cube8a2637_LGU password 0
    Password123 realm 12013670.us10.bcld.webex.com
 no remote-party-id
 sip-server dns:12013670.us10.bcld.webex.com
 connection-reuse
 srtp-crypto 200
 session transport tcp tls
 url sips
 error-passthru
 asserted-id pai
 bind control source-interface GigabitEthernet1
 bind media source-interface GigabitEthernet1
 no pass-thru content custom-sdp
 sip-profiles 200
 outbound-proxy dns:ch05.sipconnect-us.bcld.webex.com
 privacy-policy passthru
```



Managed Gateway – Config Validation

Calling > Managed Gateways

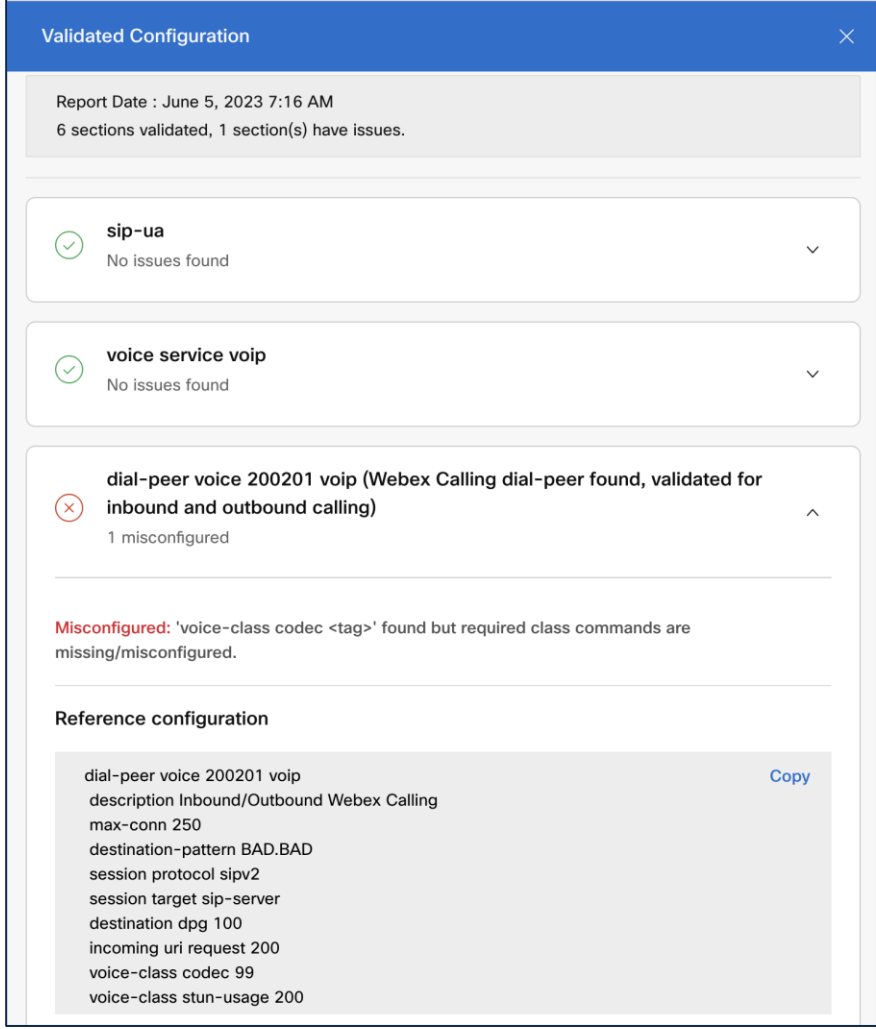




Managed Gateway

- Requires Gateway Connector be installed on Local Gateway
- Performs basic configuration validation
- Not all configuration is checked today
- Can miss some misconfiguration such as invalid password (it cannot see what your password is)

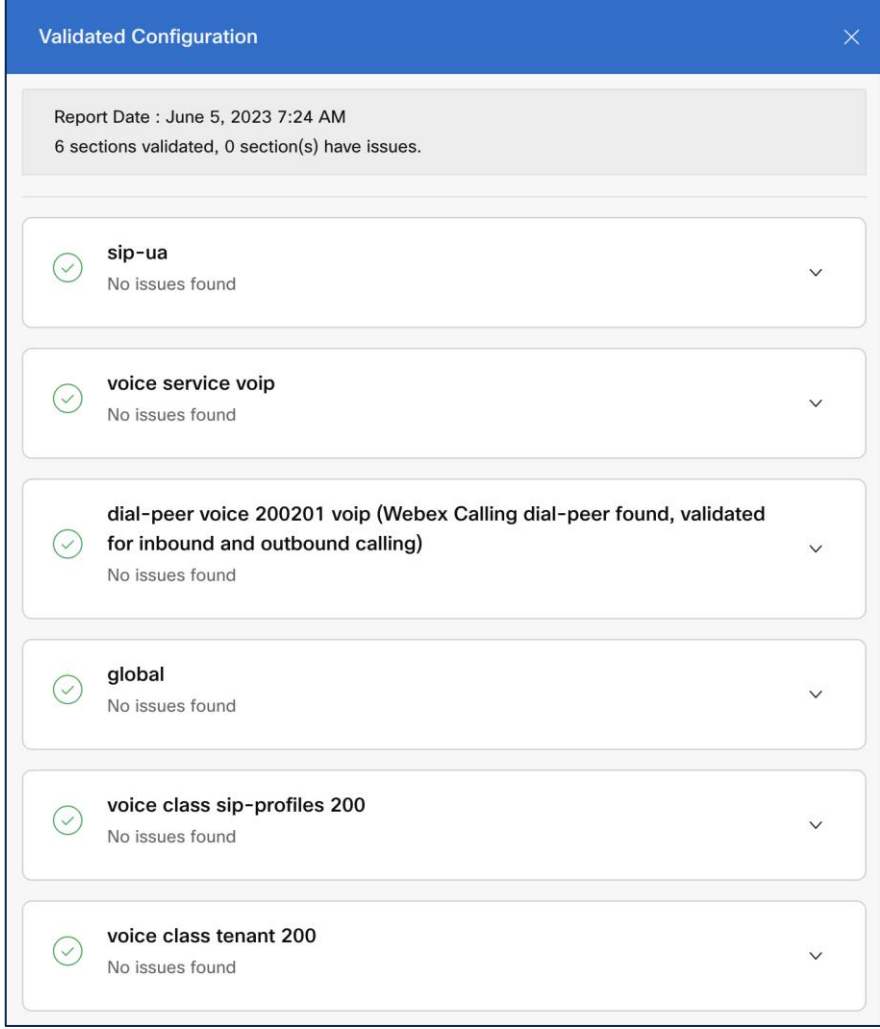
```
svs-rtp-dmz-cube8a#sh run | beg codec
voice class codec 99
 codec preference 1 g711ulaw
 codec preference 2 g711alaw
```



Managed Gateway

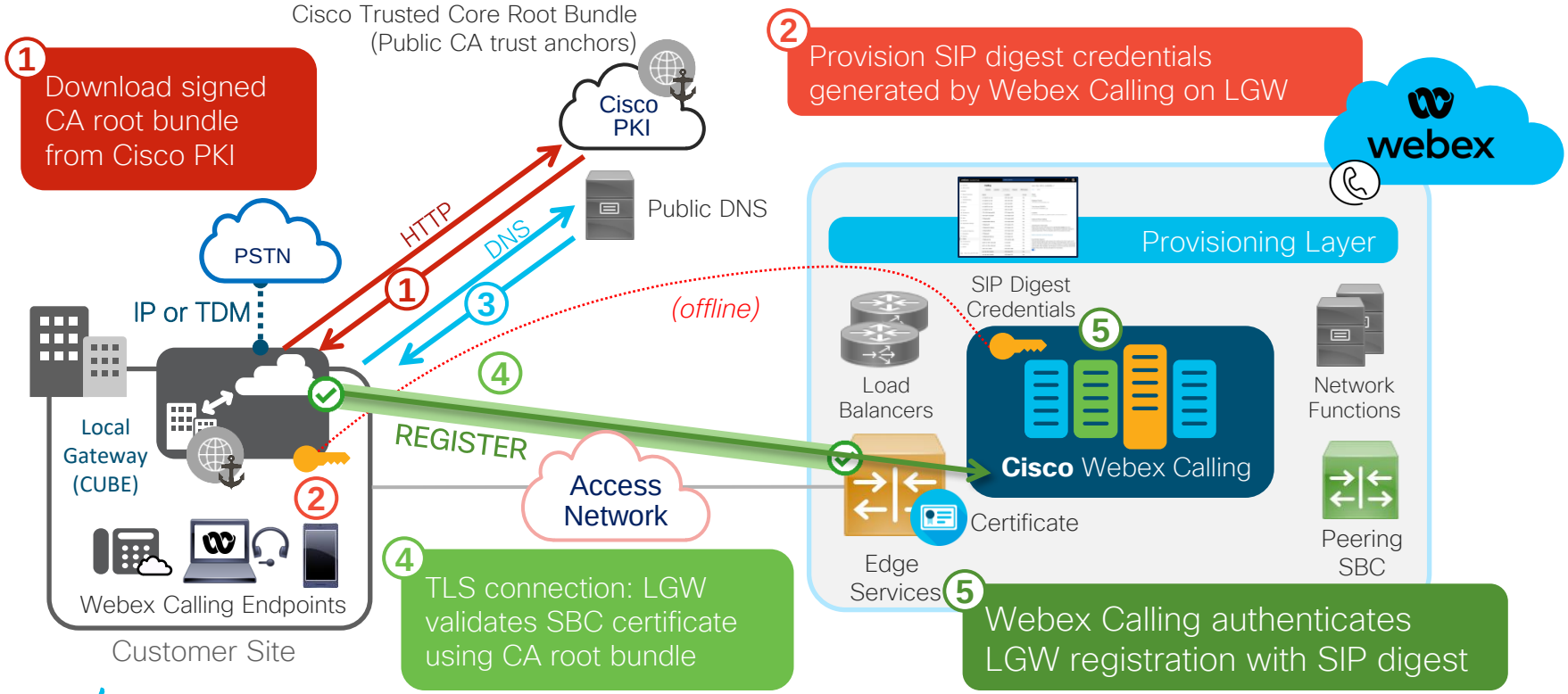
- Requires Gateway Connector be installed on Local Gateway
- Performs basic configuration validation
- Not all configuration is checked today
- Can miss some misconfiguration such as invalid password (it cannot see what your password is)

```
svs-rtp-dmz-cube8a#sh run | beg codec
voice class codec 99
 codec preference 1 g711ulaw
 codec preference 2 g711alaw
 codec preference 3 opus
```

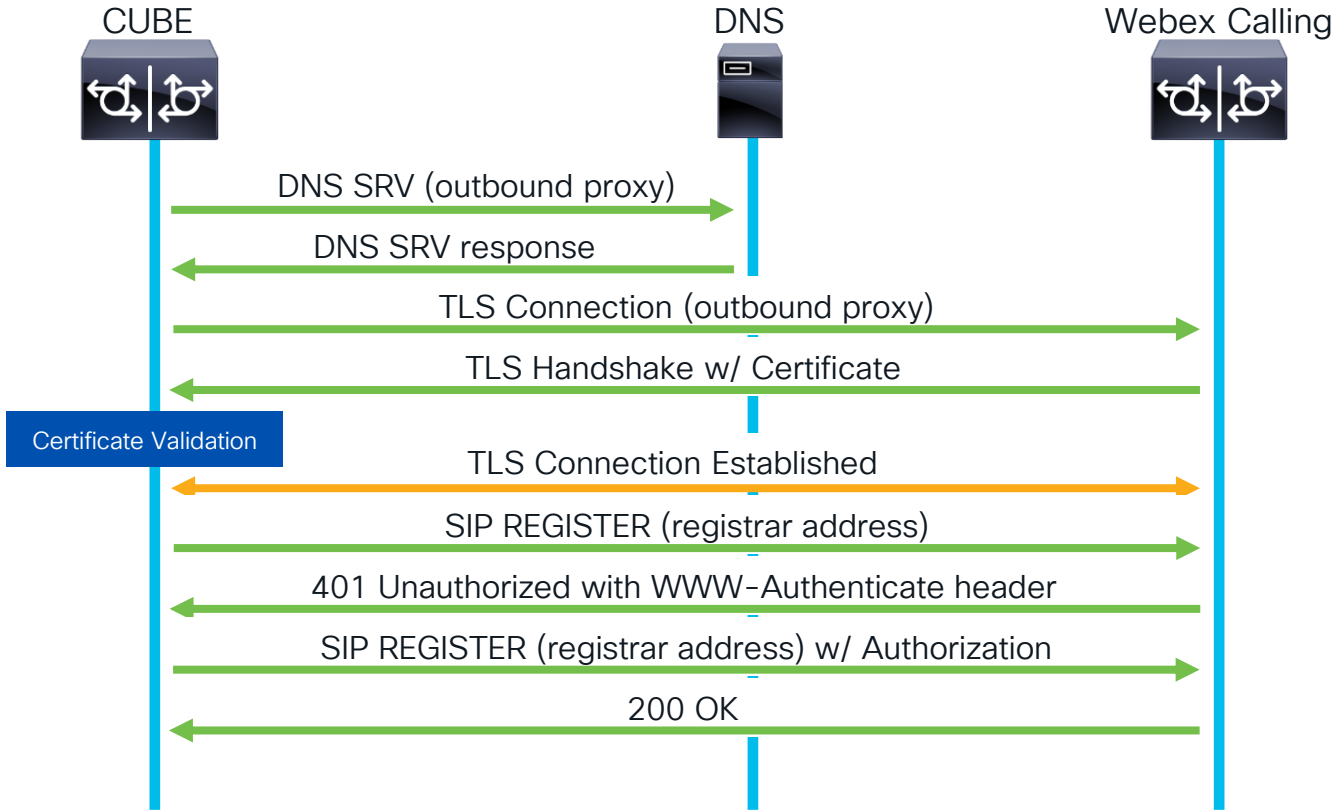


CUBE Onboarding and Registration

Registration-based Trunks



CUBE Registration Process



Troubleshooting DNS Issues

```
❯ dig SRV _sips._tcp.ch05.sipconnect-us.bcld.webex.com

;; ANSWER SECTION:
_sips._tcp.ch05.sipconnect-us.bcld.webex.com. 300 IN SRV 10 50 8934 sipconnect01ac-us.bcld.webex.com.
_sips._tcp.ch05.sipconnect-us.bcld.webex.com. 300 IN SRV  5 50 8934 sipconnect02ac-us.bcld.webex.com.

❯ dig A sipconnect02ac-us.bcld.webex.com

;; ANSWER SECTION:
sipconnect02ac-us.bcld.webex.com. 5 INA     139.177.65.12

❯ dig A sipconnect01ac-us.bcld.webex.com

;; ANSWER SECTION:
sipconnect01ac-us.bcld.webex.com. 5 INA     139.177.64.12
```

Troubleshooting DNS Issues

```
CUBE#show sip-ua statistics | beg SIP Global
SIP Global Counters:
  <File Id,   Line:  Count    First Occurence          Most Recent Occurence
      Message>
    0x12  , 1155  : 5         May 27 2022 09:38:00     Jun 02 2022 20:53:59
      DNS Query failed for query_type:%d
```

Troubleshooting DNS Issues

```
CUBE#debug ip domain
*May 31 17:29:22.434: DNS: detail: cdns_get_first_hop: dst 64.102.6.247, intf NULL
*May 31 17:29:23.435: DNS: detail: iter_operate: iterator[module 1] operate: extstate:module_wait_reply event:module_event_noreply
*May 31 17:29:23.435: DNS: info: log_nametypeclass: iterator operate: query _sips._tcp.12013670.us10.bcld.webex.com. SRV IN
*May 31 17:29:23.435: DNS: info: log_nametypeclass: processQueryTargets: _sips._tcp.12013670.us10.bcld.webex.com. SRV IN
*May 31 17:29:23.435: DNS: info: log_nametypeclass: sending query: _sips._tcp.12013670.us10.bcld.webex.com. SRV IN
*May 31 17:29:23.435: DNS: detail: log_name_addr: sending to target: <.> 64.102.6.247#53
*May 31 17:29:23.435: DNS: detail: cdns_get_first_hop: dst 64.102.6.247, intf NULL
*May 31 17:29:25.435: DNS: detail: cdns_get_first_hop: dst 64.102.6.247, intf NULL
*May 31 17:29:27.436: DNS: detail: iter_operate: iterator[module 1] operate: extstate:module_wait_reply event:module_event_noreply
*May 31 17:29:27.436: DNS: info: log_nametypeclass: iterator operate: query _sips._tcp.12013670.us10.bcld.webex.com. SRV IN
*May 31 17:29:27.436: DNS: info: log_nametypeclass: processQueryTargets: _sips._tcp.12013670.us10.bcld.webex.com. SRV IN
*May 31 17:29:27.436: DNS: detail: can_have_last_resort: configured forward servers failed -- returning SERVFAIL
*May 31 17:29:27.436: DNS: detail: error_response: return error response SERVFAIL
```

Registrar Domain
12013670.us10.bcld.webex.com

Trunk Group OTG/DTG
svs-rtp-dmz-cube8a2637_lgu

Line/Port
svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com

Outbound Proxy Address
ch05.sipconnect-us.bcld.webex.com

Troubleshooting DNS Issues

```
CUBE#debug ip domain
*May 31 17:27:04.713: DNS: detail: cdns_get_rr_type: converting name kind 20000 to type 33
*May 31 17:27:04.713: DNS: detail: read_forwards: Forward zone server list:
*May 31 17:27:04.713: DNS: info: delegpt_log: DelegationPoint<.>: 0 names (0 missing), 1 addrs (0 result, 1 avail) parentNS
*May 31 17:27:04.713: DNS: detail: val_operate: validator[module 0] operate: extstate:module_state_initial event:module_event_new
*May 31 17:27:04.713: DNS: info: log_nametypeclass: validator operate: query _sips._tcp.ch05.sipconnect-us.bcld.webex.com. SRV IN
*May 31 17:27:04.713: DNS: detail: iter_operate: iterator[module 1] operate: extstate:module_state_initial event:module_event_pass
*May 31 17:27:04.714: DNS: info: log_nametypeclass: resolving _sips._tcp.ch05.sipconnect-us.bcld.webex.com. SRV IN
*May 31 17:27:04.714: DNS: info: log_nametypeclass: finishing processing for _sips._tcp.ch05.sipconnect-us.bcld.webex.com. SRV IN
*May 31 17:27:04.714: DNS: detail: val_operate: validator[module 0] operate: extstate:module_wait_module event:module_event_moddone
*May 31 17:27:04.714: DNS: info: log_nametypeclass: validator operate: query _sips._tcp.ch05.sipconnect-us.bcld.webex.com. SRV IN
*May 31 17:27:04.714: DNS: detail: cdns_new_nametype: new nametype 0x80007F39A6FE2CE0
*May 31 17:27:04.714: DNS: detail: cdns_get_rr_type: converting name kind 4 to type 1
*May 31 17:27:04.714: DNS: detail: read_forwards: Forward zone server list:
*May 31 17:27:04.714: DNS: info: delegpt_log: DelegationPoint<.>: 0 names (0 missing), 1 addrs (0 result, 1 avail) parentNS
*May 31 17:27:04.715: DNS: detail: val_operate: validator[module 0] operate: extstate:module_state_initial event:module_event_new
*May 31 17:27:04.715: DNS: info: log_nametypeclass: validator operate: query sipconnect02ac-us.bcld.webex.com. A IN
*May 31 17:27:04.715: DNS: detail: iter_operate: iterator[module 1] operate: extstate:module_state_initial event:module_event_pass
*May 31 17:27:04.715: DNS: info: log_nametypeclass: resolving sipconnect02ac-us.bcld.webex.com. A IN
*May 31 17:27:04.715: DNS: info: log_nametypeclass: finishing processing for sipconnect02ac-us.bcld.webex.com. A IN
*May 31 17:27:04.715: DNS: detail: val_operate: validator[module 0] operate: extstate:module_wait_module event:module_event_moddone
*May 31 17:27:04.715: DNS: info: log_nametypeclass: validator operate: query sipconnect02ac-us.bcld.webex.com. A IN
*May 31 17:27:04.715: DNS: detail: cdns_new_nametype: new nametype 0x80007F39AF441638
*May 31 17:27:04.715: DNS: detail: cdns_nametype_free: deleting nametype 0x80007F39AF441638
*May 31 17:27:04.715: DNS: detail: cdns_nametype_free: deleting nametype 0x80007F39A6FE2CE0
```

Check TCP Session Establishment

```
svs-rtp-dmz-cube8a#show tcp brief numeric
TCB           Local Address               Foreign Address             (state)
7F39A6F861A8  64.102.250.135.50993        139.177.65.12.8934          ESTAB
```

Check TCP Session Establishment - Failure

```
svs-rtp-dmz-cube8a#debug ip tcp transactions address 139.177.65.12
May 26 13:41:30.135: TCP: Setting Keepalive interval and retries to 60 and 4
May 26 13:41:30.135:  tcp_uniqueport: using ephemeral max 55000
May 26 13:41:30.139: TCP: Setting Keepalive interval and retries to 60 and 4
May 26 13:41:30.139:  tcp_uniqueport: using ephemeral max 55000
May 26 13:41:30.139: Reserved port 20588 in Transport Port Agent for TCP IP type 1
May 26 13:41:30.140: TCP0: Connection to 139.177.65.12:8934, advertising MSS 536
May 26 13:41:30.140: TCP0: state was CLOSED -> SYNSENT [20588 -> 139.177.65.12 (8934)]
May 26 13:41:30.140: Released port 20588 in Transport Port Agent for TCP IP type 1 delay 240000
May 26 13:41:30.141: TCP0: state was SYNSENT -> CLOSED [20588 -> 139.177.65.12 (8934)]
May 26 13:41:30.141: TCP0: bad seg from 139.177.65.12 -- closing connection: port 20588 seq 0 ack
19785811 rcvnxt 0 rcvwnd 0 len 0
May 26 13:41:30.141: TCP0: connection closed - remote sent RST
May 26 13:41:30.141: TCB7F5EFFA41B78 getting property TCP_VRFTABLEID (20)
May 26 13:41:30.141: TCB 0x7F5EFFA41B78 destroyed
```

TLS Handshake Failure

- TLS Handshake failure will display a Syslog message:

```
Jan 24 08:11:50.364: %SIP-2-TLS_HANDSHAKE_FAILED: TLS handshake
failure - remote_addr= 139.177.65.12, remote_port=8934
```

Verify TLS Connection

```
CUBE#show sip-ua connections tcp tls detail
Total active connections      : 1
No. of send failures          : 1
No. of remote closures        : 0
No. of conn. failures         : 0
No. of inactive conn. ageouts : 0
Max. tls send msg queue size of 1, recorded for 139.177.65.12:8934
TLS client handshake failures : 0
TLS server handshake failures : 0

---------Printing Detailed Connection Report---------
Note:
 ** Tuples with no matching socket entry
    - Do 'clear sip <tcp[tls]/udp> conn t ipv4:<addr>:<port>'
      to overcome this error condition
 ++ Tuples with mismatched address/port entry
    - Do 'clear sip <tcp[tls]/udp> conn t ipv4:<addr>:<port> id <connid>'
      to overcome this error condition
 * Connections with SIP OAuth ports

Remote-Agent:139.177.65.12, Connections-Count:1
  Remote-Port Conn-Id Conn-State  WriteQ-Size            Local-Address               TLS-Version Cipher                          Curve Tenant
  =========== ======= =========== =========== ==================================== =========== ============================== ===== ======
         8934       7 Established           0 64.102.250.135:50993                     TLSv1.2    ECDHE-RSA-AES256-GCM-SHA384 P-521     0


-------------- SIP Transport Layer Listen Sockets ---------------
  Conn-Id             Local-Address                      Tenant
 ==========    ==========================              ========
  0             [0.0.0.0]:5061:                             0
  6             [64.102.250.135]:5061:Internet              0
```

REFERENCE

Local Gateway Trustpool Update

- The default trustpool bundle does not include the “DigiCert Root CA” certificate needed for validating the server-side certificate during TLS connection establishment to BroadCloud
- Download the latest **“Cisco Trusted Core Root Bundle”** from http://www.cisco.com/security/pki/

Check

```
CUBE#show crypto pki trustpool | include DigiCert
```

Update

```
CUBE #configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
LocalGateway(config)#crypto pki trustpool import clean url
http://www.cisco.com/security/pki/trs/ios_core.p7b
Reading file from http://www.cisco.com/security/pki/trs/ios_core.p7b
Loading http://www.cisco.com/security/pki/trs/ios_core.p7b
% PEM files import succeeded.
LocalGateway(config)#end
```

Verify

```
CUBE #show crypto pki trustpool | include DigiCert
    cn=DigiCert Global Root CA
    o=DigiCert Inc
    cn=DigiCert Global Root CA
    o=DigiCert Inc
```

TLS Connection Setup

```
voice class tenant 200
 registrar dns:12013670.us10.bcld.webex.com scheme sips expires 240 refresh-ratio 50 tcp tls
 credentials number svs-rtp-dmz-cube8a5913_LGU username svs-rtp-dmz-cube8a2637_LGU password 6 <removed> …
 authentication username svs-rtp-dmz-cube8a2637_LGU password 6 <removed> realm BroadWorks
 authentication username svs-rtp-dmz-cube8a2637_LGU password 6 <removed> realm 12013670.us10.bcld.webex.com
 no remote-party-id
 sip-server dns:12013670.us10.bcld.webex.com
 connection-reuse
 srtp-crypto 200
 session transport tcp tls
 url sips
 error-passthru
 asserted-id pai
 bind control source-interface GigabitEthernet1
 bind media source-interface GigabitEthernet1
 no pass-thru content custom-sdp
 sip-profiles 200
 outbound-proxy dns:ch05.sipconnect-us.bcld.webex.com
 privacy-policy passthru

sip-ua
 transport tcp tls v1.2
 crypto signaling default trustpoint dummyTp cn-san-validate server
```

- Source IP is based on the **bind control** configuration. Source port is ephemeral
- **TLS version** and **crypto trustpoint** and **CN/SAN validation** is configured under sip-ua

Note: The crypto trustpoint is needed for TLS to work even though a local client certificate (i.e. mTLS) is not required for the connection to be setup

Showing SIP registration status

```
CUBE#show sip-ua register status

Tenant:  200
-------------------- Registrar-Index  1 --------------------
Line                                peer      expires(sec)  reg survival  P-Associ-URI
=================================== ========= ============  === ========  ============
svs-rtp-dmz-cube8a5913_LGU          -1         56           no  normal
```

Troubleshooting Registration Issues

```
CUBE#debug ccsip message
CUBE#debug ccsip non-call

*Jun  2 20:00:55.047: //-1/xxxxxxxxxxxx/SIP/Msg/ccsipDisplayMsg:
Sent:
REGISTER sip:12013670.us10.bcld.webex.com:5061 SIP/2.0
Via: SIP/2.0/TLS 64.102.250.135:5061;branch=z9hG4bK37F2657
From: <sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com;otg=svs-rtp-dmz-
cube8a2637_lgu>;tag=3229010F-153
To: <sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com>
Date: Thu, 02 Jun 2022 20:00:55 GMT
Call-ID: ABBD84C-E03E11EC-8005C535-8219C882

User-Agent: Cisco-SIPGateway/IOS-17.8.1a
Max-Forwards: 70
Timestamp: 1654200055
CSeq: 3028 REGISTER
Contact: <sip:svs-rtp-dmz-cube8a5913_LGU@64.102.250.135:5061;transport=tls>
Expires:  240
Supported: path
Content-Length: 0
```

Troubleshooting Registration Issues

```
*Jun  2 20:00:55.097: //12502/000000000000/SIP/Msg/ccsipDisplayMsg:
Received:
SIP/2.0 401 Unauthorized
Via:SIP/2.0/TLS 64.102.250.135:5061;branch=z9hG4bK37F2657
From:<sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com;otg=svs-rtp-dmz-
cube8a2637_lgu>;tag=3229010F-153
To:<sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com>;tag=139819501-1654200075749
Call-ID:ABBD84C-E03E11EC-8005C535-8219C882
CSeq:3028 REGISTER
Session-ID:84b3c5760080414f9684277168c26d0b;remote=13a947af00804b4dba1347ec16e6cc55
WWW-Authenticate:DIGEST
realm="BroadWorks",qop="auth",nonce="BroadWorksXl3xh0jboTdvjlnkBW",algorithm=MD5
Contact:<sip:svs-rtp-dmz-cube8a5913_LGU@64.102.250.135:5061;transport=tls>;expires=120
Content-Length:0
```

Troubleshooting Registration Issues

```
*Jun  2 20:00:55.098: //-1/xxxxxxxxxxxx/SIP/Msg/ccsipDisplayMsg:
Sent:
REGISTER sip:12013670.us10.bcld.webex.com:5061 SIP/2.0
Via: SIP/2.0/TLS 64.102.250.135:5061;branch=z9hG4bK37F32160
From: <sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com;otg=svs-rtp-dmz-
cube8a2637_lgu>;tag=3229010F-153
To: <sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com>
Date: Thu, 02 Jun 2022 20:00:55 GMT
Call-ID: ABBD84C-E03E11EC-8005C535-8219C882
User-Agent: Cisco-SIPGateway/IOS-17.8.1a
Max-Forwards: 70
Timestamp: 1654200055
CSeq: 3029 REGISTER
Contact: <sip:svs-rtp-dmz-cube8a5913_LGU@64.102.250.135:5061;transport=tls>
Expires: 240
Supported: path
Authorization: Digest username="svs-rtp-dmz-
cube8a2637_LGU",realm="BroadWorks",uri="sips:12013670.us10.bcld.webex.com:5061",response="3e5f
b6c7664832a0de686e9fd9defcf3",nonce="BroadWorksXl3xh0jboTdvjlnkBW",cnonce="59C09EF6",qop=auth,
algorithm=MD5,nc=00000001
Content-Length: 0
```

Troubleshooting Registration Issues

```
*Jun  2 20:00:55.146: //12502/000000000000/SIP/Msg/ccsipDisplayMsg:
Received:
SIP/2.0 401 Unauthorized
Via:SIP/2.0/TLS 64.102.250.135:5061;branch=z9hG4bK37F32160
From:<sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com;otg=svs-rtp-dmz-
cube8a2637_lgu>;tag=3229010F-153
To:<sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com>;tag=187893186-1654200075798
Call-ID:ABBD84C-E03E11EC-8005C535-8219C882
CSeq:3029 REGISTER
Session-ID:84b3c5760080414f9684277168c26d0b;remote=13a947af00804b4dba1347ec16e6cc55
Content-Length:0
```

Troubleshooting Registration Issues

Control Hub > Calling > Call Routing > Trunk > *select trunk*

Authentication Information

Retrieve the username and password for **CUBE LGW**. Each time authentication information is retrieved, a new password is generated. During the password generation, PSTN is disrupted until the new password is saved.

Retrieve Username and Reset Password

Authentication Information

Retrieving authentication information generates a new password and disrupts PSTN service for locations using this trunk until the password reset is completed. Do you want to continue?

No Yes

Authentication Information

Record the username and password below. If you lose this information, you need to reset the password again.

Username

svs-rtp-dmz-cube8a2637_LGU

Password

NewPassword

Done

Troubleshooting Registration Issues

```
CUBE(config)#voice class tenant 200
CUBE(config-class)#$svs-rtp-dmz-cube8a5913_LGU username svs-rtp-dmz-cube8a2637_LGU password 0
NewPassword realm BroadWorks
 Updating password

CUBE(config-class)#  authentication username svs-rtp-dmz-cube8a2637_LGU password 0 NewPassword
realm BroadWorks
Updating username/password for realm BroadWorks

CUBE(config-class)#  authentication username svs-rtp-dmz-cube8a2637_LGU password 0 NewPassword
realm 12013670.us10.bcld.webex.com
Updating username/password for realm 12013670.us10.bcld.webex.com

svs-rtp-dmz-cube8a(config-class)#end
```

Troubleshooting Registration Issues

```
*Jun  2 20:10:55.744: //-1/xxxxxxxxxxxx/SIP/Msg/ccsipDisplayMsg:
Sent:
REGISTER sip:12013670.us10.bcld.webex.com:5061 SIP/2.0
Via: SIP/2.0/TLS 64.102.250.135:5061;branch=z9hG4bK37FC26BD
From: <sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com;otg=svs-rtp-dmz-
cube8a2637_lgu>;tag=32322B88-25CD
To: <sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com>
Date: Thu, 02 Jun 2022 20:10:55 GMT
Call-ID: ABBD84C-E03E11EC-8005C535-8219C882
User-Agent: Cisco-SIPGateway/IOS-17.8.1a
Max-Forwards: 70
Timestamp: 1654200655
CSeq: 3038 REGISTER
Contact: <sip:svs-rtp-dmz-cube8a5913_LGU@64.102.250.135:5061;transport=tls>
Expires:  240
Supported: path
Content-Length: 0
```

Troubleshooting Registration Issues

```
*Jun  2 20:10:55.793: //12507/000000000000/SIP/Msg/ccsipDisplayMsg:
Received:
SIP/2.0 401 Unauthorized
Via:SIP/2.0/TLS 64.102.250.135:5061;branch=z9hG4bK37FC26BD
From:<sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com;otg=svs-rtp-dmz-
cube8a2637_lgu>;tag=32322B88-25CD
To:<sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com>;tag=45425073-1654200676460
Call-ID:ABBD84C-E03E11EC-8005C535-8219C882
CSeq:3038 REGISTER
Session-ID:7a89fbce008049b78a69e029c3dcf14d;remote=982680ab00804b63afafa55ec45f8f8b
WWW-Authenticate:DIGEST
realm="BroadWorks",qop="auth",nonce="BroadWorksXl3xgdeu4T9663sfBW",algorithm=MD5
Contact:<sip:svs-rtp-dmz-cube8a5913_LGU@64.102.250.135:5061;transport=tls>;expires=120
Content-Length:0
```

Troubleshooting Registration Issues

```
*Jun  2 20:10:55.795: //-1/xxxxxxxxxxxx/SIP/Msg/ccsipDisplayMsg:
Sent:
REGISTER sip:12013670.us10.bcld.webex.com:5061 SIP/2.0
Via: SIP/2.0/TLS 64.102.250.135:5061;branch=z9hG4bK37FD946
From: <sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com;otg=svs-rtp-dmz-
cube8a2637_lgu>;tag=32322B88-25CD
To: <sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com>
Date: Thu, 02 Jun 2022 20:10:55 GMT
Call-ID: ABBD84C-E03E11EC-8005C535-8219C882
User-Agent: Cisco-SIPGateway/IOS-17.8.1a
Max-Forwards: 70
Timestamp: 1654200655
CSeq: 3039 REGISTER
Contact: <sip:svs-rtp-dmz-cube8a5913_LGU@64.102.250.135:5061;transport=tls>
Expires: 240
Supported: path
Authorization: Digest username="svs-rtp-dmz-
cube8a2637_LGU",realm="BroadWorks",uri="sips:12013670.us10.bcld.webex.com:5061",response="84ee9
b374977c02315e6c75579a47175",nonce="BroadWorksXl3xgdeu4T9663sfBW",cnonce="D193A761",qop=auth,al
gorithm=MD5,nc=00000001
Content-Length: 0
```

Troubleshooting Registration Issues

```
*Jun  2 20:10:55.843: //12507/000000000000/SIP/Msg/ccsipDisplayMsg:
Received:
SIP/2.0 200 OK
Via:SIP/2.0/TLS 64.102.250.135:5061;branch=z9hG4bK37FD946
From:<sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com;otg=svs-rtp-dmz-
cube8a2637_lgu>;tag=32322B88-25CD
To:<sip:svs-rtp-dmz-cube8a5913_LGU@12013670.us10.bcld.webex.com>;tag=656451609-1654200676510
Call-ID:ABBD84C-E03E11EC-8005C535-8219C882
CSeq:3039 REGISTER
Session-ID:7a89fbce008049b78a69e029c3dcf14d;remote=982680ab00804b63afafa55ec45f8f8b
Allow-Events:call-info,line-seize,dialog,message-summary,as-feature-event,x-broadworks-
hoteling,x-broadworks-call-center-status,conference
Contact:<sip:svs-rtp-dmz-cube8a5913_LGU@64.102.250.135:5061;transport=tls>;q=0.5;expires=120
Path:<sip:10.71.132.84:5060;transport=udp;lr>;x-bw-nat="64.102.250.135:50993;transport=tls"
Content-Length:0
```

Troubleshooting Registration Issues

```
svs-rtp-dmz-cube8a#show sip-ua register status

Tenant:  200
-------------------- Registrar-Index  1 --------------------
Line                              peer      expires(sec) reg survival  P-Associ-URI
================================= ========= ============ === ========  ============
svs-rtp-dmz-cube8a5913_LGU        -1        30           yes normal
```

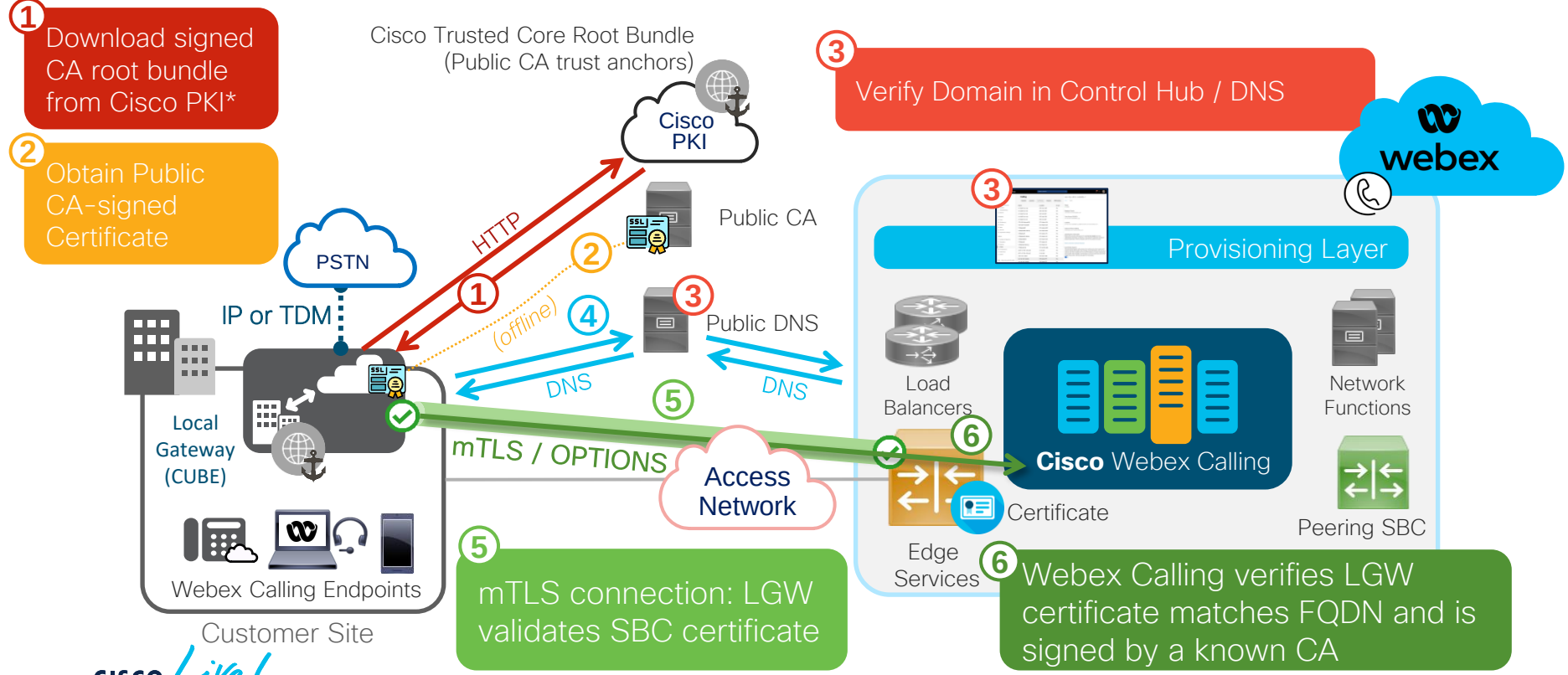
Response Error Code	Resolution
404 User Not Found	Check “number” configured under credentials is correct
401 Unauthorized	Check ”realm” is configured to “BroadWorks”
	Check “username”, “password” under credentials is correct
403 Authentication Failure	Check “username”, “password” under credentials is correct

Certificate-Based Local Gateway: Troubleshooting Peering

cisco Live!

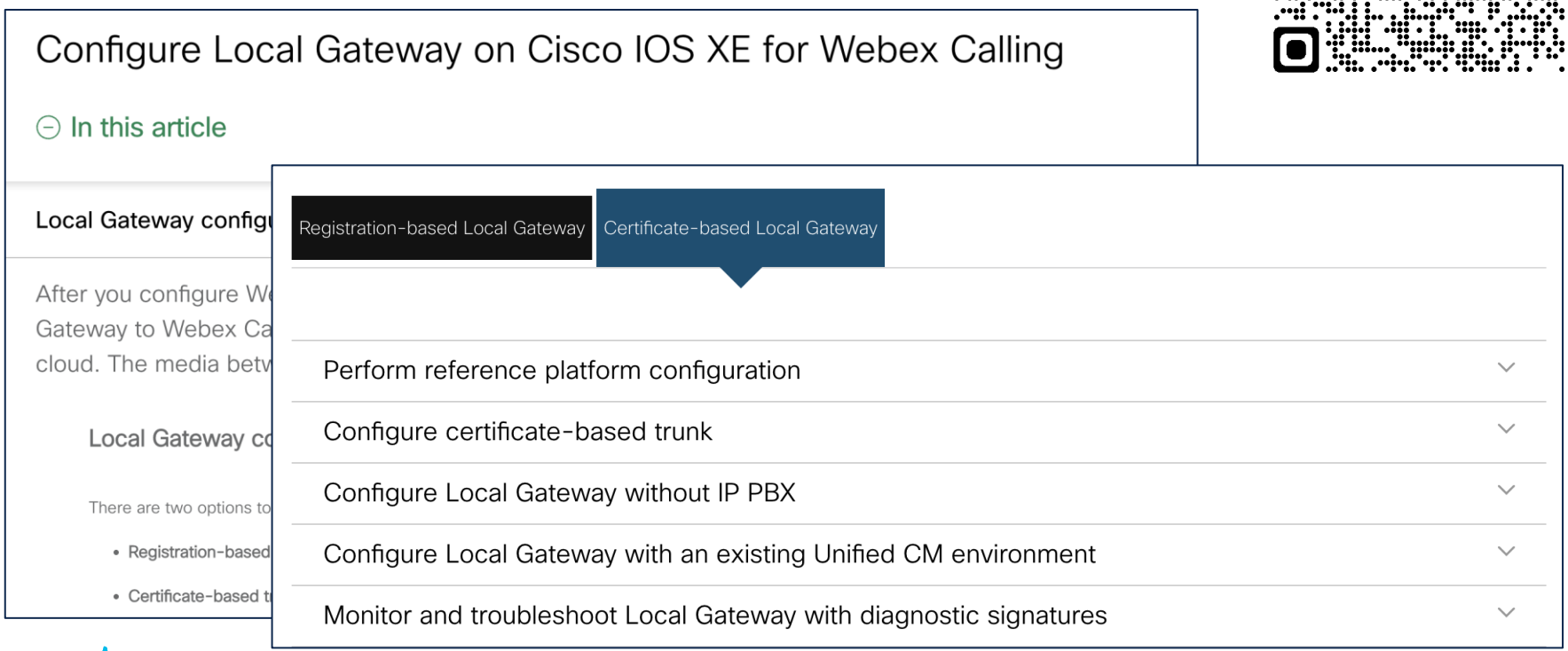
CUBE Onboarding and Registration

Certificate-Based Trunks



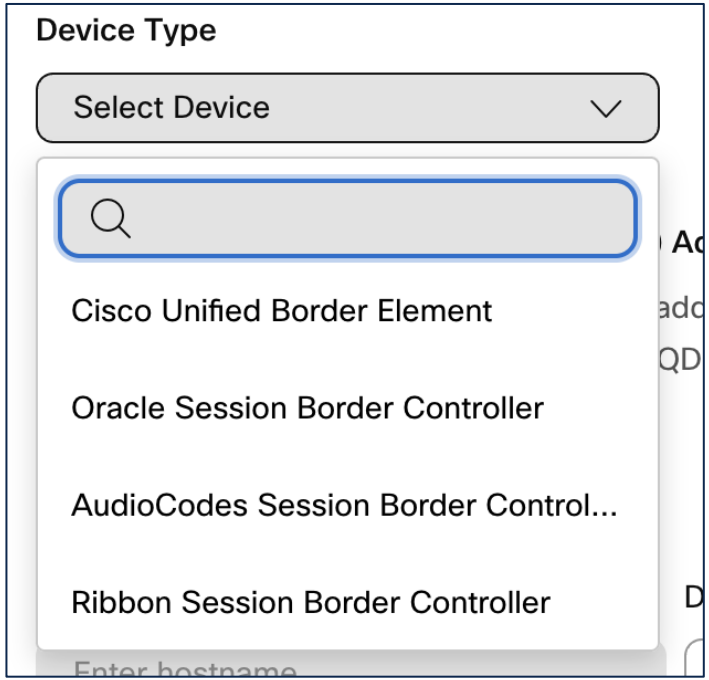
CUBE Configuration Guide

https://help.webex.com/en-us/article/jr1i3r/Configure-Local-Gateway-on-IOS-XE-for-Webex-Calling



Configuring 3rd Party SBCs

https://www.webex.com/content/dam/wbx/us/aag/webex_calling_third_party_sbc_support_cm-5753.pdf



SBC Vendor	AudioCodes	
SBC models supported	• Mediant 500 Gateway & E-SBC • Mediant 800B/C Gateway & E-SBC • Mediant 1000B Gateway & E-SBC	• Mediant 2600 E-SBC • Mediant 4000/B SBC • Mediant 9000, 9030, 9080 SBC • Mediant Software SBC (VE/SE/CE)
Software version supported	7.40A.250.440 or later	
Resources	• AudioCodes Cisco Community Post • Configure AudioCodes SBC • Contact AudioCodes	

SBC Vendor	Oracle	
SBC models supported	• AP 1100 • AP 3900 • AP 4600 • AP 6300 • AP 6350	• AP 3950 (Starting from SBC 9.0 version) • AP 4900 (Starting from SBC 9.0 version) • VME • Oracle SBC on Public Cloud
Software version supported	SBC 9.0 Software	
Resources	• Oracle Cisco Community Post • Configuration guide • Contact: cgbu_alliances_ww_grp@oracle.com	

SBC Vendor	Ribbon	
SBC models supported	Supported today: • SBC Core 5000 Series • SBC Core 7000 • SBC Core SWe	Certification planned for CY Q1 2023: • SBC Edge 1000 • SBC Edge 2000 • SBC SWeEdge
Software version supported	Ribbon SBC Core SWe V10.01.00	
Resources	• Ribbon Cisco Communities Post • Configure Ribbon Core SBC • Contact Ribbon	

Control Hub Status for Certificate-Based Trunks

- Check Control Hub for status / warnings / errors

https://help.webex.com/en-us/article/n0xb944/Configure-Trunks,-Route-Groups,-and-Dial-Plans-for-Webex-Calling

Troubleshooting

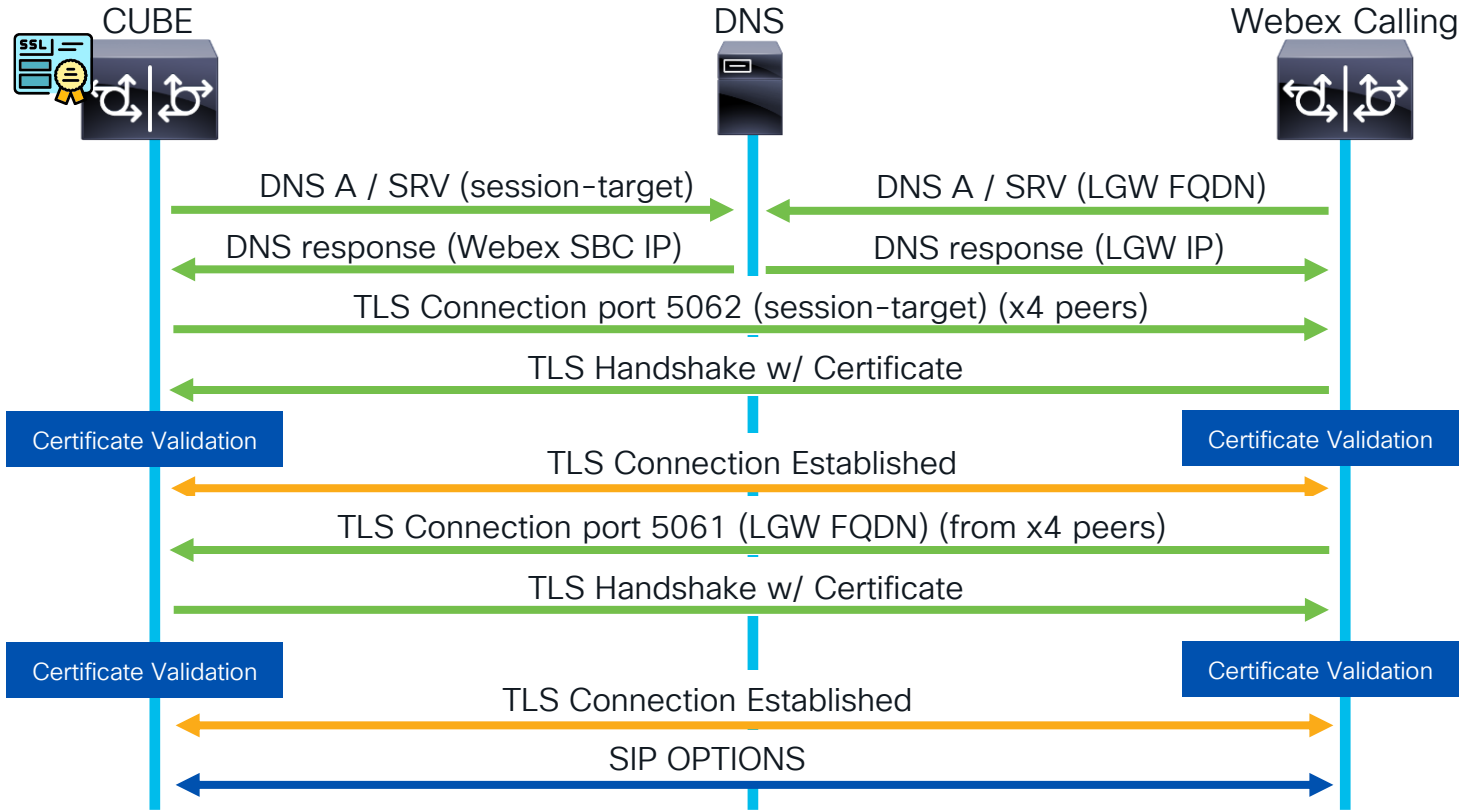
Sl No.	Error Description	Action
1.	TLS Connection to Local Gateway failed due to DNS resolution failure of the FQDN configured for your gateway	Verify the DNS configurations for the SRV /FQDN configured and ensure they are resolvable
2.	TLS Connection to Local Gateway failed due to a transport issue	Verify that the resolved IP addresses and port to the Local Gateway are valid

Control Hub Status for Certificate-Based Trunks

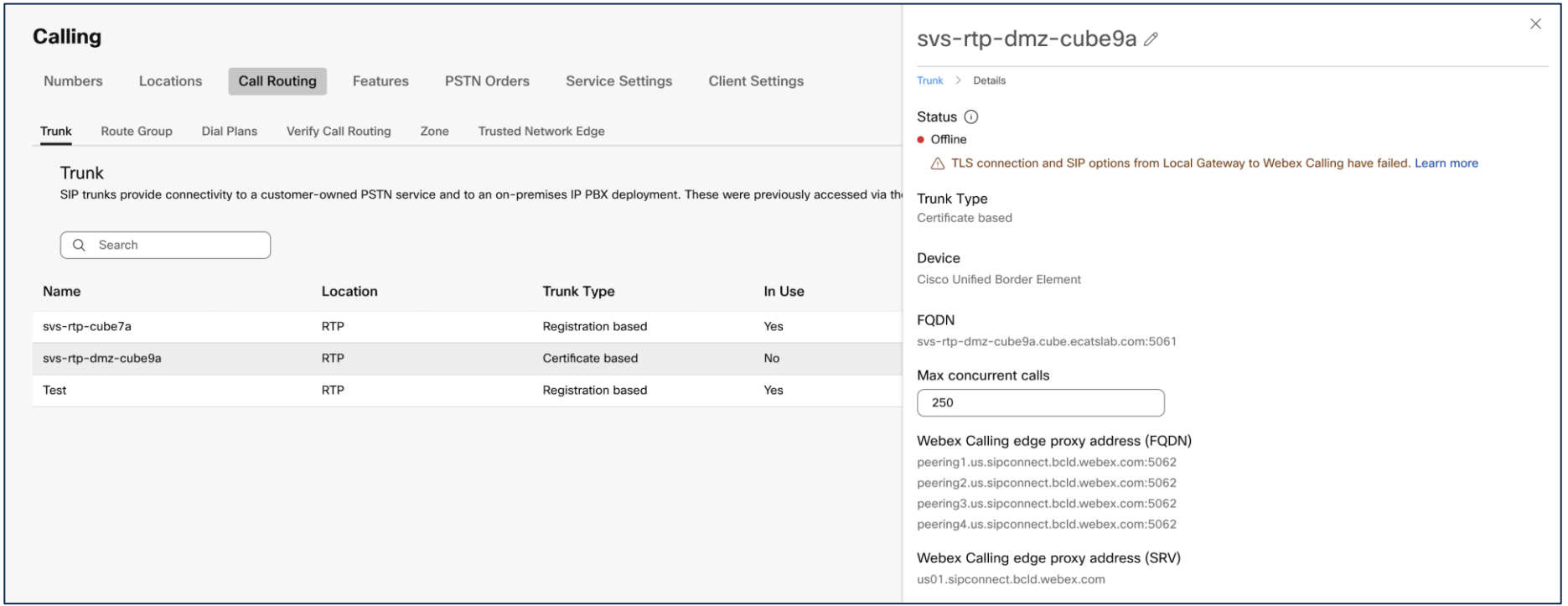
https://help.webex.com/en-us/article/n0xb944/Configure-Trunks,-Route-Groups,-and-Dial-Plans-for-Webex-Calling

TLS Connection to Local Gateway failed due to DNS resolution failure of the FQDN configured for your gateway
TLS Connection to Local Gateway failed due to a transport issue
TLS Connection to Local Gateway failed as the gateway's certificate is signed by an invalid Certificate Authority
TLS Connection to Local Gateway failed as the gateway's certificate has expired
TLS Connection to Local Gateway failed as the gateway's certificate has been issued by an expired Certificate Authority
TLS Connection to Local Gateway failed as the FQDN configured for your gateway is missing from CN or SAN
SIP options sent to the Local Gateway received no response
TLS connection from Local Gateway to Webex Calling failed due to an invalid gateway certificate
TLS connection from Local Gateway to Webex Calling failed as we were unable to trust the Certificate Authority
TLS connection from Local Gateway to Webex Calling failed due to expired certificates in the chain
TLS connection and SIP options from Local Gateway to Webex Calling have failed
SIP options response from the Local Gateway indicates a Server error or Service Unavailable
TLS Connection to Local Gateway failed as Local gateway's certificate has been revoked
TLS Connection from Local Gateway to Webex Calling failed as the gateway's certificate has been revoked
TLS Connection from Local Gateway to Webex Calling failed as the gateway's certificate has expired
TLS Connection from Local Gateway to Webex Calling failed due to a certificate error
TLS Connection to Local Gateway from Webex Calling failed due to a certificate error

CUBE Certificated-Based Peering Process



Check TCP Session Establishment



Check TCP Session Establishment

```
svs-rtp-dmz-cube8a#show tcp brief numeric
TCB            Local Address               Foreign Address             (state)
7F6EB38F1DB0   10.81.2.20.5060             172.18.106.58.41601         ESTAB
7F6E47C940B8   10.81.2.20.5060             172.18.106.59.35575         ESTAB
7F6EB38C24D8   10.81.2.20.5060             172.18.106.60.44110         ESTAB
7F6EB38C12E8   64.102.250.137.5061         139.177.65.53.8934          ESTAB
7F6E47E0BA68   64.102.250.137.5061         139.177.64.54.8934          ESTAB
7F6E47E85BE8   64.102.250.137.5061         139.177.64.53.8934          ESTAB
7F6E47E5BDC8   64.102.250.137.5061         139.177.65.54.8934          ESTAB
7F6E47DE2CB0   64.102.250.137.21819        139.177.65.54.5062          ESTAB
7F6E48DD75E0   64.102.250.137.11636        139.177.65.53.5062          ESTAB
7F6E47E7FCB8   64.102.250.137.39113        139.177.64.53.5062          ESTAB
7F6E47D92AD8   64.102.250.137.48188        139.177.64.54.5062          ESTAB
```

CUBE to UCM

WxC to CUBE

CUBE to WxC

Check TCP Session Establishment

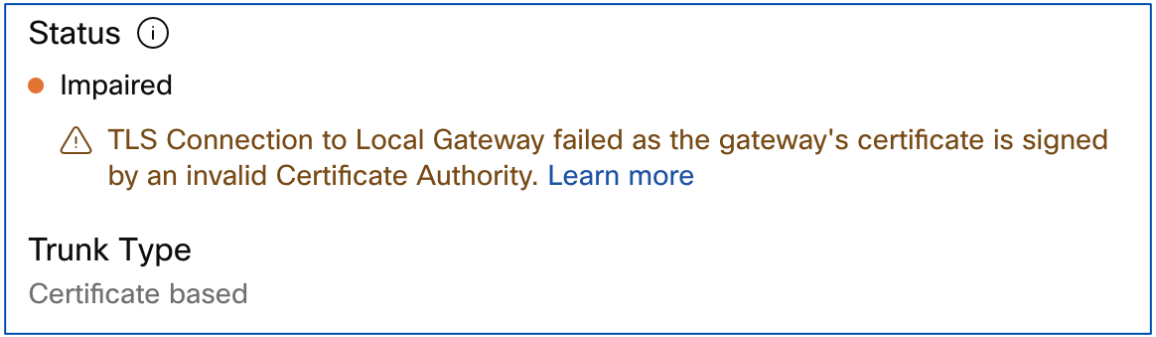
```
svs-rtp-dmz-cube9a#deb ip tcp transactions port 5062
TCP special event debugging is on
*Nov 21 20:53:14.864: TCP: Setting Keepalive interval and retries to 60 and 4
*Nov 21 20:53:14.864:  tcp_uniqueport: using ephemeral max 55000
*Nov 21 20:53:14.864: Reserved port 54086 in Transport Port Agent for TCP IP type 1
*Nov 21 20:53:14.864: TCP: sending SYN, seq 3703836424, ack 0
*Nov 21 20:53:14.864: TCP0: Connection to 135.84.175.164:5062, advertising MSS 536
*Nov 21 20:53:14.865: TCP0: state was CLOSED -> SYNSENT [54086 -> 135.84.175.164(5062)]
*Nov 21 20:53:14.891: Released port 54086 in Transport Port Agent for TCP IP type 1 delay 240000
*Nov 21 20:53:14.891: TCP0: state was SYNSENT -> CLOSED [54086 -> 135.84.175.164(5062)]
*Nov 21 20:53:14.891: TCP0: bad seg from 135.84.175.164 -- closing connection: port 54086 seq
2075661766 ack 3703836425 rcvnxt 0 rcvwnd 0 len 0
*Nov 21 20:53:14.891: TCP0: connection closed - remote sent RST
*Nov 21 20:53:14.891: TCB7F6E47D97548 getting property TCP_VRFTABLEID (20)
*Nov 21 20:53:14.891: TCB 0x7F6E47D97548 destroyed
```

TLS Handshake Failure

- TLS Handshake failure will display a Syslog message:

```
Nov 22 21:45:31.712: %SIP-2-TLS_HANDSHAKE_FAILED: TLS handshake
failure - remote_addr=139.177.64.53, remote_port=5062
```

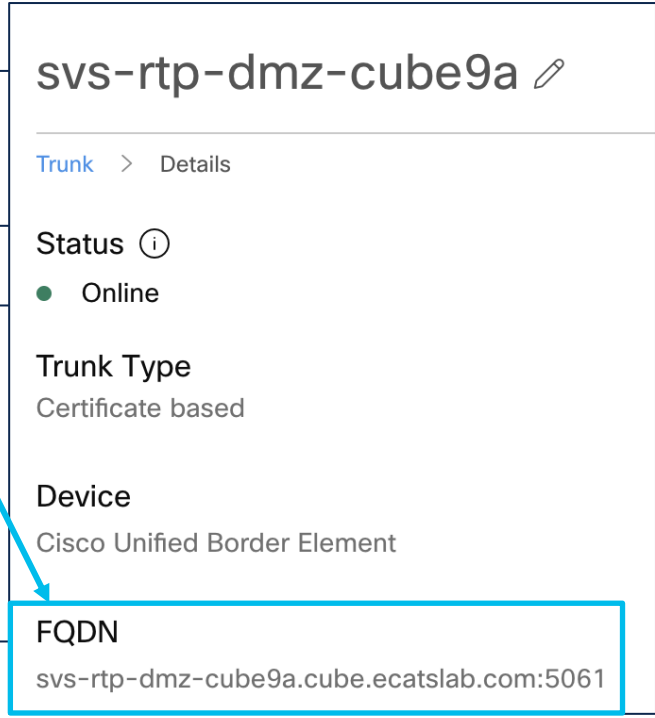
- Control Hub will show TLS Connection errors on Trunk Configuration (**Calling** > **Call Routing** > **Trunk** > **Trunk Info**)



Verify Correct Certificate Configured

```
sip-ua
 transport tcp tls v1.2
 crypto signaling default trustpoint CUBE_CA_CERT
```

```
crypto pki trustpoint CUBE_CA_CERT
 enrollment terminal pem
 serial-number none
 subject-name CN=svs-rtp-dmz-cube9a.cube.ecatslab.com
 subject-alt-name svs-rtp-dmz-cube9a.cube.ecatslab.com
 revocation-check none
 rsakeypair svs-rtp-dmz-cube9a
```

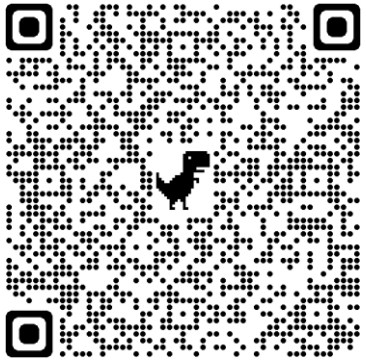


Verify CA is trusted by Webex

https://help.webex.com/en-us/article/WBX9000008850/What-Root-Certificate-Authorities-are-Supported-for-Calls-to-Cisco-Webex-Audioand-Video-Platforms

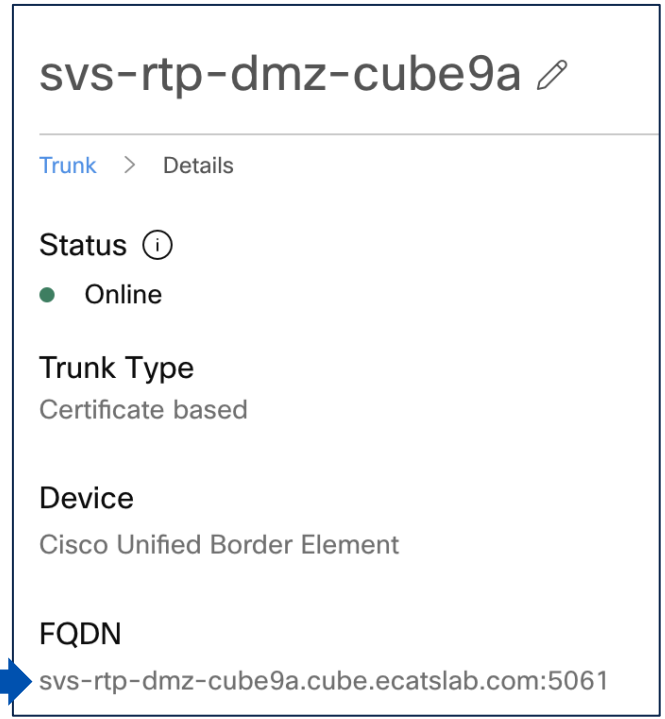
Supported Root Certificate Authorities:

Fingerprint (SHA1)	Subject	Date Added
b1bc968bd4f49d622aa89a81f2150152a41d829c	C=BE/O=GlobalSign nv-sa/OU=Root CA/CN=GlobalSign Root CA	January 1st, 2016
ca3afbcf1240364b44b216208880483919937cf7	C=BM/O=QuoVadis Limited/CN=QuoVadis Root CA 2	January 1st, 2016
590d2d7d884f402e617ea562321765cf17d894e9	C=DE/O=T-Systems Enterprise Services GmbH/OU=T-Systems Trust Center/CN=T-TeleSec GlobalRoot Class	January 1st, 2016



Verify CA is trusted by Webex

```
svs-rtp-dmz-cube9a#show crypto pki certificates
Certificate
  Status: Available
  Certificate Serial Number (hex): 00FADBC625153DAA0…
  Certificate Usage: General Purpose
  Issuer:
    cn=Sectigo RSA Domain Validation Secure Server CA
    o=Sectigo Limited
    l=Salford
    st=Greater Manchester
    c=GB
  Subject:
    Name: svs-rtp-dmz-cube9a.cube.ecatslab.com
    cn=svs-rtp-dmz-cube9a.cube.ecatslab.com
  Validity Date:
    start date: 19:00:00 EST Nov 20 2022
    end   date: 18:59:59 EST Dec 22 2023
  Associated Trustpoints: CUBE_CA_CERT
  Storage: nvram:SectigoRSADo#A910.cer
```



Verify CA is trusted by Webex

```
svs-rtp-dmz-cube9a#show crypto pki certificates
Certificate
  Status: Available
  Certificate Serial Number (hex): 00FADBC625153DAA0…
  Certificate Usage: General Purpose
  Issuer:
    cn=Sectigo RSA Domain Validation Secure Server CA
    o=Sectigo Limited
    l=Salford
    st=Greater Manchester
    c=GB
  Subject:
    Name: svs-rtp-dmz-cube9a.cube.ecatslab.com
    cn=svs-rtp-dmz-cube9a.cube.ecatslab.com
  Validity Date:
    start date: 19:00:00 EST Nov 20 2022
    end   date: 18:59:59 EST Dec 22 2023
  Associated Trustpoints: CUBE_CA_CERT
  Storage: nvram:SectigoRSADo#A910.cer
```

```
CA Certificate
  Status: Available
  Certificate Serial Number (hex): 7D5B51
  Certificate Usage: Signature
  Issuer:
    cn=USERTrust RSA Certification Author
    o=The USERTRUST Network
    l=Jersey City
    st=New Jersey
    c=US
  Subject:
    cn=Sectigo RSA Domain Validation Secu
    o=Sectigo Limited
    l=Salford
    st=Greater Manchester
    c=GB
  CRL Distribution Points:
    http://crl.usertrust.com/USERTrustRSA
  Validity Date:
    start date: 20:00:00 EDT Nov 1 2018
    end   date: 18:59:59 EST Dec 31 2030
  Associated Trustpoints: CUBE_CA_CERT Ir
  Storage: nvram:USERTrustRSA#DA7CA.cer
```

Verify CA is trusted by Webex

```
CA Certificate
  Status: Available
  Certificate Serial Number (hex): 7D5B5126B476BA11DB7…
  Certificate Usage: Signature
  Issuer:
    cn=USERTrust RSA Certification Authority
    o=The USERTRUST Network
    l=Jersey City
    st=New Jersey
    c=US
  Subject:
    cn=Sectigo RSA Domain Validation Secure Server CA
    o=Sectigo Limited
    l=Salford
    st=Greater Manchester
    c=GB
  CRL Distribution Points:
    http://crl.usertrust.com/USERTrustRSACertification…
  Validity Date:
    start date: 20:00:00 EDT Nov 1 2018
    end   date: 18:59:59 EST Dec 31 2030
  Associated Trustpoints: CUBE_CA_CERT Intermediate_CA2
  Storage: nvram:USERTrustRSA#DA7CA.cer
```

```
CA Certificate
  Status: Available
  Certificate Serial Number (hex): 3972
  Certificate Usage: Signature
  Issuer:
    cn=AAA Certificate Services
    o=Comodo CA Limited
    l=Salford
    st=Greater Manchester
    c=GB
  Subject:
    cn=USERTrust RSA Certification Autho
    o=The USERTRUST Network
    l=Jersey City
    st=New Jersey
    c=US
  CRL Distribution Points:
    http://crl.comodoca.com/AAACertifica
  Validity Date:
    start date: 20:00:00 EDT Mar 11 201
    end   date: 18:59:59 EST Dec 31 202
  Associated Trustpoints: Intermediate_
  Storage: nvram:AAACertifica#3595CA.ce
```

Verify CA is trusted by Webex

```
CA Certificate
  Status: Available
  Certificate Serial Number (hex): 3972443AF922B751D…
  Certificate Usage: Signature
  Issuer:
    cn=AAA Certificate Services
    o=Comodo CA Limited
    l=Salford
    st=Greater Manchester
    c=GB
  Subject:
    cn=USERTrust RSA Certification Authority
    o=The USERTRUST Network
    l=Jersey City
    st=New Jersey
    c=US
  CRL Distribution Points:
    http://crl.comodoca.com/AAACertificateServices.crl
  Validity Date:
    start date: 20:00:00 EDT Mar 11 2019
    end   date: 18:59:59 EST Dec 31 2028
  Associated Trustpoints: Intermediate_CA
  Storage: nvram:AAACertifica#3595CA.cer
```

```
CA Certificate
  Status: Available
  Certificate Serial Number (hex): 01
  Certificate Usage: Signature
  Issuer:
    cn=AAA Certificate Services
    o=Comodo CA Limited
    l=Salford
    st=Greater Manchester
    c=GB
  Subject:
    cn=AAA Certificate Services
    o=Comodo CA Limited
    l=Salford
    st=Greater Manchester
    c=GB
  CRL Distribution Points:
    http://crl.comodoca.com/AAACertifica
    http://crl.comodo.net/AAACertificate
  Validity Date:
    start date: 19:00:00 EST Dec 31 200
    end   date: 18:59:59 EST Dec 31 202
  Associated Trustpoints: Root_CA_CERT
  Storage: nvram:AAACertifica#1CA.cer
```

Verify CA is trusted by Webex

```
CA Certificate
  Status: Available
  Certificate Serial Number (hex): 01
  Certificate Usage: Signature
  Issuer:
    cn=AAA Certificate Services
    o=Comodo CA Limited
    l=Salford
    st=Greater Manchester
    c=GB
  Subject:
    cn=AAA Certificate Services
    o=Comodo CA Limited
    l=Salford
    st=Greater Manchester
    c=GB
  CRL Distribution Points:
    http://crl.comodoca.com/AAACertificateServices.crl
    http://crl.comodo.net/AAACertificateServices.crl
  Validity Date:
    start date: 19:00:00 EST Dec 31 2003
    end   date: 18:59:59 EST Dec 31 2028
  Associated Trustpoints: Root_CA_CERT
```

Self-signed indicates Root CA

```
show crypto pki trustpoints Root_CA_CERT status
```

Verify CA is trusted by Webex

```
Associated Trustpoints: Root_CA_CERT
```

```
svs-rtp-dmz-cube9a#show crypto pki trustpoints Root_CA_CERT status
Trustpoint Root_CA_CERT:
  Issuing CA certificate configured:
    Subject Name:
     cn=AAA Certificate Services,o=Comodo CA Limited,l=Salford,st=Greater Manchester,c=GB
    Fingerprint MD5: 497904B0 EB8719AC 47B0BC11 519B74D0
    Fingerprint SHA1: D1EB23A4 6D17D68F D92564C2 F1F16017 64D8E349
  State:
    Keys generated ..... No
    Issuing CA authenticated ..... Yes
    Certificate request(s) ..... None
```

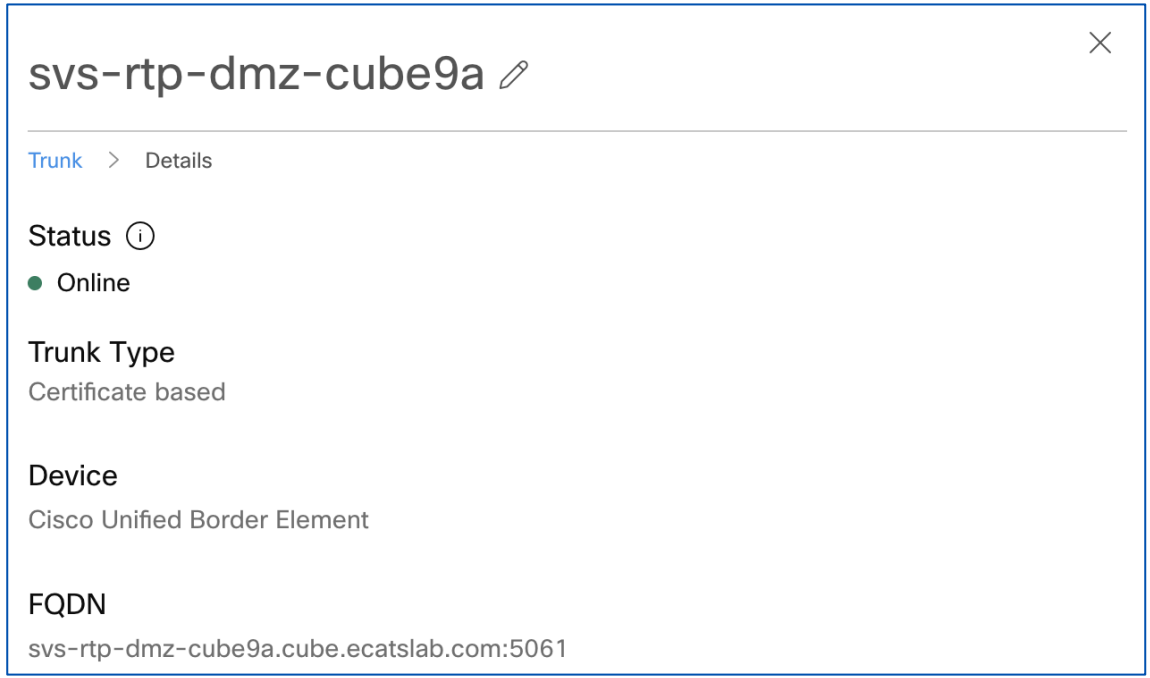
https://help.webex.com/en-us/article/WBX9000008850/What-Root-Certificate-Authorities-are-Supported-for-Calls-to-Cisco-Webex-Audioand-Video-Platforms

d1eb23a46d17d68fd92564c2f1f1601764d8e349	C=GB/ST=Greater Manchester/L=Salford/O=Comodo CA Limited/CN=AAA Certificate Services	August 3, 2018

Verify TLS Connections

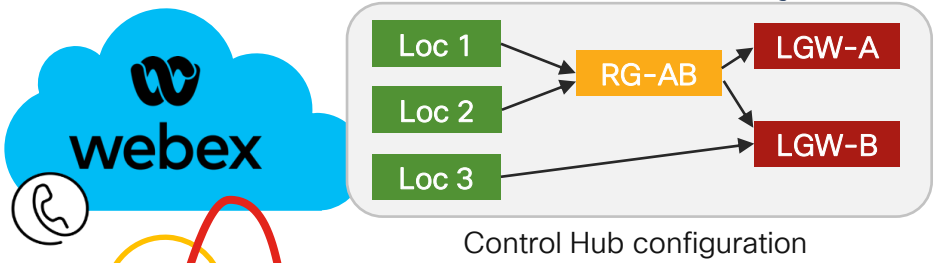
```
svs-rtp-dmz-cube9a#show sip-ua connections tcp tls detail
Total active connections      : 8
No. of send failures          : 4
No. of remote closures        : 105
No. of conn. failures         : 1595
No. of inactive conn. ageouts : 0
Max. tls send msg queue size of 3, recorded for 139.177.65.53:8934
TLS client handshake failures : 0
TLS server handshake failures : 0

Remote-Agent:139.177.65.54, Connections-Count:2
  Remote-Port Conn-Id Conn-State  WriteQ-Size           Local-Address               TLS-Version Cipher                          Curve Tenant
  =========== ======= =========== =========== ===================================== =========== ============================== ===== ======
         5062    1658 Established           0 64.102.250.137:21819                      TLSv1.2    ECDHE-RSA-AES256-GCM-SHA384 P-256     0
         8934    1715 Established           0 64.102.250.137:5061                       TLSv1.2    ECDHE-RSA-AES256-GCM-SHA384 P-256     0

Remote-Agent:139.177.64.53, Connections-Count:2
  Remote-Port Conn-Id Conn-State  WriteQ-Size           Local-Address               TLS-Version Cipher                          Curve Tenant
  =========== ======= =========== =========== ===================================== =========== ============================== ===== ======
         5062    1657 Established           0 64.102.250.137:39113                      TLSv1.2    ECDHE-RSA-AES256-GCM-SHA384 P-256     0
         8934    1717 Established           0 64.102.250.137:5061                       TLSv1.2    ECDHE-RSA-AES256-GCM-SHA384 P-256     0

Remote-Agent:139.177.64.54, Connections-Count:2
  Remote-Port Conn-Id Conn-State  WriteQ-Size           Local-Address               TLS-Version Cipher                          Curve Tenant
  =========== ======= =========== =========== ===================================== =========== ============================== ===== ======
         5062    1659 Established           0 64.102.250.137:48188                      TLSv1.2    ECDHE-RSA-AES256-GCM-SHA384 P-256     0
         8934    1714 Established           0 64.102.250.137:5061                       TLSv1.2    ECDHE-RSA-AES256-GCM-SHA384 P-256     0

Remote-Agent:139.177.65.53, Connections-Count:2
  Remote-Port Conn-Id Conn-State  WriteQ-Size           Local-Address               TLS-Version Cipher                          Curve Tenant
  =========== ======= =========== =========== ===================================== =========== ============================== ===== ======
         5062    1660 Established           0 64.102.250.137:11636                      TLSv1.2    ECDHE-RSA-AES256-GCM-SHA384 P-256     0
         8934    1716 Established           0 64.102.250.137:5061                       TLSv1.2    ECDHE-RSA-AES256-GCM-SHA384 P-256     0
```

Successful Connection from Control Hub



CUBE Call Routing

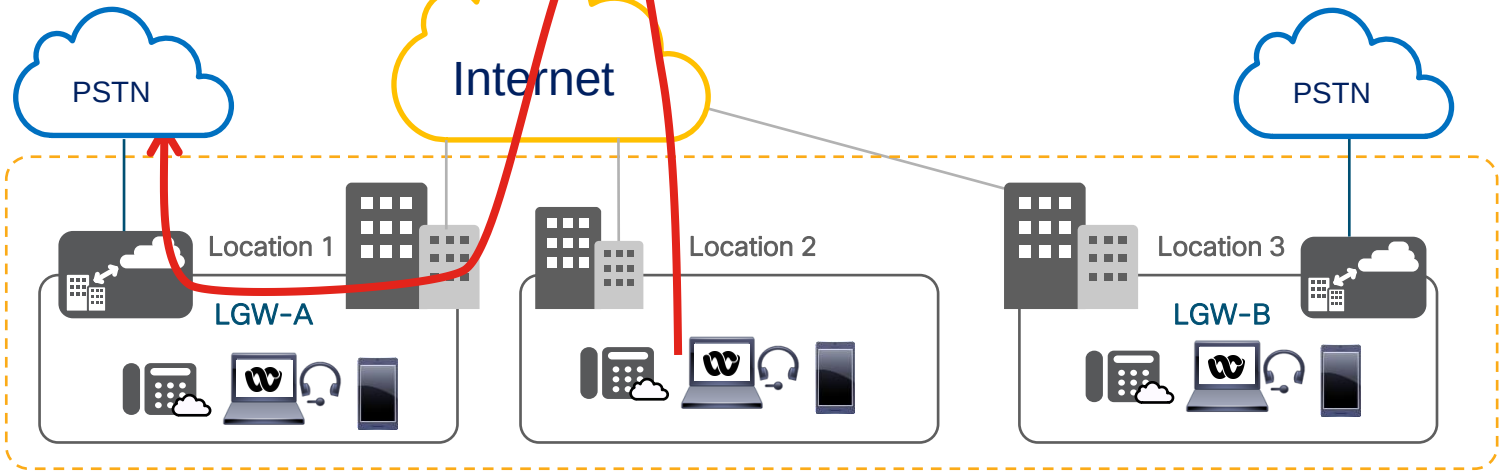
Premises-based PSTN Deployment Models
Multi-site with Multiple Local Gateways



Control Hub configuration

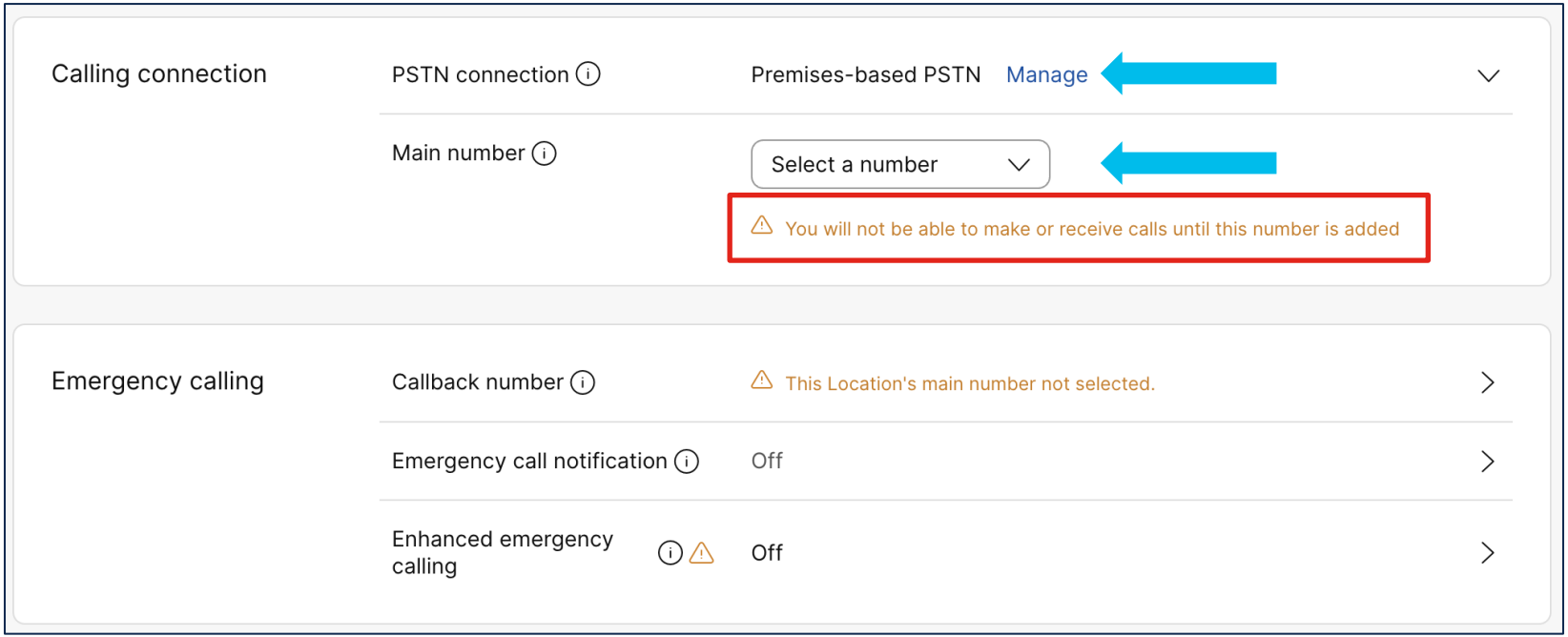
Multiple locations can use the same Trunk / Route Group

One Trunk or Route Group must be assigned to each location



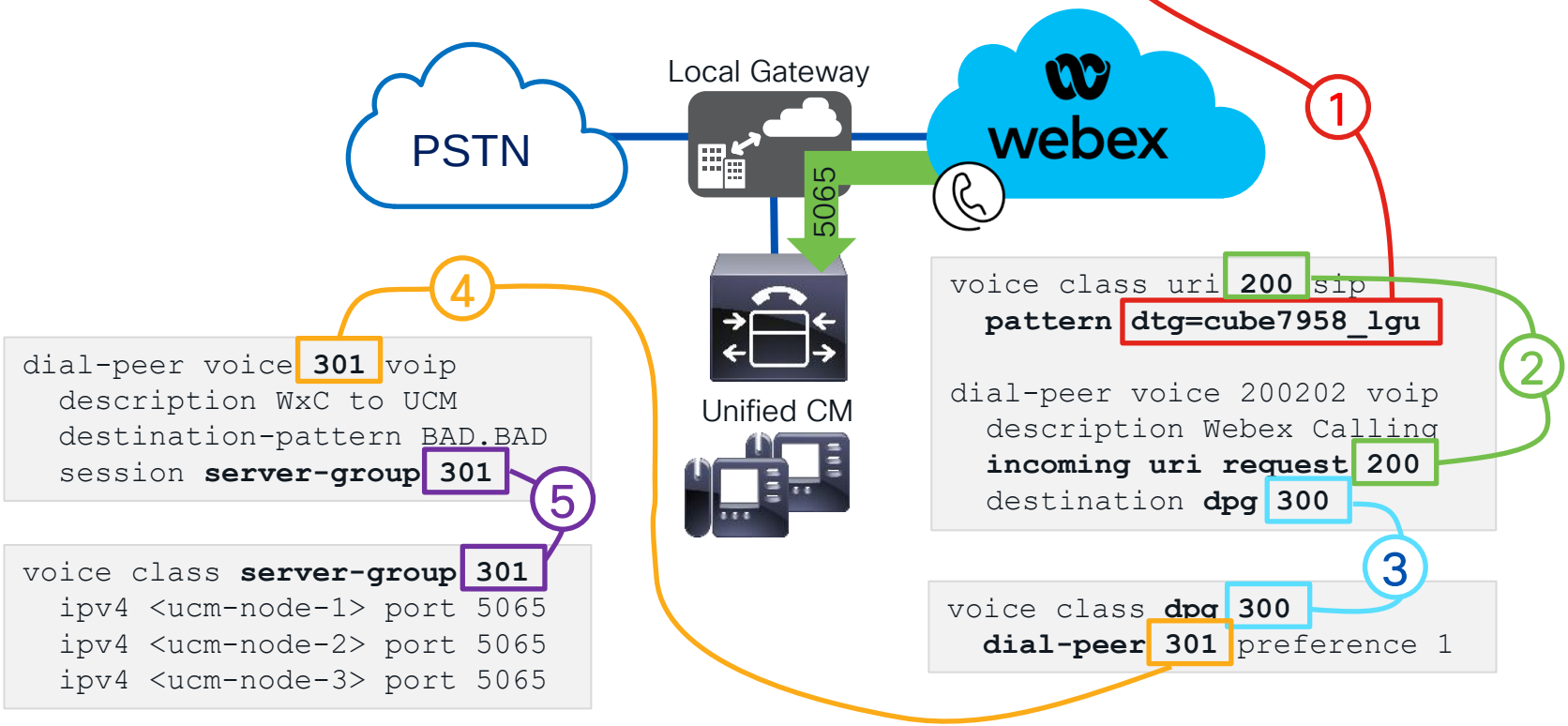
PSTN Connection and Main Number selection

Calling > Locations > Select Location



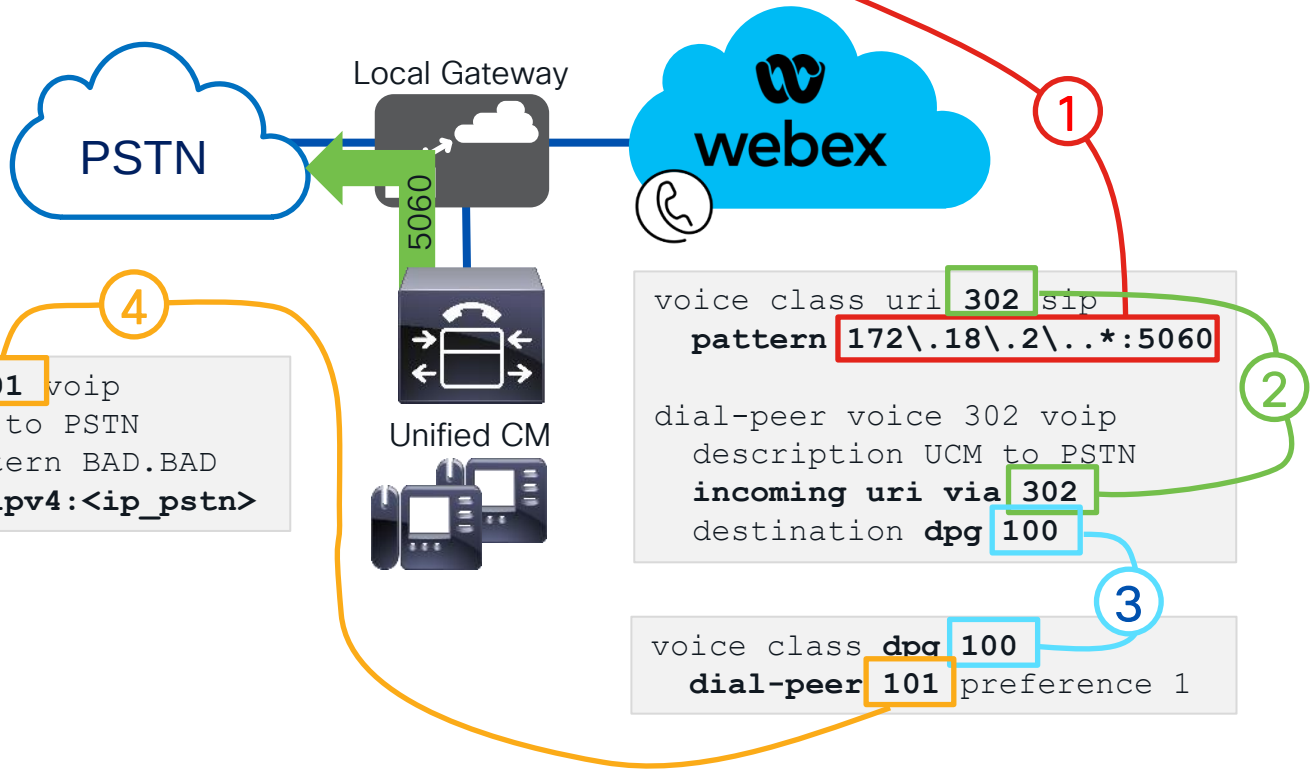
Dial Peer Matching

```
INVITE sip:+18008001180@64.102.250.133:5061;
transport=tls;dtg=cube7958_lgu SIP/2.0
```



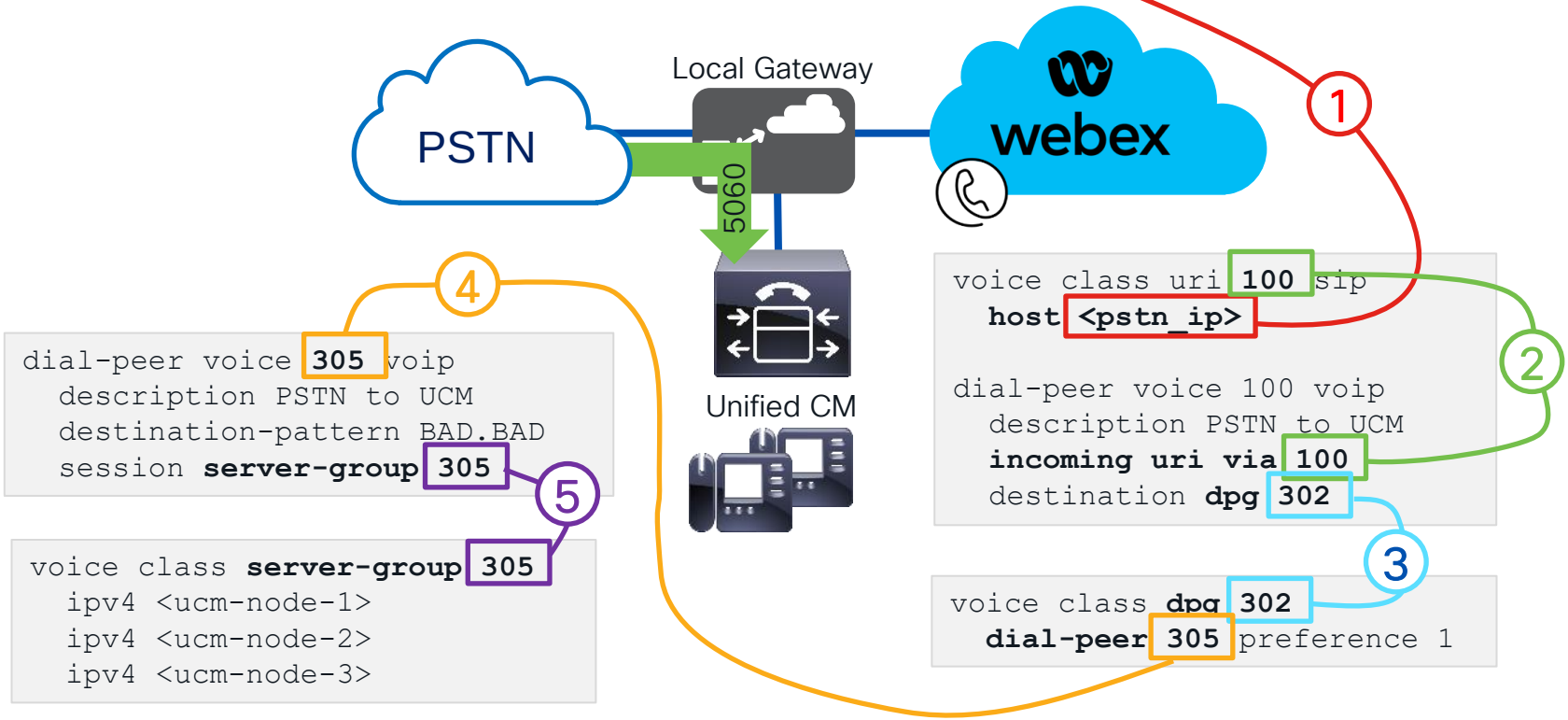
Dial Peer Matching

```
INVITE sip:+18008001180@172.19.54.10:5060;transport=…
Via: SIP/2.0/TCP 172.18.2.20:5060;branch=z9hG4bK247e…
```



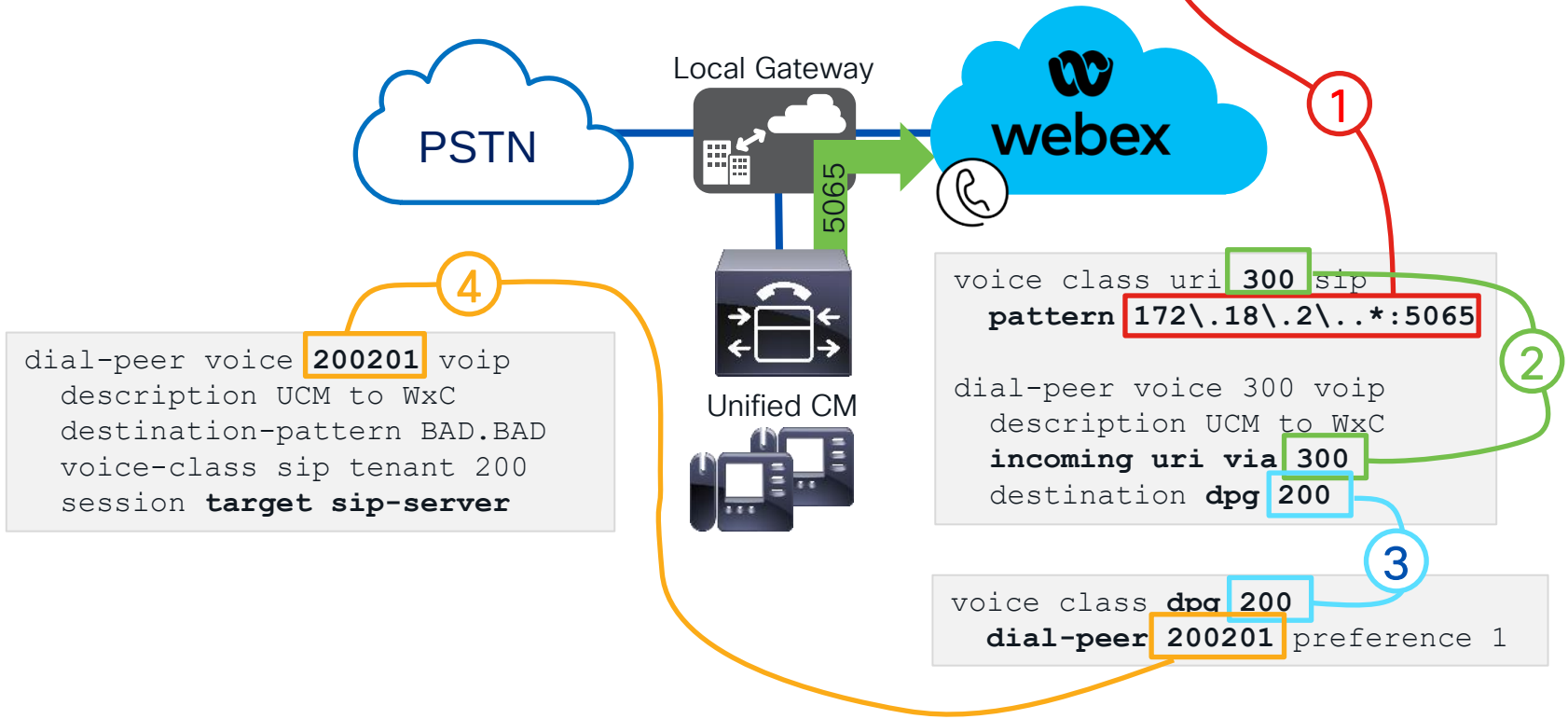
Dial Peer Matching

```
INVITE sip:+1919552345@64.102.2.123:5060;transport=…
Via: SIP/2.0/TCP <pstn_ip>:5060;branch=z9hG4bK247e…
```



Dial Peer Matching

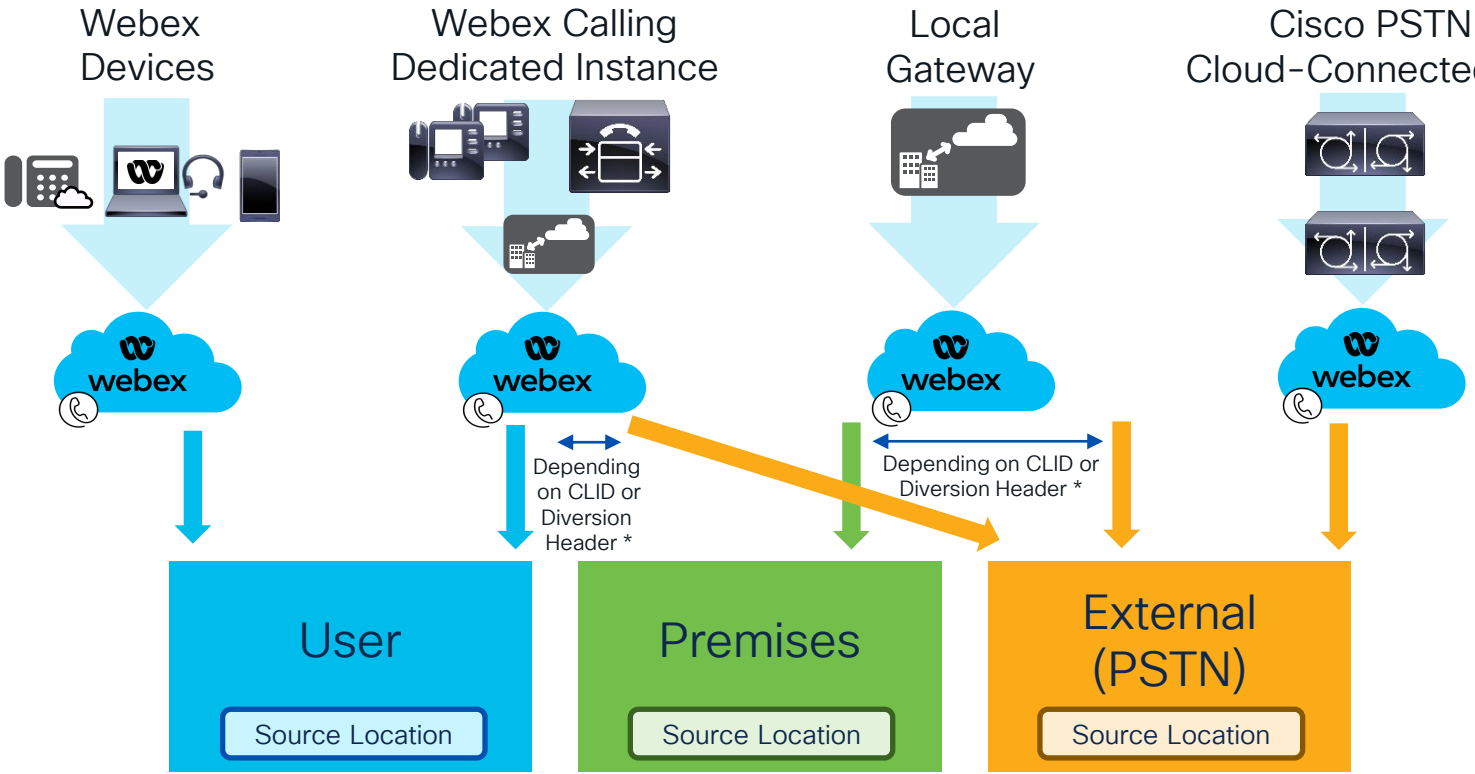
```
INVITE sip:+19195552345@86194638.us10.bcld.webex.com…
Via: SIP/2.0/TCP 172.18.2.20:5065;branch=z9hG4bK247e…
```



Webex Calling call routing overview

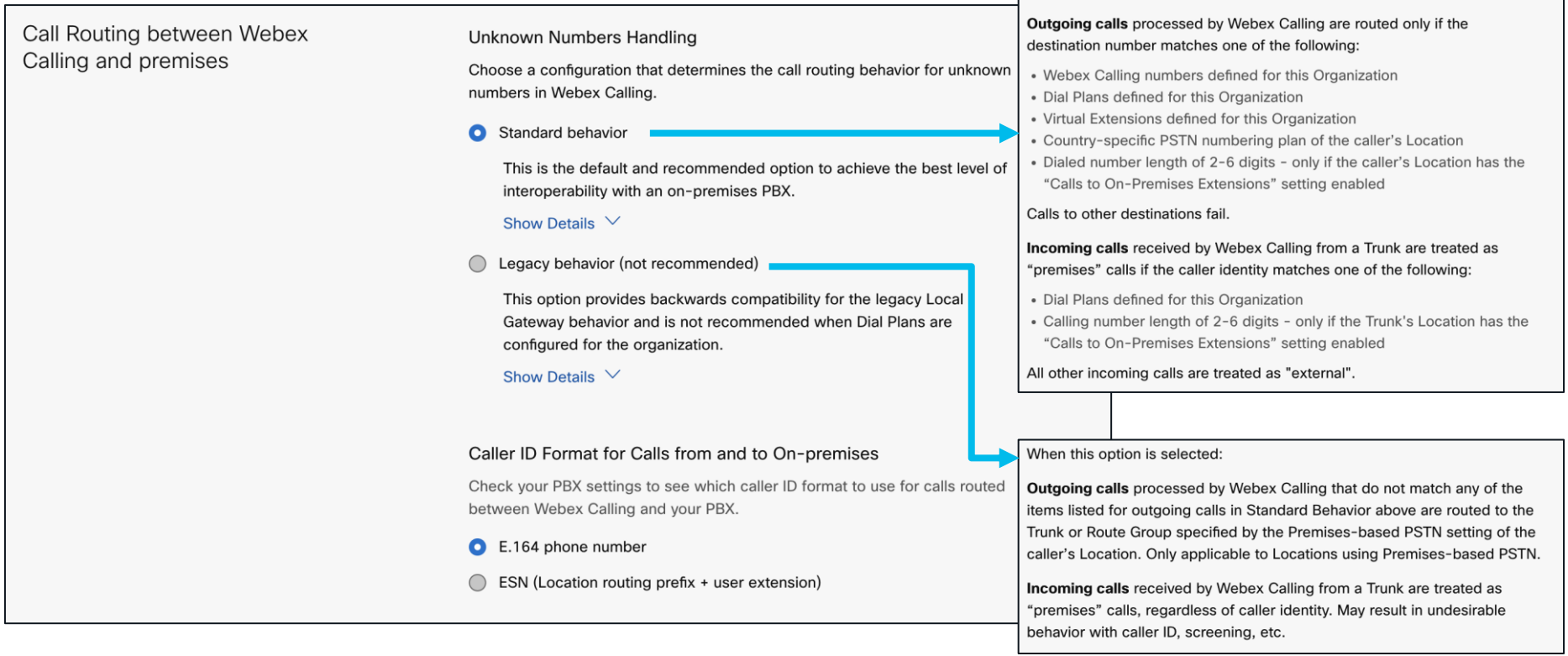
- Call Routing undergoes three distinct phases

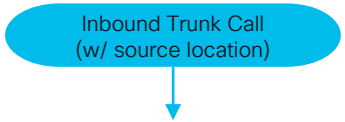
Webex Calling Source Classification



* Depends on incoming calling party number, presence of Diversion header, number of dialed digits, and configuration settings

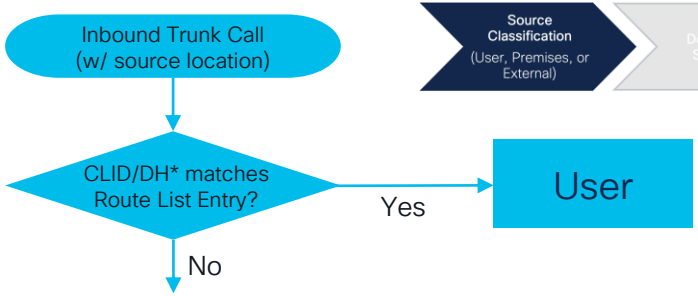
Call Routing Configuration – Service Settings





Source Classification

Source Classification

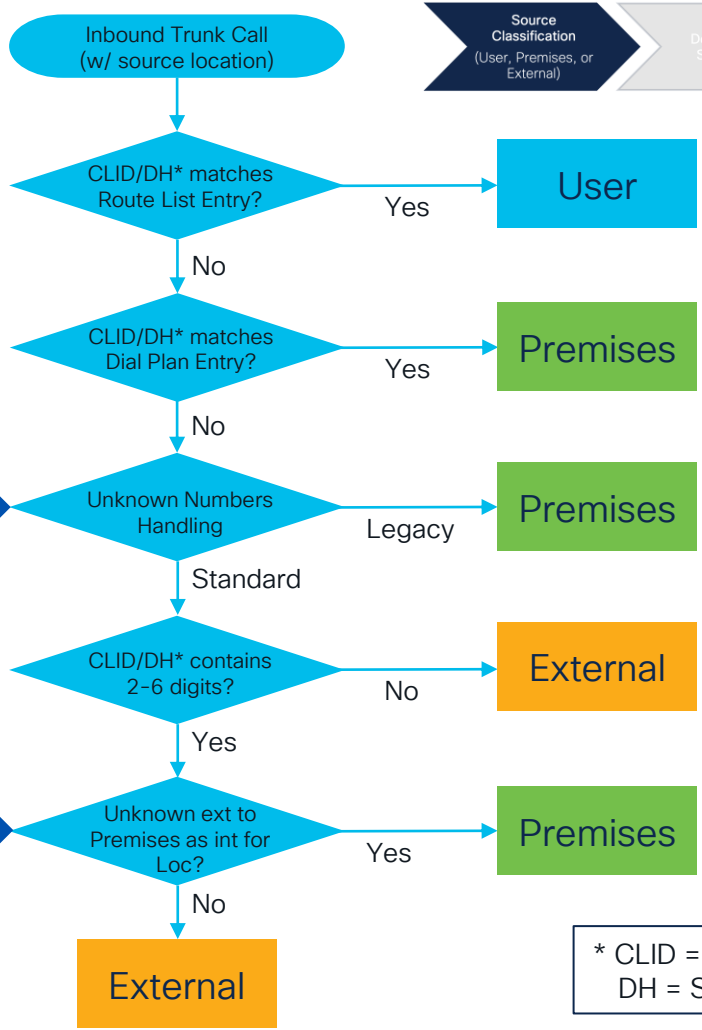


Number in Diversion header used if present, if not number in From header is used

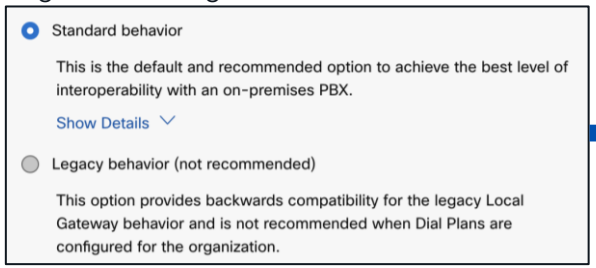
```
INVITE sip:89943702@peering3.us.sipconnect.bcld.webex.com:5062 SIP/2.0
Via: SIP/2.0/TLS 64.102.250.137:5061;branch=z9hG4bK8BF831C1E
From: <sip:+19194766200@64.102.250.137>;tag=FD340CF9-200D
To: <sip:89943702@peering3.us.sipconnect.bcld.webex.com>
Call-ID: 2EB7BD48-EF7111ED-B8429147-F554AD62@64.102.250.137
Supported: timer,resource-priority,replaces
Min-SE:  1800
User-Agent: Cisco-SIPGateway/IOS-17.10.1a
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
CSeq: 101 INVITE
Contact: <sip:+19194766200@svs-rtp-dmz-cube9a.cube.ecatslab.com:5061;transport=tls>
Diversion: <sip:89915678@svs-rtp-dmz-cube9a.cube.ecatslab.com>
Expires: 180
Max-Forwards: 68
… snip …
```

* CLID = Calling Party ID
  DH = SIP Diversion Header

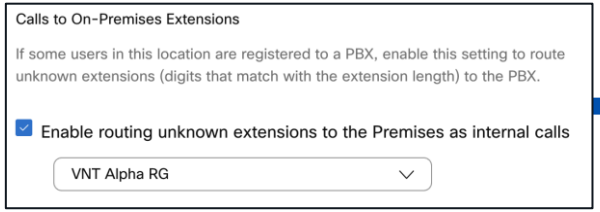
Source Classification



Org-wide Configuration



Trunk Location Configuration



* CLID = Calling Party ID
DH = SIP Diversion Header

Routing overview

2) Destination selection

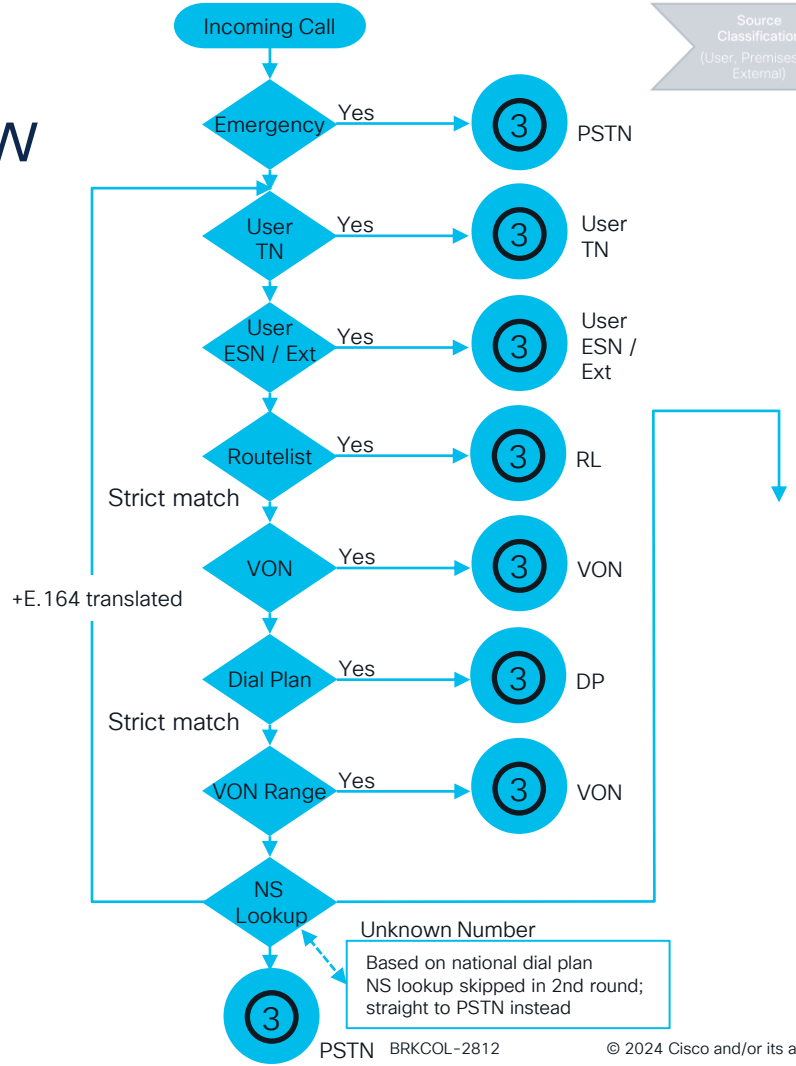
Routing overview

2) Destination selection

Dialed number might be translated to +E.164 based on national numbering plan.

For example:
9011496100123 → +496100123

If number is translated, then go back to check for +E.164 matches



Country Calling Plans

https://help.webex.com/en-us/article/757iyo/Dial-plans-by-country

- NS Lookup uses calling plan for the country of the Location
- Call Type tagging used for call restrictions (covered later)

Netherlands

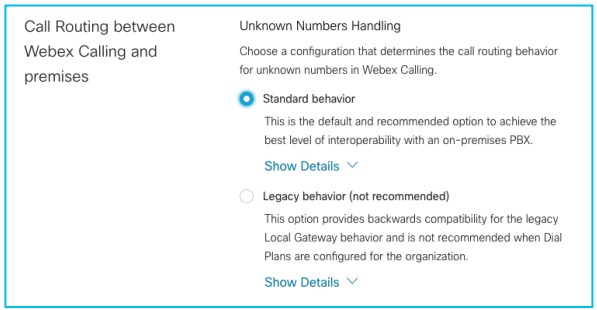
Outbound calling plan

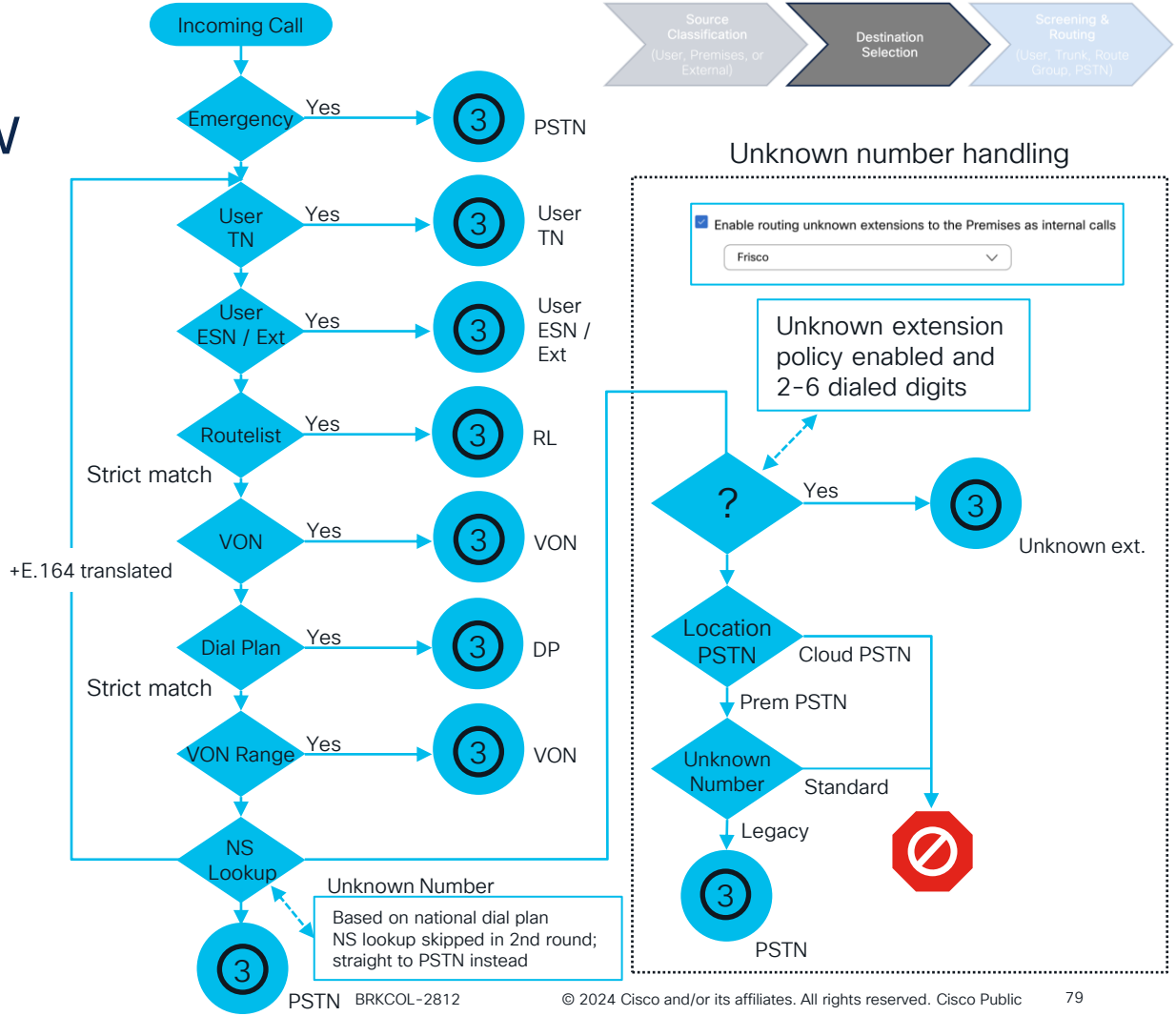
Table 185. **Netherlands outbound calling plan**

Country code	Digit map	Call type	Description
31	18xx	Chargeable Directory Assistance	Directory Assistance
31	116xxx	Chargeable Directory Assistance	European Harmonized Services
31	00xxxxx.	International	International Destinations
31	xxxxxx	Local	Local Calls
31	xxxxxxx	Local	Local Calls
31	084xxxxxxx	Premium Services I	Personal Assistant Services

Routing overview

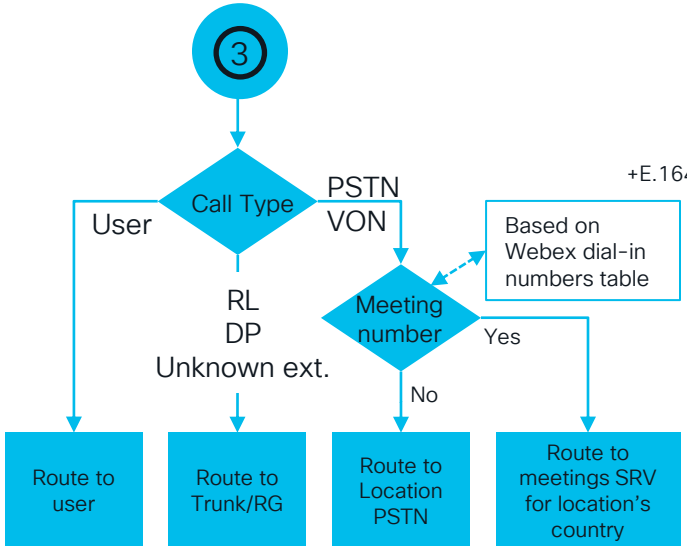
2) Destination selection

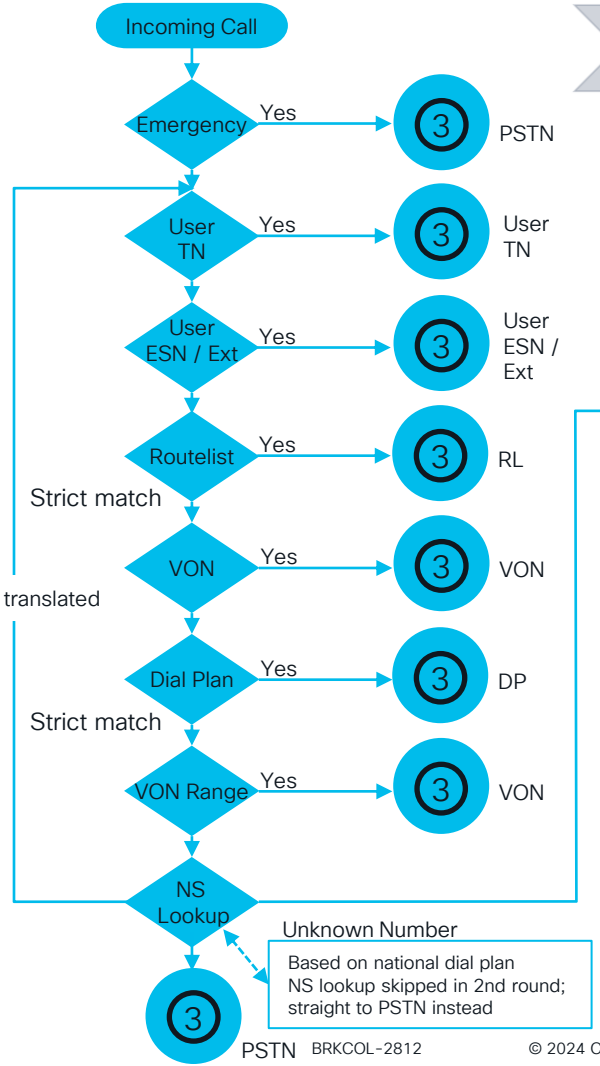


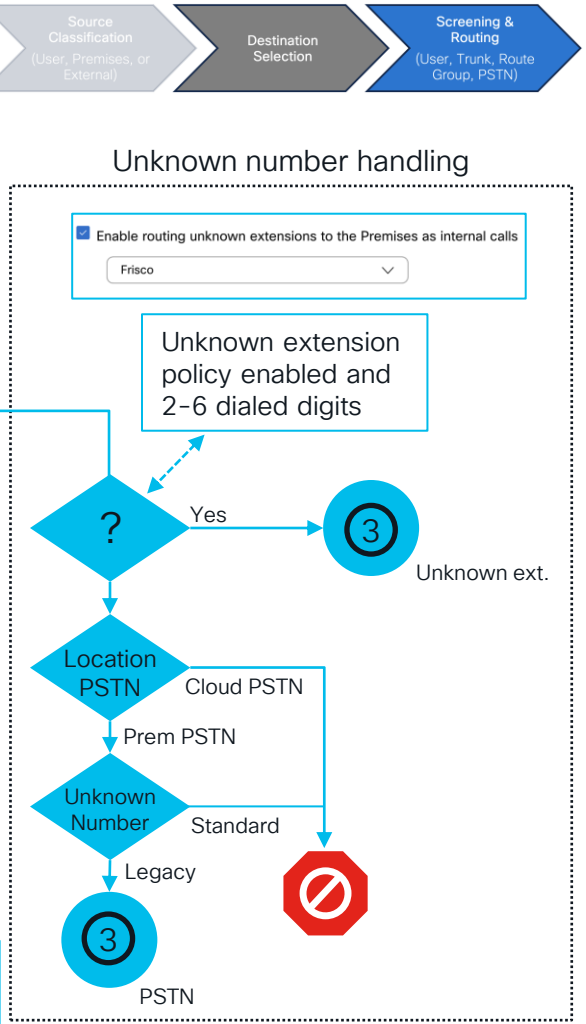


Routing overview

2) Destination selection
3) Block or allow based on calling permissions and route







Screening and Routing

From \ To	User (TN)	User (ESN/Ext)	Trunk (RL)	Trunk (DP or unknown ext)	PSTN / VON
User	✓	✓	✓	✓	✓
Premises	✓	✓	✓	✓	✗
External	✓	✗	✓	✗	✗

Screening and Routing

From \ To	User (TN)	User (ESN/Ext)	Trunk (RL)	Trunk (DP or unknown ext)	PSTN / VON
User	✓	✓	✓	✓	✓
Premises	✓	✓	✓	✓	✗
External	✓	✗	✓	✗	✗

- Calls from Webex Calling users (including DI users) can be routed anywhere

Screening and Routing

From \ To	User (TN)	User (ESN/Ext)	Trunk (RL)	Trunk (DP or unknown ext)	PSTN / VON
User	✓	✓	✓	✓	✓
Premises	✓	✓	✓	✓	✗
External	✓	✗	✓	✗	✗

- Calls from On-Premises Users can be routed anywhere except for the PSTN

Screening and Routing

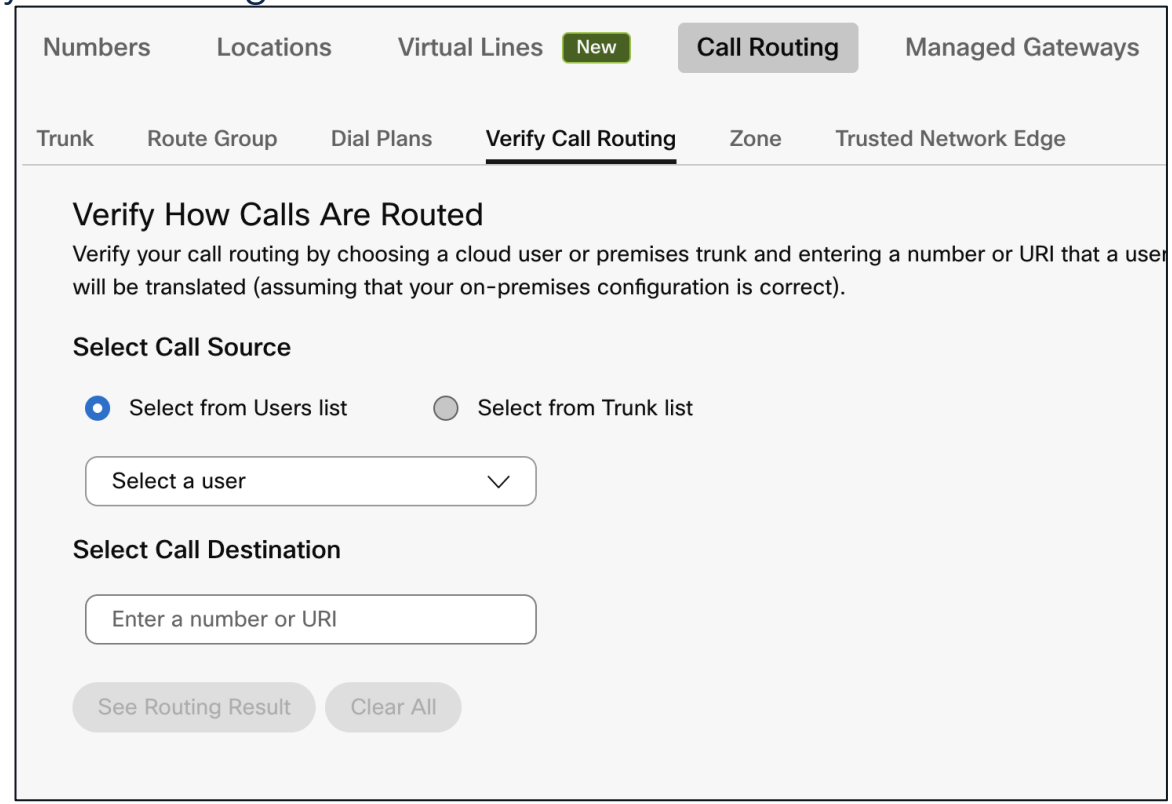
From \ To	User (TN)	User (ESN/Ext)	Trunk (RL)	Trunk (DP or unknown ext)	PSTN / VON
User	✓	✓	✓	✓	✓
Premises	✓	✓	✓	✓	✗
External	✓	✗	✓	✗	✗

- Calls from PSTN can only route to User TN's (including DI users). Calls from PSTN cannot call ESN / Extension.

Call Routing Troubleshooting Tool

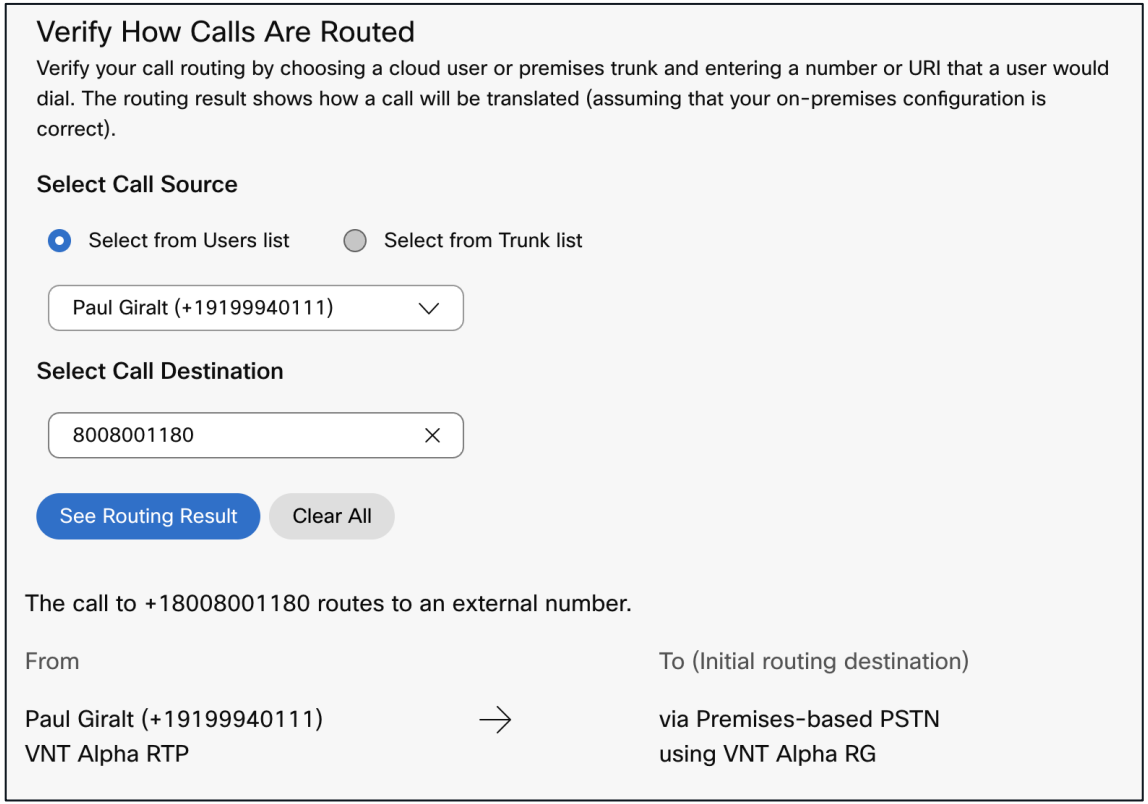
Calling > Call Routing > Verify Call Routing

- Select Source (User or Trunk and Number)
- Enter Destination
- Tool performs a live route lookup



Call Routing Troubleshooting Tool

- Example call from User to PSTN

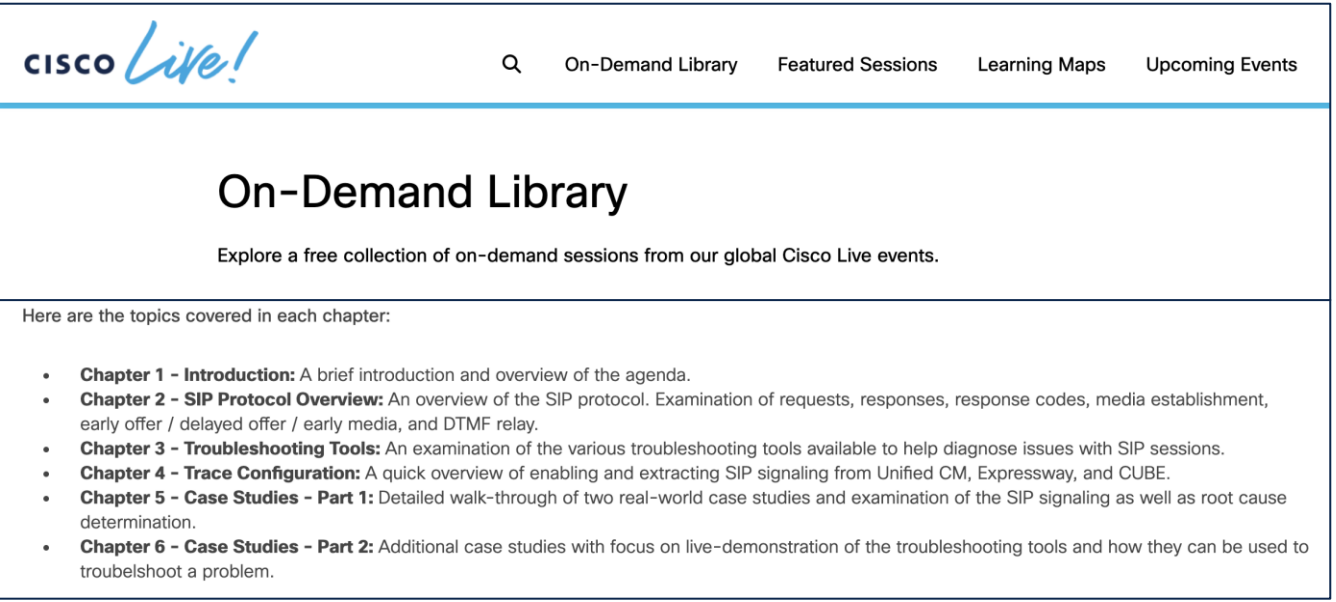


SIP Troubleshooting on CUBE

cisco Live!

Understanding the Session Initiation Protocol (SIP)

- Watch Chapter 2 from **DGTL-BRKUCC-2932** on Cisco Live On-Demand Library – https://ciscolive.com/on-demand



Make sure you log in after going to the above site

CUBE VOIP Trace Feature

```
voice sevice voip
  trace
```

- Logs debugs for individual calls automatically
- VOIP Trace is enabled by default from IOS-XE 17.4.1, 17.3.2
- VOIP Trace captures:
  - SIP messages for SIP Trunk to Trunk calls
  - Events and API calls from SIP layer to other layers in CUBE
  - SIP Errors
  - Call Control (unified communication call flows processed by CUBE)
  - FSM (Finite State Machines) states and events
  - Dial peer matched
  - RTP ports allocated
- Will not log REGISTER, OPTIONS, SUBSCRIBE/NOTIFY, INFO

VOIP Trace - Configuration

Memory allocated for VOIP Trace is configurable:

```
CUBE(conf-serv-trace)#memory-limit ?
<10-1000>  Specify maximum memory limit in MB
platform   Use 10 percent of available memory
```

```
Router#show processes memory
Processor Pool Total: 8039169484 Used:  403977744 Free: 7635191740
reserve P Pool Total:     102404 Used:         88 Free:     102316
 lsmpi_io Pool Total:    6295128 Used:    6294296 Free:        832
```

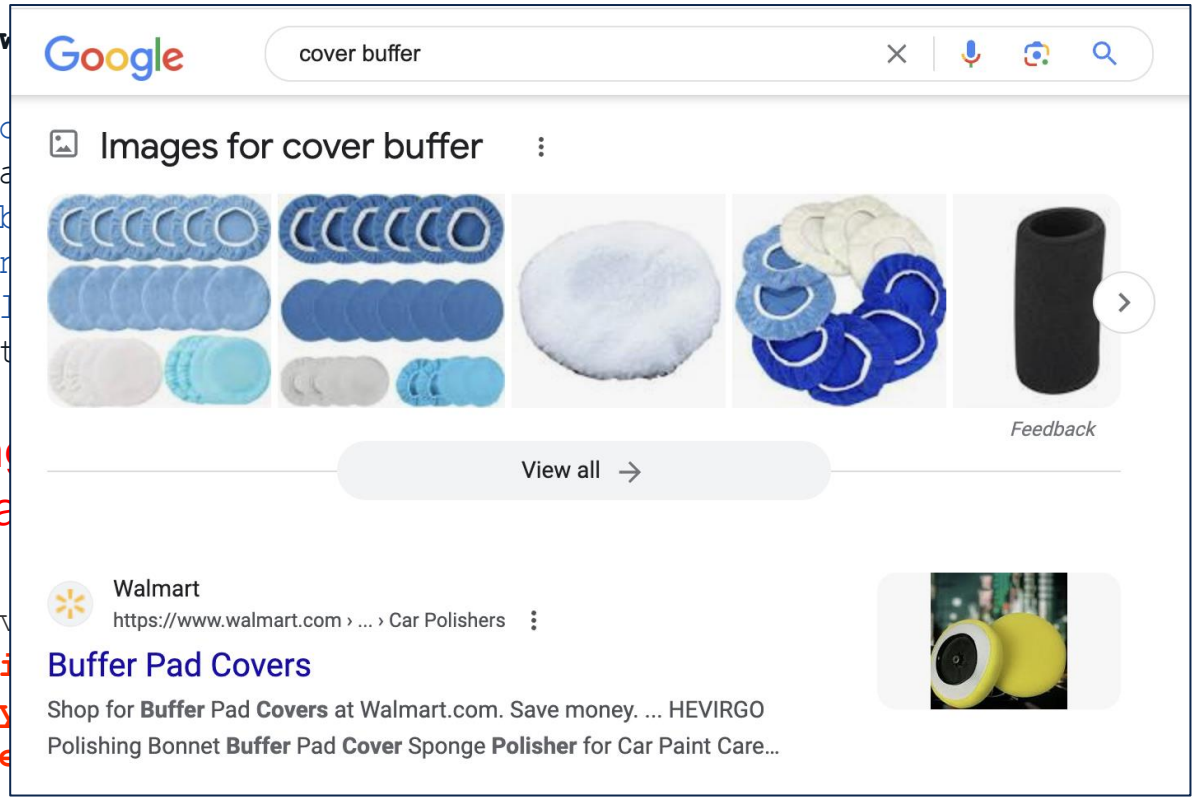
VOIP Trace – Show commands

```
CUBE#show
  all
  call-ic
  correla
  cover-b
  session
  sip-cal
  statist
```

Executing

I impact the performa

```
CUBE#sh v
 Displayi
 This may
 Continue
```



VOIP Trace - Cover Buffer - Search-Key

```
------------------ Cover Buffer ----------------
Search-key     = 9898:4000:9972
  Timestamp      = *Aug 26 16:30:59.361
  Buffer-Id      = 1
  CallID         = 9972
  Peer-CallID    = 9973
  Correlator     = 3
  Called-Number  = 4000
  Calling-Number = 9898
  SIP CallID     = 01e60dfa9d8442848336d79e3155a8a1
  SIP Session ID = 87003120822b5dbd8fd80f62d8e57c48
  GUID           = 5BB91F5FA6F3
-----------------------------------------------
------------------ Cover Buffer ----------------
Search-key     = 9898:4000:9973
  Timestamp      = *Aug 26 16:30:59.366
  Buffer-Id      = 2
  CallID         = 9973
  Peer-CallID    = 9972
  Correlator     = 3
  Called-Number  = 4000
  Calling-Number = 9898
  SIP CallID     = 5BBA3059-E6F011EA-A6F9946B-7389E770@10.65.105.50
  SIP Session ID = 4849c736509352fa919b340231ffe741
  GUID           = 5BB91F5FA6F3
-----------------------------------------------
```

- Search key is added in each cover buffer and for each call leg
- Search key is a combination of Calling number, Called number and call-id

In-leg
Search-key : 9898 : 4000 : 9972

Out-leg
Search-key : 9898 : 4000 : 9973

VOIP Trace - Cover Buffer - Search-Key

- To find a call, search for calling or called number

  show voip trace cover-buffer | include <calling or called number>

  show voip trace cover-buffer | section <calling or called number>

- Detailed call information can be filtered further using the call-id from the search-key

  show voip trace call-id <call-id>

VOIP Trace – Tip!

- Create aliases to make finding and showing calls easier.

```
alias exec fc show voip trace cover-buffer | section
alias exec sc show voip trace call-id
```

- Usage:
  - To find a call by calling / called number:

```
CUBE#fc 9195551234
```

  - To show the call details based on call-id:

```
CUBE#sc 37298
```

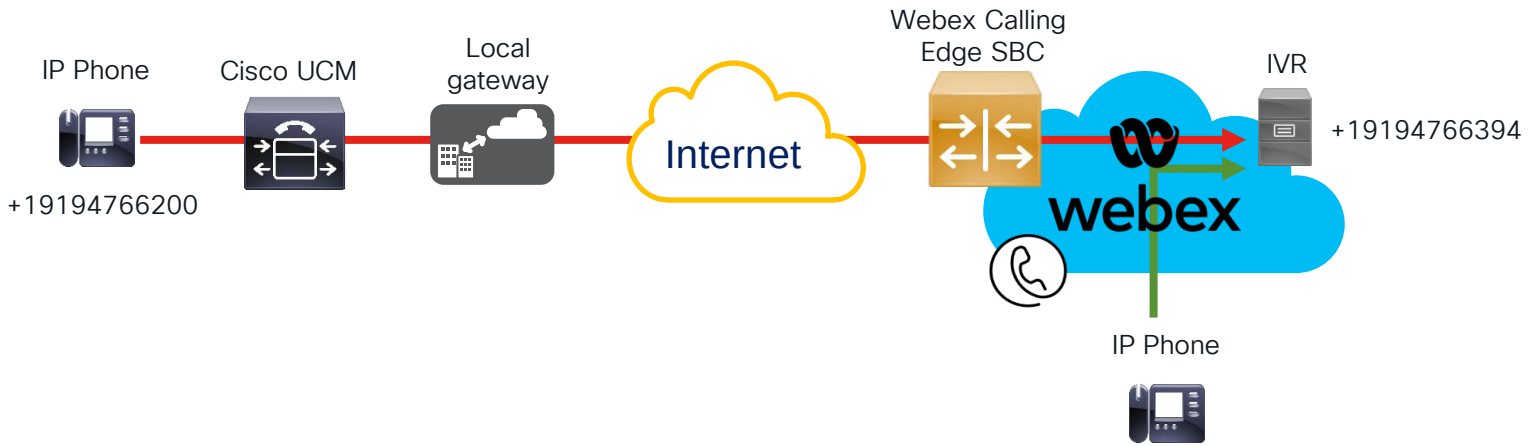
VOIP Trace – Show VOIP Trace Statistics

VOIP trace statistics displays extensive information about the status, memory consumption, errored or failure calls, successful calls etc..

```
Router#show voip trace statistics
VoIP Trace Statistics
Tracing status              : ENABLED at *Sep 12 06:44:02.349
Memory limit configured     : 803209216 bytes
Memory consumed             : 254550928 bytes (31%)
Total call legs dumped      : 2
Oldest trace dumped         : *Sep 12 07:29:21.077 Search-key: 9898:30000:64
Latest trace dumped         : *Sep 12 07:29:21.010 Search-key: 9898:30000:63
Total call legs captured    : 11858
Total call legs available   : 11858
Oldest trace available      : *Sep 12 06:57:23.923, Search-key: 5250001:4720001:11
Latest trace available      : *Sep 13 05:08:25.353, Search-key: 19074502232:30000:13177
Total traces missed         : 0
```

Case Study: Calls not ringing destination

- Scenario: Calling from UCM phone to Webex Calling IVR number
  - User gets ring back continuously – Call is never answered
  - Call from Webex Calling registered phone works



Case Study : Calls not ringing destination

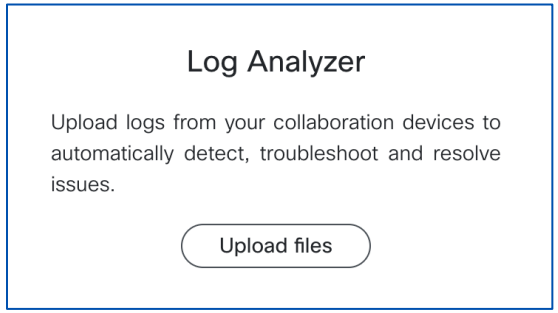
```
CUBE#show voip trace cover-buffers | section \+19194766394
Search-key     = +19194766200:+19194766394:13542
  Timestamp      = *Jun  3 03:10:43.063
  Buffer-Id      = 13
  CallID         = 13542
  Peer-CallID    = 13543
  Correlator     = NA
  Called-Number  = +19194766394
  Calling-Number = +19194766200
  SIP CallID     = cc4e5980-1ee100ed-33f97f9-3b6a12ac@172.18.106.59
  SIP Session ID = d443532f00804a2bb4c1dcb68423024d
  GUID           = CC4E59800000
  Tenant         = 300
Search-key     = +19194766200:+19194766394:13543
  Timestamp      = *Jun  3 03:10:43.067
  Buffer-Id      = 14
  CallID         = 13543
  Peer-CallID    = 13542
  Correlator     = NA
  Called-Number  = +19194766394
  Calling-Number = +19194766200
  SIP CallID     = 96A29B58-E22111EC-8290C535-8219C882@64.102.250.135
  SIP Session ID = 377caecb00105000a000ac7e8ab6043b
  GUID           = CC4E59800000
  Tenant         = 200

CUBE#show voip trace call-id 13542
```

Save output to .txt file

Case Study: Calls not ringing destination

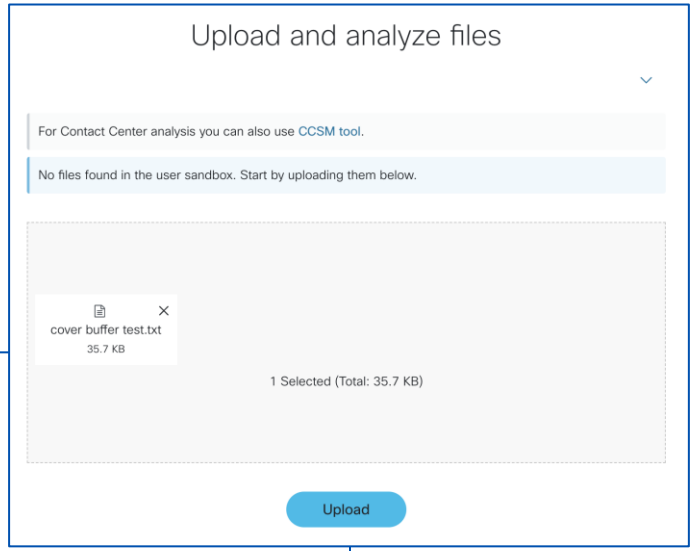
Collaboration Solutions Analyzer – **https://cway.cisco.com/csa/**

1

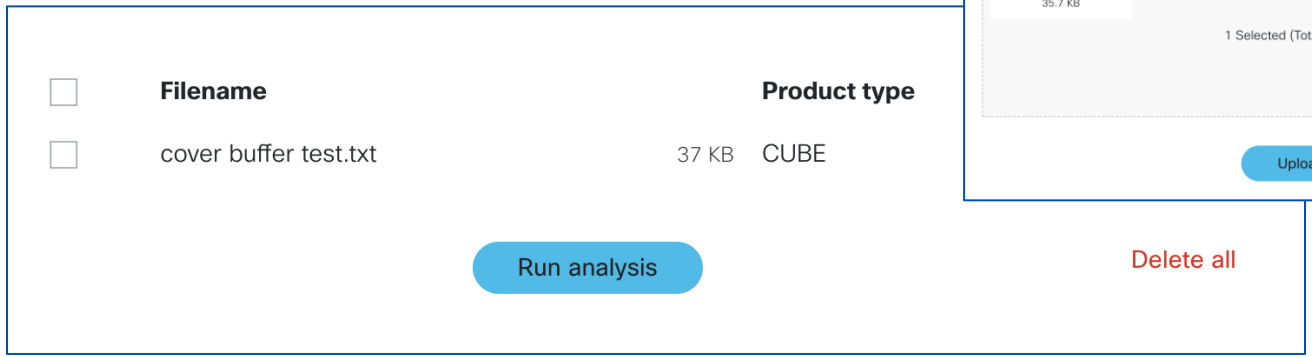


2

Include ‘show ver’ and ‘show run’ in the file in addition to traces

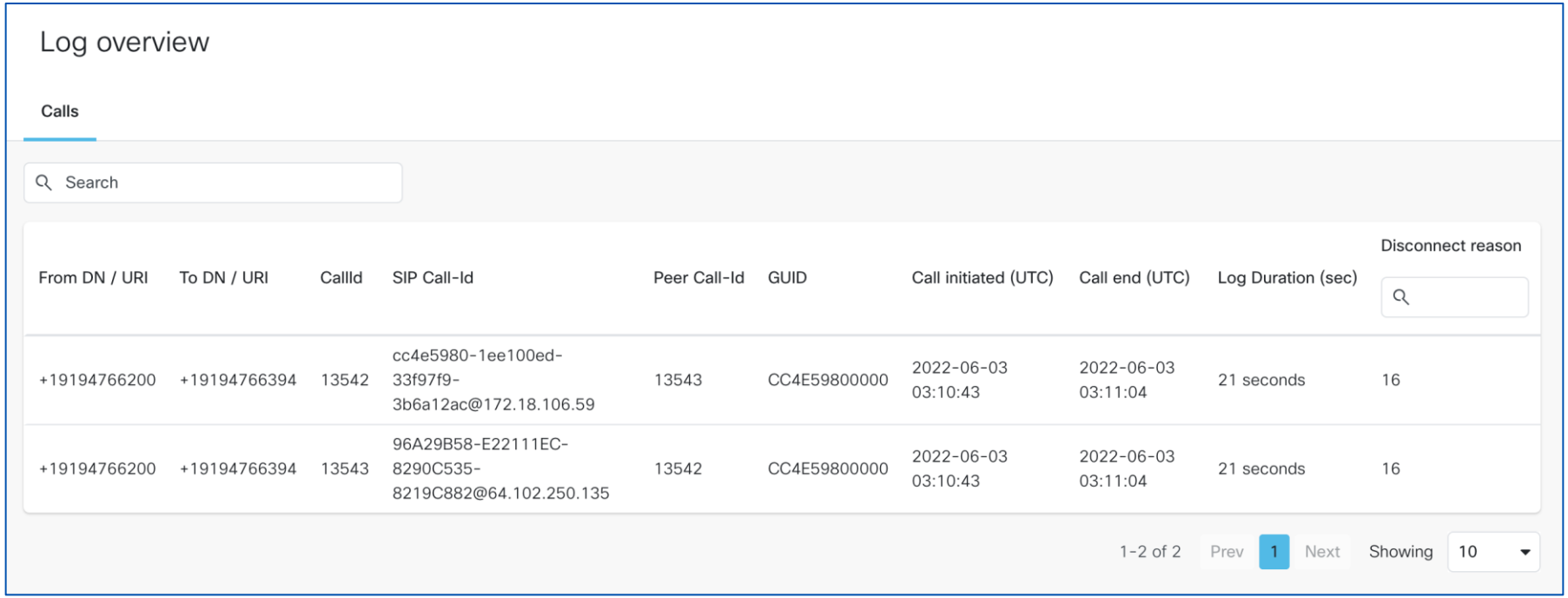


3



Case Study: Calls not ringing destination

Collaboration Solutions Analyzer - **https://cway.cisco.com/csa/**



Log overview

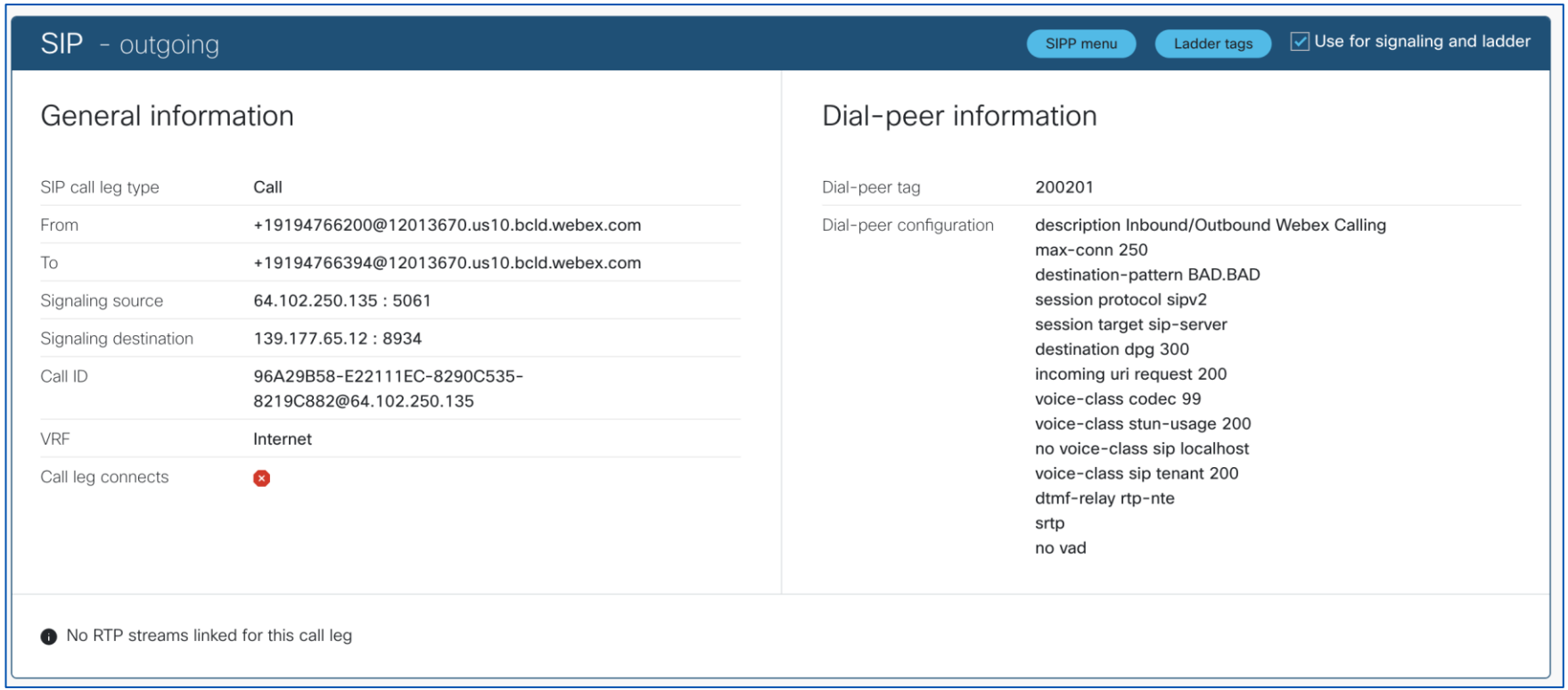
Calls

Search

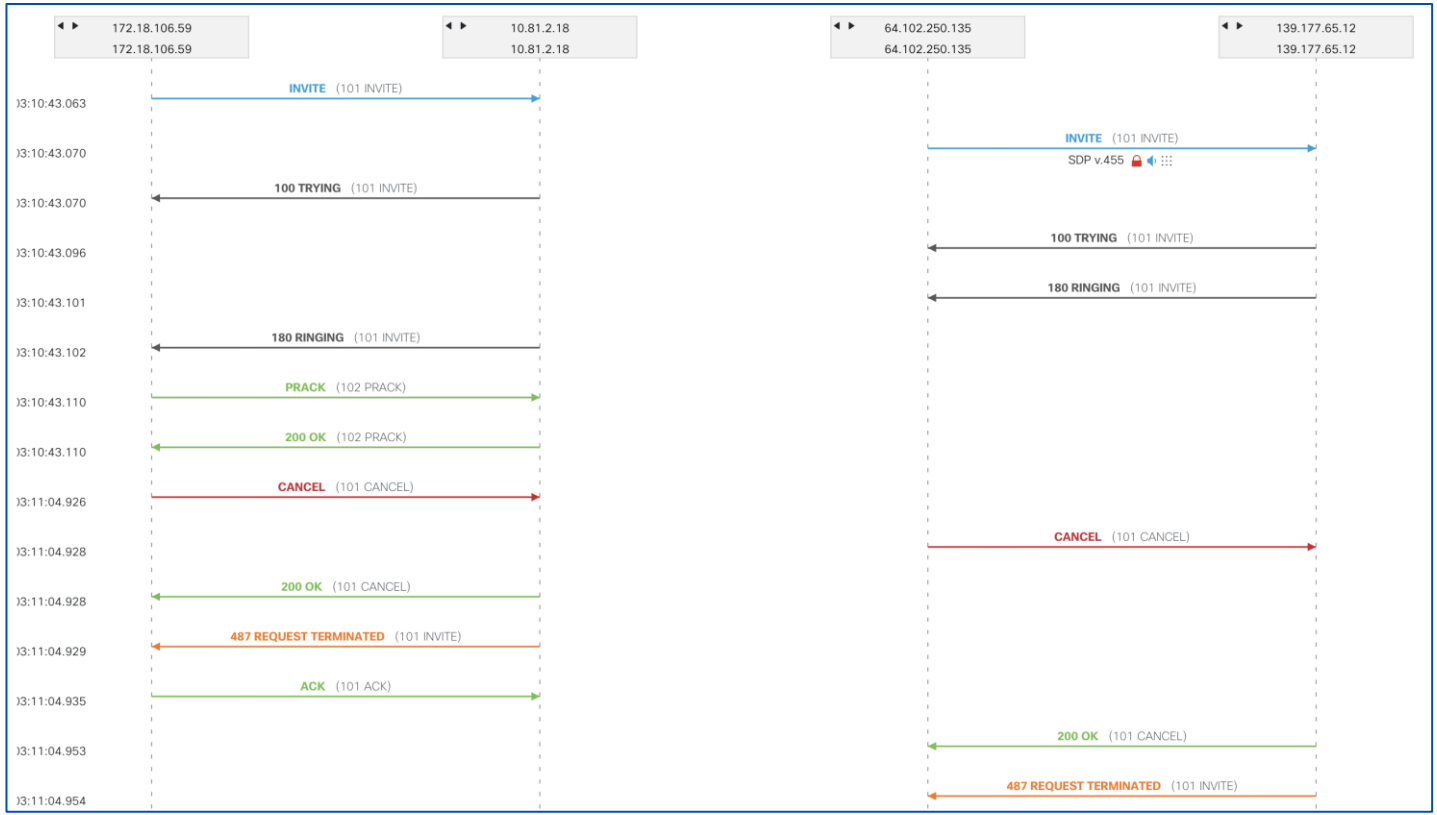
From DN / URI	To DN / URI	CallId	SIP Call-Id	Peer Call-Id	GUID	Call initiated (UTC)	Call end (UTC)	Log Duration (sec)	Disconnect reason
+19194766200	+19194766394	13542	cc4e5980-1ee100ed-33f97f9-3b6a12ac@172.18.106.59	13543	CC4E59800000	2022-06-03 03:10:43	2022-06-03 03:11:04	21 seconds	16
+19194766200	+19194766394	13543	96A29B58-E22111EC-8290C535-8219C882@64.102.250.135	13542	CC4E59800000	2022-06-03 03:10:43	2022-06-03 03:11:04	21 seconds	16

1-2 of 2 Prev 1 Next Showing 10

Case Study: Calls not ringing destination



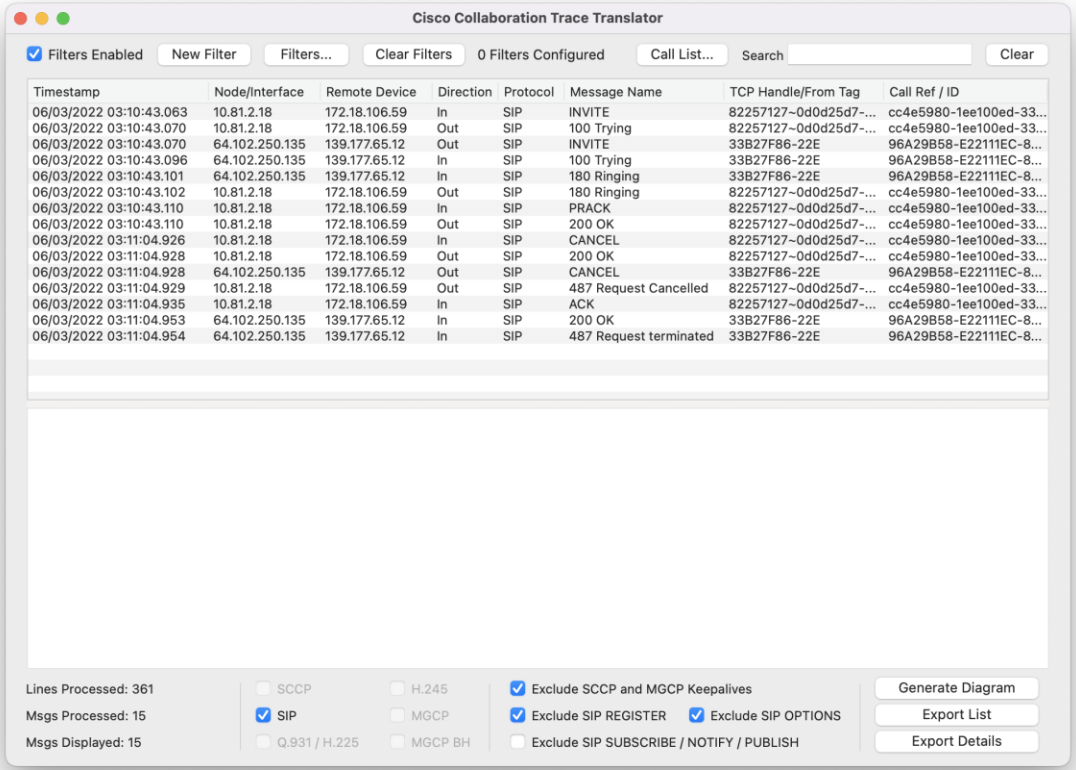
Case Study: Calls not ringing destination



Case Study: Calls not ringing destination

Use TranslatorX – translatorx.org

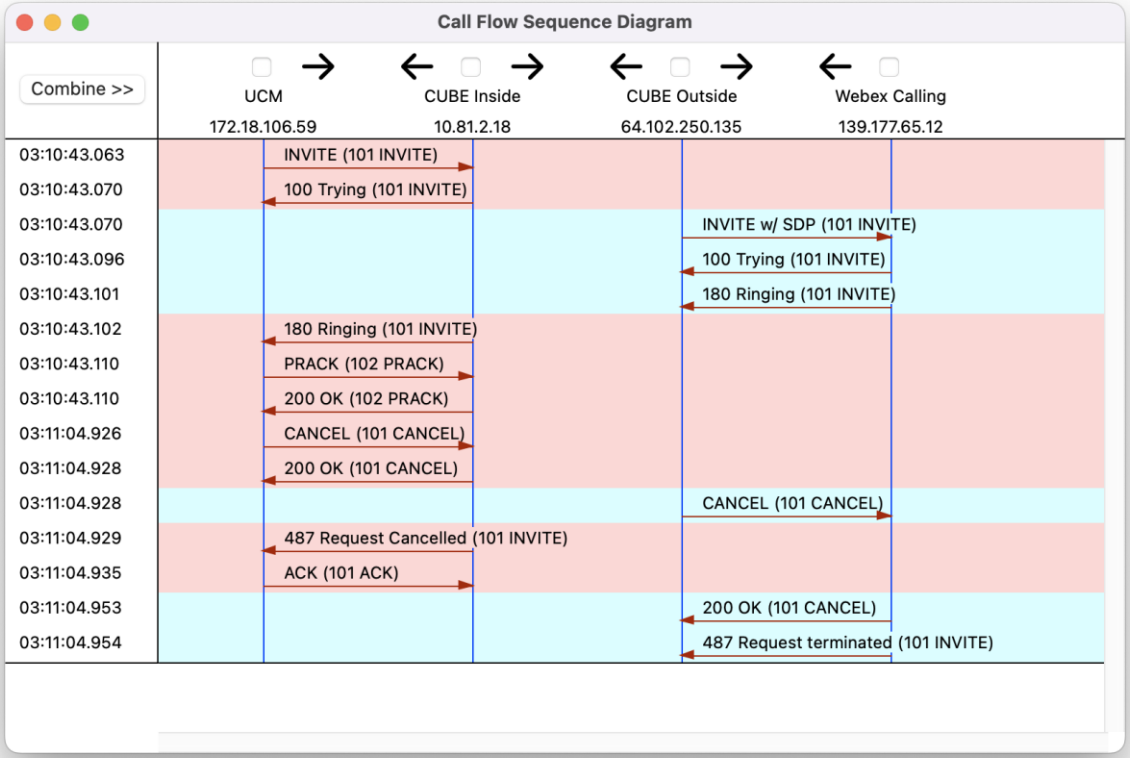
- Copy Text debug output from CLI and Paste into TranslatorX



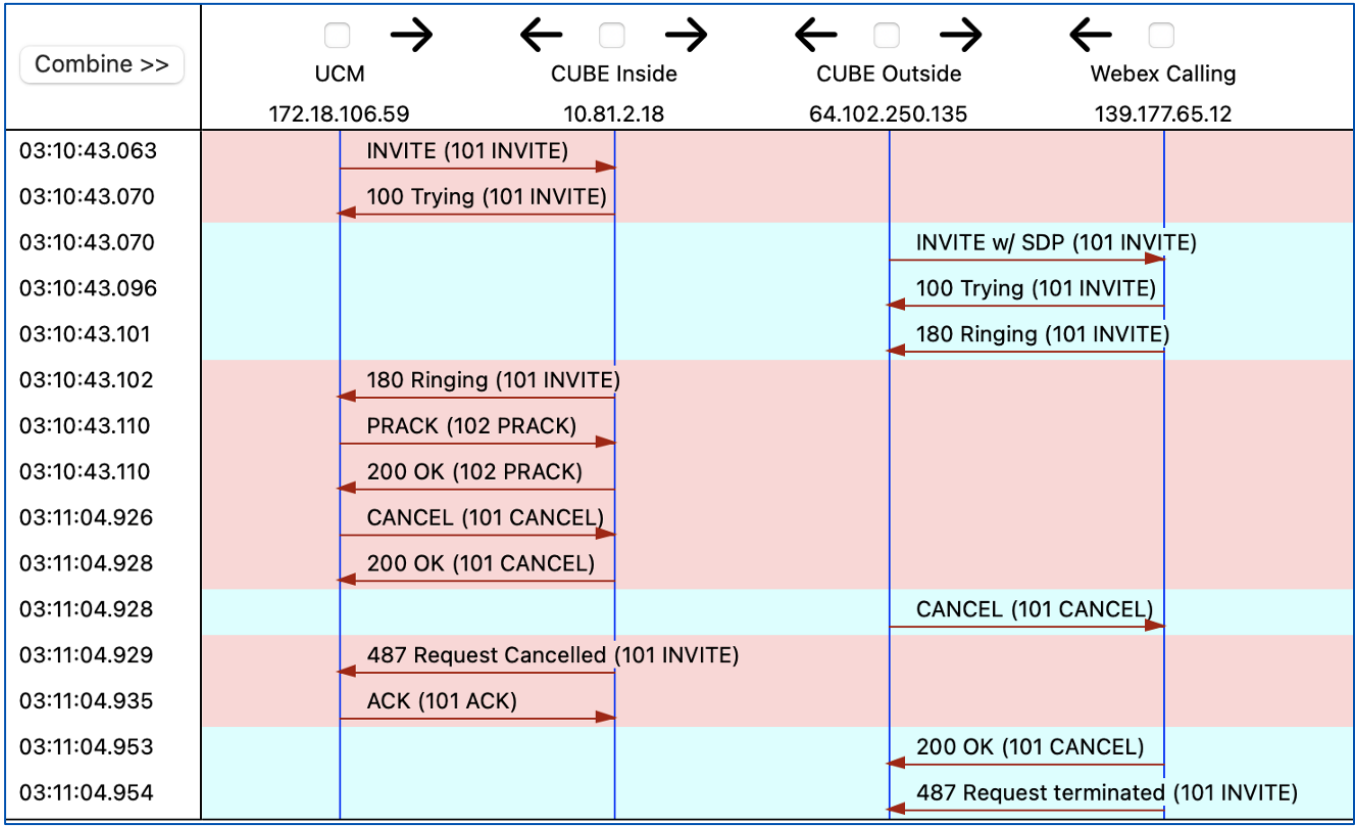
Case Study : Calls not ringing destination

Use TranslatorX – translatorx.org

- Click “Generate Diagram” button



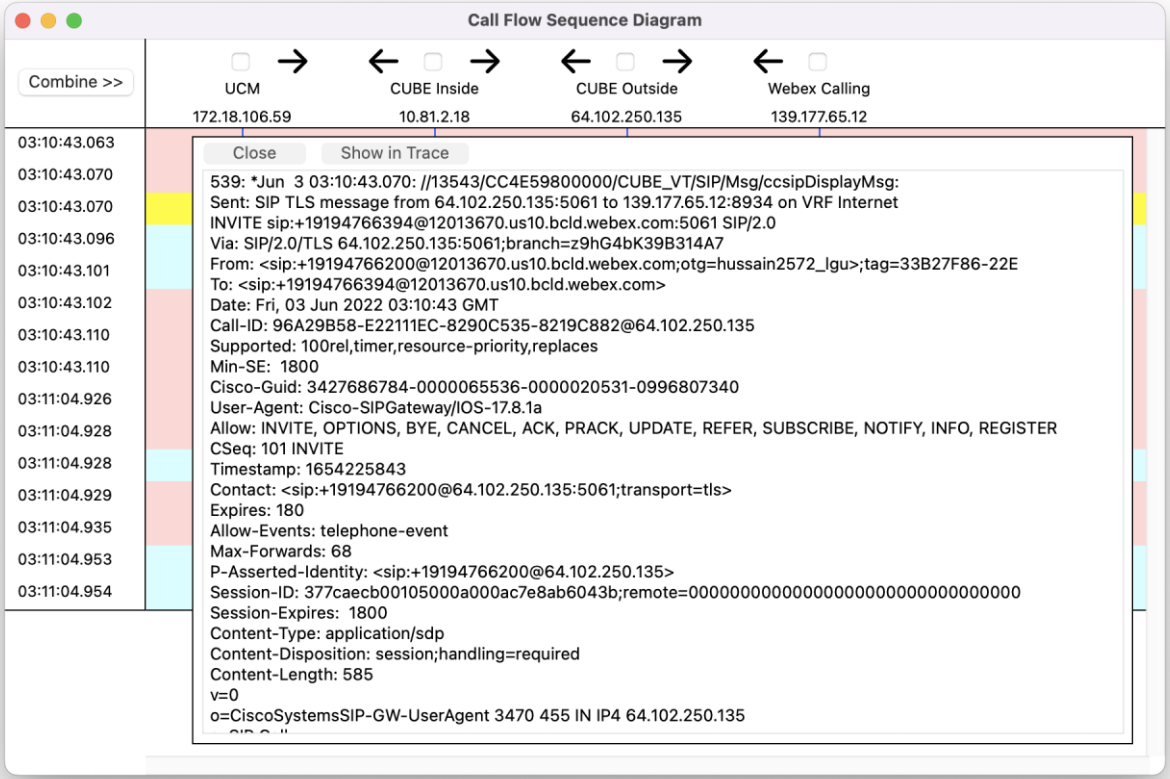
Case Study : Calls not ringing destination



Case Study: Calls not ringing destination

Use TranslatorX – translatorx.org

- Click on outbound INVITE to Webex Calling



Case Study: Calls not ringing destination

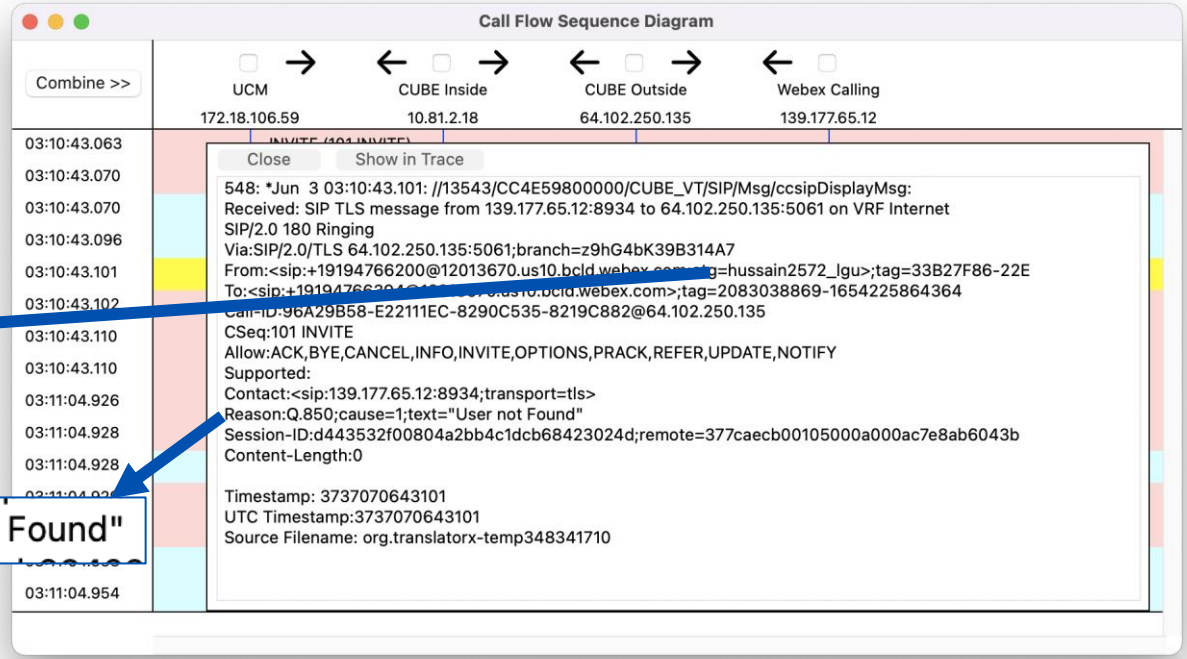
Use TranslatorX – translatorx.org

- Examine 180 Ringing coming from Webex Calling

Case Study: Calls not ringing destination

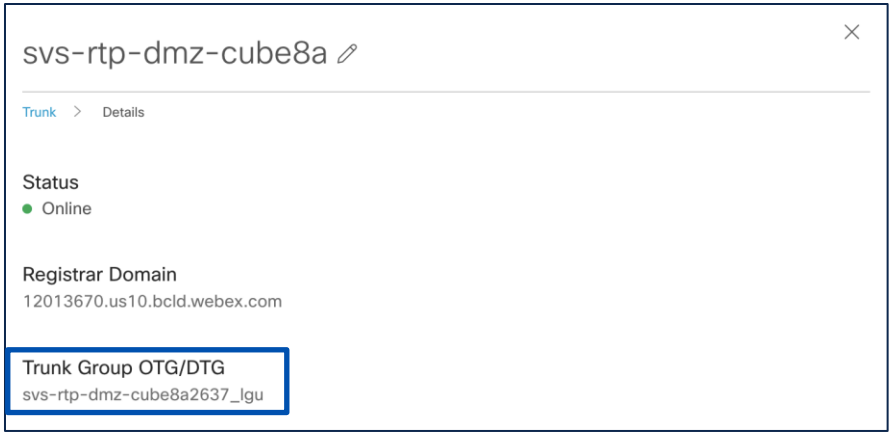
Use TranslatorX – translatorx.org

- Examine 180 Ringing coming from Webex Calling



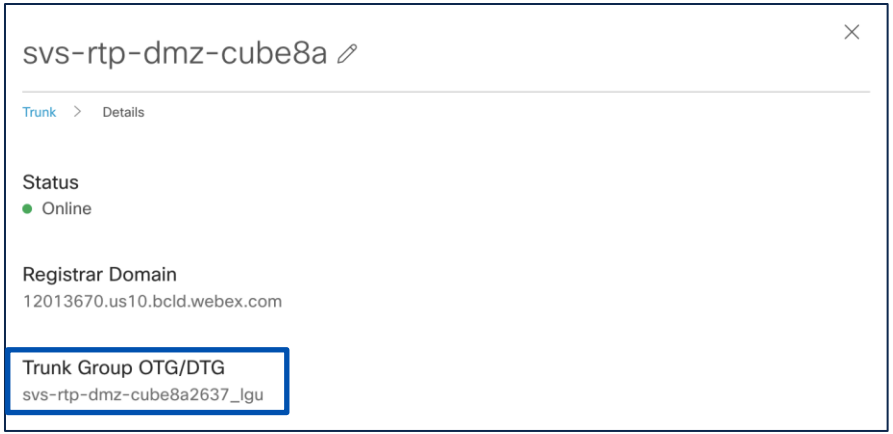
Case Study: Calls not ringing destination

```
voice class sip-profiles 200
 rule 9 request ANY sip-header SIP-Req-URI modify "sips:(.*)" "sip:\1"
 rule 10 request ANY sip-header To modify "<sips:(.*)" "<sip:\1"
 rule 11 request ANY sip-header From modify "<sips:(.*)" "<sip:\1"
 rule 12 request ANY sip-header Contact modify "<sips:(.*)>" "<sip:\1;transport=tls>"
 rule 13 response ANY sip-header To modify "<sips:(.*)" "<sip:\1"
 rule 14 response ANY sip-header From modify "<sips:(.*)" "<sip:\1"
 rule 15 response ANY sip-header Contact modify "<sips:(.*)" "<sip:\1"
 rule 20 request ANY sip-header From modify ">" ";otg=hussain2572_lgu>"
 rule 30 request ANY sip-header P-Asserted-Identity modify "sips:(.*)" "sip:\1"
```



Case Study: Calls not ringing destination

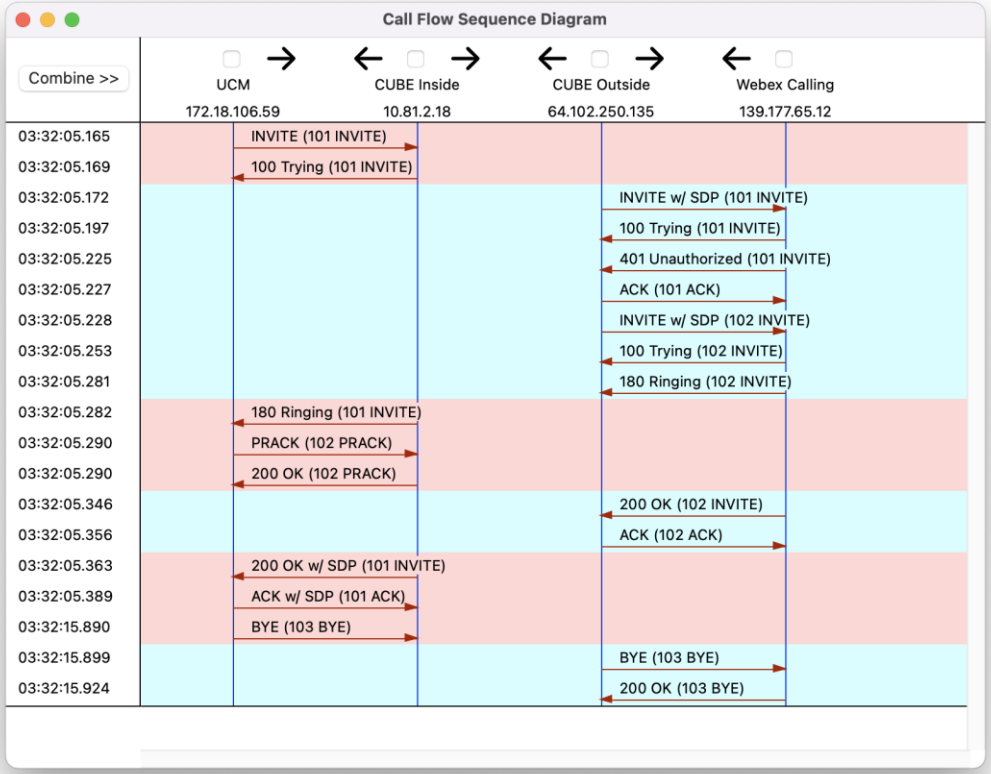
```
voice class sip-profiles 200
 rule 9 request ANY sip-header SIP-Req-URI modify "sips:(.*)" "sip:\1"
 rule 10 request ANY sip-header To modify "<sips:(.*)" "<sip:\1"
 rule 11 request ANY sip-header From modify "<sips:(.*)" "<sip:\1"
 rule 12 request ANY sip-header Contact modify "<sips:(.*)>" "<sip:\1;transport=tls>"
 rule 13 response ANY sip-header To modify "<sips:(.*)" "<sip:\1"
 rule 14 response ANY sip-header From modify "<sips:(.*)" "<sip:\1"
 rule 15 response ANY sip-header Contact modify "<sips:(.*)" "<sip:\1"
 rule 20 request ANY sip-header From modify ">" ";otg=svs-rtp-dmz-cube8a2637_lgu>"
 rule 30 request ANY sip-header P-Asserted-Identity modify "sips:(.*)" "sip:\1"
```



Case Study: Calls not ringing destination

Use TranslatorX – translatorx.org

- After fixing the otg configuration in the SIP profile



CUBE not responding to OPTIONS

```
CUBE#debug ccsip all
*Jun  3 01:58:05.255: //-1/xxxxxxxxxxxx/SIP/Msg/ccsipDisplayMsg:
Received:
OPTIONS sip:64.102.250.135:5061;transport=tls SIP/2.0
Via:SIP/2.0/TLS 139.177.65.12:8934;branch=z9hG4bKBroadworksSSE.-64.102.250.135V11176-0-100-1997318647-
1654221506418-
From:<sip:139.177.65.12>;tag=1997318647-1654221506418-
To:<sip:64.102.250.135>
Call-ID:SSE015826418030622-1947046482@139.177.65.12
CSeq:100 OPTIONS
Max-Forwards:0
Content-Length:0


*Jun  3 01:58:05.255: //-1/xxxxxxxxxxxx/SIP/Info/verbose/4096/ccsip_new_msg_preprocessor: Checking
Invite Dialog
*Jun  3 01:58:05.260: //-1/xxxxxxxxxxxx/SIP/Info/verbose/8192/sipSPIIpTrustSilentDiscard:
sipSPIIpTrustSilentDiscard: called for method [101]
*Jun  3 01:58:05.260: //-1/xxxxxxxxxxxx/SIP/Info/info/8192/sipSPIIpTrustSilentDiscard: Message from
untrusted ip address. Silently discard
```

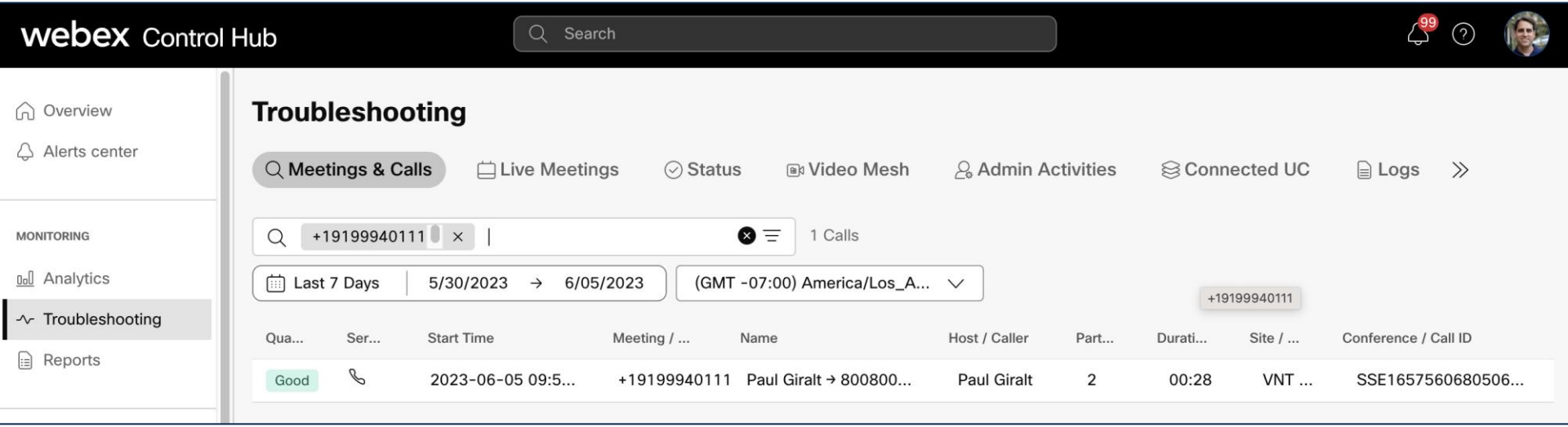
CUBE not responding to OPTIONS

```
voice service voip
 ip address trusted list
  ipv4 172.18.106.0 255.255.255.0
  ipv4 139.177.72.0 255.255.254.0
  ipv4 23.89.1.128 255.255.255.128
  ipv4 23.89.33.0 255.255.255.0
  ipv4 23.89.40.0 255.255.255.128
  ipv4 23.89.76.128 255.255.255.128
  ipv4 52.26.82.0 255.255.255.0
  ipv4 85.119.56.0 255.255.254.0
  ipv4 128.177.14.0 255.255.255.0
  ipv4 128.177.36.0 255.255.255.0
  ipv4 135.84.168.0 255.255.248.0
  ipv4 139.177.64.0 255.255.248.0
  ipv4 150.253.209.128 255.255.255.128
  ipv4 170.72.0.128 255.255.255.128
  ipv4 170.72.17.128 255.255.255.128
  ipv4 170.72.29.0 255.255.255.0
  ipv4 170.72.82.0 255.255.255.128
  ipv4 185.115.196.0 255.255.252.0
  ipv4 199.19.196.0 255.255.254.0
  ipv4 199.19.199.0 255.255.255.0
  ipv4 199.59.64.0 255.255.248.0
```

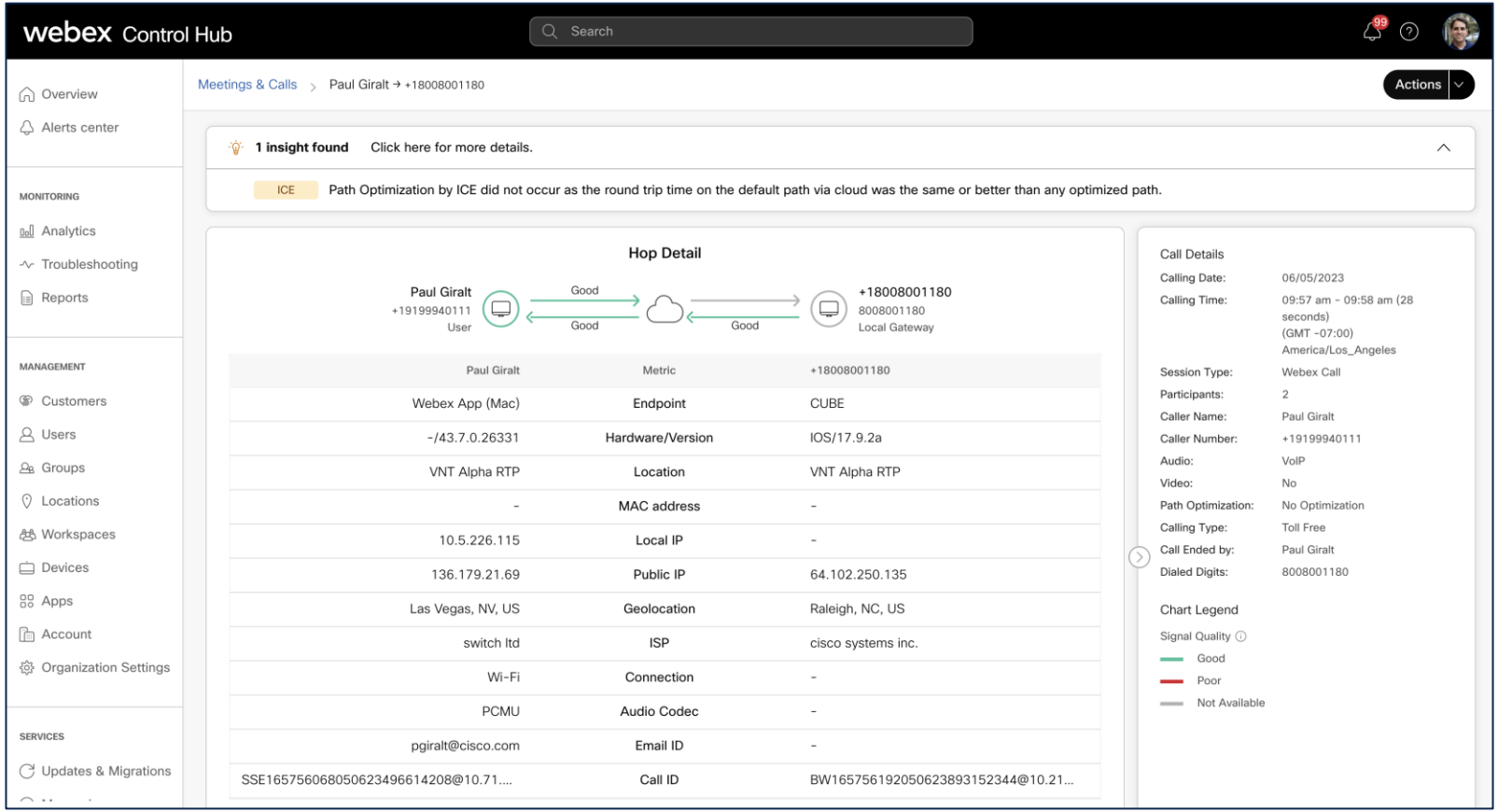
IP Subnets for Webex Calling Services		
23.89.1.128/25	23.89.33.0/24	23.89.40.0/25
23.89.76.128/25	52.26.82.54/24	85.119.56.0/23
128.177.14.0/24	128.177.36.0/24	135.84.168.0/21
139.177.64.0/21	139.177.72.0/23	150.253.209.128/25
170.72.0.128/25	170.72.17.128/25	170.72.29.0/24
170.72.82.0/25	185.115.196.0/22	199.19.196.0/23
199.19.199.0/24	199.59.64.0/21	

https://help.webex.com/en-us/article/b2exve/Port-Reference-Information-for-Cisco-Webex-Calling

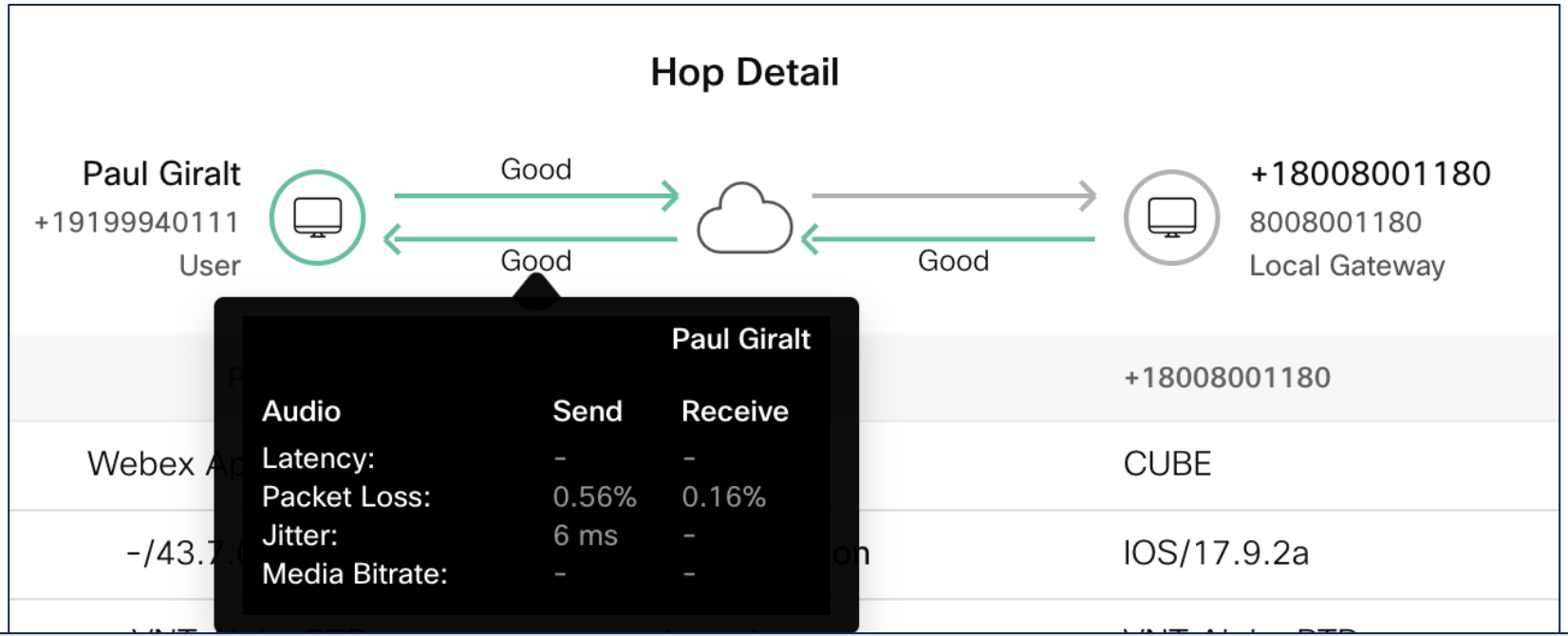
Troubleshooting from Webex Control Hub



Troubleshooting from Webex Control Hub



Troubleshooting from Webex Control Hub



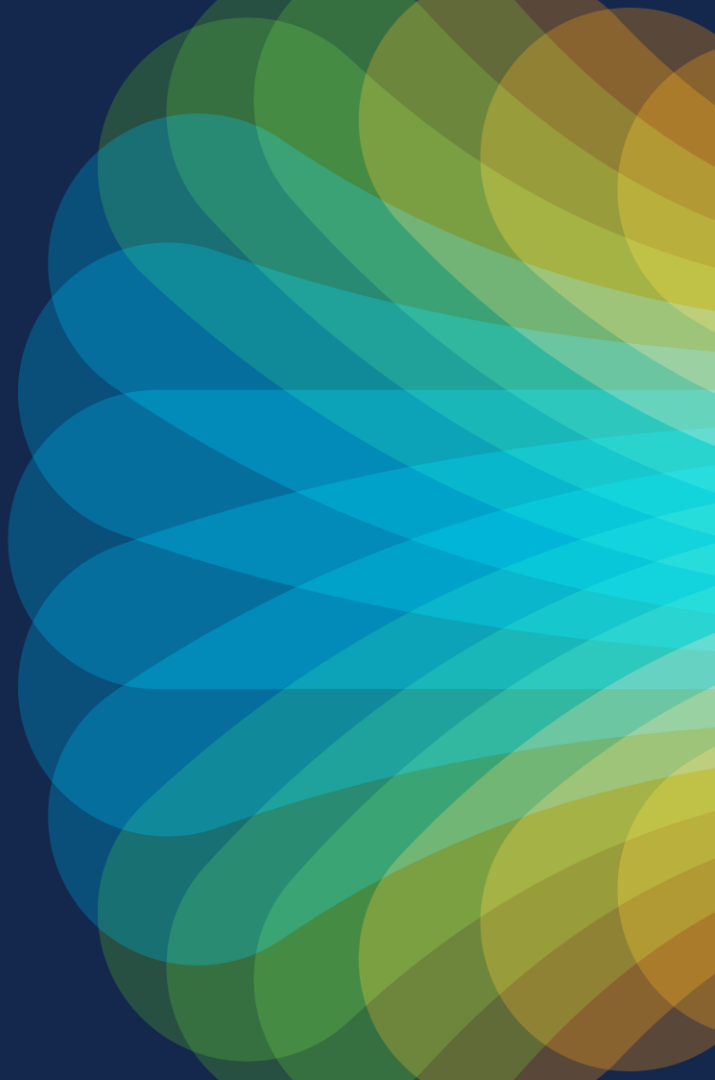
1 insight found Click here for more details.

ICE Path Optimization by ICE did not occur as the round trip time on the default path via cloud was the same or better than any optimized path.

Local Gateway Troubleshooting Demo

The bridge to possible

Thank you



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Let's go