Application Note

Microsoft Skype for Business Server [v6.0.9319.0] to Verizon Business SIP Trunk via Cisco Unified Border Element 11.5 [v15.6.1.S, ISR4431/XE- 3.17.00.S]

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Introduction

Service Providers today, such as Verizon, are offering alternative methods to connect to the PSTN via their IP network. 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.

Verizon Business SIP Trunk is a service provider offering that allows connection to the PSTN and may offer the end customer a viable alternative to traditional PSTN connectivity. A demarcation device between these services and customer owned services is recommended. As an intermediary device between Microsoft Skype for Business Server 2015 and Verizon network, Cisco Unified Border Element (Cisco UBE 11.5.0) 15.6.1.S [IOS-XE 3.17] can be used. The Cisco Unified Border Element (Cisco UBE) 15.6.1.S provides demarcation, security and inter-working and session control services for Microsoft Skype for Business Server 2015 connected to Verizon IP network.

This document assumes the reader is knowledgeable with the terminology and configuration of Microsoft Skype for Business Server 2015. 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 Microsoft Skype for Business Server 2015 and Cisco Unified Border Element (Cisco UBE 11.5.0) 15.6.1.S [IOS-XE 3.17] for connectivity to Verizon SIP Trunking service. The deployment model covered in this application note is Skype for Business Server 2015 to PSTN via Cisco Unified Border Element (Cisco UBE) 15.6.1.S.
- Testing was performed in accordance to Cisco generic SIP Trunking test methodology and among features verified were – basic calls, DTMF transport, Music on Hold (MOH), unattended and attended transfers, call forward, conferences and High Availability.
- The Cisco Unified Border Element (Cisco UBE) 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 Microsoft Skype for Business Server. 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 Microsoft Skype for Business Server to interoperate to Verizon SIP Trunking network.

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Network Topology

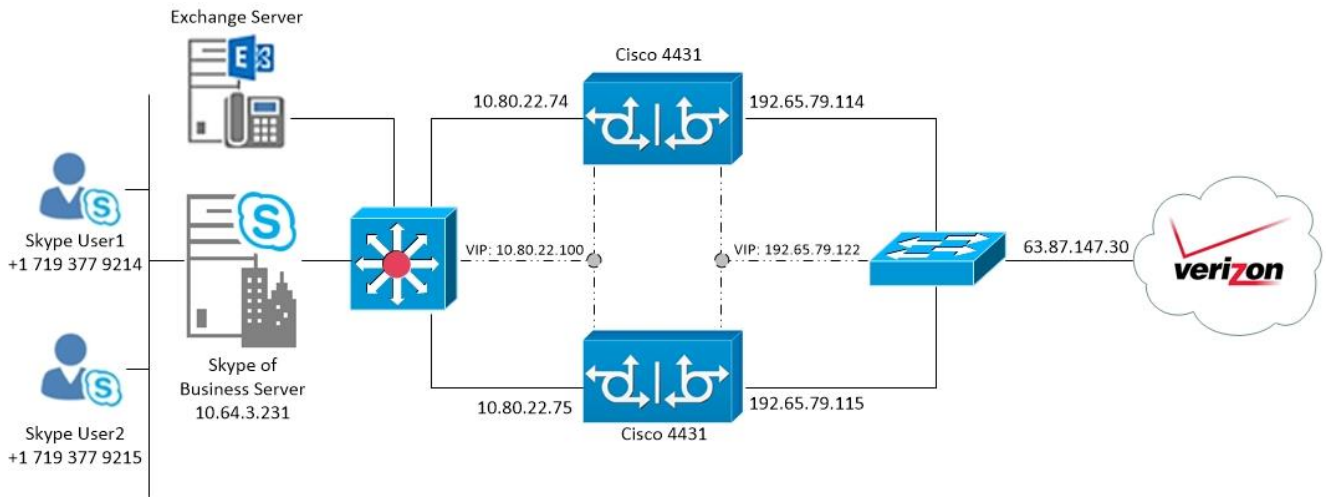

Figure 1 Network Topology

- The network topology includes the Microsoft Skype for Business Server Enterprise Edition and 2 Lync clients. Cisco UBE published as a PSTN gateway in the Skype for Business Server topology. Verizon was used as the service provider with a SIP trunk to the Cisco UBE
- 2 Cisco Unified Border Elements are used here for High Availability.
- SIP Trunk transport type used between Cisco Unified Border Element and Microsoft Skype for Business is either TCP or TLS. Configuration for each trunk type is explained in the Dial-peer section of this document.

IP-PBX - CUBE Trunk Settings:

Setting	Value
Media Bypass	OFF
REFER Support	ON
Session Timer	ON
Early Media support with PRACK	ON

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System Components

Hardware Requirements

- Cisco UBE on Cisco ISR 4431 router
- Generic Server for Skype for Business

Software Requirements

- Cisco UBE IOS CUBE-Version: 11.5.0, SW-Version: 15.6.1.S, XE- 3.17.00.S
- Microsoft Skype for Business Server 2015- Version: 6.0.9319.0
- Microsoft Skype for Business Client – Version 15.0.4797.1000

Features

Features Supported

- Incoming and outgoing off-net calls using G711
- International Calls and digit manipulations
- Call Conference
- CPE Voice Mail support
- Call hold & Resume with and without MoH
- Unattended and Attended Call transfer
- Call forward (all and no answer)
- DTMF (RFC2833)
- IP-PBX Calling number privacy
- High Availability
- Early Media support

Features Not Supported

- G729 is not Supported by Skype for Business
- Fax (G.711 and T.38)
- Blind Call transfer
- Call forward on Busy

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Caveats

- Skype for Business does not support G729 so g711 is preferred.
- Trunk from Skype for Business to CUBE is tested with both TCP / RTP and TLS / SRTP.
- Ring back tone is not heard in off-net phone when the Skype user transfers the call.
- Caller ID updates are not observed on attended call transfer scenarios.
- Testing is done with only one IP PBX.
- Skype for Business requires 3rd party FAX for FAX support
- The Media Bypass is turned off in trunk between Skype for business and CUBE
- Workaround is done for SRTP negotiation between Skype for Business and CUBE
- Workaround is done for Diversion header manipulations for Call Forward and call Transfer
- RTCP Sender reports are not sent from CUBE to Skype unless ITSP sends it to CUBE.
- CUBE has an added dial-peer for Skype for Business REFER support to work
- SIP Global Binding should be done with the interface pointing to Skype for Business

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Configuration

Configuring Cisco Unified Border Element

Network Interface

The IP address used are for illustration only, the actual IP address can vary. The Active/Standby pair share the same virtual IP address and continually exchange status messages.

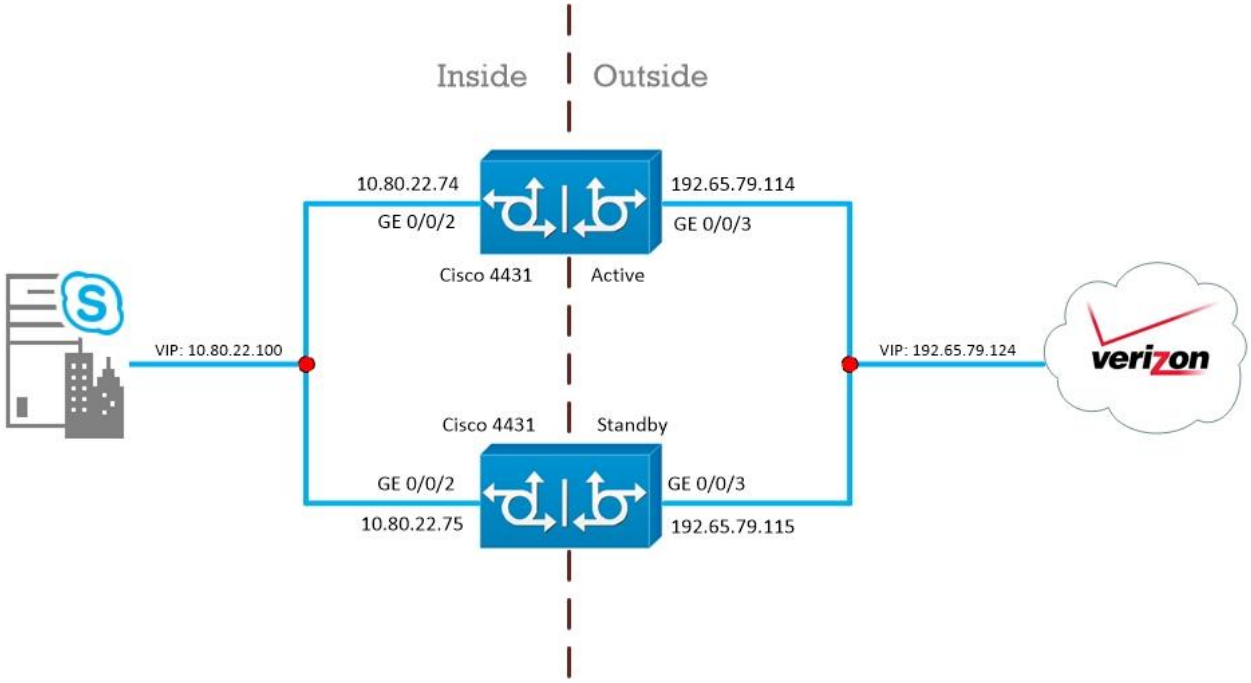

Figure 2 High Availability topology

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CUBE 1:

```
interface GigabitEthernet0/0/0
 ip address 10.64.4.19 255.255.0.0
 media-type rj45
 negotiation auto
!

interface GigabitEthernet0/0/1
 no ip address
 shutdown
 media-type rj45
 negotiation auto
!
interface GigabitEthernet0/0/2
 description LAN interface
 ip address 10.80.22.74 255.255.255.0
 media-type rj45
 negotiation auto
 redundancy rii 1
 redundancy group 1 ip 10.80.22.100 exclusive
!
interface GigabitEthernet0/0/3
 description WAN interface
 ip address 192.65.79.114 255.255.255.224
 media-type rj45
 negotiation auto
 redundancy rii 2
 redundancy group 1 ip 192.65.79.124 exclusive
!
```

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CUBE 2:

```
!
interface GigabitEthernet0/0/0
 ip address 10.64.4.20 255.255.0.0
 media-type rj45
 negotiation auto
!

interface GigabitEthernet0/0/1
 no ip address
 shutdown
 media-type rj45
 negotiation auto
!
interface GigabitEthernet0/0/2
 ip address 10.80.22.75 255.255.255.0
 media-type rj45
 negotiation auto
 redundancy rii 1
 redundancy group 1 ip 10.80.22.100 exclusive
!
interface GigabitEthernet0/0/3
 description Wan Interface
 ip address 192.65.79.115 255.255.255.224
 media-type rj45
 negotiation auto
 redundancy rii 2
 redundancy group 1 ip 192.65.79.122 exclusive
!
```

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Global Cisco UBE settings

In order to enable Cisco UBE IP2IP SBC functionality, following command has to be entered:

```
voice service voip
 no ip address trusted authenticate
 rtcp keepalive
 address-hiding
 mode border-element license capacity 20
 allow-connections sip to sip
 redundancy-group 1
 no supplementary-service sip moved-temporarily
 no supplementary-service sip refer
 supplementary-service media-renegotiate
 sip
  bind control source-interface GigabitEthernet0/0/2
  bind media source-interface GigabitEthernet0/0/2
  session refresh
  header-passing
  referto-passing
  conn-reuse
  sip-profiles inbound
  sip-profiles 248 inbound
```

Explanation

Command	Description
allow-connections sip to sip	Allow IP2IP connections between two SIP call legs
redundancy-group 1	Enable High Availability for the VoIP service
rtcp keepalive	Enables the CUBE to send rtcp keepalive packets for the session keepalive
Bind control and media	SIP Global binding is done with the interface pointing to Skype for Business to avoid TCP socket issue

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Codecs

G711 is used as the preferred codec for this testing as G729 is not supported in Skype for Business.

```
voice class codec 2
 codec preference 1 g711ulaw
 codec preference 2 g729r8 bytes 30
 codec preference 3 g726r32
 codec preference 4 g729br8
```

SIP Profiles

SIP Profile 1 is used in the dial-peer pointing towards Verizon. Here the Diversion header is inserted by copying the uri from "REFERRED-BY" header and then truncating the preceding "+1". SIP Profile 248 is used to invalidate the 'a' attribute of the SDP that has MKI. As the CUBE does not support crypto with MKI we have to apply this profile for the SRTP calls to work.

```
voice class sip-profiles 1
 request INVITE peer-header sip REFERRED-BY copy "sip:(.*)@" u01
 request INVITE sip-header Diversion add "Diversion: <sip:sip-
uri@192.65.79.122>"
 request INVITE sip-header Diversion modify "sip:(.*)@" "sip:\u01@"
 request INVITE sip-header Diversion modify "sip:\+1" "sip:"
 request REFER sip-header Referred-By remove
```

```
voice class sip-profiles 248
 request ANY sdp-header Audio-Attribute modify
"a=(.*)AES_CM_128_HMAC_SHA1_(.*) inline(.*)\|(.*):(.*)" "a=\1CRYPTO_UNKNOWN
inline\3|\4:\5"
 response ANY sdp-header Audio-Attribute modify
"a=(.*)AES_CM_128_HMAC_SHA1_(.*) inline(.*)\|(.*):(.*)" "a=\1CRYPTO_UNKNOWN
inline\3|\4:\5"
```

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Dial peer

Dial-peer to Skype for Business for TCP with RTP:

```
!
dial-peer voice 107 voip
 description " Incoming PSTN to IP-PBX - IP-PBX facing side "
 translation-profile outgoing e164
 destination-pattern 719.......
 session protocol sipv2
 session target dns:lync1.sfblabis.local:5060
 session transport tcp
 incoming uri request FQDNsfb
 voice-class codec 2
 voice-class sip localhost dns:isr4k.sfblabis.local:5060
 voice-class sip call-route url
 voice-class sip options-keepalive
 voice-class sip bind control source-interface GigabitEthernet0/0/2
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 dtmf-relay rtp-nte
 refer consume
 no vad
!
dial-peer voice 105 voip
 description incoming from IP-PBX
 session protocol sipv2
 session transport tcp
 incoming called-number 921424259..
 voice-class codec 2
 voice-class sip localhost dns:isr4k.sfblabis.local:5060
 voice-class sip copy-list 1
 voice-class sip bind control source-interface GigabitEthernet0/0/2
```

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```
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 dtmf-relay rtp-nte
 no vad
!
dial-peer voice 786 voip
 description TEST for REFER
 translation-profile outgoing e164
 session protocol sipv2
 session target sip-uri
 session transport tcp
 destination uri SFB
 voice-class codec 2
 voice-class sip localhost dns:isr4k.skypelabsk.local:5060
 voice-class sip profiles 248
 voice-class sip bind control source-interface GigabitEthernet0/0/2
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 voice-class sip referto-passing
 voice-class sip requri-passing
 dtmf-relay rtp-nte
 no vad
```

Dial-peer to Skype for Business for TLS with SRTP:

```
dial-peer voice 107 voip
 description " Incoming PSTN to IP-PBX - IP-PBX facing side "
 translation-profile outgoing e164
 destination-pattern 719.......
 session protocol sipv2
 session target dns:fe.skypelabsk.local:5067
 session transport tcp tls
 incoming uri request FQDNsfb
 voice-class codec 2
 voice-class sip srtp-auth sha1-80 sha1-32
```

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```
 voice-class sip localhost dns:isr4k.skypelabsk.local:5061
 voice-class sip asserted-id pai
 voice-class sip call-route url
 voice-class sip profiles 248
 voice-class sip options-keepalive
 voice-class sip bind control source-interface GigabitEthernet0/0/2
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 voice-class sip referto-passing
 dtmf-relay rtp-nte
 refer consume
 rtcp keepalive
 srtp
 no vad
!
dial-peer voice 105 voip
 description incoming from IP-PBX
 session protocol sipv2
 session transport tcp tls
 incoming called-number 9..........
 incoming uri request SFB
 voice-class codec 2
 voice-class sip srtp-auth sha1-80 sha1-32
 voice-class sip localhost dns:isr4k.skypelabsk.local:5061
 no voice-class sip asserted-id
 voice-class sip call-route url
 no voice-class sip srtp negotiate
 voice-class sip bind control source-interface GigabitEthernet0/0/2
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 voice-class sip requri-passing
 dtmf-relay rtp-nte
 srtp
 no vad
```

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```
!
dial-peer voice 786 voip
 description TEST for REFER
 translation-profile outgoing e164
 session protocol sipv2
 session target sip-uri
 session transport tcp tls
 destination uri SFB
 voice-class codec 2
 voice-class sip srtp-auth sha1-80 sha1-32
 voice-class sip localhost dns:isr4k.skypelabsk.local:5061
 voice-class sip profiles 248
 voice-class sip bind control source-interface GigabitEthernet0/0/2
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 voice-class sip referto-passing
 voice-class sip requri-passing
 dtmf-relay rtp-nte
 srtp
 no vad
```

Dial-peer to Verizon:

```
dial-peer voice 400 voip
 description "Outgoing To PSTN"
 translation-profile outgoing pstn
 destination-pattern .T
 rtp payload-type comfort-noise 13
 session protocol sipv2
 session target ipv4:63.87.147.30:5072
 session transport udp
 voice-class codec 2
```

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```
 voice-class sip rel1xx disable
 voice-class sip privacy-policy passthru
 voice-class sip profiles 1
 voice-class sip session refresh
 voice-class sip bind control source-interface GigabitEthernet0/0/3
 voice-class sip bind media source-interface GigabitEthernet0/0/3
 dtmf-relay rtp-nte
 rtcp keepalive
 srtp fallback
 no vad
!
dial-peer voice 201 voip
 description incoming from PSTN
 translate-outgoing called 25
 session protocol sipv2
 session transport udp
 incoming called-number 719.......
 voice-class codec 2
 voice-class sip rel1xx disable
 voice-class sip profiles 2 inbound
 voice-class sip session refresh
 voice-class sip bind control source-interface GigabitEthernet0/0/3
 voice-class sip bind media source-interface GigabitEthernet0/0/3
 dtmf-relay rtp-nte
 srtp fallback
 no vad
```

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Configuration example

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

Active Cisco UBE:

```
CISCO_4K_ROUTER1#sh run

Building configuration...

Current configuration : 15142 bytes

!

! Last configuration change at 08:00:33 UTC Sat Feb 13 2016 by cisco

!

version 15.6

service timestamps debug datetime msec localtime year

service timestamps log datetime msec localtime year

service sequence-numbers

no platform punt-keepalive disable-kernel-core

!

hostname CISCO_4K_ROUTER1

!

boot-start-marker

boot system flash bootflash:isr4400-universalk9.03.17.00.S.156-1.S-
std.SPA.bin

boot-end-marker

!

!

vrf definition Mgmt-intf

 !

 address-family ipv4

 exit-address-family
```

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```
 !
 address-family ipv6
 exit-address-family
!
vrf definition mgmt-intf
!
logging queue-limit 500000
logging queue-limit trap 500000
logging buffered 9999999
logging rate-limit 10000
no logging console
no logging monitor
enable secret 5 $1$EWC0$6QpPfaUZ/LO4rhx3qQlj7/
!
aaa new-model
!
!
aaa session-id common
!
ipc zone default
 association 1
  no shutdown
!
ip host dc.skypelabsk.local 10.64.3.230
ip host fe.skypelabsk.local 10.64.3.231
ip host isr4k.skypelabsk.local 10.80.22.74

no ip domain lookup
```

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```
!
subscriber templating
!
multilink bundle-name authenticated
!
crypto pki trustpoint SFBCA
 enrollment terminal
 fqdn isr4k.skypelabsk.local
 subject-name CN=isr4k.skypelabsk.local
 revocation-check none
 rsakeypair SFBCAKey
!
crypto pki certificate chain SFBCA
 certificate 5400000017CCECC867005D14ED000000000017
  30820525 3082040D A0030201 02021354 00000017 CCECC867 005D14ED 00000000
  0017300D 06092A86 4886F70D 01010505 00304E31 15301306 0A099226 8993F22C
  64011916 056C6F63 616C311A 3018060A 09922689 93F22C64 0119160A 736B7970
  656C6162 736B3119 30170603 55040313 10736B79 70656C61 62736B2D 44432D43
  41301E17 0D313531 32303931 39313030 385A170D 31373132 30383139 31303038
  5A302131 1F301D06 03550403 13166973 72346B2E 736B7970 656C6162 736B2E6C
  6F63616C 30820122 300D0609 2A864886 F70D0101 01050003 82010F00 3082010A
  02820101 00B8F496 C7301835 BD6448F1 A6826B11 F46E75E2 141D6B2F 3794F139
  639C8760 6AC90F46 14E4E7D0 74A33B52 CC7B77A7 55815F6A 10E767CB 45968A94
  6DB83F89 B3709C83 36F1E44D FED6A78C 447C6068 DD86E04E 1637BE4C F9CD2938
  5A91B593 B840ADE8 E1EFE131 B2089BB0 3F83AE3D 2CD878FC B9286508 212CE087
  D7A69F12 81DAB2F2 AD31CCFF 50932BE5 710BB7B5 6D584CC2 783941BC BC9F5AF7
  B00408A8 81186776 D72F62E3 0032155A A0ED0853 9CEFB562 B1AE25FC EC855041
  A8DF0638 3C1E7EC3 259288C5 75FE9004 1D8E6956 DAE0DD1C 898AFA1A 175614BB
```

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865A7271 AB9A7EFD 0F2AA952 54921B30 051C8693 59DFBF73 31D73F65 C72B8B27
A52B573C 33020301 0001A382 02273082 0223300E 0603551D 0F0101FF 04040302
05A0301D 0603551D 0E041604 143C5A45 4FB75366 F0D79628 042D724D A2CDB349
5F301F06 03551D23 04183016 8014590D F87D6E08 A3424ABC 7A85FAFD 4E0F4BDD
A5B83081 CE060355 1D1F0481 C63081C3 3081C0A0 81BDA081 BA8681B7 6C646170
3A2F2F2F 434E3D73 6B797065 6C616273 6B2D4443 2D43412C 434E3D64 632C434E
3D434450 2C434E3D 5075626C 69632532 304B6579 25323053 65727669 6365732C
434E3D53 65727669 6365732C 434E3D43 6F6E6669 67757261 74696F6E 2C44433D
736B7970 656C6162 736B2C44 433D6C6F 63616C3F 63657274 69666963 61746552
65766F63 6174696F 6E4C6973 743F6261 73653F6F 626A6563 74436C61 73733D63
524C4469 73747269 62757469 6F6E506F 696E7430 81C70608 2B060105 05070101
0481BA30 81B73081 B406082B 06010505 07300286 81A76C64 61703A2F 2F2F434E
3D736B79 70656C61 62736B2D 44432D43 412C434E 3D414941 2C434E3D 5075626C
69632532 304B6579 25323053 65727669 6365732C 434E3D53 65727669 6365732C
434E3D43 6F6E6669 67757261 74696F6E 2C44433D 736B7970 656C6162 736B2C44
433D6C6F 63616C3F 63414365 72746966 69636174 653F6261 73653F6F 626A6563
74436C61 73733D63 65727469 66696361 74696F6E 41757468 6F726974 79302106
092B0601 04018237 14020414 1E120057 00650062 00530065 00720076 00650072
30130603 551D2504 0C300A06 082B0601 05050703 01300D06 092A8648 86F70D01
01050500 03820101 0038BFE5 91F1C381 65849077 CF4F9B45 2E15C057 D9E2F37A
E093B3A5 4123A11E 583ABE8B CE32DD02 1C96DED1 C29EF720 72FF6AAA 979E6102
E1890607 826CAACA 46B83B04 FE80E06C 90327490 CF7044EE 23FCB2B8 A2608B20
F8436982 02B12AAC 23F4EE6C 3253D5AD FD5BBEEC 10E9B770 713961B9 425FE5CF
DBF90AD0 DCE8DD04 82A312C7 3BE02FE3 C120F76F E506DEB0 37727C0B 9AA925B1
E0E94BCB 96DD08DA C5DC08E7 811CEB79 7C8B550E 340818B7 C26804C7 CF0A6F0E
11D5938D 4B10D809 4C2C568A 54D0DA61 90DEA44E FBC61AEF FED2FB93 12482104
2DF666FA 537B7B01 E0522FBA 670C4C7C 08D1693F 39887A50 9DC2B113 0D6AEA1F
CA0706A4 3C84C418 D3

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```
      quit
certificate ca 4776AE3591B921AF45CB8415421DF2DD
 30820377 3082025F A0030201 02021047 76AE3591 B921AF45 CB841542 1DF2DD30
 0D06092A 864886F7 0D010105 0500304E 31153013 060A0992 268993F2 2C640119
 16056C6F 63616C31 1A301806 0A099226 8993F22C 64011916 0A736B79 70656C61
 62736B31 19301706 03550403 1310736B 7970656C 6162736B 2D44432D 4341301E
 170D3135 30323034 31363536 31385A17 0D323030 32303431 37303631 375A304E
 31153013 060A0992 268993F2 2C640119 16056C6F 63616C31 1A301806 0A099226
 8993F22C 64011916 0A736B79 70656C61 62736B31 19301706 03550403 1310736B
 7970656C 6162736B 2D44432D 43413082 0122300D 06092A86 4886F70D 01010105
 00038201 0F003082 010A0282 010100B1 55EF48A2 FC6A1500 5314D0CC F2D9381E
 991FF2FB 012EF82F 15F9DC2E C1C94F15 77AAA417 3529D9BD C0197CDA 74A963A5
 41D7B081 3E1615DB 893C7693 7AEED838 0EC572CD 87791C64 86A5D2EB 5BF3A54C
 DD63C4CE BEC3D834 E77AA7E9 F0E66DF6 729D612C B649ADFA 7837C660 0D932964
 4F481344 B3A51479 3F6F9D98 D7488E2D 6BC145EE 6A6FA2CF 90C01AC6 E2C19D91
 D4873656 A7625FB9 4FCCB793 09E7F825 68108464 A8C94B1A 5F0E4D9B B54711BD
 162FF78C 09952D8F 94B1318A 77E37F00 E32EB1CB 63915804 844DAD2C E26FC898
 3117F86F E78A0AE7 3F5FCA67 919C9BA4 B5D3C05E 74656D18 6AA19F39 1431A8E5
 E10D6F75 5A6A77A6 A50C3C7E CE4B4B02 03010001 A351304F 300B0603 551D0F04
 04030201 86300F06 03551D13 0101FF04 05300301 01FF301D 0603551D 0E041604
 14590DF8 7D6E08A3 424ABC7A 85FAFD4E 0F4BDDA5 B8301006 092B0601 04018237
 15010403 02010030 0D06092A 864886F7 0D010105 05000382 01010052 961F4C96
 4BE0ECEE DF1E49EF 98C1E483 D0AA05A5 955DB3C6 200ACCB5 FFD7E8D9 8182430E
 8C22880F 3B4D71A6 F5848ED5 0B5F6A49 17A53F20 A75D45CF 4796C2E9 298C1B28
 1584B717 13435874 4D31C21F 5F26535D D685E41A 74399A1E AC5D3A05 BCD484EF
 F37BD773 51B23F3B A1928226 1088D276 F4583E6E DB3B2D74 4FD66E21 00031A4C
 1EAC877E D5246E96 8323FFC5 DD3F2C77 82364246 7411AC35 24D89BDE 9DEFD183
 1BCCFA3A F53AD01E 0225D825 0A094649 840DD901 EBE87F00 2F44CE0E DFF19546
```

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```
  89734152 00A7EA67 0035C565 D9E77F2B C8C6A429 AB38AA7E 39722A61 DDB5628C
  611E3733 7ACB9C48 6F2FF520 319DCF45 F8F91C1D 00BF68D4 F5CE6F
        quit
cts logging verbose
!
voice service voip
 no ip address trusted authenticate
 rtcp keepalive
 address-hiding
 mode border-element license capacity 20
 allow-connections sip to sip
 redundancy-group 1
 no supplementary-service sip moved-temporarily
 no supplementary-service sip refer
 supplementary-service media-renegotiate
 sip
  bind control source-interface GigabitEthernet0/0/2
  bind media source-interface GigabitEthernet0/0/2
  session refresh
  header-passing
  referto-passing
  conn-reuse
  midcall-signaling passthru media-change
  sip-profiles inbound
  sip-profiles 248 inbound
!
voice class uri PSTN sip
 host ipv4:63.87.147.30
```

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```
!
voice class uri SFB sip
 host fe.skypelabsk.local
!
voice class uri FQDNsfb sip
 host 10.80.22.74
!
voice class codec 2
 codec preference 1 g711ulaw
 codec preference 2 g729r8 bytes 30
 codec preference 3 g726r32
 codec preference 4 g729br8
!
voice class sip-profiles 2
 request ANY sip-header Allow-Header modify ",PRACK" ""
!
voice class sip-profiles 203
!
voice class sip-profiles 248
 request ANY sdp-header Audio-Attribute modify
"a=(.*)AES_CM_128_HMAC_SHA1_(.*) inline(.*)\|(.*):(.*)" "a=\1CRYPTO_UNKNOWN
inline\3|\4:\5"
 response ANY sdp-header Audio-Attribute modify
"a=(.*)AES_CM_128_HMAC_SHA1_(.*) inline(.*)\|(.*):(.*)" "a=\1CRYPTO_UNKNOWN
inline\3|\4:\5"
!
!
```

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```
voice class sip-profiles 1
 request INVITE sip-header Referred-By remove
 request INVITE sip-header Diversion remove
 request INVITE sip-header Diversion add "Diversion:
<sip:7193779214@192.65.79.124>"
 request INVITE sip-header P-Asserted-Identity remove
!
!
voice class sip-copylist 1
 sip-header REFERRED-BY
!
voice translation-rule 1
 rule 2 /\(^..........$\)/ /+1\1/
!
voice translation-rule 2
 rule 1 /7193779226/ /2255/
 rule 2 /\(^..........$\)/ /+1\1/
 rule 3 /\(^...........$\)/ /+\1/
!
voice translation-rule 3
 rule 1 /^\+1\(..........\)$/ /\1/
 rule 3 /^9\(..........\)$/ /1\1/
 rule 4 /^9\(01191..........\)$/ /\1/
!
voice translation-rule 4
 rule 1 /^\+1\(..........\)$/ /\1/
!
```

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```
voice translation-profile e164
translate calling 1
translate called 2
!
voice translation-profile pstn
translate calling 4
translate called 3
!
media service
 !
license accept end user agreement
license boot level appxk9
license boot level uck9
license boot level securityk9
!
spanning-tree extend system-id
!
redundancy
 mode none
 application redundancy
  group 1
   name voice-b2bha
   priority 100 failover threshold 75
   timers delay 30 reload 60
   control GigabitEthernet0/0/0 protocol 1
   data GigabitEthernet0/0/0
   track 1 shutdown
   track 2 shutdown
```

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```
!
vlan internal allocation policy ascending
!
track 1 interface GigabitEthernet0/0/2 line-protocol
track 2 interface GigabitEthernet0/0/3 line-protocol
!
translation-rule 25
 rule 1 7193779214 18563330430
!
interface GigabitEthernet0/0/0
 ip address 10.64.4.19 255.255.0.0
 media-type rj45
 negotiation auto
!
interface GigabitEthernet0/0/1
 no ip address
 shutdown
 media-type rj45
 negotiation auto
!
interface GigabitEthernet0/0/2
 description LAN interface
 ip address 10.80.22.74 255.255.255.0
 media-type rj45
 negotiation auto
 redundancy rii 1
 redundancy group 1 ip 10.80.22.100 exclusive
!
```

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```
interface GigabitEthernet0/0/3
 description WAN interface
 ip address 192.65.79.114 255.255.255.224
 media-type rj45
 negotiation auto
 redundancy rii 2
 redundancy group 1 ip 192.65.79.124 exclusive
!
interface GigabitEthernet0
 vrf forwarding Mgmt-intf
 no ip address
 shutdown
 negotiation auto
!
interface Vlan1
 no ip address
 shutdown
!
ip forward-protocol nd
ip ftp username admin
ip ftp password admin
no ip http server
no ip http secure-server
ip tftp source-interface GigabitEthernet0
ip route 0.0.0.0 0.0.0.0 192.65.79.97
ip route 10.64.0.0 255.255.0.0 10.80.22.1
ip route 172.16.2.0 255.255.255.0 10.80.22.1
ip route 172.16.29.0 255.255.255.0 10.80.22.1
```

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```
ip route 172.16.31.0 255.255.255.0 10.80.22.1
ip ssh version 1
!
control-plane
!
mgcp behavior rsip-range tgcp-only
mgcp behavior comedia-role none
mgcp behavior comedia-check-media-src disable
mgcp behavior comedia-sdp-force disable
!
mgcp profile default
!
sccp ccm 10.64.1.72 identifier 1 version 4.0
!
sccp ccm group 1
 associate ccm 1 priority 1
 associate profile 1 register XCODE123456
 keepalive retries 1
 keepalive timeout 10
 switchover method immediate
 switchback method immediate
!
sccp ccm group 2
 associate ccm 1 priority 1
 associate profile 2 register SCCPTLS
!
```

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```
telephony-service
 max-conferences 8 gain -6
 transfer-system full-consult
!
!
dspfarm profile 2 transcode universal
 associate application SCCP
 shutdown
!
dspfarm profile 1 transcode universal
 associate application SCCP
 shutdown
!
dial-peer voice 107 voip
 description " Incoming PSTN to IP-PBX - IP-PBX facing side "
 translation-profile outgoing e164
 destination-pattern 719.......
 session protocol sipv2
 session target dns:fe.skypelabsk.local:5067
 session transport tcp tls
 incoming uri request FQDNsfb
 voice-class codec 2
 voice-class sip srtp-auth sha1-80 sha1-32
 voice-class sip localhost dns:isr4k.skypelabsk.local:5061
 voice-class sip asserted-id pai
 voice-class sip call-route url
 voice-class sip profiles 248
 voice-class sip options-keepalive
```

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```
 voice-class sip bind control source-interface GigabitEthernet0/0/2
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 voice-class sip referto-passing
 dtmf-relay rtp-nte
 refer consume
 rtcp keepalive
 srtp
 no vad
!
dial-peer voice 105 voip
 description incoming from IP-PBX
 session protocol sipv2
 session transport tcp tls
 incoming called-number 9..........
 incoming uri request SFB
 voice-class codec 2
 voice-class sip srtp-auth sha1-80 sha1-32
 voice-class sip localhost dns:isr4k.skypelabsk.local:5061
 no voice-class sip asserted-id
 voice-class sip call-route url
 no voice-class sip srtp negotiate
 voice-class sip bind control source-interface GigabitEthernet0/0/2
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 voice-class sip requri-passing
 dtmf-relay rtp-nte
 srtp
 no vad
!
```

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```
dial-peer voice 400 voip
 description "Outgoing To PSTN"
 translation-profile outgoing pstn
 destination-pattern .T
 rtp payload-type comfort-noise 13
 session protocol sipv2
 session target ipv4:63.87.147.30:5072
 session transport udp
 voice-class codec 2
 voice-class sip rel1xx disable
 voice-class sip privacy-policy passthru
 voice-class sip profiles 1
 voice-class sip session refresh
 voice-class sip bind control source-interface GigabitEthernet0/0/3
 voice-class sip bind media source-interface GigabitEthernet0/0/3
 dtmf-relay rtp-nte
 rtcp keepalive
 srtp fallback
 no vad
!
dial-peer voice 201 voip
 description incoming from PSTN
 translate-outgoing called 25
 session protocol sipv2
 session transport udp
 incoming called-number 719.......
 voice-class codec 2
 voice-class sip rel1xx disable
```

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```
 voice-class sip profiles 2 inbound
 voice-class sip session refresh
 voice-class sip bind control source-interface GigabitEthernet0/0/3
 voice-class sip bind media source-interface GigabitEthernet0/0/3
 dtmf-relay rtp-nte
 srtp fallback
 no vad
!
dial-peer voice 786 voip
 description TEST for REFER
 translation-profile outgoing e164
 session protocol sipv2
 session target sip-uri
 session transport tcp tls
 destination uri SFB
 voice-class codec 2
 voice-class sip srtp-auth sha1-80 sha1-32
 voice-class sip localhost dns:isr4k.skypelabsk.local:5061
 voice-class sip profiles 248
 voice-class sip bind control source-interface GigabitEthernet0/0/2
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 voice-class sip referto-passing
 voice-class sip requri-passing
 dtmf-relay rtp-nte
 srtp
 no vad
!
!
```

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```
gateway
 media-inactivity-criteria all
 timer receive-rtcp 5
 timer receive-rtp 86400
!
sip-ua
 no remote-party-id
 timers options 1000
 connection-reuse
 crypto signaling default trustpoint SFBCA
!
line con 0
 logging synchronous
 stopbits 1
line aux 0
 stopbits 1
line vty 0
 session-timeout 90
 exec-timeout 960 0
 no activation-character
 logging synchronous
 transport preferred ssh
 transport input all
 stopbits 1
line vty 1 4
 exec-timeout 960 0
 logging synchronous
 transport input all
```

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```
!
end

CISCO_4K_ROUTER1#
```

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Standby Cisco UBE:

```
!
! Last configuration change at 19:45:02 UTC Fri Feb 12 2016
!
version 15.6
service timestamps debug datetime msec
service timestamps log datetime msec
no platform punt-keepalive disable-kernel-core
!
hostname CISCO_4K_ROUTER2
!
boot-start-marker
boot system flash bootflash:isr4400-universalk9.03.17.00.S.156-1.S-
std.SPA.bin
boot-end-marker
!
!
vrf definition Mgmt-intf
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
!
enable password cisco
!
aaa new-model
!
aaa session-id common
!
```

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```
ipc zone default
 association 1
  no shutdown
!
ip host dc.skypelabsk.local 10.64.3.230
ip host fe.skypelabsk.local 10.64.3.231
ip host isr4k.skypelabsk.local 10.80.22.100
ip name-server 8.8.8.8

no ip domain lookup
!
ipv6 unicast-routing
!
subscriber templating
!
multilink bundle-name authenticated
!
crypto pki trustpoint SFBCA
 enrollment terminal
 fqdn isr4k.skypelabsk.local
 subject-name CN=isr4k.skypelabsk.local
 revocation-check none
 rsakeypair SFBCAKey
!
!
crypto pki certificate chain SFBCA
 certificate 54000000251CFE0A478A81E0A8000000000025
  30820525 3082040D A0030201 02021354 00000025 1CFE0A47 8A81E0A8 00000000
  0025300D 06092A86 4886F70D 01010505 00304E31 15301306 0A099226 8993F22C
  64011916 056C6F63 616C311A 3018060A 09922689 93F22C64 0119160A 736B7970
  656C6162 736B3119 30170603 55040313 10736B79 70656C61 62736B2D 44432D43
  41301E17 0D313630 32313231 37343331 335A170D 31383032 31313137 34333133
```

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5A302131 1F301D06 03550403 13166973 72346B2E 736B7970 656C6162 736B2E6C
6F63616C 30820122 300D0609 2A864886 F70D0101 01050003 82010F00 3082010A
02820101 00B72329 C34720B3 5858DA0B F4A6D62C C17C84F7 608DF09F 8FC76F13
214A4116 58BF4F45 C5070DFF B6F5CAA9 E3E56C26 DDDAC5F9 AF4FD957 A51DD796
51CF2775 0EA1671C E60A5455 777FD6C6 8E0E0B92 86892C82 5F385C8A F7629411
B172E948 24129C66 BE9B9D36 7C95AEC1 4641C095 0F7CA3B5 E6CC999D 66404AAA
2064EE0B 5BBDB3AC 89FF9D95 94DECB9D 6BC64AA0 15ADECD4 6066BFFC BE7BE818
76E4E7D3 E39212EB D77397D0 C91ADB3E 99BE3EEA 64205075 6FA33467 40725C22
21B8AEE8 12A59B6E 22EA9DFB 5AA11A3B B2B4374F 6AC09584 8ACB9346 2D81041C
45E7C8E3 A310B90E 639D5749 C586EF72 AC2331E9 D625E5FE AA1F8D76 47B0A626
47DAE3F7 9D020301 0001A382 02273082 0223300E 0603551D 0F0101FF 04040302
05A0301D 0603551D 0E041604 14599528 4E896450 DD4B716C 3B9B55A2 18ACD75E
33301F06 03551D23 04183016 8014590D F87D6E08 A3424ABC 7A85FAFD 4E0F4BDD
A5B83081 CE060355 1D1F0481 C63081C3 3081C0A0 81BDA081 BA8681B7 6C646170
3A2F2F2F 434E3D73 6B797065 6C616273 6B2D4443 2D43412C 434E3D64 632C434E
3D434450 2C434E3D 5075626C 69632532 304B6579 25323053 65727669 6365732C
434E3D53 65727669 6365732C 434E3D43 6F6E6669 67757261 74696F6E 2C44433D
736B7970 656C6162 736B2C44 433D6C6F 63616C3F 63657274 69666963 61746552
65766F63 6174696F 6E4C6973 743F6261 73653F6F 626A6563 74436C61 73733D63
524C4469 73747269 62757469 6F6E506F 696E7430 81C70608 2B060105 05070101
0481BA30 81B73081 B406082B 06010505 07300286 81A76C64 61703A2F 2F2F434E
3D736B79 70656C61 62736B2D 44432D43 412C434E 3D414941 2C434E3D 5075626C
69632532 304B6579 25323053 65727669 6365732C 434E3D53 65727669 6365732C
434E3D43 6F6E6669 67757261 74696F6E 2C44433D 736B7970 656C6162 736B2C44
433D6C6F 63616C3F 63414365 72746966 69636174 653F6261 73653F6F 626A6563
74436C61 73733D63 65727469 66696361 74696F6E 41757468 6F726974 79302106
092B0601 04018237 14020414 1E120057 00650062 00530065 00720076 00650072
30130603 551D2504 0C300A06 082B0601 05050703 01300D06 092A8648 86F70D01
01050500 03820101 00048D06 49B8D463 989E6B13 3EA25EB0 0E6E6604 15B0EE34
B72EC5A2 B7EF8CA9 EAA39AF5 DDDB54A9 F3EBADC3 2A30AB5D EF4DD860 BD20F698
912534E8 B81DA260 1AC742E9 DB5266FC 4996206A 4649043F DFA35F10 B0C5D8BB
0EFC002D 0303991C 689B8B85 88430DD4 1E9A96AC 9403F208 513756A1 5ADD4C87

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```
 1CF5801A A0A5FFA8 7CC07F79 91578935 60F5A032 064C281C 48ED81BE 0B827DDC
 92204AFF 1B5A5918 FAADBA6E A2D73E0D B7279E26 70B3C67C 8E12CDCA 121AF195
 CAFB1C60 7B4E067F 26E99686 CFD80B03 808424C6 356C65ED D892D3E0 481A65F3
 769E5D1F CD29158C C97D25C2 31144DD4 851B4DEC B8DB86C1 DB134961 86ADFB7D
 09713AD0 3FC87F28 3E
     quit
certificate ca 4776AE3591B921AF45CB8415421DF2DD
 30820377 3082025F A0030201 02021047 76AE3591 B921AF45 CB841542 1DF2DD30
 0D06092A 864886F7 0D010105 0500304E 31153013 060A0992 268993F2 2C640119
 16056C6F 63616C31 1A301806 0A099226 8993F22C 64011916 0A736B79 70656C61
 62736B31 19301706 03550403 1310736B 7970656C 6162736B 2D44432D 4341301E
 170D3135 30323034 31363536 31385A17 0D323030 32303431 37303631 375A304E
 31153013 060A0992 268993F2 2C640119 16056C6F 63616C31 1A301806 0A099226
 8993F22C 64011916 0A736B79 70656C61 62736B31 19301706 03550403 1310736B
 7970656C 6162736B 2D44432D 43413082 0122300D 06092A86 4886F70D 01010105
 00038201 0F003082 010A0282 010100B1 55EF48A2 FC6A1500 5314D0CC F2D9381E
 991FF2FB 012EF82F 15F9DC2E C1C94F15 77AAA417 3529D9BD C0197CDA 74A963A5
 41D7B081 3E1615DB 893C7693 7AEED838 0EC572CD 87791C64 86A5D2EB 5BF3A54C
 DD63C4CE BEC3D834 E77AA7E9 F0E66DF6 729D612C B649ADFA 7837C660 0D932964
 4F481344 B3A51479 3F6F9D98 D7488E2D 6BC145EE 6A6FA2CF 90C01AC6 E2C19D91
 D4873656 A7625FB9 4FCCB793 09E7F825 68108464 A8C94B1A 5F0E4D9B B54711BD
 162FF78C 09952D8F 94B1318A 77E37F00 E32EB1CB 63915804 844DAD2C E26FC898
 3117F86F E78A0AE7 3F5FCA67 919C9BA4 B5D3C05E 74656D18 6AA19F39 1431A8E5
 E10D6F75 5A6A77A6 A50C3C7E CE4B4B02 03010001 A351304F 300B0603 551D0F04
 04030201 86300F06 03551D13 0101FF04 05300301 01FF301D 0603551D 0E041604
 14590DF8 7D6E08A3 424ABC7A 85FAFD4E 0F4BDDA5 B8301006 092B0601 04018237
 15010403 02010030 0D06092A 864886F7 0D010105 05000382 01010052 961F4C96
 4BE0ECEE DF1E49EF 98C1E483 D0AA05A5 955DB3C6 200ACCB5 FFD7E8D9 8182430E
 8C22880F 3B4D71A6 F5848ED5 0B5F6A49 17A53F20 A75D45CF 4796C2E9 298C1B28
 1584B717 13435874 4D31C21F 5F26535D D685E41A 74399A1E AC5D3A05 BCD484EF
 F37BD773 51B23F3B A1928226 1088D276 F4583E6E DB3B2D74 4FD66E21 00031A4C
 1EAC877E D5246E96 8323FFC5 DD3F2C77 82364246 7411AC35 24D89BDE 9DEFD183
```

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```
  1BCCFA3A F53AD01E 0225D825 0A094649 840DD901 EBE87F00 2F44CE0E DFF19546
  89734152 00A7EA67 0035C565 D9E77F2B C8C6A429 AB38AA7E 39722A61 DDB5628C
  611E3733 7ACB9C48 6F2FF520 319DCF45 F8F91C1D 00BF68D4 F5CE6F
      quit
cts logging verbose
!
!
voice service voip
 no ip address trusted authenticate
 rtcp keepalive
 address-hiding
 mode border-element license capacity 20
 allow-connections sip to sip
 redundancy-group 1
 no supplementary-service sip moved-temporarily
 no supplementary-service sip refer
 supplementary-service media-renegotiate
 sip
  bind control source-interface GigabitEthernet0/0/2
  bind media source-interface GigabitEthernet0/0/2
  session refresh
  header-passing
  referto-passing
  conn-reuse
  midcall-signaling passthru media-change
  sip-profiles inbound
  sip-profiles 248 inbound
!
!
voice class uri PSTN sip
 host ipv4:63.87.147.30
!
```

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```
voice class uri SFB sip
 host fe.skypelabsk.local
!
voice class uri FQDNsfb sip
 host 10.80.22.74
voice class codec 2
 codec preference 1 g711ulaw
 codec preference 2 g729r8 bytes 30
 codec preference 3 g726r32
 codec preference 4 g729br8
!
voice class sip-profiles 248
 request ANY sdp-header Audio-Attribute modify
"a=(.*)AES_CM_128_HMAC_SHA1_(.*) inline(.*)\|(.*):(.*)" "a=\1CRYPTO_UNKNOWN
inline\3|\4:\5"
 response ANY sdp-header Audio-Attribute modify
"a=(.*)AES_CM_128_HMAC_SHA1_(.*) inline(.*)\|(.*):(.*)" "a=\1CRYPTO_UNKNOWN
inline\3|\4:\5"
!
voice class sip-profiles 2
 request ANY sip-header Allow-Header modify ",PRACK" ""
!
voice class sip-profiles 1
 request INVITE sip-header Referred-By remove
 request INVITE sip-header Diversion remove
 request INVITE sip-header Diversion add "Diversion:
<sip:7193779214@192.65.79.124>"
 request INVITE sip-header P-Asserted-Identity remove
!
voice class sip-copylist 1
 sip-header REFERRED-BY
!
voice translation-rule 1
 rule 2 /\(^..........$\)/ /+1\1/
```

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```
!
voice translation-rule 2
 rule 1 /7193779226/ /2255/
 rule 2 /\(^..........$\)/ /+1\1/
 rule 3 /\(^...........$\)/ /+\1/
!
voice translation-rule 3
 rule 1 /^\+1\(..........\)$/ /\1/
 rule 3 /^9\(..........\)$/ /1\1/
 rule 4 /^9\(01191..........\)$/ /\1/
!
voice translation-rule 4
 rule 1 /^\+1\(..........\)$/ /\1/
!
!
voice translation-profile e164
translate calling 1
translate called 2
!
voice translation-profile pstn
translate calling 4
translate called 3
!
license udi pid ISR4431/K9 sn FOC18232988
license boot level appxk9
license boot level uck9
license boot level securityk9
!
spanning-tree extend system-id
!
username cisco privilege 15 secret 5 $1$AGR7$e7pQx6UIObe3bzRbcOlr81
!
```

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```
redundancy
 mode none
 application redundancy
  group 1
   name voice-b2bha
   priority 100 failover threshold 75
   timers delay 30 reload 60
   control GigabitEthernet0/0/0 protocol 1
   data GigabitEthernet0/0/0
   track 1 shutdown
   track 2 shutdown
!
vlan internal allocation policy ascending
!
track 1 interface GigabitEthernet0/0/2 line-protocol
track 2 interface GigabitEthernet0/0/3 line-protocol
!
interface GigabitEthernet0/0/0
 ip address 10.64.4.20 255.255.0.0
 media-type rj45
 negotiation auto
!
interface GigabitEthernet0/0/1
 no ip address
 shutdown
 media-type rj45
 negotiation auto
!
```

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```
interface GigabitEthernet0/0/2
 ip address 10.80.22.75 255.255.255.0
 media-type rj45
 negotiation auto
 redundancy rii 1
 redundancy group 1 ip 10.80.22.100 exclusive
!
interface GigabitEthernet0/0/3
 description Wan Interface
 ip address 192.65.79.115 255.255.255.224
 media-type rj45
 negotiation auto
 redundancy rii 2
 redundancy group 1 ip 192.65.79.124 exclusive
!
interface GigabitEthernet0
 vrf forwarding Mgmt-intf
 no ip address
 shutdown
 negotiation auto
!
interface Vlan1
 no ip address
 shutdown
!
ip forward-protocol nd
no ip http server
no ip http secure-server
ip route 0.0.0.0 0.0.0.0 192.65.79.97
ip route 10.64.0.0 255.255.0.0 10.80.22.1
ip route 10.80.22.0 255.255.255.0 10.80.22.1
ip route 172.16.0.0 255.255.0.0 10.80.22.1
```

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```
control-plane
!
mgcp behavior rsip-range tgcp-only
mgcp behavior comedia-role none
mgcp behavior comedia-check-media-src disable
mgcp behavior comedia-sdp-force disable
!
mgcp profile default
!
dial-peer voice 107 voip
 description " Incoming PSTN to IP-PBX - IP-PBX facing side "
 translation-profile outgoing e164
 destination-pattern 719.......
 session protocol sipv2
 session target dns:fe.skypelabsk.local:5067
 session transport tcp tls
 incoming uri request FQDNsfb
 voice-class codec 2
 voice-class sip srtp-auth sha1-80 sha1-32
 voice-class sip localhost dns:isr4k.skypelabsk.local:5061
 voice-class sip asserted-id pai
 voice-class sip call-route url
 voice-class sip profiles 248
 voice-class sip options-keepalive
 voice-class sip bind control source-interface GigabitEthernet0/0/2
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 voice-class sip referto-passing
 dtmf-relay rtp-nte
 refer consume
 rtcp keepalive
 srtp
 no vad
```

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```
!
dial-peer voice 105 voip
 description incoming from IP-PBX
 session protocol sipv2
 session transport tcp tls
 incoming called-number 9..........
 incoming uri request SFB
 voice-class codec 2
 voice-class sip srtp-auth sha1-80 sha1-32
 voice-class sip localhost dns:isr4k.skypelabsk.local:5061
 no voice-class sip asserted-id
 voice-class sip call-route url
 no voice-class sip srtp negotiate
 voice-class sip bind control source-interface GigabitEthernet0/0/2
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 voice-class sip requri-passing
 dtmf-relay rtp-nte
 srtp
 no vad
!
dial-peer voice 400 voip
 description "Outgoing To PSTN"
 translation-profile outgoing pstn
 destination-pattern .T
 rtp payload-type comfort-noise 13
 session protocol sipv2
 session target ipv4:63.87.147.30:5072
 session transport udp
 voice-class codec 2
 voice-class sip rel1xx disable
 voice-class sip privacy-policy passthru
 voice-class sip profiles 1
```

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```
 voice-class sip bind control source-interface GigabitEthernet0/0/3
 voice-class sip bind media source-interface GigabitEthernet0/0/3
 dtmf-relay rtp-nte
 rtcp keepalive
 srtp fallback
 no vad
!
dial-peer voice 201 voip
 description incoming from PSTN
 translate-outgoing called 25
 session protocol sipv2
 session transport udp
 incoming called-number 719.......
 voice-class codec 2
 voice-class sip rel1xx disable
 voice-class sip profiles 2 inbound
 voice-class sip bind control source-interface GigabitEthernet0/0/3
 voice-class sip bind media source-interface GigabitEthernet0/0/3
 dtmf-relay rtp-nte
 srtp fallback
 no vad
!
dial-peer voice 786 voip
 description TEST for REFER
 translation-profile outgoing e164
 session protocol sipv2
 session target sip-uri
 session transport tcp tls
 destination uri SFB
 voice-class codec 2
 voice-class sip srtp-auth sha1-80 sha1-32
 voice-class sip localhost dns:isr4k.skypelabsk.local:5061
```

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```
 voice-class sip profiles 248
 voice-class sip bind control source-interface GigabitEthernet0/0/2
 voice-class sip bind media source-interface GigabitEthernet0/0/2
 voice-class sip referto-passing
 voice-class sip requri-passing
 dtmf-relay rtp-nte
 srtp
 no vad
!
gateway
 media-inactivity-criteria all
 timer receive-rtcp 5
 timer receive-rtp 86400
!
sip-ua
 no remote-party-id
 timers options 1000
 connection-reuse
 crypto signaling default trustpoint SFBCA
!
line con 0
 stopbits 1
line aux 0
 stopbits 1
line vty 0
 session-timeout 90
 exec-timeout 960 0
 password tekV1z10n
 no activation-character
 logging synchronous
 transport preferred ssh
 transport input all
```

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```
 stopbits 1
line vty 1 4
 exec-timeout 960 0
 password tekV1z1On
 logging synchronous
 transport input all
!
!
end
```

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Trunk configuration from Skype for Business to the LAN side of the CUBE.

PSTN gateway configuration

Trunk to CUBE using TCP

- Open Skype for Business Server 2015 Topology Builder and navigate to Shared Components → PSTN gateways → New IP/PSTN Gateway

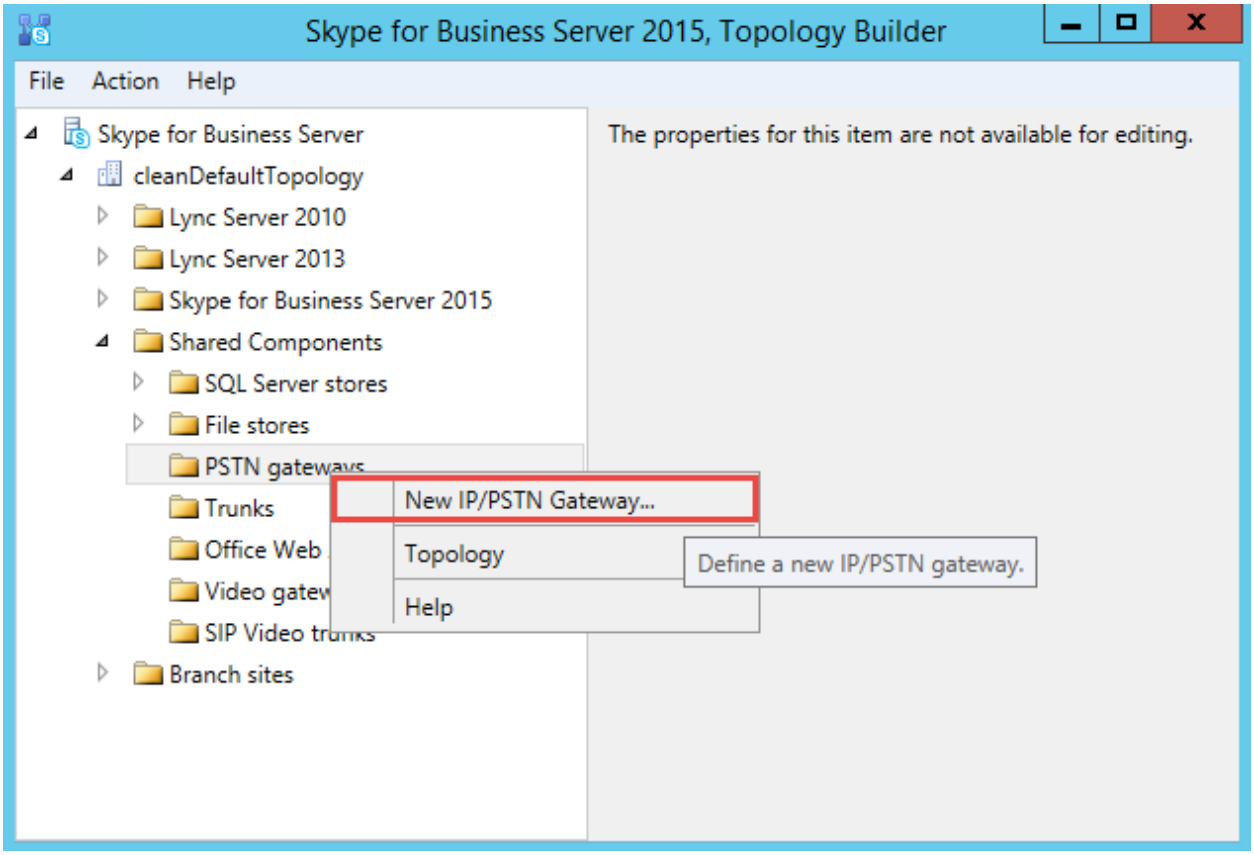

Figure 3 Add new IP/PSTN Gateway in Skype for Business Topology Builder

- The FQDN of the CUBE is configured in the new SIP trunk wizard.

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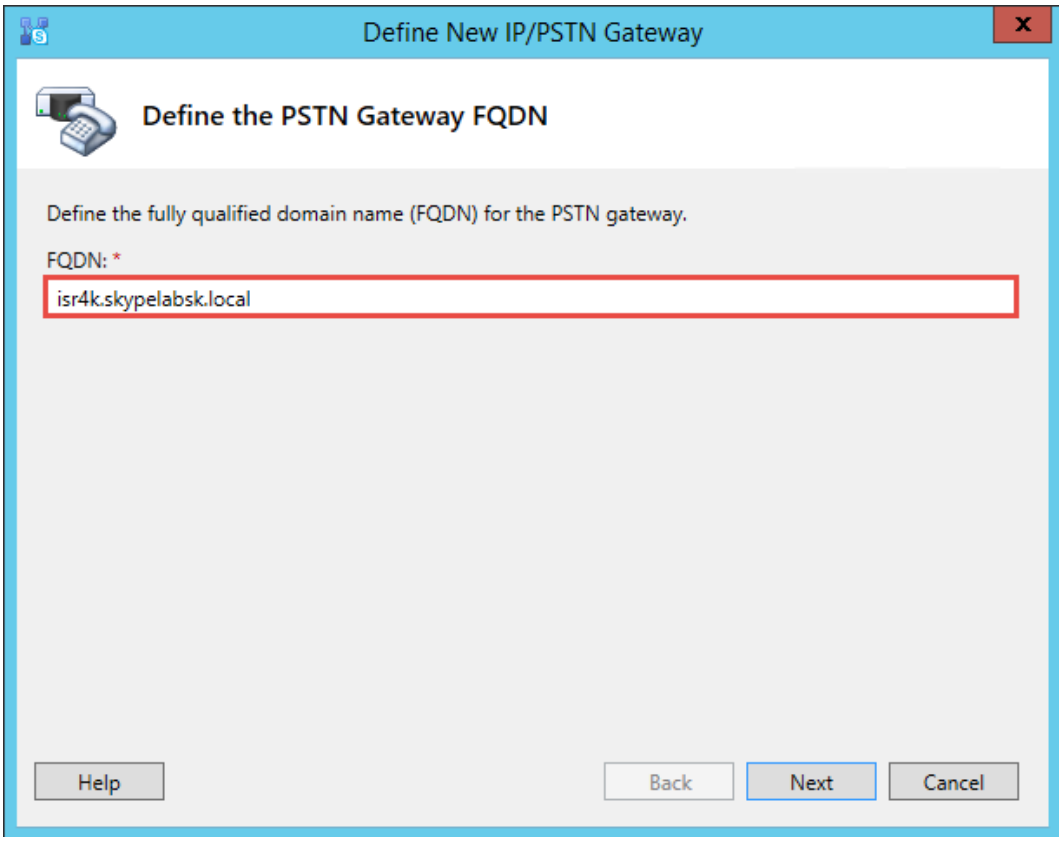

Figure 4 Define the FQDN of the CUBE

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- Select “Enable IPv4” with all configured IP Address.

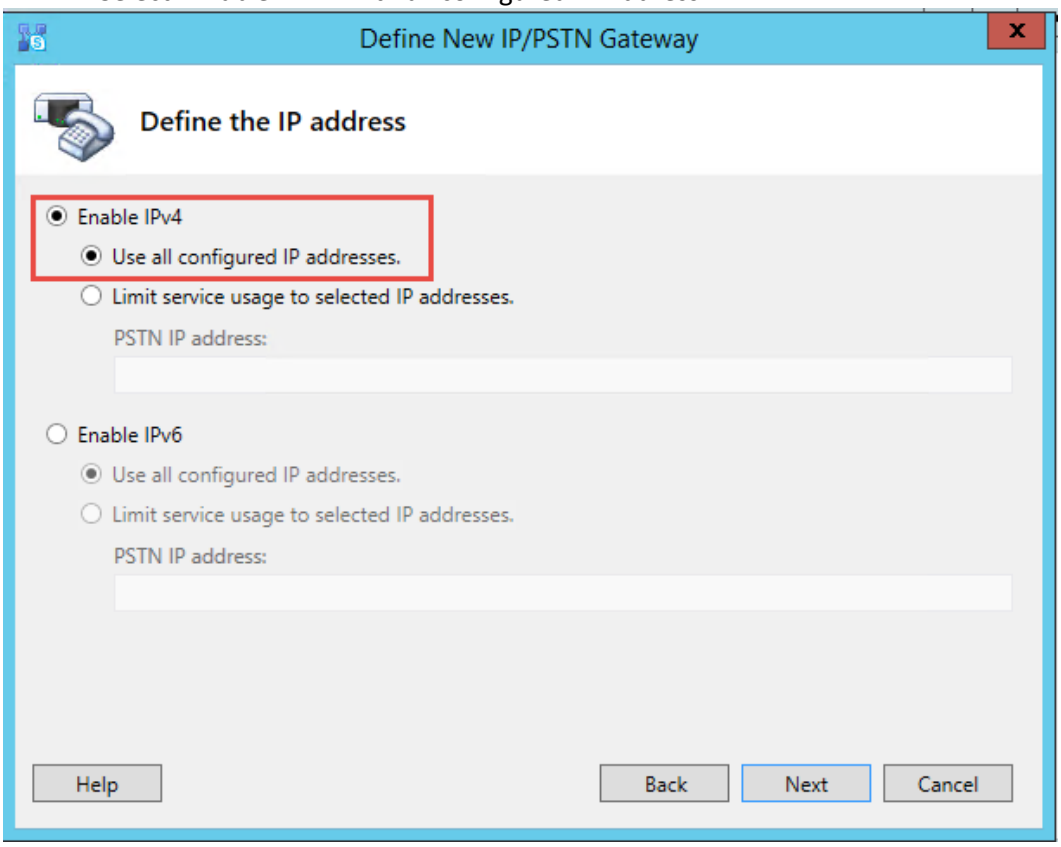

Figure 5: IPv4/IPv6 address selection

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- Please configure the port number, transport protocol and associated Mediation Server.

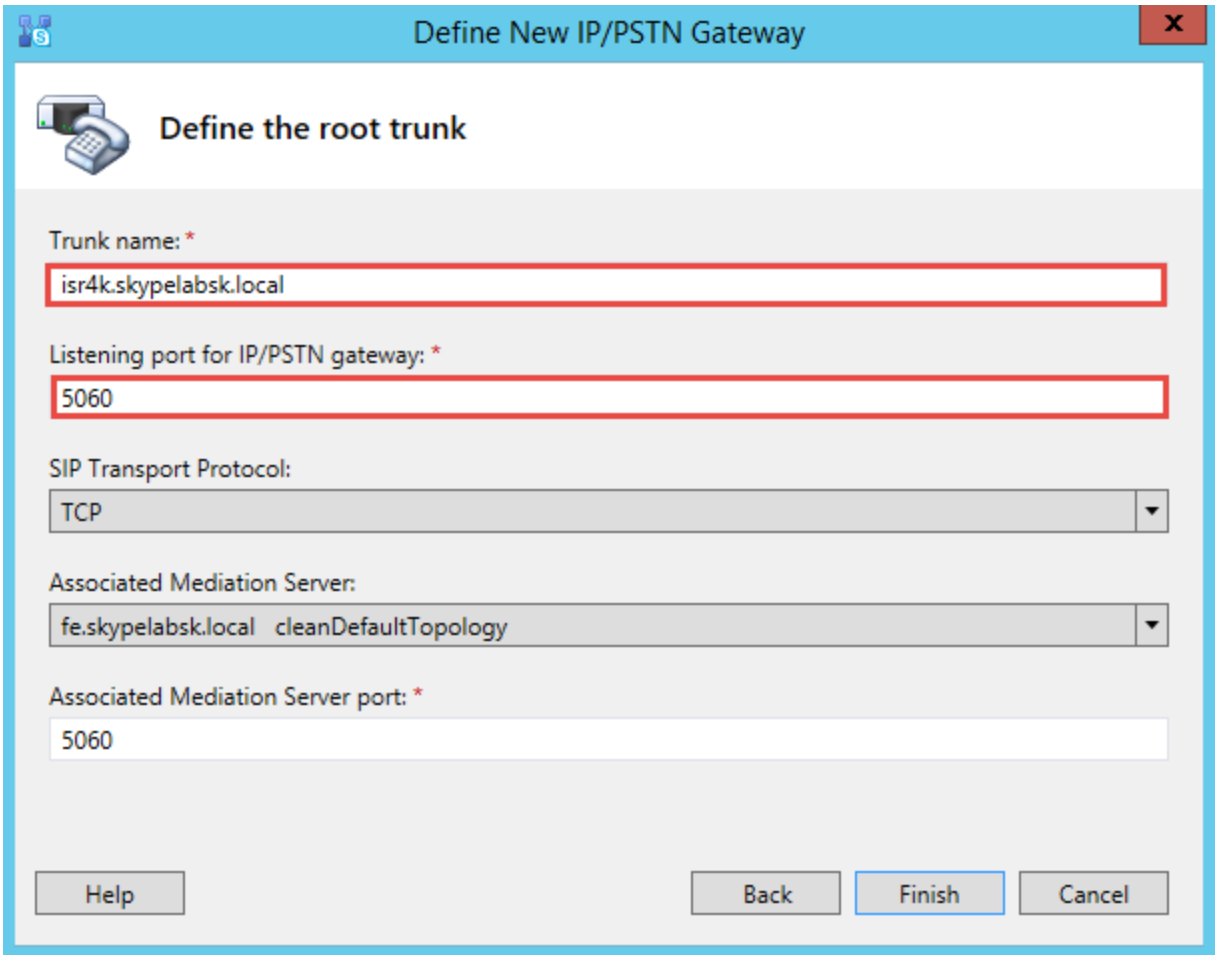

Figure 6: Transport protocol and Port number

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- After completion, the newly created trunk will appear under the PSTN gateways with the associated Mediation Server as shown below

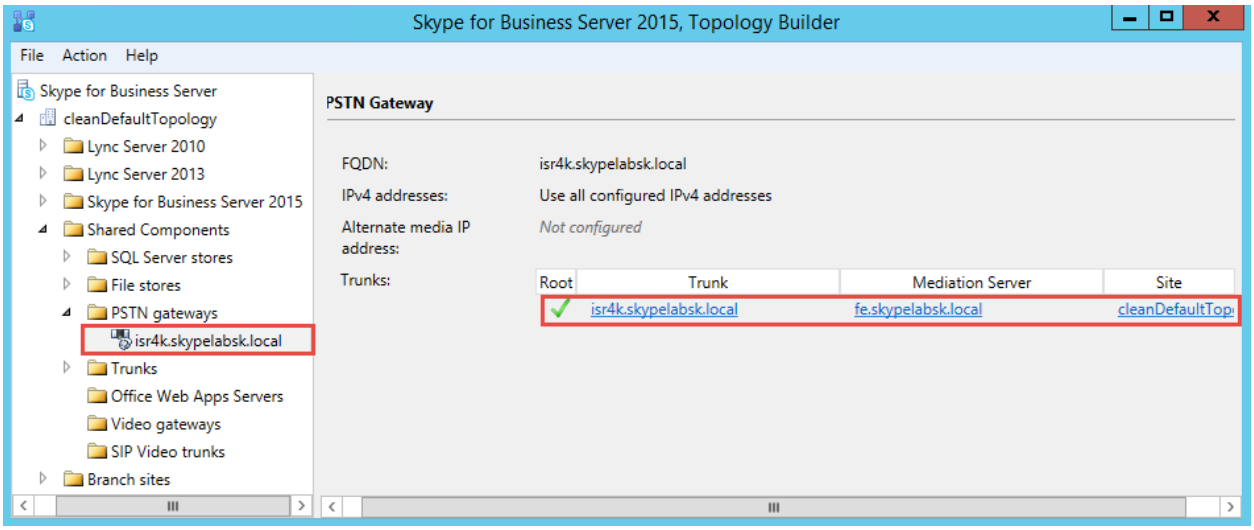

Figure 7 PSTN Gateway is added successfully using TCP

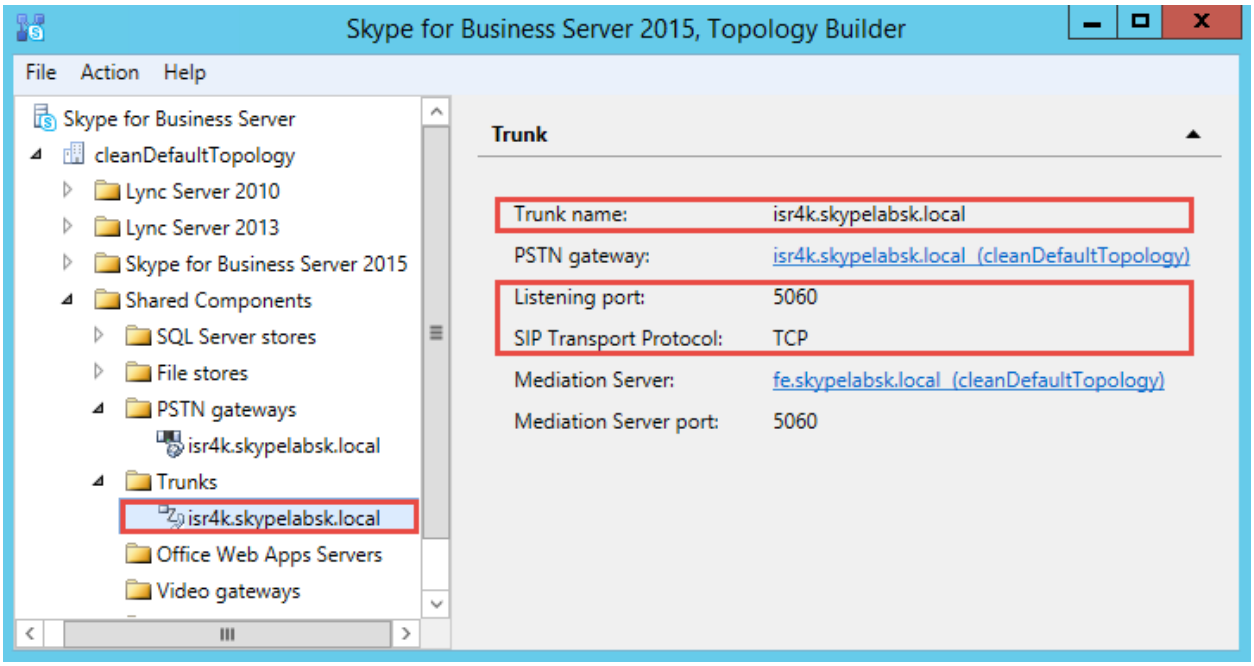

Figure 8 Trunk to CUBE is added successfully in TCP

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Trunk to CUBE using TLS

- Open Skype for Business Server 2015 Topology Builder and navigate to Shared Components → PSTN gateways → New IP/PSTN Gateway

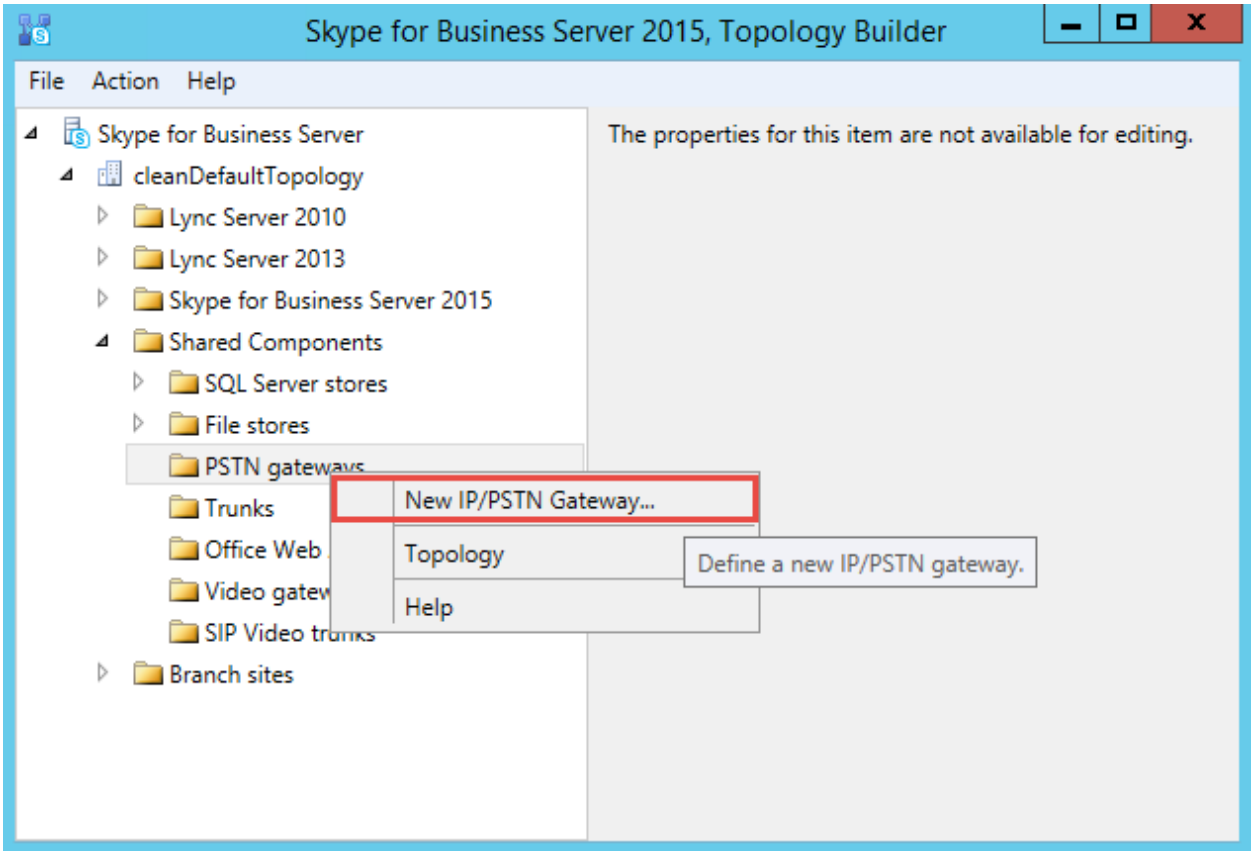

Figure 9 Add new IP/PSTN Gateway in Skype for Business Topology Builder

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- The FQDN of the CUBE is configured in the new SIP trunk wizard.

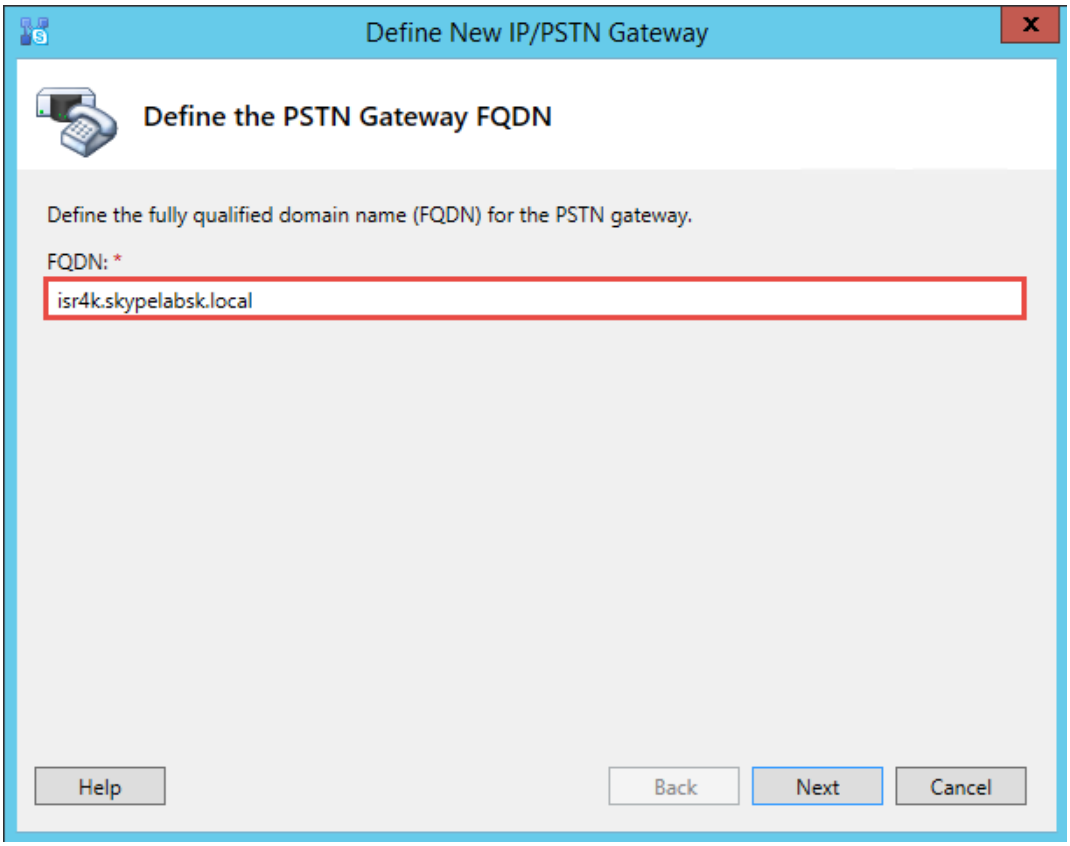

Figure 10 FQDN of the CUBE

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- Select “Enable IPv4” with all configured IP Address.

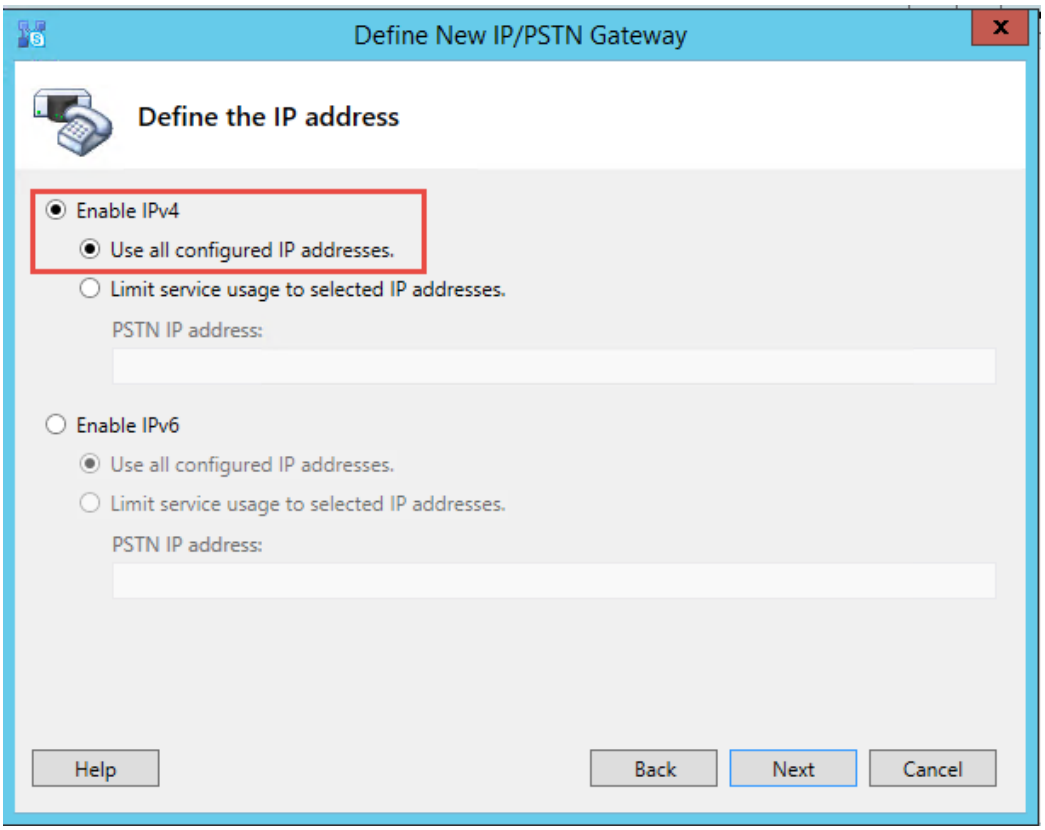

Figure 11: IPv4/IPv6 address selection

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- Please configure the port number, transport protocol and associated Mediation Server.

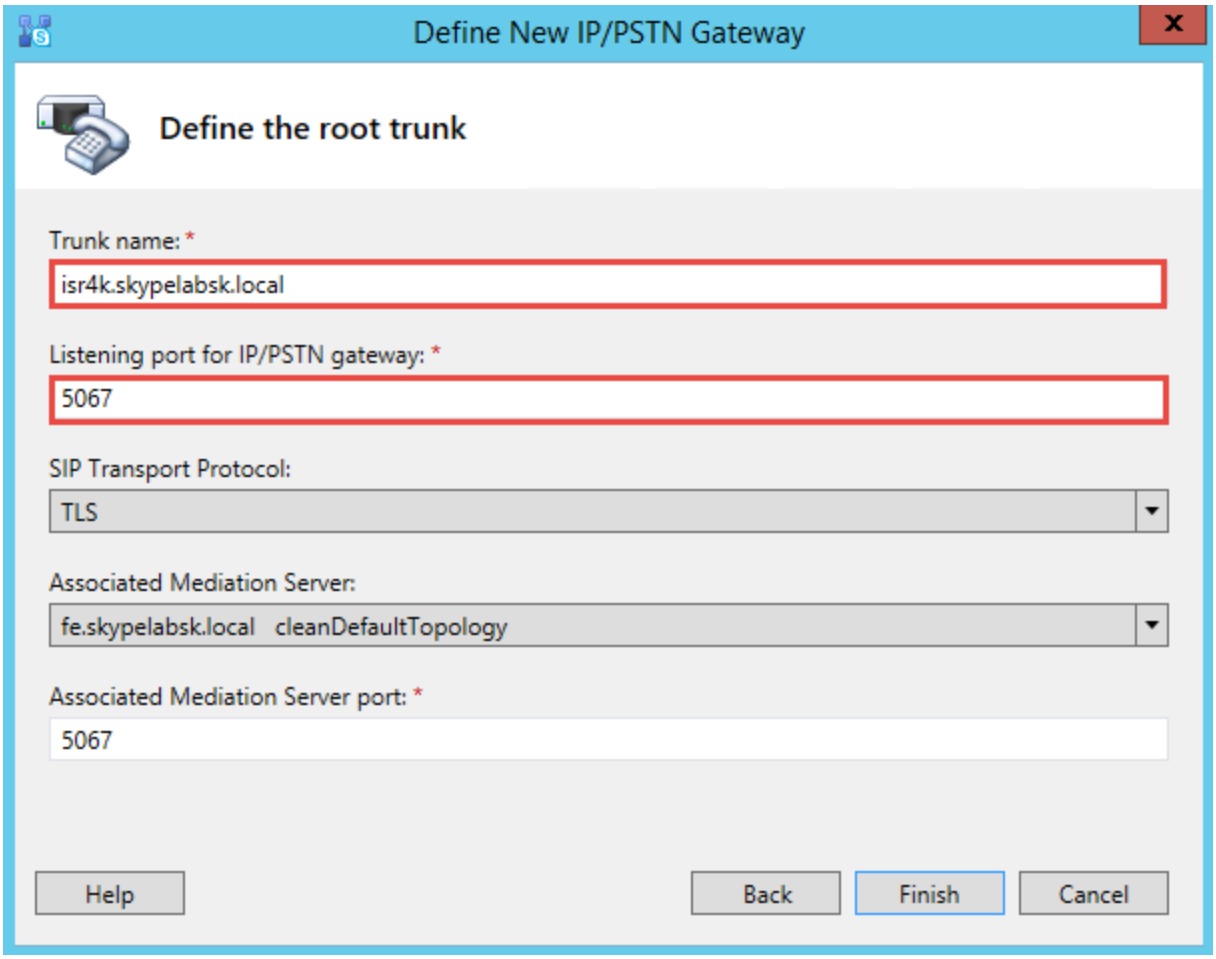

Figure 12: Transport protocol and Port number

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- After completion, the newly created trunk will appear under the PSTN gateways with the associated Mediation Server as shown below

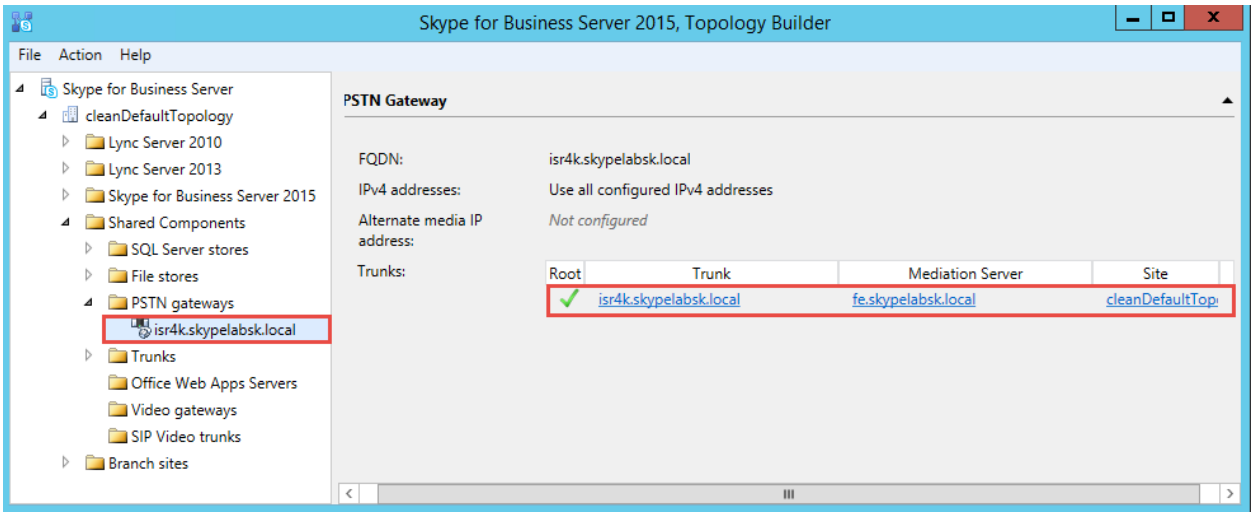

Figure 13 PSTN Gateway to CUBE is added successfully using TLS

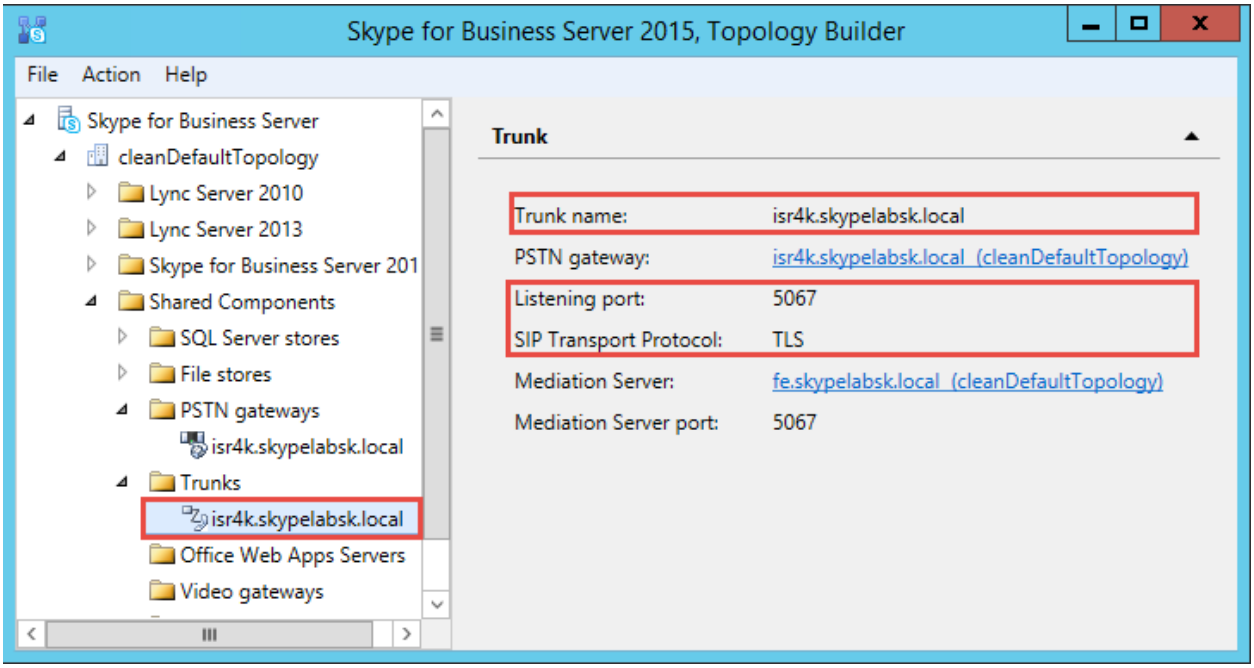

Figure 14 Trunk to CUBE is added successfully using TLS

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Publish the skype for Business Topology

- Navigate to Action → Topology → Publish
- Follow the wizard to publish the changes in the topology

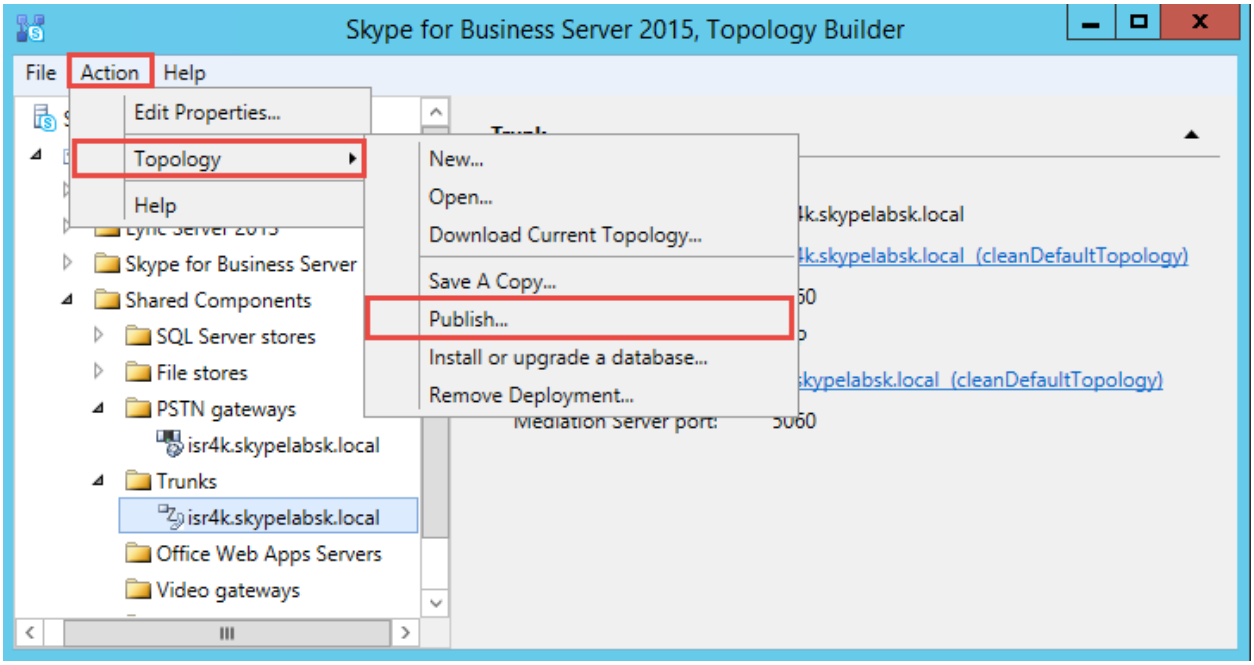

Figure 15 Publish the Skype for Business topology

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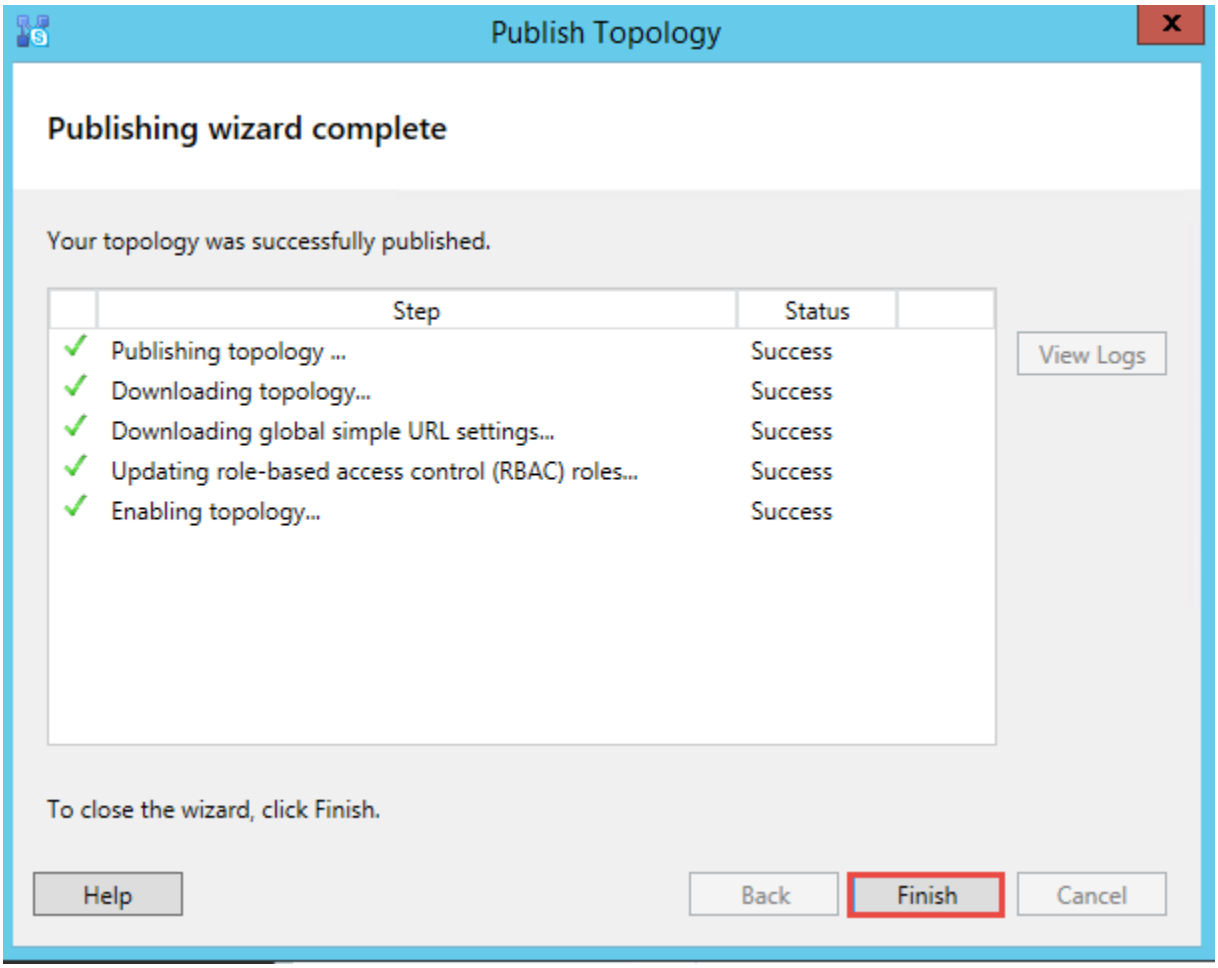

Figure 16 Changes to the Topology published successfully

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Voice Routing Configuration

Voice Policy

- Open Skype for Business Server 2015 Control Panel and select 'Voice Routing' and select 'Voice Policy'. Click on "New" and select "User Policy" to add the new Voice Policy as shown below.

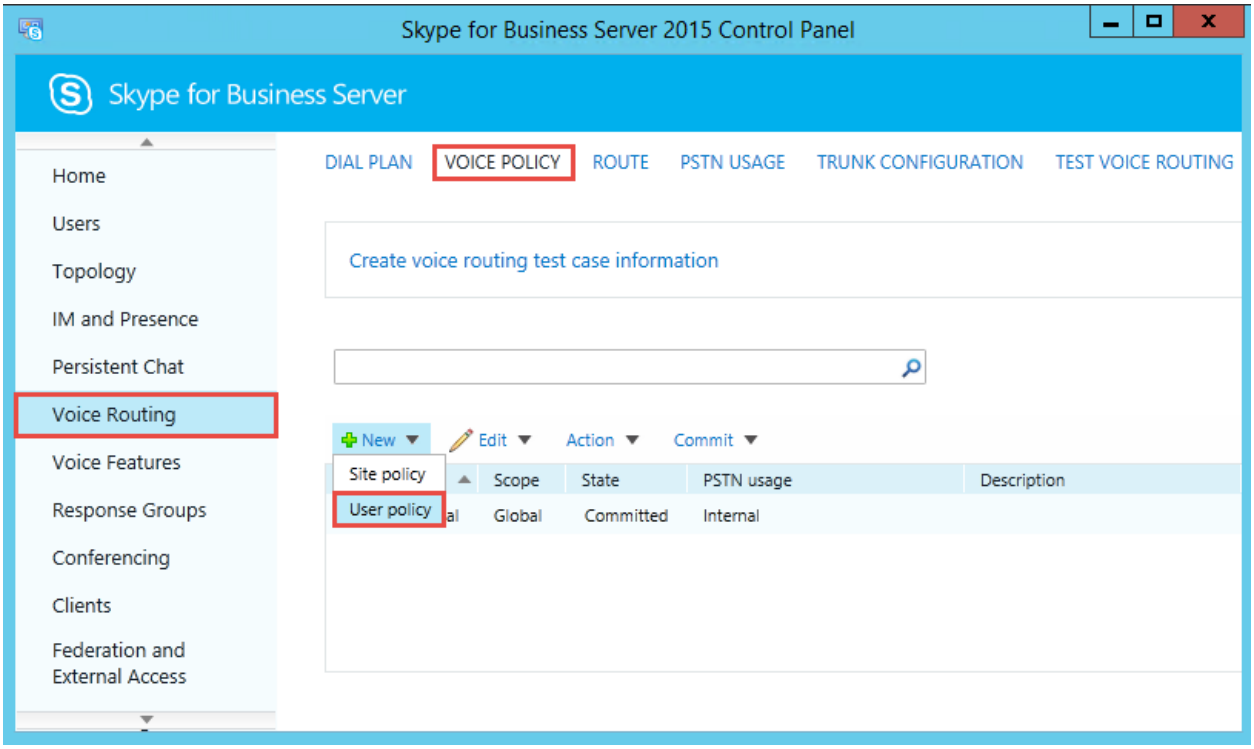

Figure 17 Voice Routing Configuration

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- Select the needed features and click “New” as shown below to add a new PSTN Usage.

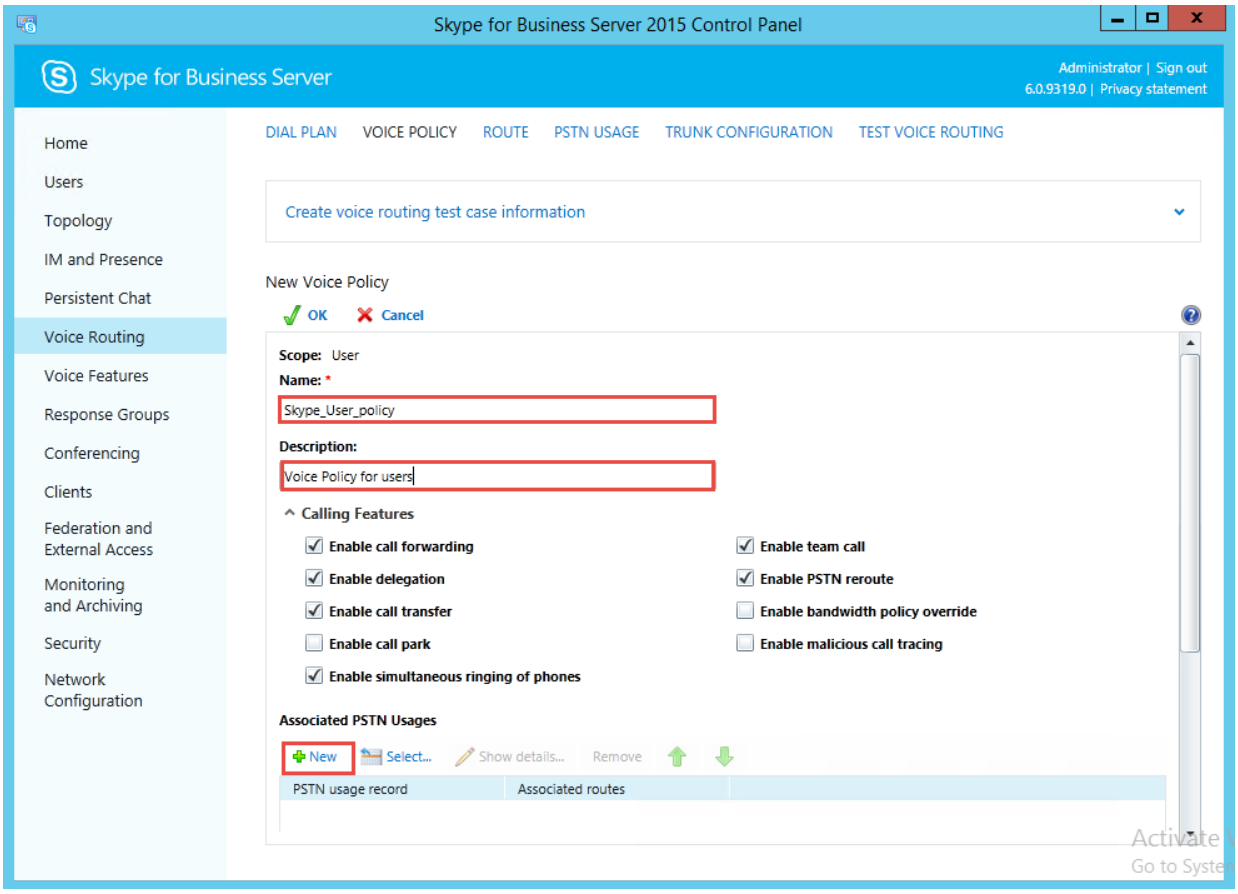

Figure 18 New User Voice Policy configuration

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- Add a new PSTN Usage with name 'PSTN_Usage_1' and click on "New" to add a new Route.

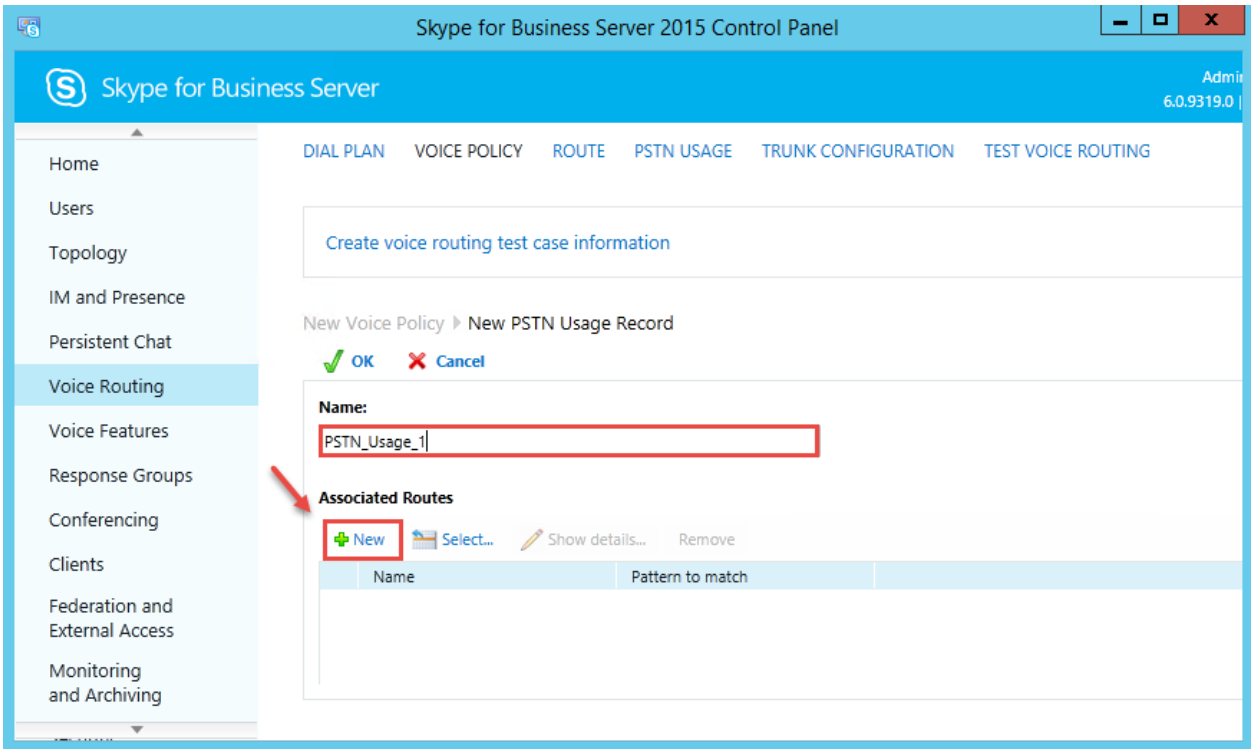

Figure 19 New PSTN Usage Record configuration

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- Add a new route pointing to CUBE. The Pattern to Match is set to ".*" which matches any dialed number from this Voice Policy.
- Under Associated Trunks, select "Add" to choose the CUBE and associate it with the trunk "Cisco ISR 4K"

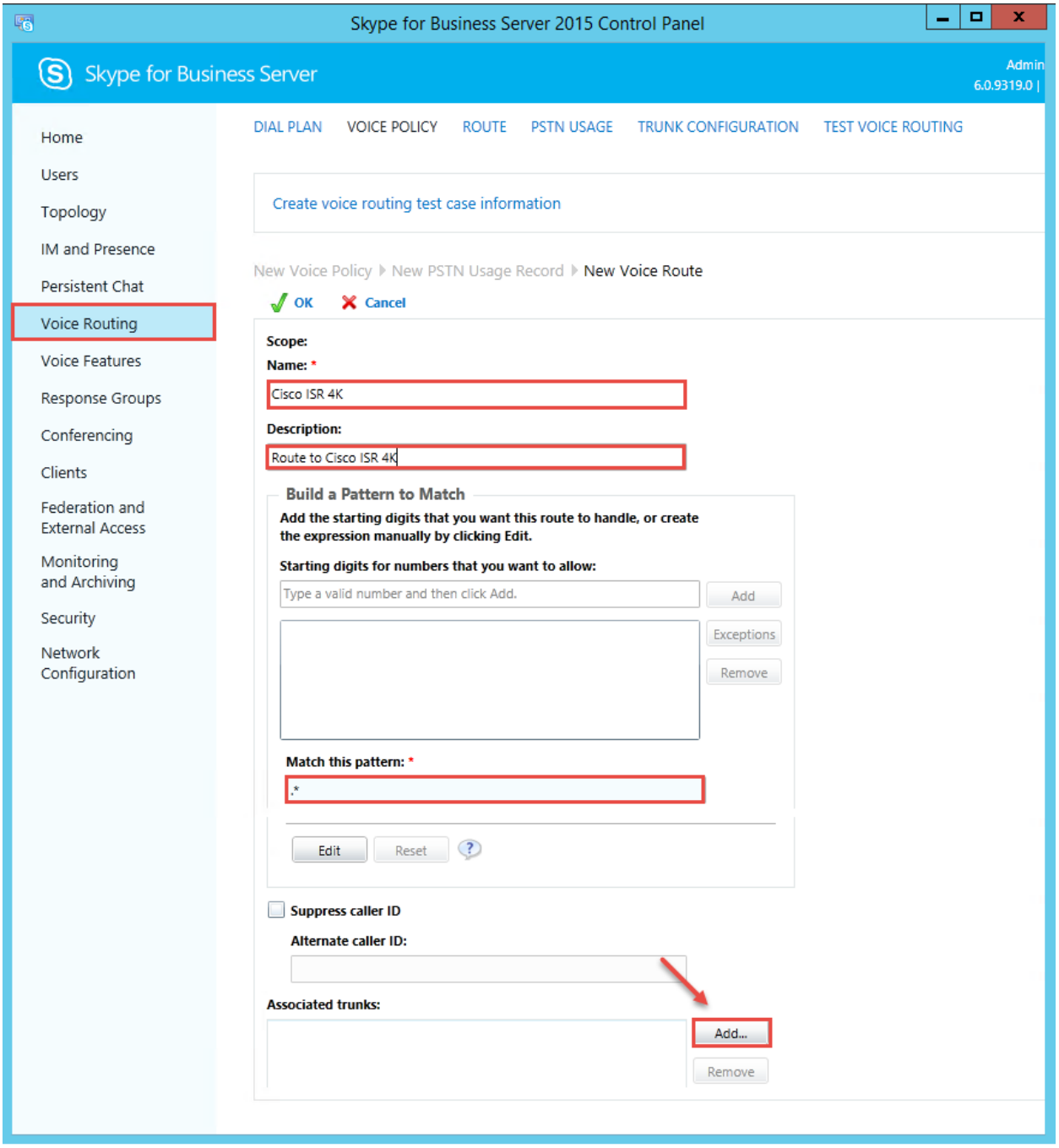

Figure 20 New Voice Route details and Add Trunk to associate

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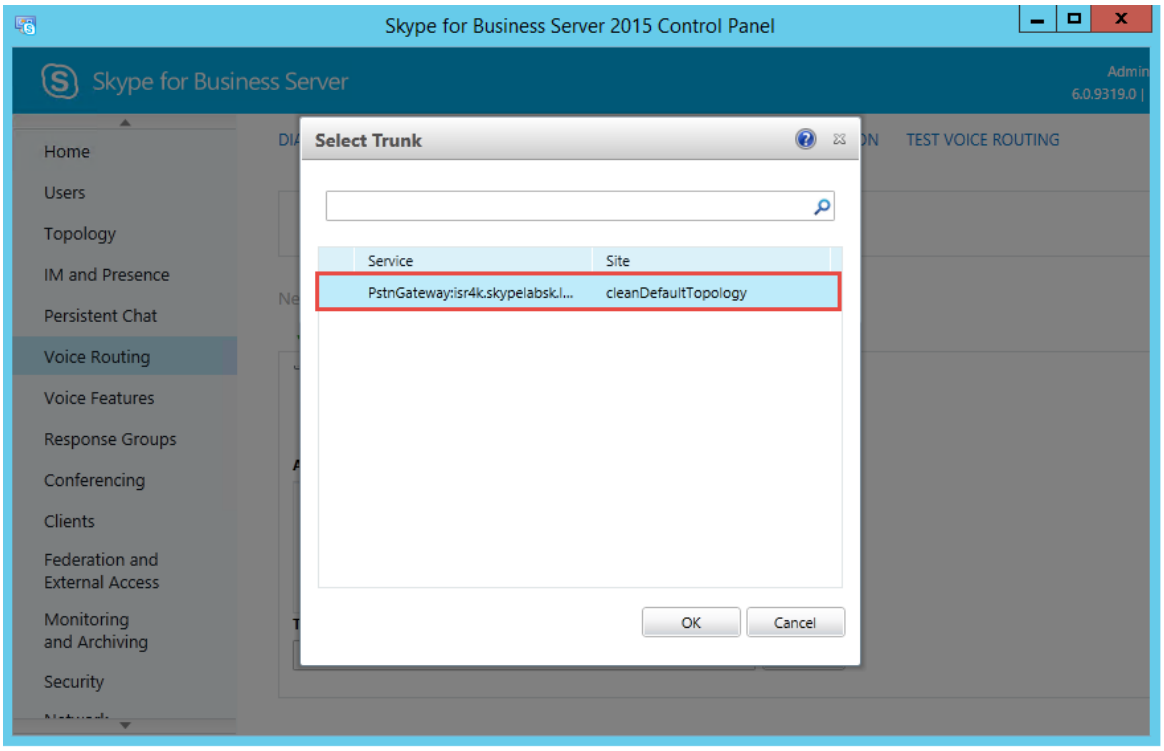

Figure 21 Select Trunk to associate with Route

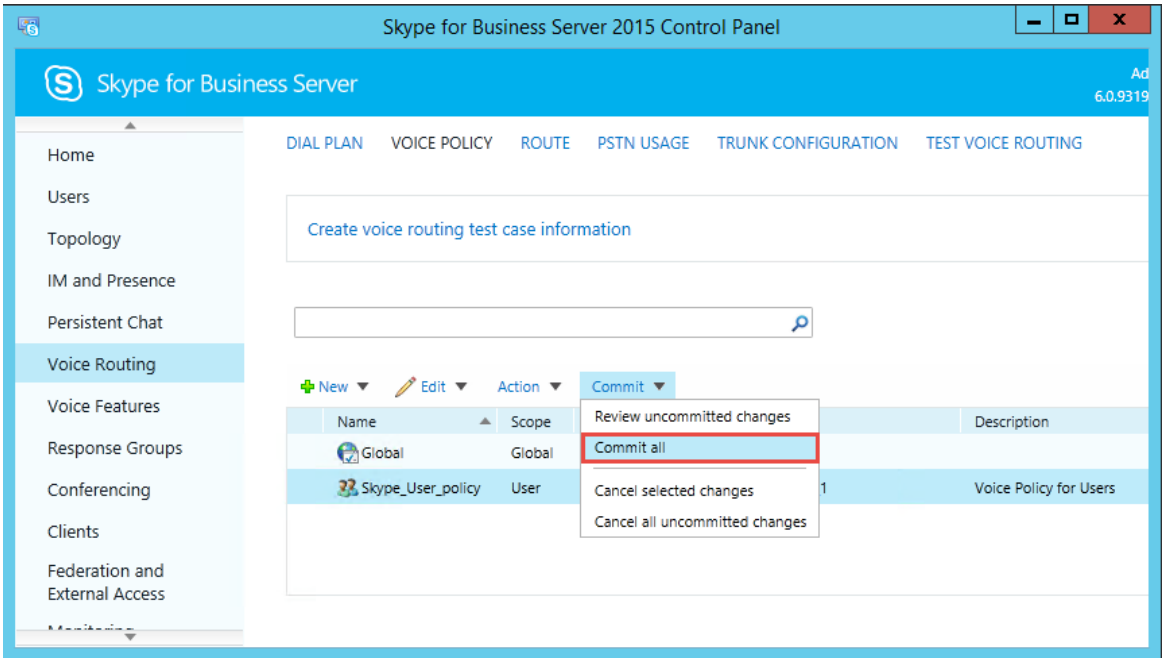

Figure 22 Commit changes to Voice Policy

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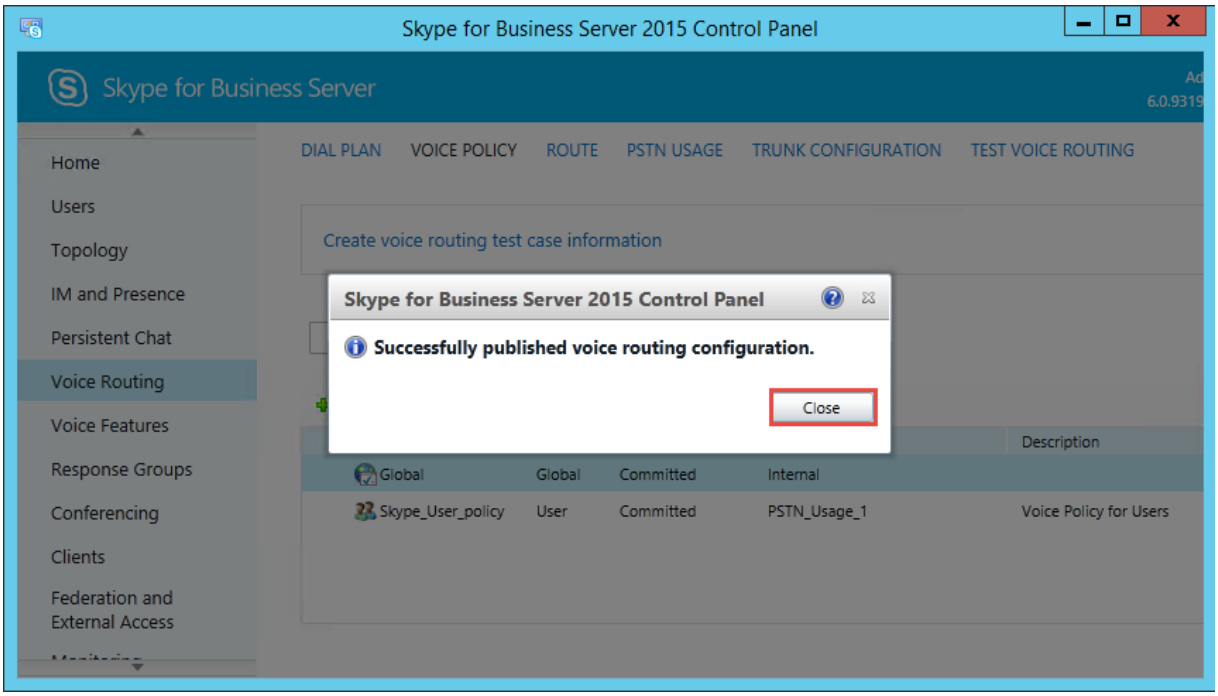

Figure 23 Voice Policy added successfully

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Trunk configuration

- In Skype for Business Server Control Panel, navigate to Voice Routing → Trunk Configuration
- Select New → Pool Trunk to add the trunk to CUBE

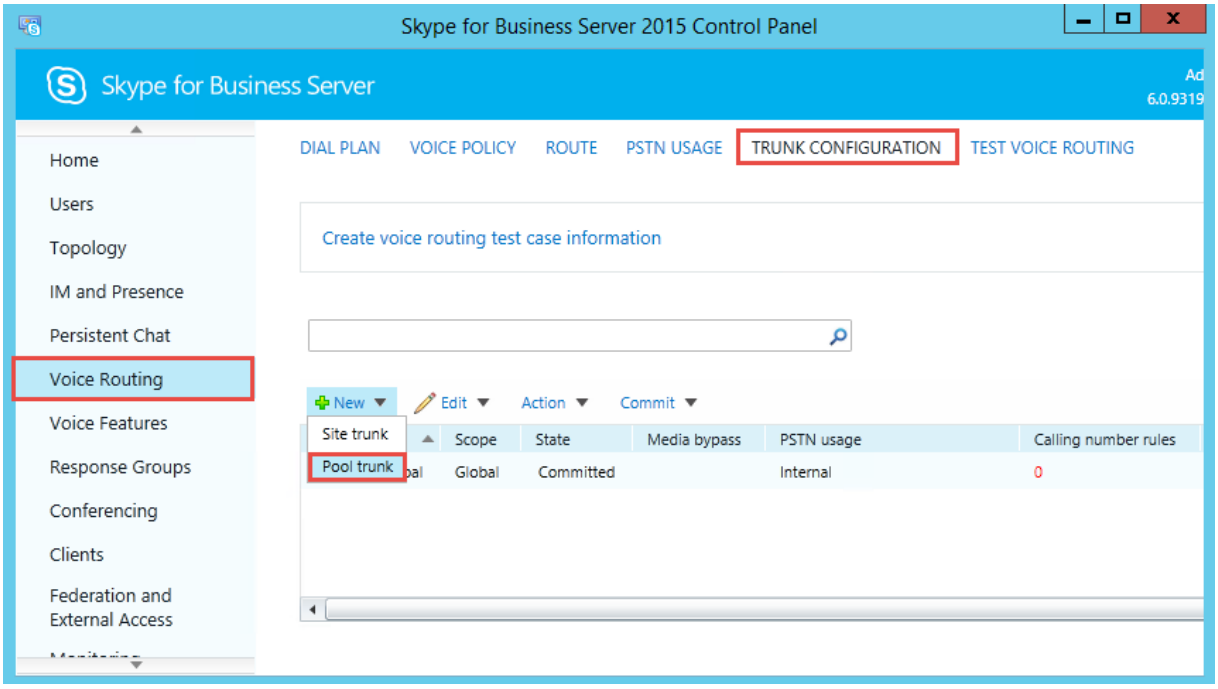

Figure 24 New Pool Trunk

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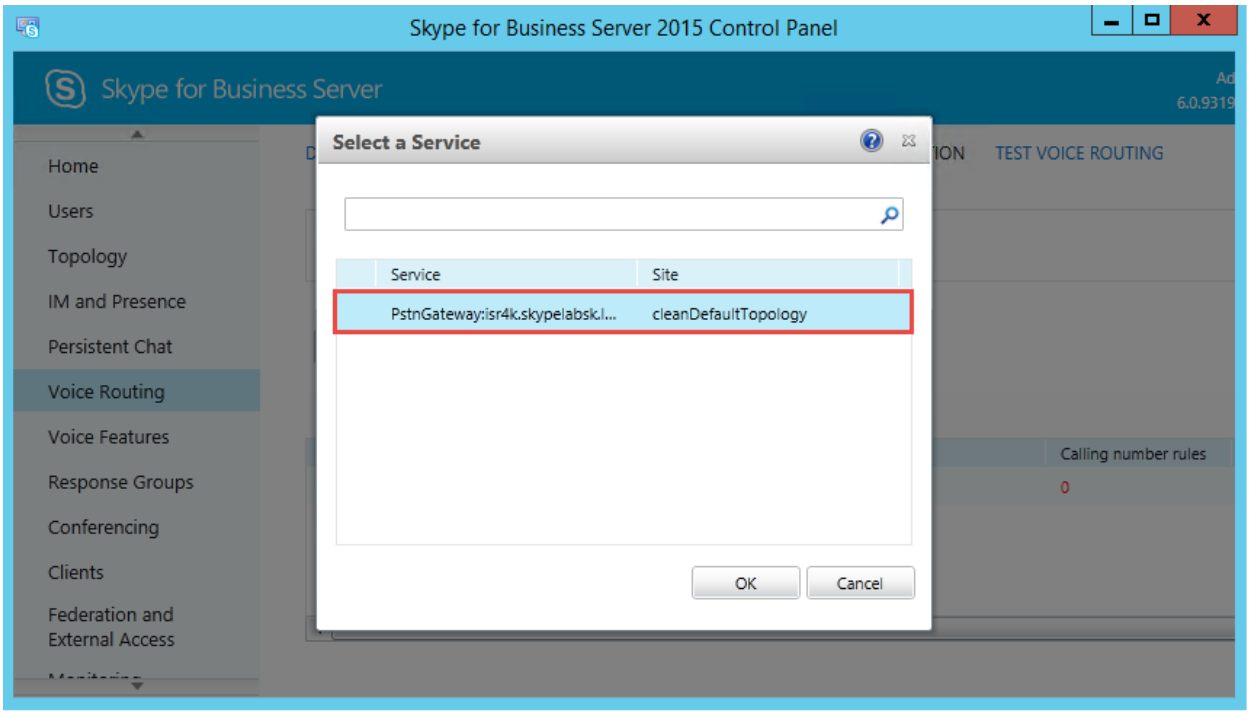

Figure 25 Select the Trunk Service

- Add the trunk with the corresponding requirements as shown below and associate the newly added PSTN Usage

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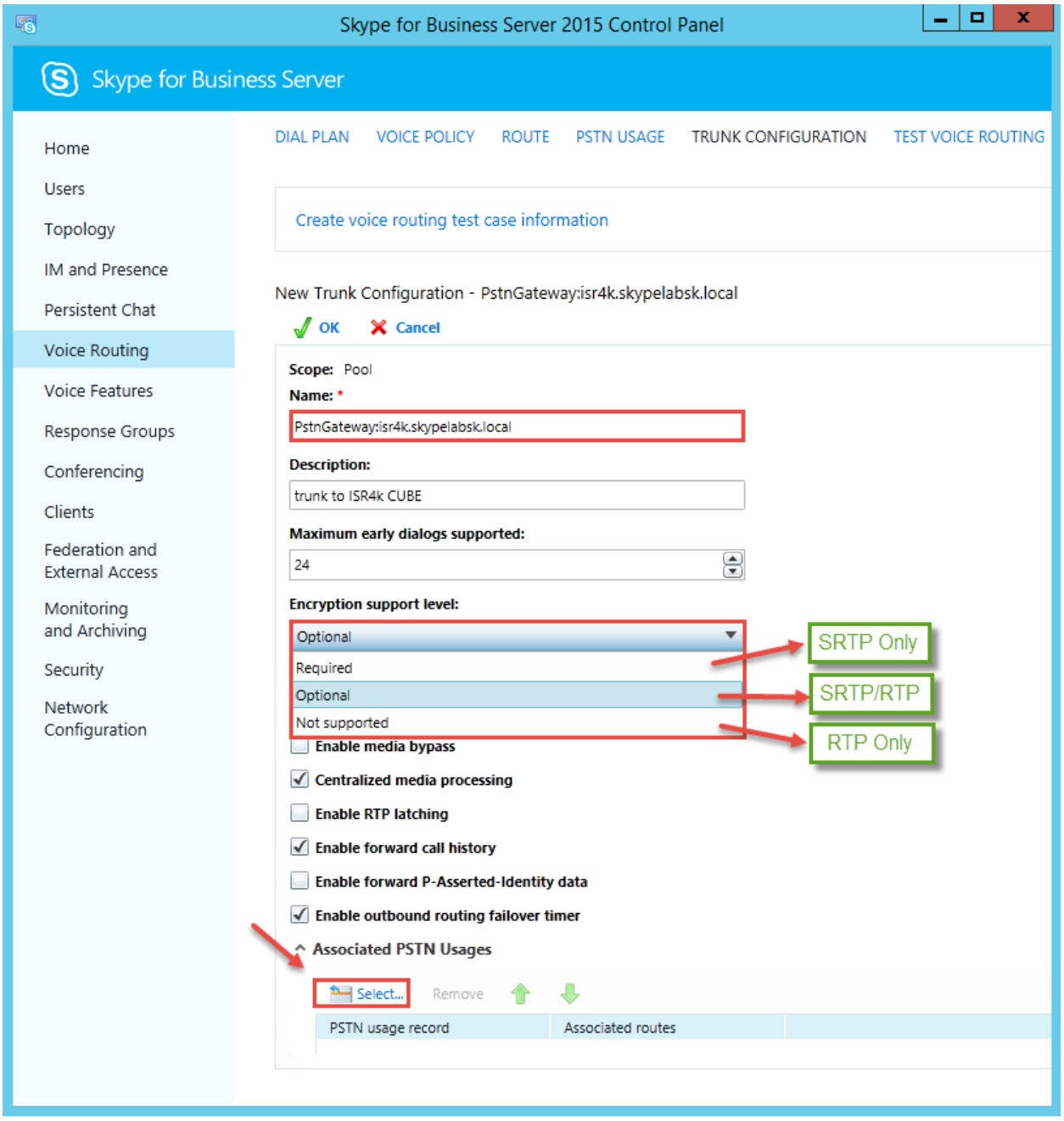

Figure 26 New Trunk Configuration

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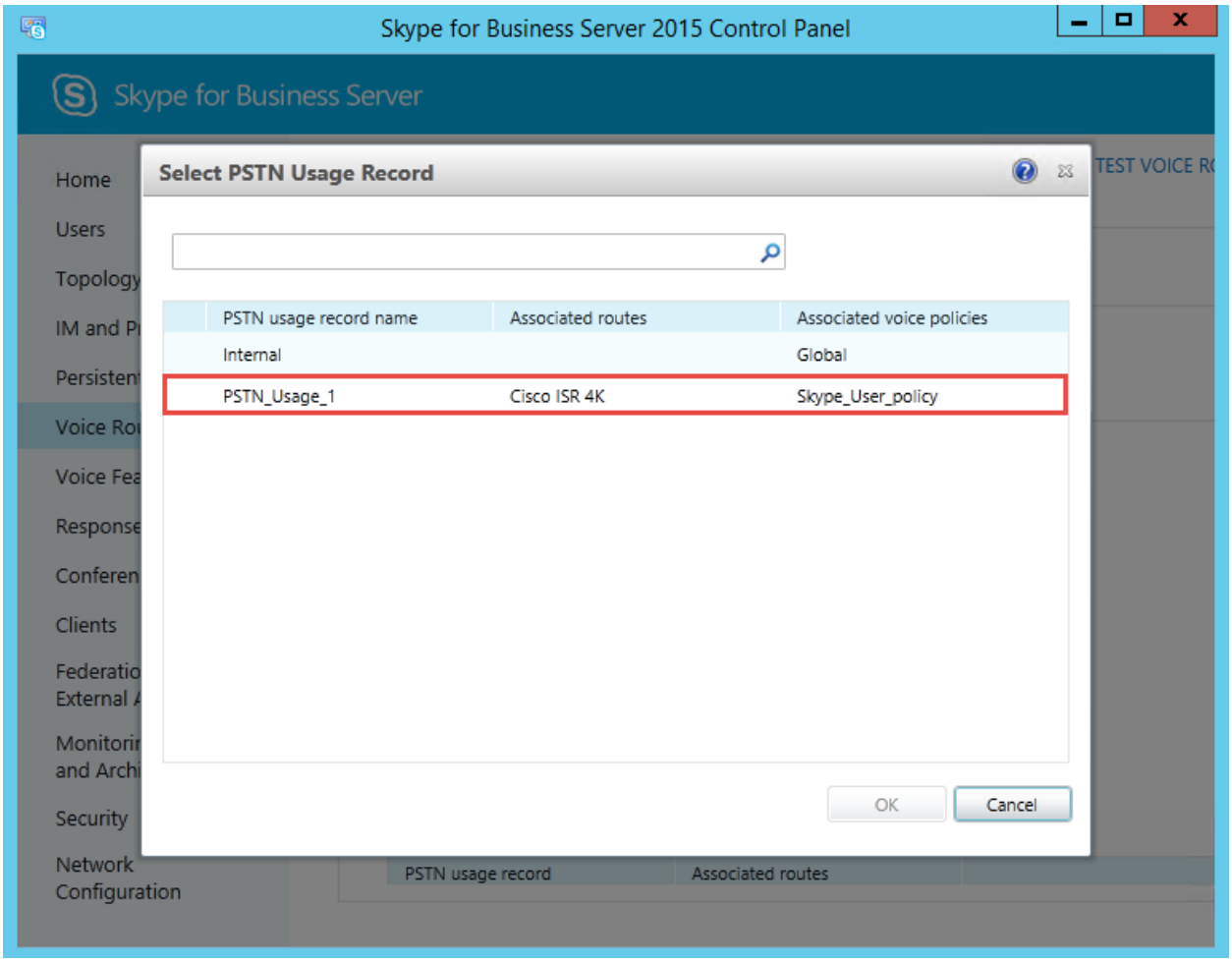

Figure 27 Associate PSTN Usage to the Trunk

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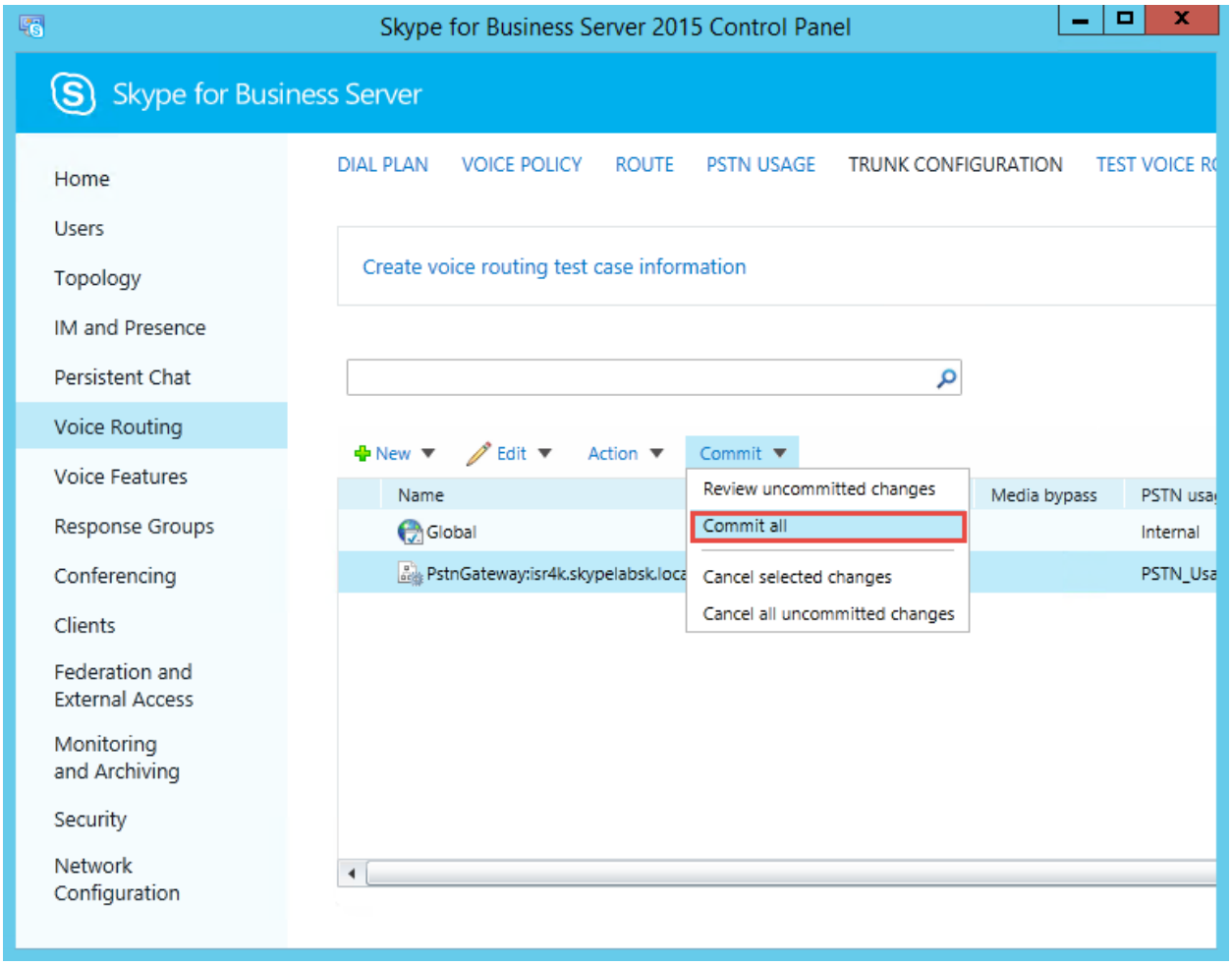

Figure 28 Commit the Changes to the Trunk

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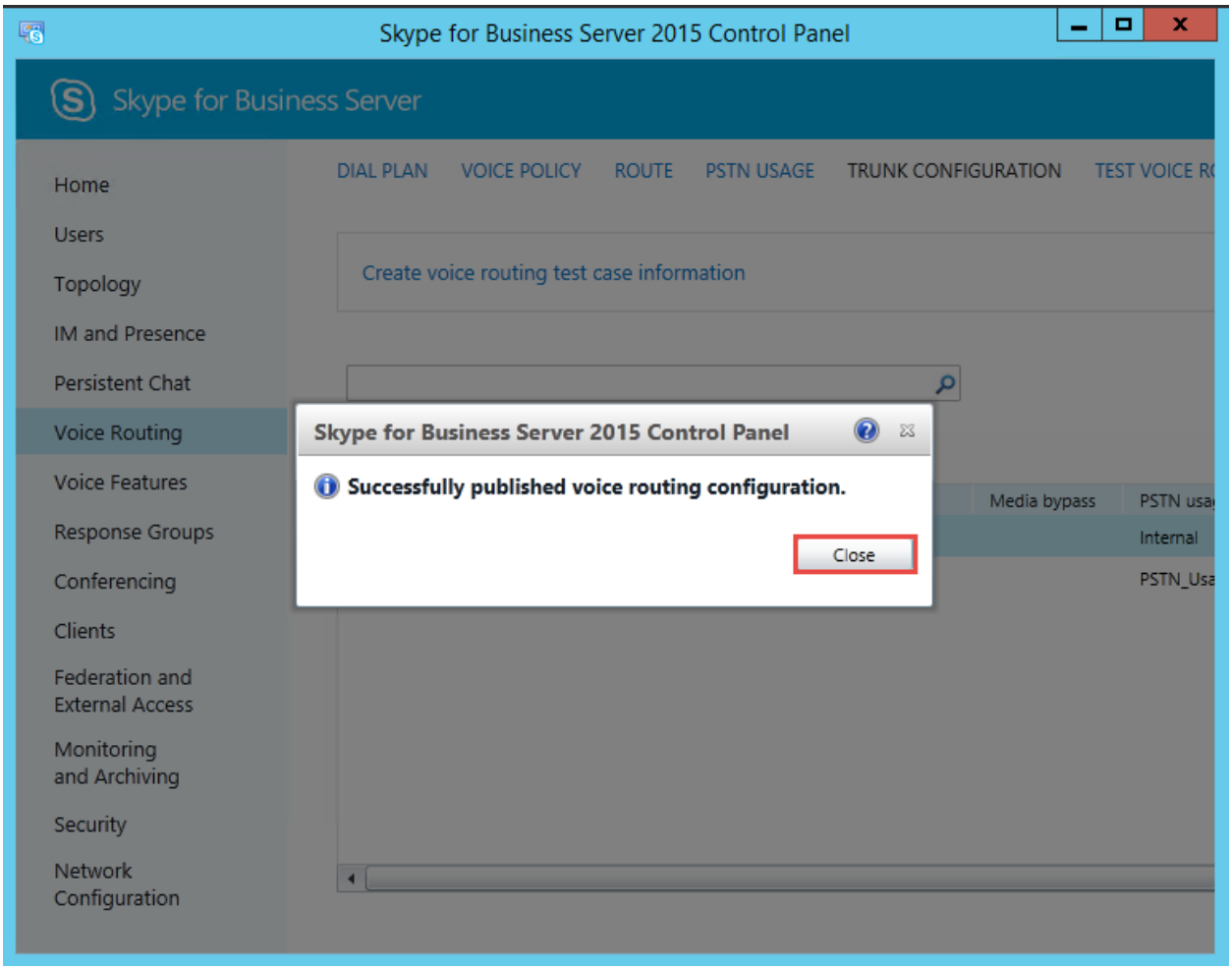

Figure 29 Trunk to CUBE added successfully

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User Configuration

- Select the Skype Users who are intend to the use the Enterprise Voice feature and fill the Verizon DID in the Line URI field. Select the newly added User Voice Policy in 'Voice Policy' field.

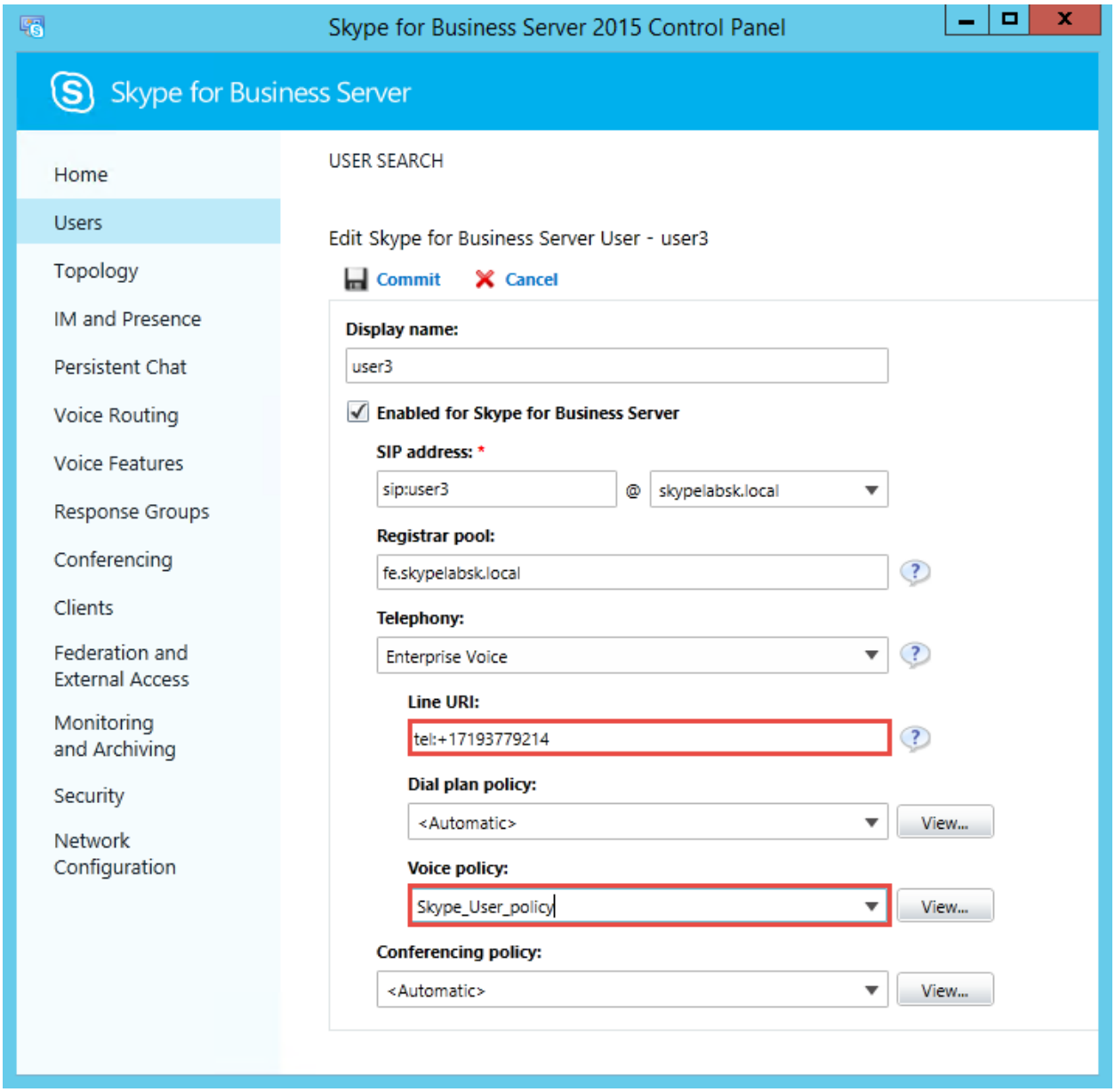

Figure 30 Skype User Configuration 1

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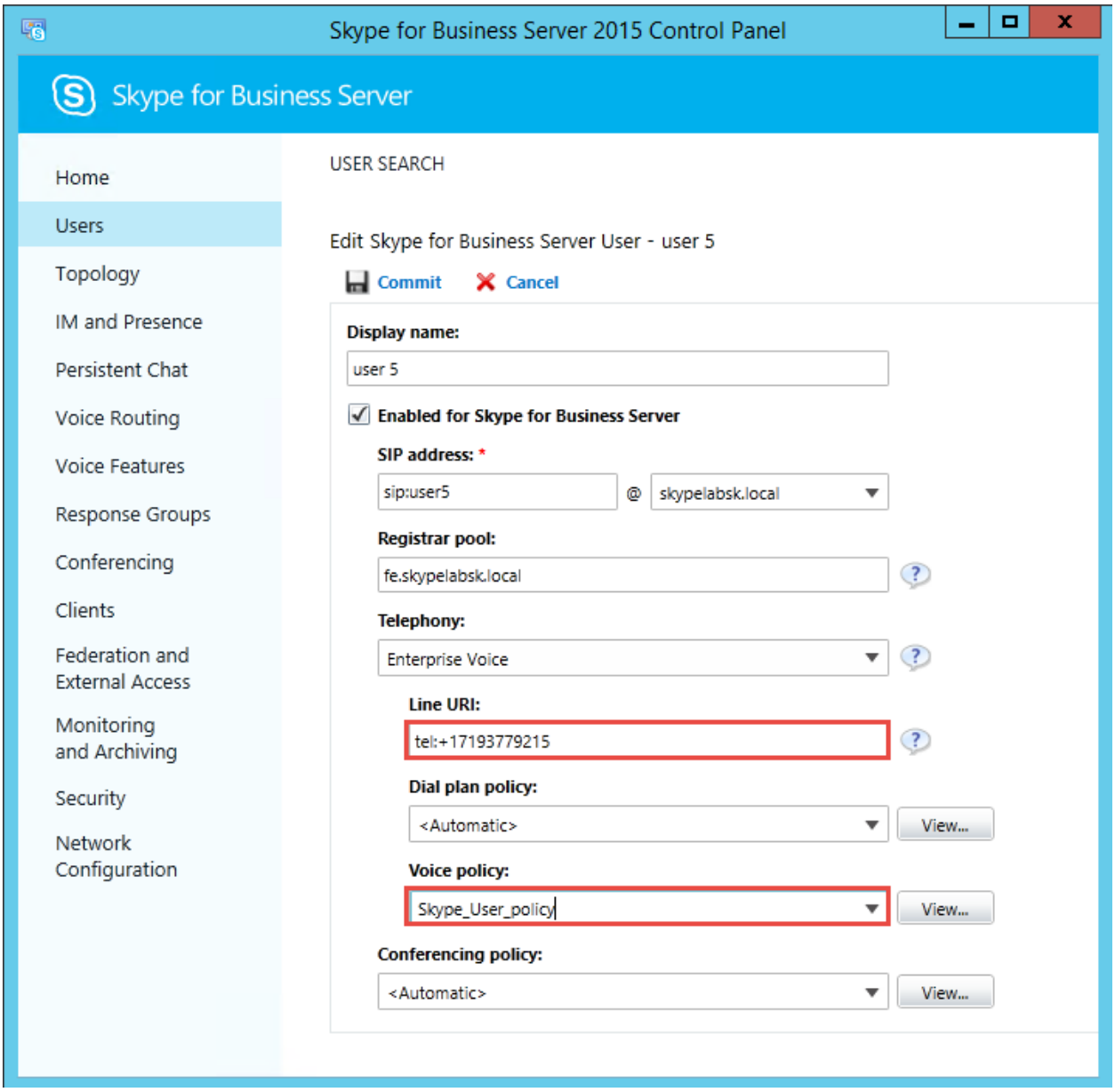

Figure 31 Skype User Configuration 2

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Acronyms

Acronym	Definitions
CPE	Customer Premise Equipment
Cisco UBE	Cisco Unified Border Element
Cisco UCM	Cisco Unified Communications Manager
MTP	Media Termination Point
POP	Point of Presence
PSTN	Public Switched Telephone Network
ESBC	Enterprise Session Border Controller
SCCP	Skinny Client Control Protocol
SIP	Session Initiation Protocol

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