Application Note

Microsoft Skype for Business Server [v6.0.9319.0] to Verizon Business SIP Trunk via Cisco Unified Border Element 11.5.2 [v16.3.1a, ISR4431/XE- 16.3.1a]

February 03, 2017

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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 11.5.2) IOS-XE 16.03.1a can be used. The Cisco Unified Border Element (Cisco UBE) 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 11.5.2) IOS-XE version 16.03.1a 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 11.5.2) IOS-XE version 16.03.1a.
- 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

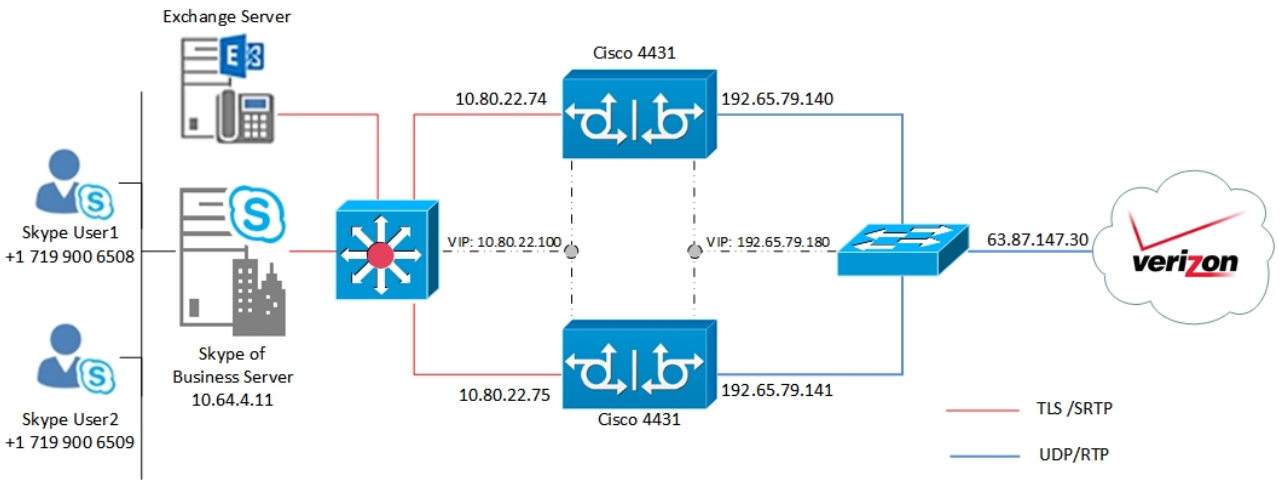

Figure 1 Network Topology

- 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 using it FQDN. 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 TLS with SRTP.

IP-PBX - CUBE Trunk Settings:

Setting	Value
Media Bypass	ON
Encryption Support	ON
REFER Support	ON
Session Timer	ON
Early Media support with PRACK	ON
Transport from CUBE to Skype for Business	TLS with SRTP
Transport from CUBE to Service Provider	UDP with RTP

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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: 11.5.2, SW-Version: 16.03.1a, XE- 16.03.1a
- Microsoft Skype for Business Server 2015- Version: 6.0.9319.0
- Microsoft Skype for Business Client – Version 15.0.4867.1001

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 using TLS with 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 ON in trunk between Skype for business and CUBE. So the media flows directly from Skype to CUBE and vice versa.
- 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

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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.

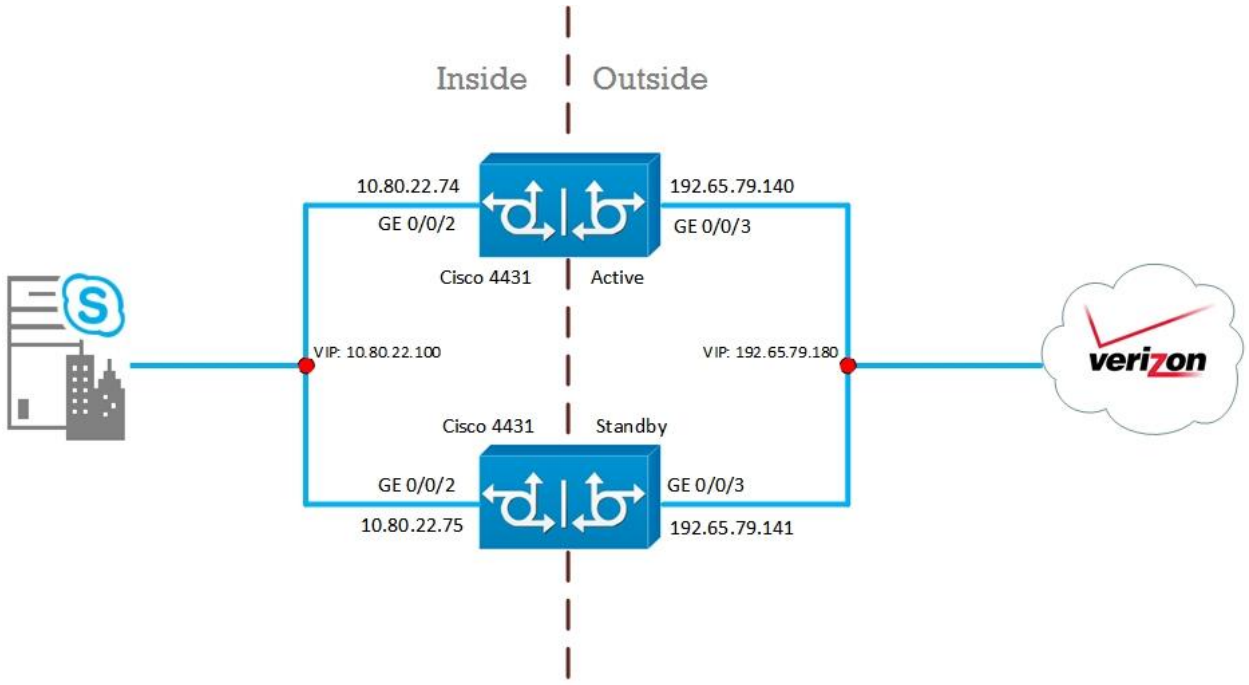

Figure 2 High Availability topology

CUBE 1:

```
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
```

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```
 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 192.65.79.140 255.255.255.128
 media-type rj45
 negotiation auto
 redundancy rii 2
 redundancy group 1 ip 192.65.79.180 exclusive
!
```

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CUBE 2:

```
! 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 WAN
 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 192.65.79.141 255.255.255.128
 media-type rj45
 negotiation auto
 redundancy rii 2
 redundancy group 1 ip 192.65.79.180 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 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
  sip-profiles 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

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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
```

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Dial peers

Dial-peer to Skype for Business using 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:fe01.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 options-keepalive
 voice-class sip session refresh
 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 +1..........
```

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```
 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 copy-list 1
 voice-class sip session refresh
 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
 rtcp keepalive
 srtp
 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 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
```

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```
 rtcp keepalive
 srtp
 no vad
!
```

Dial-peer to Verizon using UDP and RTP:

```
!
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 ipv4:152.188.29.149:5072
 session transport udp
 voice-class sip rel1xx supported "100rel"
 voice-class sip asserted-id pai
 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
 codec g711ulaw
 no vad
!
dial-peer voice 201 voip
 description incoming from PSTN
 translate-outgoing called 25
 session protocol sipv2
 session transport udp
```

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```
 incoming called-number 719.......
 voice-class sip rel1xx supported "100rel"
 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
 codec g711ulaw
 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:

```
!
version 16.3
service timestamps debug datetime msec
service timestamps log datetime msec
no platform punt-keepalive disable-kernel-core
!
hostname ISR4KR1
!
boot-start-marker
boot system flash isr4400-universalk9.16.03.01a.SPA.bin
boot-end-marker
!
!
vrf definition Mgmt-intf
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
!
logging buffered 9999999
no logging console
enable password ******
```

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```
!
no aaa new-model
!
ipc zone default
 association 1
  no shutdown
!
ip host dc.skypelabsk.local 10.64.4.10
ip host fe01.skypelabsk.local 10.64.4.11
ip host isr4k.skypelabsk.local 10.80.22.75
ip name-server 10.64.4.10

no ip domain lookup
!
subscriber templating
!
multilink bundle-name authenticated
!
crypto pki trustpoint SFBCA
 enrollment terminal
 serial-number
 fqdn isr4k.skypelabsk.local
 subject-name CN=isr4k.skypelabsk.local
 revocation-check none
 rsakeypair SFBCAKey
!
!
crypto pki certificate chain SFBCA
 certificate 500000004E4EBA4EF5C77B52D600000000004E
```

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3082057C 30820464 A0030201 02021350 0000004E 4EBA4EF5 C77B52D6 00000000
004E300D 06092A86 4886F70D 01010505 00305031 15301306 0A099226 8993F22C
64011916 056C6F63 616C311A 3018060A 09922689 93F22C64 0119160A 736B7970
656C6162 736A311B 30190603 55040313 12736B79 70656C61 62736A2D 44433031
2D434130 1E170D31 36313032 34313933 3833375A 170D3138 31303234 31393338
33375A30 21311F30 1D060355 04031316 69737234 6B2E736B 7970656C 6162736A
2E6C6F63 616C3082 0122300D 06092A86 4886F70D 01010105 00038201 0F003082
010A0282 0101009E 413A9039 F6CC62F5 3E27EFD4 BBC95D29 E176D49B 8AAA5B92
20BD9EAB 16A6A108 E1BA11DF 4234D63A AD0E82D1 C79105FB 9C555CA9 53A31D12
73978ABF 8F5DBDC1 1E11AECF 42234307 14F482EA BDB9152B 15D3F5B3 CD747C02
3F31C362 521FBC1C 98280F27 AB53E51F F55D723E 03DE6B71 358E73A0 44BCF786
401FB967 65F7216A C7B8917A A92A9274 3A0227AC 738BC43F 40FBDF54 A99FDA62
D9844FCF 5BE5370C F89CD4D5 BB9E6F74 A17CD165 6ACADBEB D1CA85DD 6FB4FFE4
5B0BF231 68B5238B 97131DE3 7A2756BE 4930CE3C C2CCBF11 F2A57BAC 108FAAFA
DAAE81FC 57D101D3 71BC0304 A3D9C641 0A100538 78B50373 23D6A186 1543D641
D0A3309D D8543B02 03010001 A382027C 30820278 300E0603 551D0F01 01FF0404
030204F0 301D0603 551D0E04 16041412 7245A057 8C6843D1 802EA3ED 218A0889
DFBD3830 1F060355 1D230418 30168014 D17C5CD9 2CCBD22D 8BFC99AB AF07D194
4522C018 3081D206 03551D1F 0481CA30 81C73081 C4A081C1 A081BE86 81BB6C64
61703A2F 2F2F434E 3D736B79 70656C61 62736A2D 44433031 2D43412C 434E3D44
4330312C 434E3D43 44502C43 4E3D5075 626C6963 2532304B 65792532 30536572
76696365 732C434E 3D536572 76696365 732C434E 3D436F6E 66696775 72617469
6F6E2C44 433D736B 7970656C 6162736A 2C44433D 6C6F6361 6C3F6365 72746966
69636174 65526576 6F636174 696F6E4C 6973743F 62617365 3F6F626A 65637443
6C617373 3D63524C 44697374 72696275 74696F6E 506F696E 743081C9 06082B06
01050507 01010481 BC3081B9 3081B606 082B0601 05050730 028681A9 6C646170
3A2F2F2F 434E3D73 6B797065 6C616273 6A2D4443 30312D43 412C434E 3D414941
2C434E3D 5075626C 69632532 304B6579 25323053 65727669 6365732C 434E3D53
65727669 6365732C 434E3D43 6F6E6669 67757261 74696F6E 2C44433D 736B7970

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```
  656C6162 736A2C44 433D6C6F 63616C3F 63414365 72746966 69636174 653F6261
  73653F6F 626A6563 74436C61 73733D63 65727469 66696361 74696F6E 41757468
  6F726974 79303D06 092B0601 04018237 15070430 302E0626 2B060104 01823715
  0887C882 5984899B 76828187 3786D0B2 7386C9D7 0F6B879C B26A82DB CD030201
  6402010A 301D0603 551D2504 16301406 082B0601 05050703 0106082B 06010505
  07030230 2706092B 06010401 8237150A 041A3018 300A0608 2B060105 05070301
  300A0608 2B060105 05070302 300D0609 2A864886 F70D0101 05050003 82010100
  9D150FAD E8D1791C 26C471AC 4561F763 9E8E29FB 340A7CDD 17D8A0A6 0917ED39
  652A39C8 86129758 8CD293DB 77E6962D 035C58A1 9B0E5A2B C825A940 91DA6F06
  FD93CFB3 3EB56D2C D2DA8BAE 109BCA9D E83CEAC2 D2DA1C37 6E59BAF9 7EAAC66E
  9B786F1B C8B38D79 EED2C302 9CAD5A55 A968429D 2DE3F9C9 9675CF62 366966CB
  9EEB06C9 F5244953 782F3925 849C6358 8099CA6D FA26727E 5158646A B6C67EDD
  052FA89B 1B58C7B1 3A969ED3 07AAE3EB C6576CE9 D67530F8 A9BED940 0B9C8341
  209CEBD1 68893E64 FBDEDA75 4BC14FBE 05F0115A A604C026 065D752E D64D6DC5
  FFF8B550 3F135130 EEA7CE13 BE75F9E8 9948A6FA 320888A8 B1C04CE1 DB9A3F91
      quit
certificate ca 2C0BFAFACCBD24A1420DEF837B9FBC8F
  3082037B 30820263 A0030201 0202102C 0BFAFACC BD24A142 0DEF837B 9FBC8F30
  0D06092A 864886F7 0D010105 05003050 31153013 060A0992 268993F2 2C640119
  16056C6F 63616C31 1A301806 0A099226 8993F22C 64011916 0A736B79 70656C61
  62736A31 1B301906 03550403 1312736B 7970656C 6162736A 2D444330 312D4341
  301E170D 31353036 30393138 35383534 5A170D32 30303630 39313930 3835325A
  30503115 3013060A 09922689 93F22C64 01191605 6C6F6361 6C311A30 18060A09
  92268993 F22C6401 19160A73 6B797065 6C616273 6A311B30 19060355 04031312
  736B7970 656C6162 736A2D44 4330312D 43413082 0122300D 06092A86 4886F70D
  01010105 00038201 0F003082 010A0282 010100A4 65F31045 74F51718 C32E37E1
  7EE69305 B93C6A07 7DEA2BAD EB854545 2C2A4569 AF0CF2A7 DD525288 7FA9F0BB
  7F7B9DFE E05C0A19 9C205F1E E3C913EF 753B5A88 A2B9CE4B B184E265 EEEDD894
  BFA4FE27 AC778CD4 5D76A2EF 43F2DB10 12470BF8 0807EC2F EA64D0DC 386B38EC
```

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```
  0A46454A A456DBD8 FB0AE0B5 B9AFD285 38F818C9 8E3BCD39 47CE2905 378A9128
  1836C101 7C368D89 8509281F 6F12920A 971257DD CCC23BE9 92860C8C CD47B52C
  17887B9F A20B2995 FA26D0F9 6C34B64D 672C6B76 85AEA657 C61141CF 3382836E
  6392C6EE 66F62BAB 2E72A77B 24A7A14E C34A7439 F7C460D3 DA0FB17C 9D9DC25A
  DAFB62EE 850CF72F FC069549 773D503B 44D3B102 03010001 A351304F 300B0603
  551D0F04 04030201 86300F06 03551D13 0101FF04 05300301 01FF301D 0603551D
  0E041604 14D17C5C D92CCBD2 2D8BFC99 ABAF07D1 944522C0 18301006 092B0601
  04018237 15010403 02010030 0D06092A 864886F7 0D010105 05000382 01010030
  7404A98F 9B790586 F4A8D827 5CB8BD58 E692E9CF 2C79D897 768E7F85 FF1A717D
  B2214917 5B2C8417 00787E4F EA21E1D3 F8B303DB CBB8A955 7314B955 959B47FD
  48FBD08F 79038EE7 AC560B06 4612D894 B01E573B 4D76A02F D0B4C9C0 2D289F8A
  A49C8A68 F2CAA915 B440384A BB459345 99A901F1 241A8DF4 6A2274D8 C902B806
  A9F658BA 76086857 3ED1AA3E 4CA79EE9 D2255E06 92E464C9 18764495 F753EB53
  5A60EB7F 4A8E58D7 B32A3563 AE8F90F7 E52D3B46 47F25409 4DAFE214 808D6F2C
  FA79E6FF AA11F81E 14C8D6F9 B5DCC86B DBD9216C D6557FF9 D0D0F83F E0F0E004
  33974FFF B212C328 49740D12 E96AA1CB 626BBCBC 8E786743 305F0DFB 3F3883
      quit


cts logging verbose
!
voice rtp send-recv
!
voice service voip
 no ip address trusted authenticate
 rtcp keepalive
 address-hiding
 mode border-element license capacity 20
 allow-connections sip to sip
```

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```
 redundancy-group 1
 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
  sip-profiles inbound
!
!
voice class uri SFB sip
 host FE01.skypelabsk.local
!
voice class uri FQDNsfb sip
 host 10.80.22.75
!
voice class uri PSTN sip
 host 152.188.29.149
voice class codec 2
 codec preference 1 g711ulaw
 codec preference 2 g729r8 bytes 30
 codec preference 3 g726r32
 codec preference 4 g729br8
!
!
```

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```
voice class sip-profiles 2
 request ANY sip-header Allow-Header modify ",PRACK" ""
!
voice class sip-profiles 1
 request INVITE sip-header Diversion modify "sip:\+1" "sip:"
 request INVITE sdp-header Audio-Attribute add "a=sendrecv"
!
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 2 /^19\(..........\)$/ /1\1/
 rule 3 /^9\(..........\)$/ /\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
!
license udi pid ISR4431/K9 sn FOC1844988
license boot level appxk9
license boot level uck9
license boot level securityk9
!
diagnostic bootup level minimal
spanning-tree extend system-id
!
username cisco privilege 15 secret 5 xxxx
!
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
!
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 192.65.79.140 255.255.255.128
 media-type rj45
 negotiation auto
 redundancy rii 2
```

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```
 redundancy group 1 ip 192.65.79.180 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 0.0.0.0 192.65.79.129
ip route 10.64.0.0 255.255.0.0 10.64.1.1
ip route 10.80.10.0 255.255.255.0 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
!
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
```

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```
dspfarm profile 1 conference security
 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:fe01.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 options-keepalive
 voice-class sip session refresh
 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
```

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```
 session protocol sipv2
 session transport tcp tls
 incoming called-number +1..........
 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 copy-list 1
 voice-class sip session refresh
 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
 rtcp keepalive
 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 ipv4:152.188.29.149:5072
 session transport udp
 voice-class sip rel1xx supported "100rel"
```

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```
 voice-class sip asserted-id pai
 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
 codec g711ulaw
 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 sip rel1xx supported "100rel"
 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
 codec g711ulaw
 no vad
!
dial-peer voice 786 voip
 description TEST for REFER
 translation-profile outgoing e164
```

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```
 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 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
 rtcp keepalive
 srtp
 no vad
!
!
!
sip-ua
 no remote-party-id
 retry invite 1
 timers options 1000
 connection-reuse
 crypto signaling default trustpoint SFBCA
!
!
line con 0
 stopbits 1
line aux 0
```

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```
 stopbits 1
line vty 0
 session-timeout 90
 exec-timeout 960 0
 no activation-character
 logging synchronous
 login local
 transport preferred ssh
 transport input all
 stopbits 1
line vty 1
 exec-timeout 960 0
 logging synchronous
 login
 transport input all
line vty 2 4
 exec-timeout 960 0
 logging synchronous
 login
 transport input all
!
end
```

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Standby Cisco UBE:

```
version 16.3
service timestamps debug datetime msec
service timestamps log datetime msec
no platform punt-keepalive disable-kernel-core
!
hostname ISR4KR2
!
boot-start-marker
boot system flash isr4400-universalk9.16.03.01a.SPA.bin
boot-end-marker
!
!
vrf definition Mgmt-intf
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
!
!
no aaa new-model
!
ip host dc.skypelabsk.local 10.64.4.10
ip host fe01.skypelabsk.local 10.64.4.11
ip host isr4k.skypelabsk.local 10.80.22.75
ip name-server 10.64.4.10
```

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```
subscriber templating
!
multilink bundle-name authenticated
!
crypto pki trustpoint SFBCA
 enrollment terminal
 serial-number
 fqdn isr4k.skypelabsk.local
 subject-name CN=isr4k.skypelabsk.local
 revocation-check none
 rsakeypair SFBCAKey
!
crypto pki certificate chain SFBCA
 certificate 5000000058116986E9168CF5B5000000000058
  3082052D 30820415 A0030201 02021350 00000058 116986E9 168CF5B5 00000000
  0058300D 06092A86 4886F70D 01010505 00305031 15301306 0A099226 8993F22C
  64011916 056C6F63 616C311A 3018060A 09922689 93F22C64 0119160A 736B7970
  656C6162 736A311B 30190603 55040313 12736B79 70656C61 62736A2D 44433031
  2D434130 1E170D31 36313231 36313235 3234365A 170D3138 31323136 31323532
  34365A30 21311F30 1D060355 04031316 69737234 6B2E736B 7970656C 6162736A
  2E6C6F63 616C3082 0122300D 06092A86 4886F70D 01010105 00038201 0F003082
  010A0282 01010091 D76CB7B3 C5ADE7DA F02EFC19 0FD4AA66 92745046 17568CEA
  B848FE0C 1C172A75 C02C7C18 B0DD5C0E 784803C1 B620BD0D E2ED8CA5 C62559C4
  034A6D36 738ED941 288DABCE 5EE7A384 0BD06F2C 936FB7BE C54FA75F 622A75F7
  226160D6 53CC4921 824E6A11 D0F6AD11 4436A5AB 6E7D577F 988714F5 A4ACF09D
  E5F53C96 F8FD10ED 9633F308 DD14608E 48874AF6 911A15F0 A844F194 C489C231
  6B94517C 8F8A5647 33ABA177 8C03CA14 123F40B6 3D100108 1AA16B84 BF84FC04
  0158843E 56B5B0B3 7640B596 B81D9382 9A723008 0CC693E3 385B9F6D 472867DE
  FE83D390 7243586B 0739575C B951CB55 A20CDF9D 4D6B6058 21B34196 268EA3B9
```

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```
 B198A486 34798D02 03010001 A382022D 30820229 300E0603 551D0F01 01FF0404
 030205A0 301D0603 551D0E04 160414E0 1888ECCF DAD3C021 DE3E86C1 9C70CBEC
 79CB1E30 1F060355 1D230418 30168014 D17C5CD9 2CCBD22D 8BFC99AB AF07D194
 4522C018 3081D206 03551D1F 0481CA30 81C73081 C4A081C1 A081BE86 81BB6C64
 61703A2F 2F2F434E 3D736B79 70656C61 62736A2D 44433031 2D43412C 434E3D44
 4330312C 434E3D43 44502C43 4E3D5075 626C6963 2532304B 65792532 30536572
 76696365 732C434E 3D536572 76696365 732C434E 3D436F6E 66696775 72617469
 6F6E2C44 433D736B 7970656C 6162736A 2C44433D 6C6F6361 6C3F6365 72746966
 69636174 65526576 6F636174 696F6E4C 6973743F 62617365 3F6F626A 65637443
 6C617373 3D63524C 44697374 72696275 74696F6E 506F696E 743081C9 06082B06
 01050507 01010481 BC3081B9 3081B606 082B0601 05050730 028681A9 6C646170
 3A2F2F2F 434E3D73 6B797065 6C616273 6A2D4443 30312D43 412C434E 3D414941
 2C434E3D 5075626C 69632532 304B6579 25323053 65727669 6365732C 434E3D53
 65727669 6365732C 434E3D43 6F6E6669 67757261 74696F6E 2C44433D 736B7970
 656C6162 736A2C44 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 0007EEE9 D1F21E46 6A6B2E86 60CCCDEA
 C9746813 45171AD8 77C2973D E4144737 7D797947 8ECAF5B6 1B7E6B8B 286F452C
 A4615757 56B9C353 164690FE 43D91C59 0EFFBB24 2540352F 2C368E94 5D621FFA
 596263B7 0DFD2216 72CE9654 4A54AD46 7E52DEFF 29F28936 6F3CC32F 4872C0C7
 1EAEDAFD 22003118 B455E78C D312AC4F 15F5B63E 937B43A5 4329E260 EC849A3C
 80F3FCE4 FF380232 C17CC2C8 E363E557 769A60EE FE370196 CEE6F9F2 D82CF789
 7FC8067F E483C801 5BEA8BF3 1DFCFB2E 20C548B7 C22E7E5B D6BA4396 6DA54855
 6464EFE2 CB8F9728 360A42AF 0837F879 6AFB4E18 004DFF1D 497C4176 0CC57393
 796AEAC8 3A98082E CFBFCF06 34CB6D30 02
     quit
certificate ca 2C0BFAFACCBD24A1420DEF837B9FBC8F
```

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```
3082037B 30820263 A0030201 0202102C 0BFAFACC BD24A142 0DEF837B 9FBC8F30
0D06092A 864886F7 0D010105 05003050 31153013 060A0992 268993F2 2C640119
16056C6F 63616C31 1A301806 0A099226 8993F22C 64011916 0A736B79 70656C61
62736A31 1B301906 03550403 1312736B 7970656C 6162736A 2D444330 312D4341
301E170D 31353036 30393138 35383534 5A170D32 30303630 39313930 3835325A
30503115 3013060A 09922689 93F22C64 01191605 6C6F6361 6C311A30 18060A09
92268993 F22C6401 19160A73 6B797065 6C616273 6A311B30 19060355 04031312
736B7970 656C6162 736A2D44 4330312D 43413082 0122300D 06092A86 4886F70D
01010105 00038201 0F003082 010A0282 010100A4 65F31045 74F51718 C32E37E1
7EE69305 B93C6A07 7DEA2BAD EB854545 2C2A4569 AF0CF2A7 DD525288 7FA9F0BB
7F7B9DFE E05C0A19 9C205F1E E3C913EF 753B5A88 A2B9CE4B B184E265 EEEDD894
BFA4FE27 AC778CD4 5D76A2EF 43F2DB10 12470BF8 0807EC2F EA64D0DC 386B38EC
0A46454A A456DBD8 FB0AE0B5 B9AFD285 38F818C9 8E3BCD39 47CE2905 378A9128
1836C101 7C368D89 8509281F 6F12920A 971257DD CCC23BE9 92860C8C CD47B52C
17887B9F A20B2995 FA26D0F9 6C34B64D 672C6B76 85AEA657 C61141CF 3382836E
6392C6EE 66F62BAB 2E72A77B 24A7A14E C34A7439 F7C460D3 DA0FB17C 9D9DC25A
DAFB62EE 850CF72F FC069549 773D503B 44D3B102 03010001 A351304F 300B0603
551D0F04 04030201 86300F06 03551D13 0101FF04 05300301 01FF301D 0603551D
0E041604 14D17C5C D92CCBD2 2D8BFC99 ABAF07D1 944522C0 18301006 092B0601
04018237 15010403 02010030 0D06092A 864886F7 0D010105 05000382 01010030
7404A98F 9B790586 F4A8D827 5CB8BD58 E692E9CF 2C79D897 768E7F85 FF1A717D
B2214917 5B2C8417 00787E4F EA21E1D3 F8B303DB CBB8A955 7314B955 959B47FD
48FBD08F 79038EE7 AC560B06 4612D894 B01E573B 4D76A02F D0B4C9C0 2D289F8A
A49C8A68 F2CAA915 B440384A BB459345 99A901F1 241A8DF4 6A2274D8 C902B806
A9F658BA 76086857 3ED1AA3E 4CA79EE9 D2255E06 92E464C9 18764495 F753EB53
5A60EB7F 4A8E58D7 B32A3563 AE8F90F7 E52D3B46 47F25409 4DAFE214 808D6F2C
FA79E6FF AA11F81E 14C8D6F9 B5DCC86B DBD9216C D6557FF9 D0D0F83F E0F0E004
33974FFF B212C328 49740D12 E96AA1CB 626BBCBC 8E786743 305F0DFB 3F3883
    quit
```

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```
voice service voip
 ip address trusted list
 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
 redirect ip2ip
 fax protocol pass-through g711ulaw
 sip
  bind control source-interface GigabitEthernet0/0/2
  bind media source-interface GigabitEthernet0/0/2
  session refresh
  header-passing
  referto-passing
  registrar server
  conn-reuse
  midcall-signaling passthru media-change
  sip-profiles inbound
!
voice class uri SFB sip
 host FE01.skypelabsk.local
!
voice class uri FQDNsfb sip
 host 10.80.22.74
```

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```
!
voice class uri PSTN sip
 host 152.188.29.149
!
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 1
 request INVITE sip-header Diversion modify "sip:\+1" "sip:"
 request INVITE sdp-header Audio-Attribute add "a=sendrecv"
!
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/
!
```

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```
voice translation-rule 3
 rule 1 /^1\(..........\)$/ /\1/
 rule 2 /^19\(..........\)$/ /1\1/
 rule 3 /^9\(..........\)$/ /\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
!
voice-card 0/1
 no watchdog
!
license udi pid ISR4431/K9 sn FOC18441KJL
license accept end user agreement
license boot level appxk9
license boot level uck9
license boot level securityk9
!
diagnostic bootup level minimal
spanning-tree extend system-id
!
```

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```
username cisco privilege 15 secret 5 xxxxx
!
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 10.64.4.19 255.255.0.0
 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
 description WAN
 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 192.65.79.141 255.255.255.128
 media-type rj45
 negotiation auto
 redundancy rii 2
 redundancy group 1 ip 192.65.79.180 exclusive
!
interface Service-Engine0/1/0
!
interface GigabitEthernet0
 vrf forwarding Mgmt-intf
 no ip address
 negotiation auto
!
interface Vlan1
 no ip address
 shutdown
!
ip forward-protocol nd
```

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```
ip http server
no ip http secure-server
ip route 0.0.0.0 0.0.0.0 192.65.79.129
ip route 10.64.0.0 255.255.0.0 10.64.1.1
ip route 172.16.0.0 255.255.0.0 10.80.22.1
!
ipv6 access-list preauth_v6
 permit udp any any eq domain
 permit tcp any any eq domain
 permit icmp any any nd-ns
 permit icmp any any nd-na
 permit icmp any any router-solicitation
 permit icmp any any router-advertisement
 permit icmp any any redirect
 permit udp any eq 547 any eq 546
 permit udp any eq 546 any eq 547
 deny ipv6 any any
!
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
!
```

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```
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:fe01.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 session refresh
 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 +1..........
 incoming uri request SFB
```

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```
 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 copy-list 1
 voice-class sip session refresh
 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
 rtcp keepalive
 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 ipv4:152.188.29.149:5072
 session transport udp
 voice-class sip rel1xx supported "100rel"
 voice-class sip asserted-id pai
 voice-class sip privacy-policy passthru
 voice-class sip profiles 1
 voice-class sip session refresh
```

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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
 codec g711ulaw
 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 sip rel1xx supported "100rel"
 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
 codec g711ulaw
 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
```

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```
 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 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
 rtcp keepalive
 srtp
 no vad
!
sip-ua
 no remote-party-id
 retry invite 1
 timers options 1000
 connection-reuse
 crypto signaling default trustpoint SFBCA
!
line con 0
 exec-timeout 0 0
 logging synchronous
 stopbits 1
line aux 0
 privilege level 15
 stopbits 1
line vty 0
 exec-timeout 0 0
 no activation-character
```

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```
 logging synchronous
 login local
 transport preferred ssh
 transport input telnet ssh
line vty 1 4
 exec-timeout 0 0
 logging synchronous
 login local
 transport input telnet ssh
!
ntp server 10.10.10.5
!
!
!
!
!
end
```

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Configuring Microsoft Skype for Business Server

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

PSTN gateway configuration

Trunk to CUBE using TLS

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

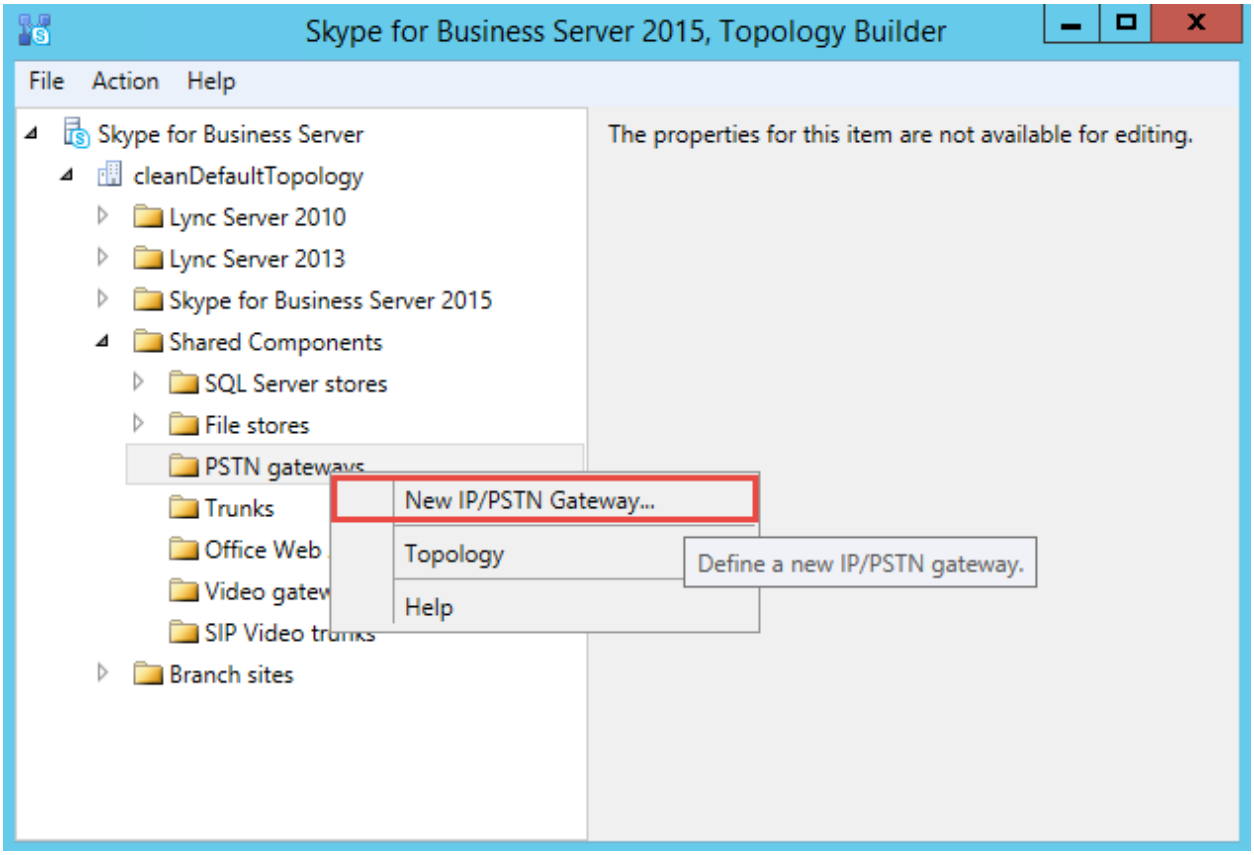

Figure 3 Add new IP/PSTN Gateway in Skype for Business Topology Builder

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

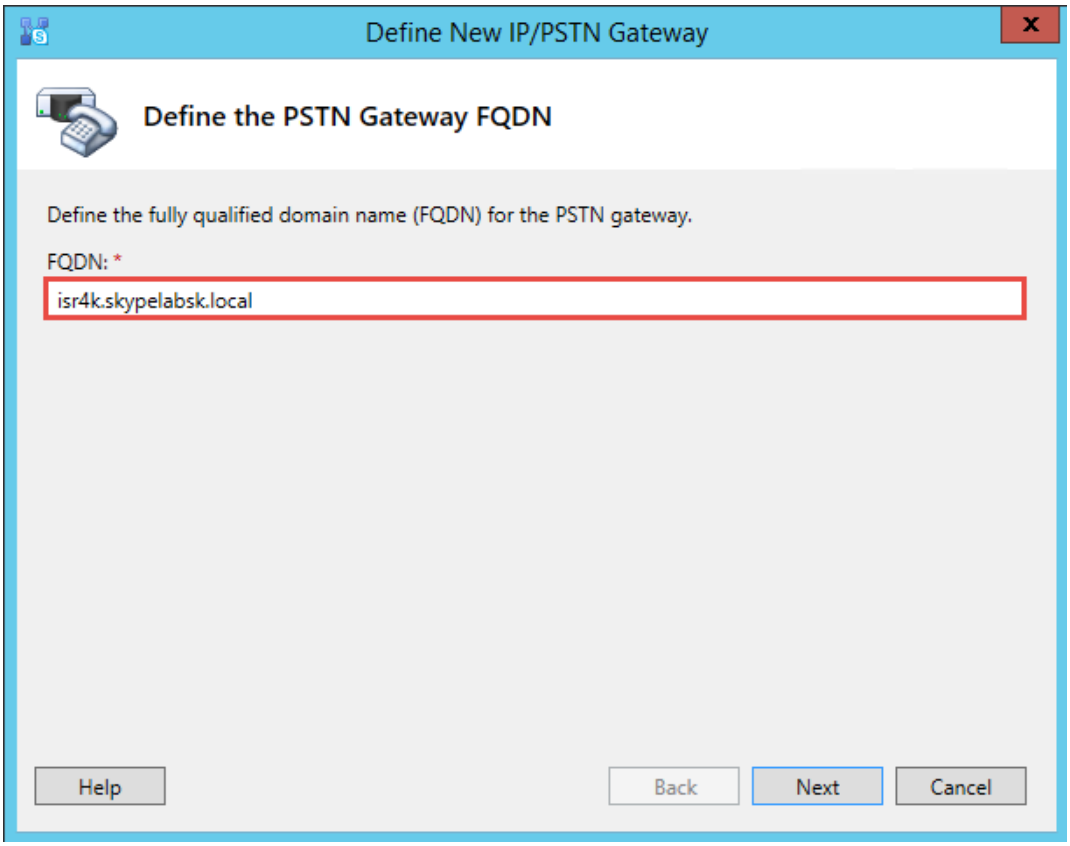

Figure 4 FQDN of the CUBE

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

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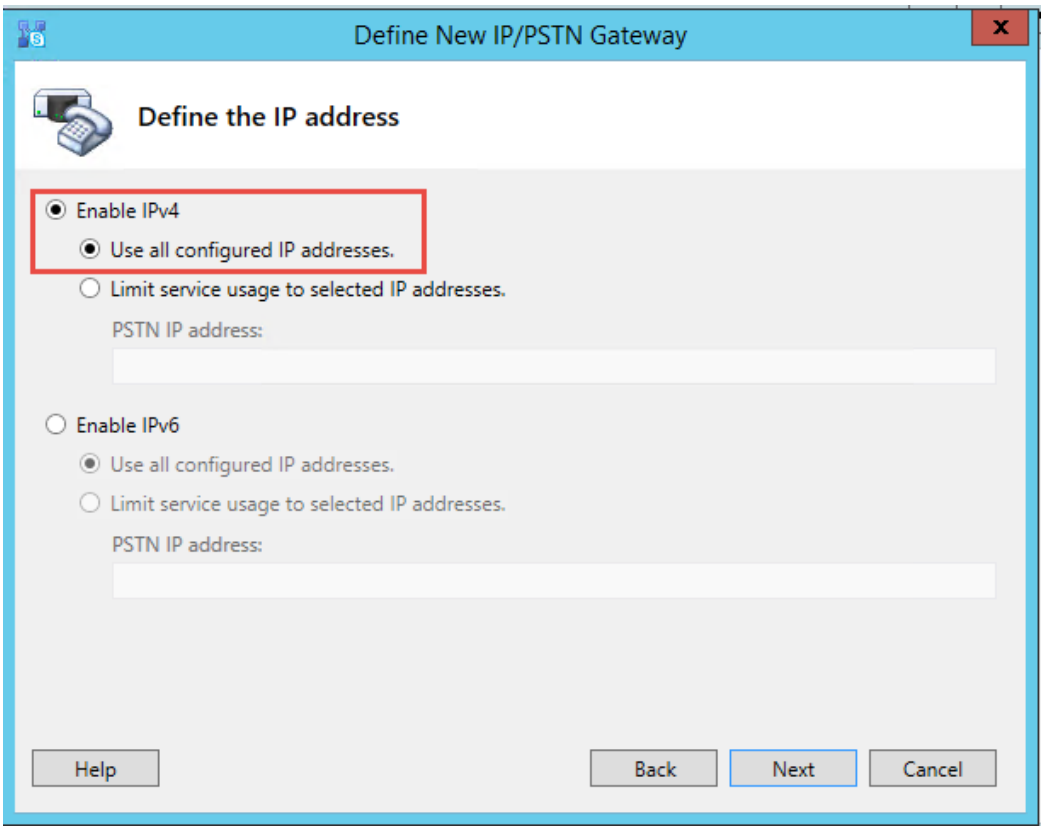

Figure 5: IPv4/IPv6 address selection

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

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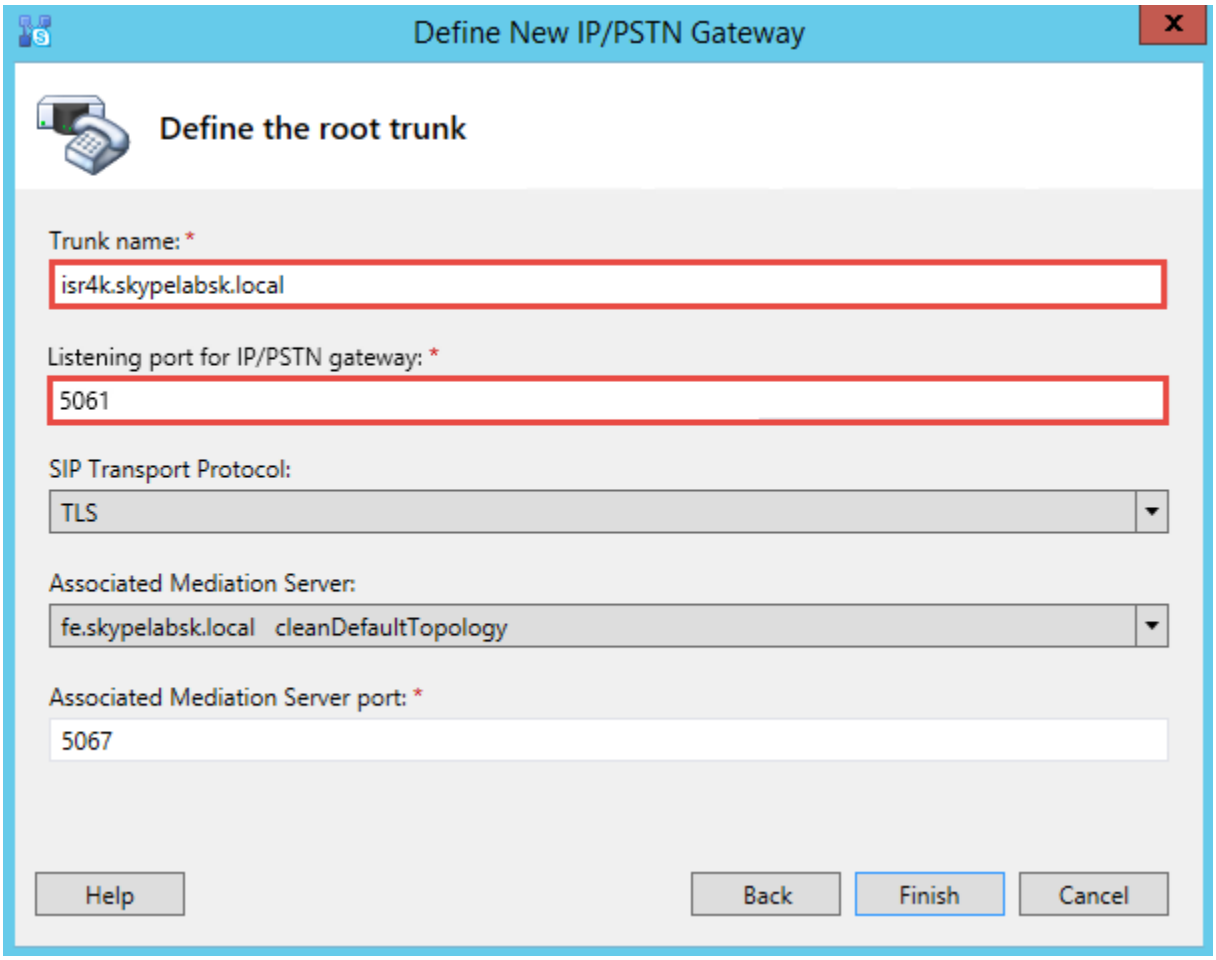

Figure 6: Transport protocol and Port number

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

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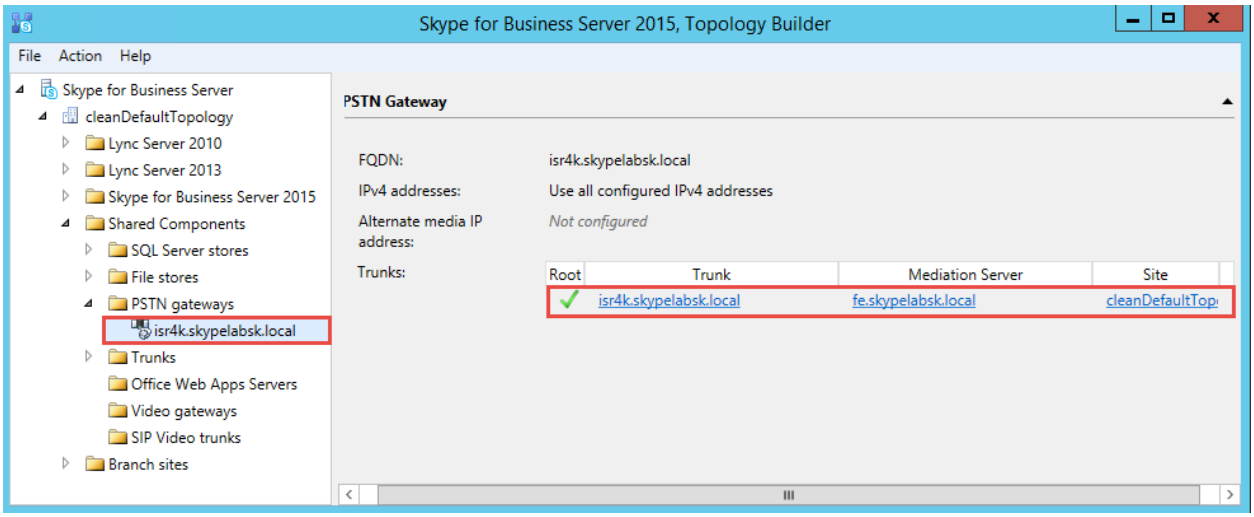

Figure 7 PSTN Gateway to CUBE is added successfully using TLS

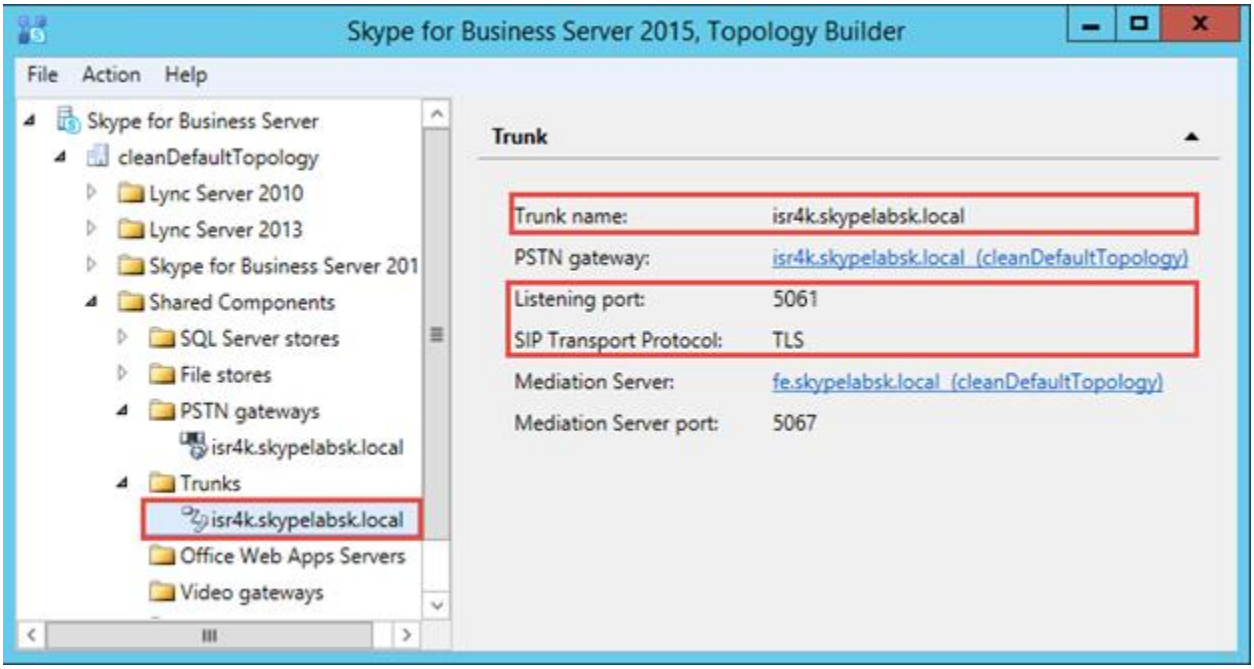

Figure 8 Trunk to CUBE is added successfully using TLS

Publish the skype for Business Topology

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

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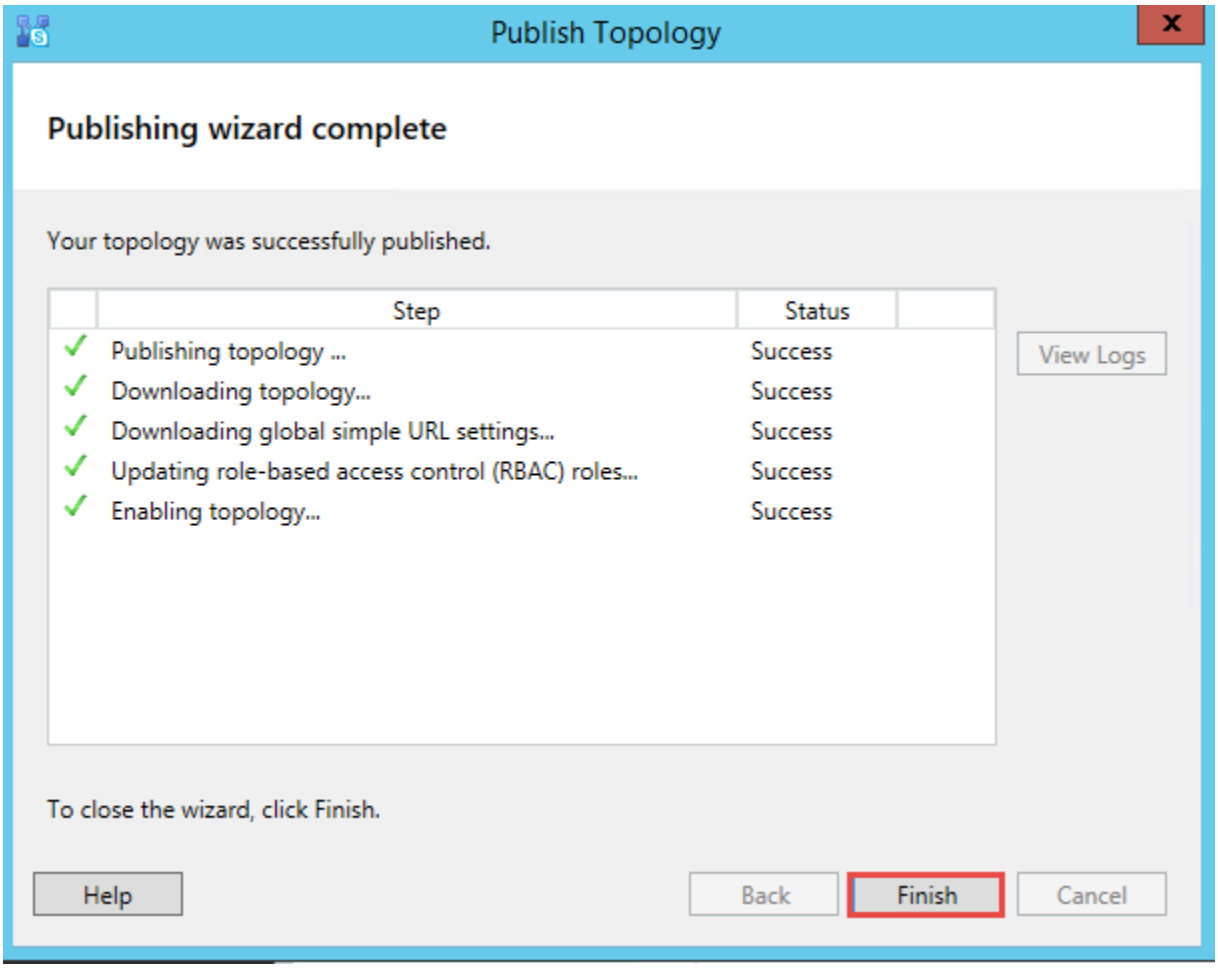

Figure 9 Changes to the Topology published successfully

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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.

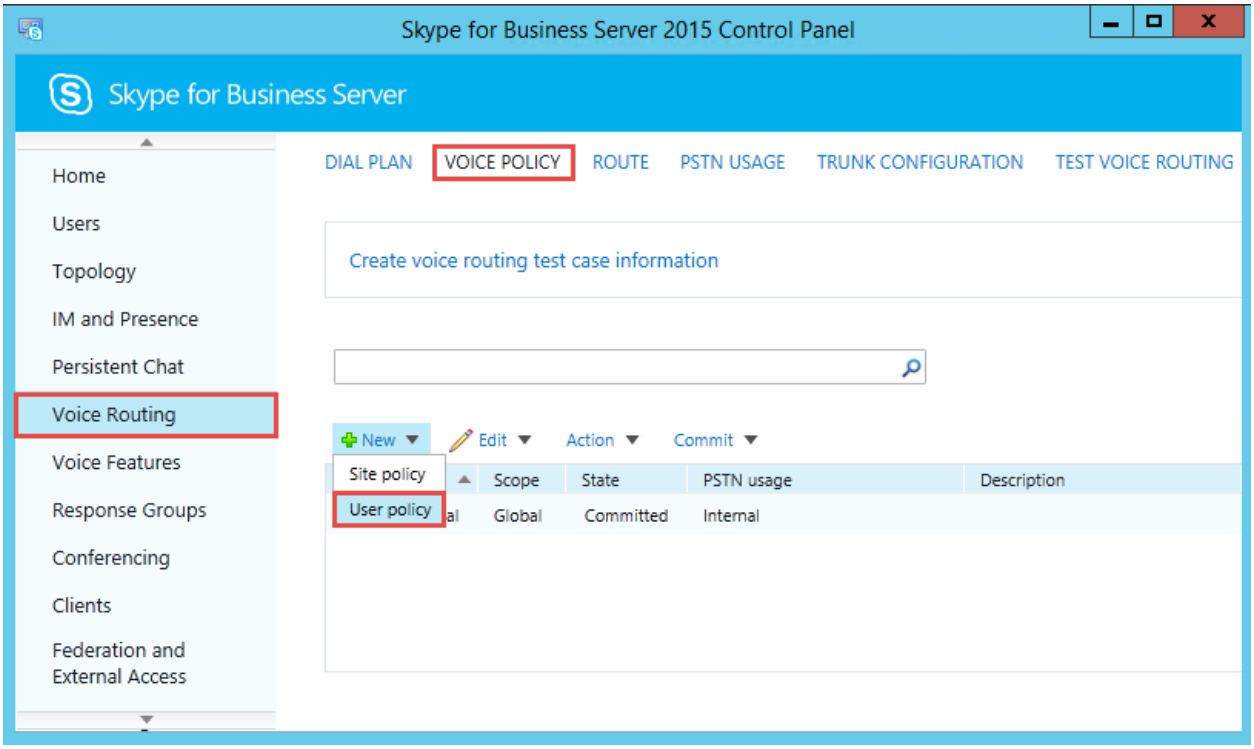

Figure 10 Voice Routing Configuration

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

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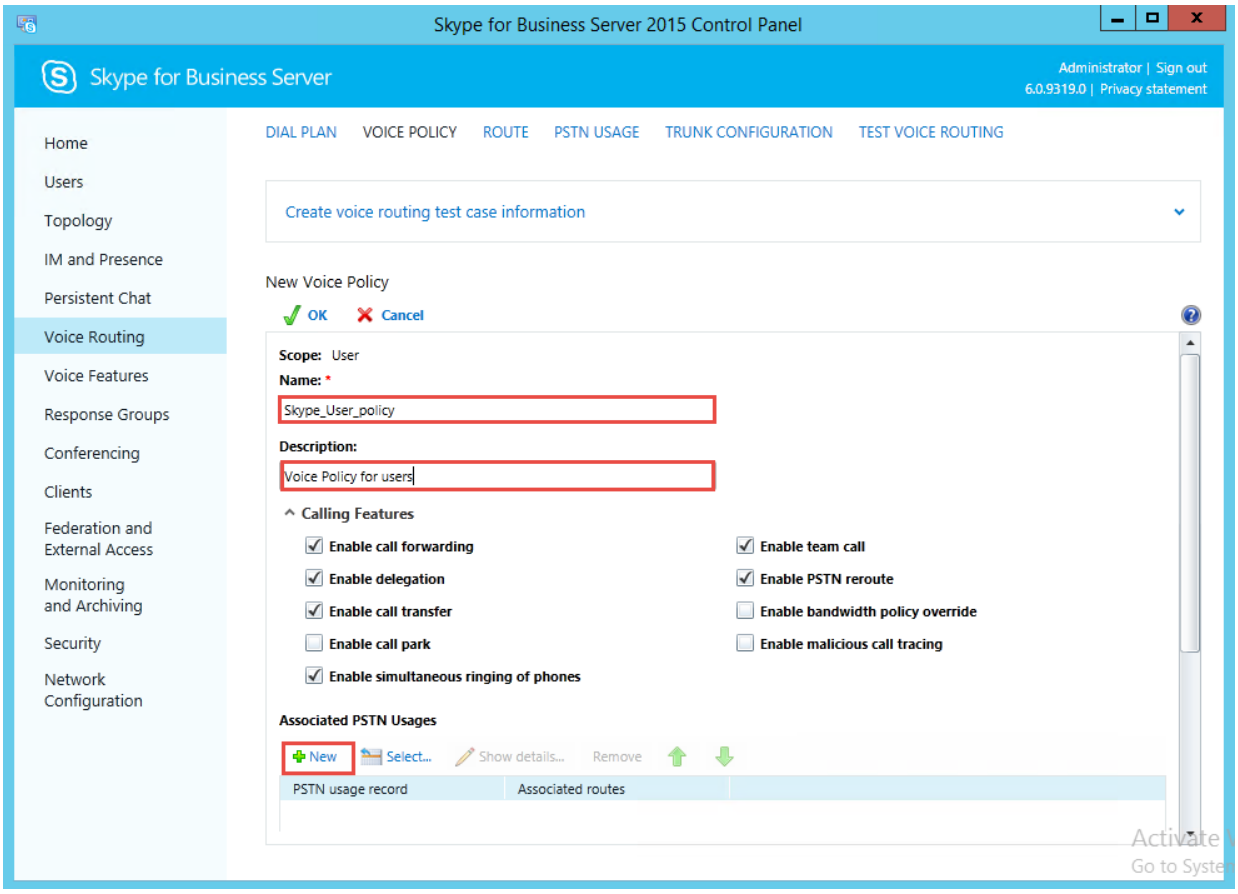

Figure 11 New User Voice Policy configuration

- Add a new PSTN Usage with name ‘PSTN_Usage_1’ and click on “New” to add a new Route.

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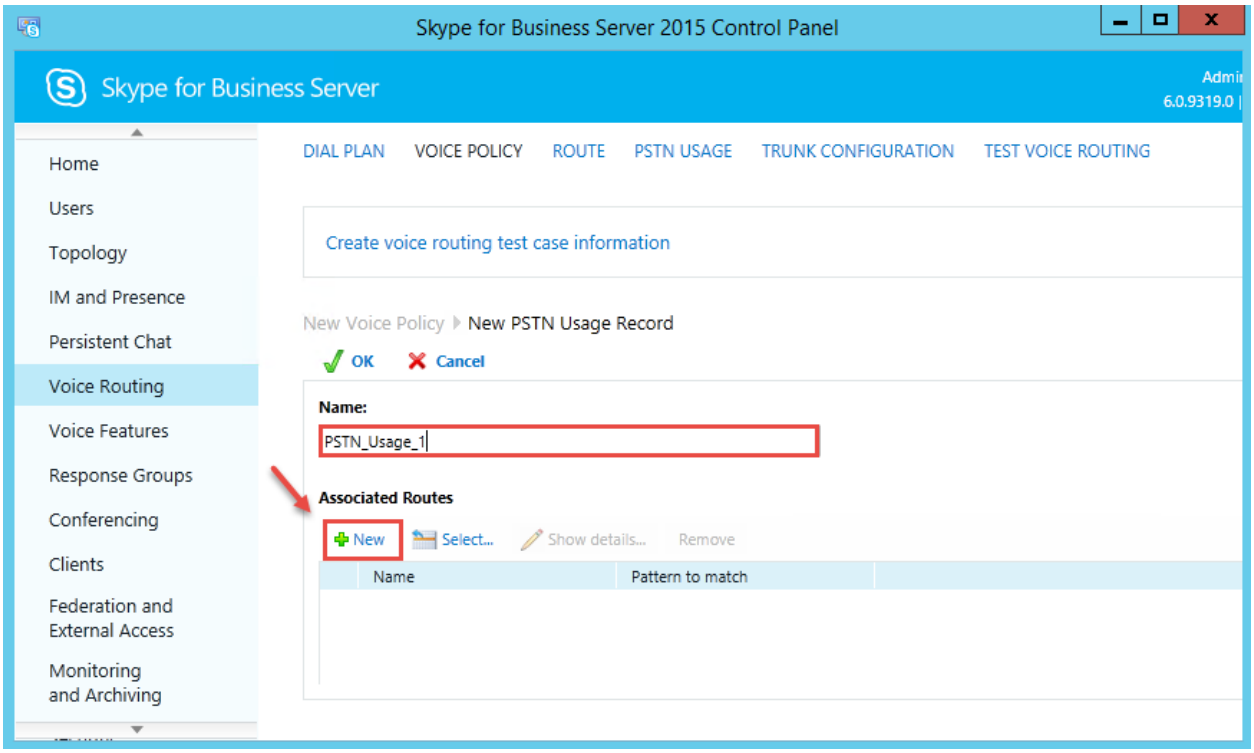

Figure 12 New PSTN Usage Record configuration

- 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"

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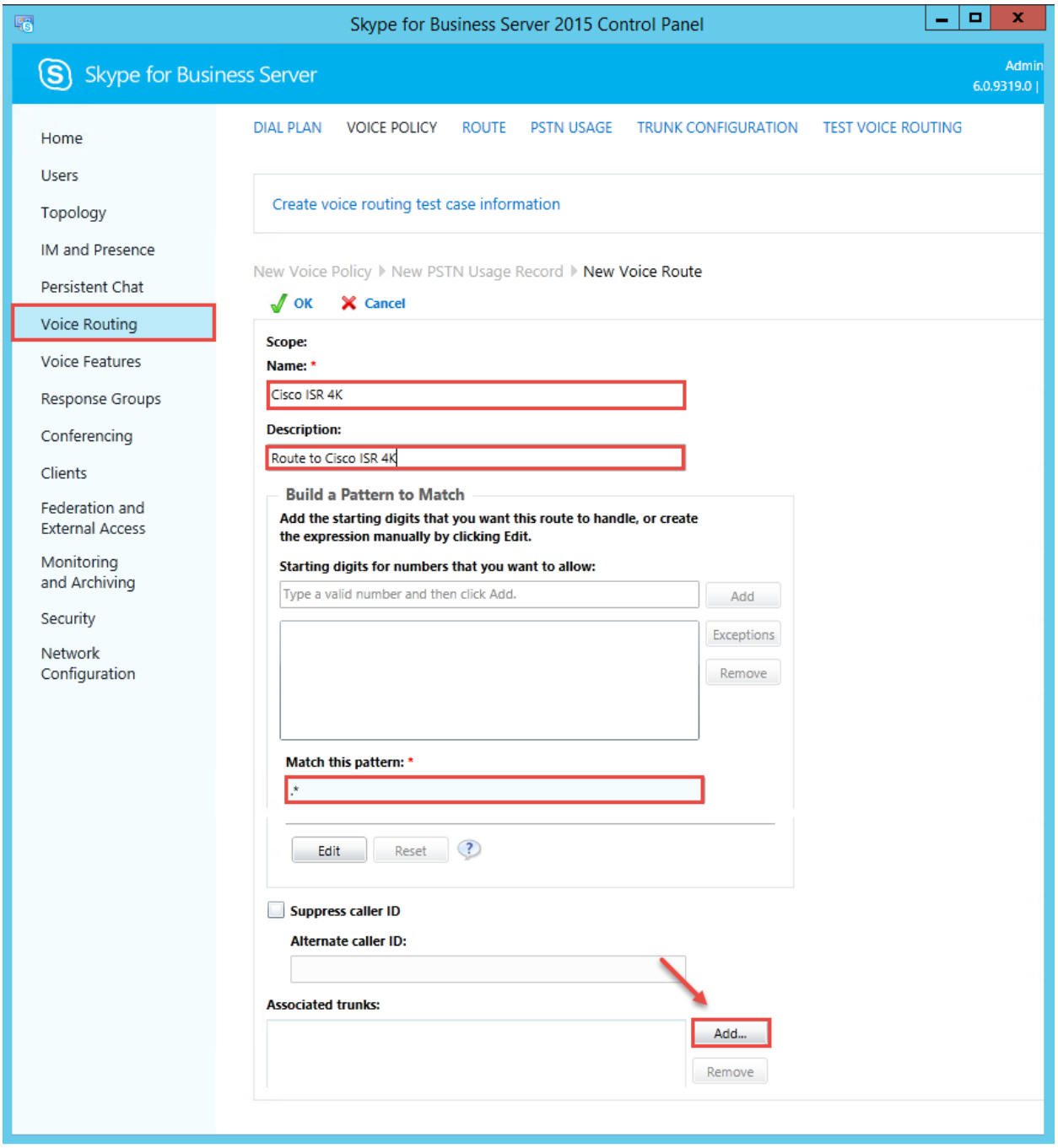

Figure 13 New Voice Route details and Add Trunk to associate

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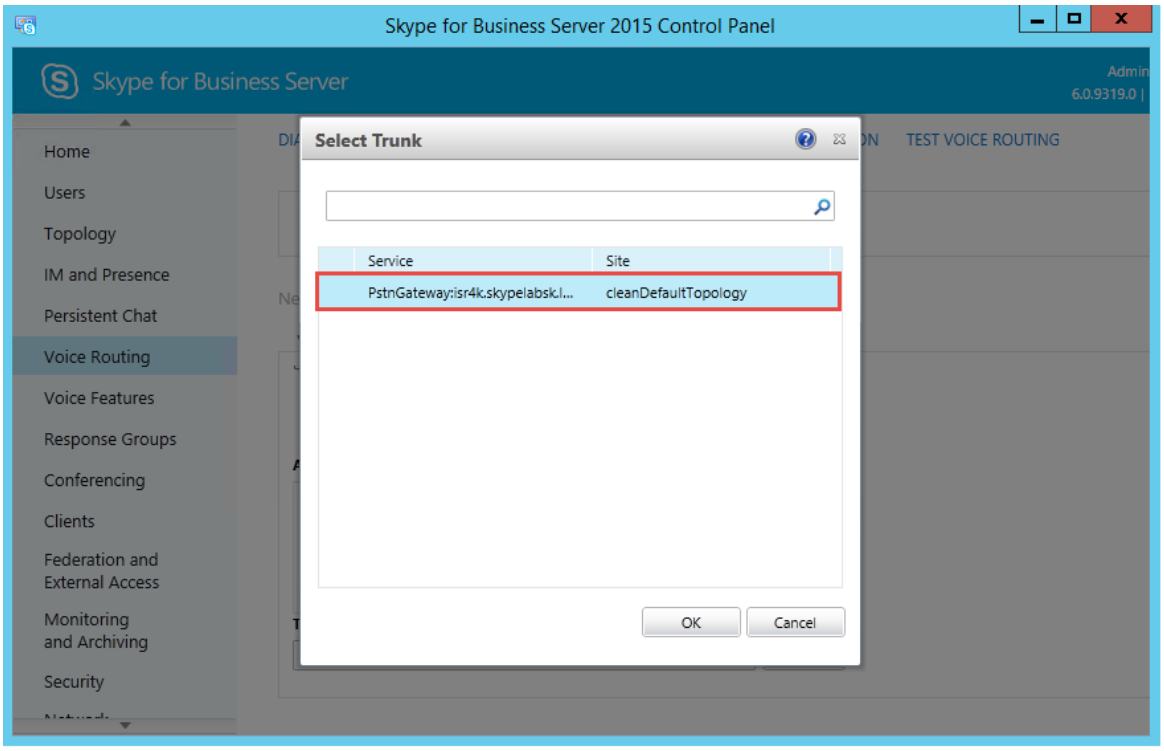

Figure 14 Select Trunk to associate with Route

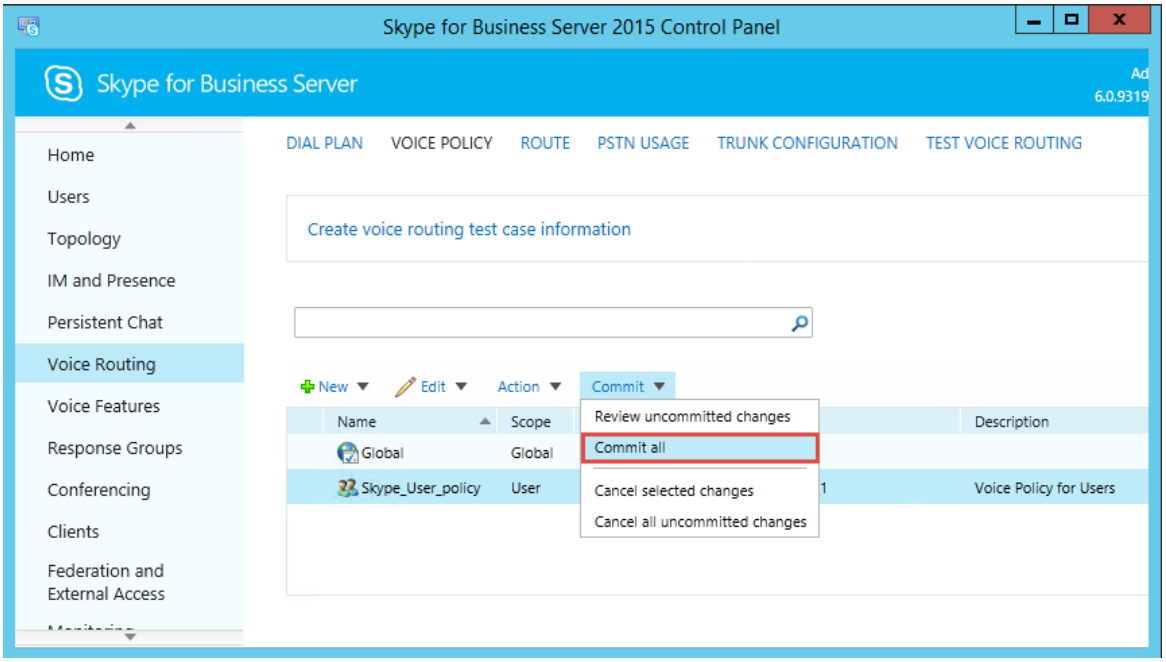

Figure 15 Commit changes to Voice Policy

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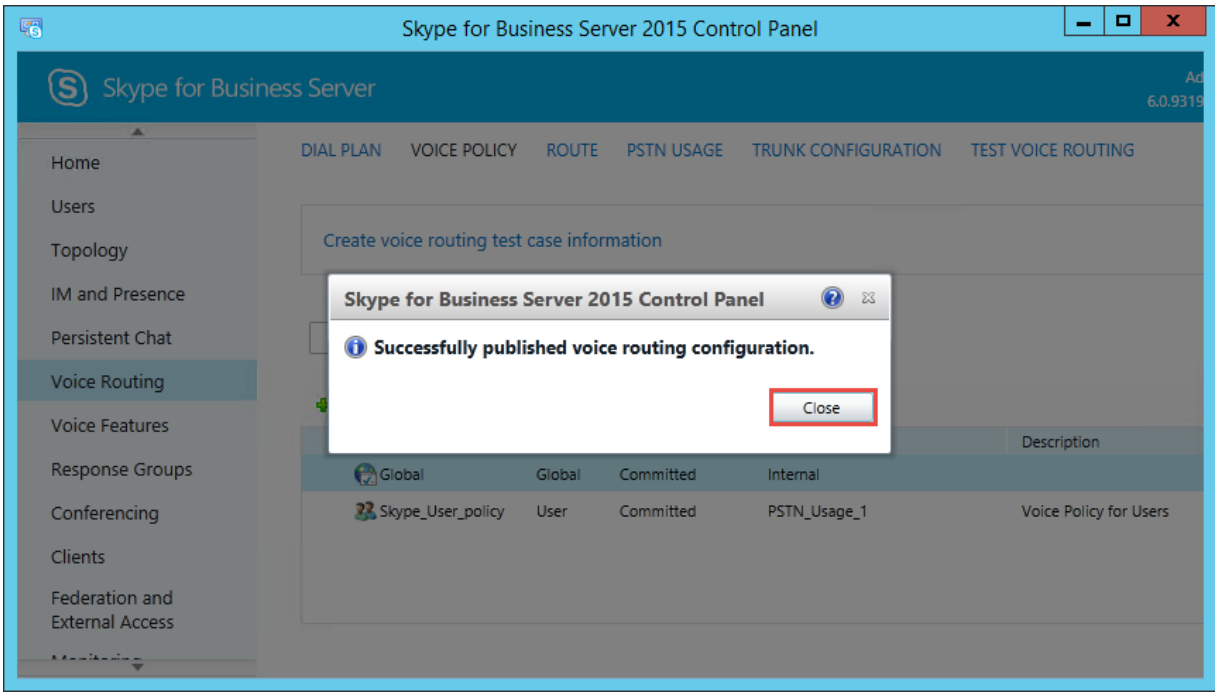

Figure 16 Voice Policy added successfully

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

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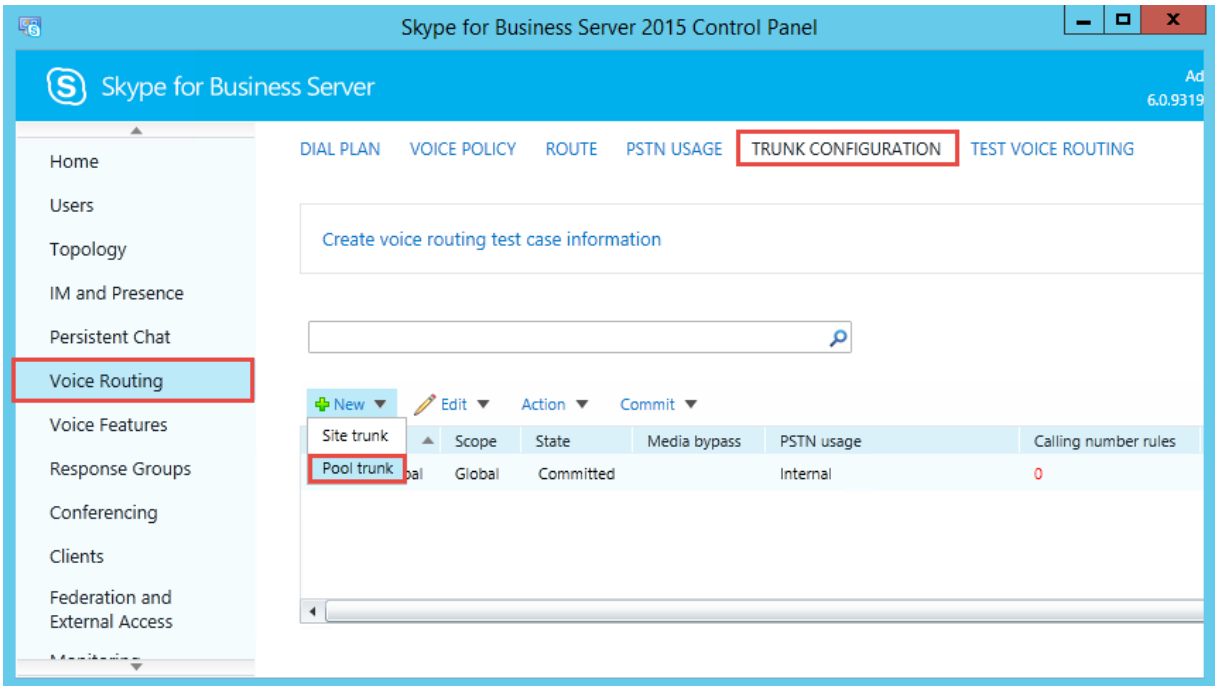

Figure 17 New Pool Trunk

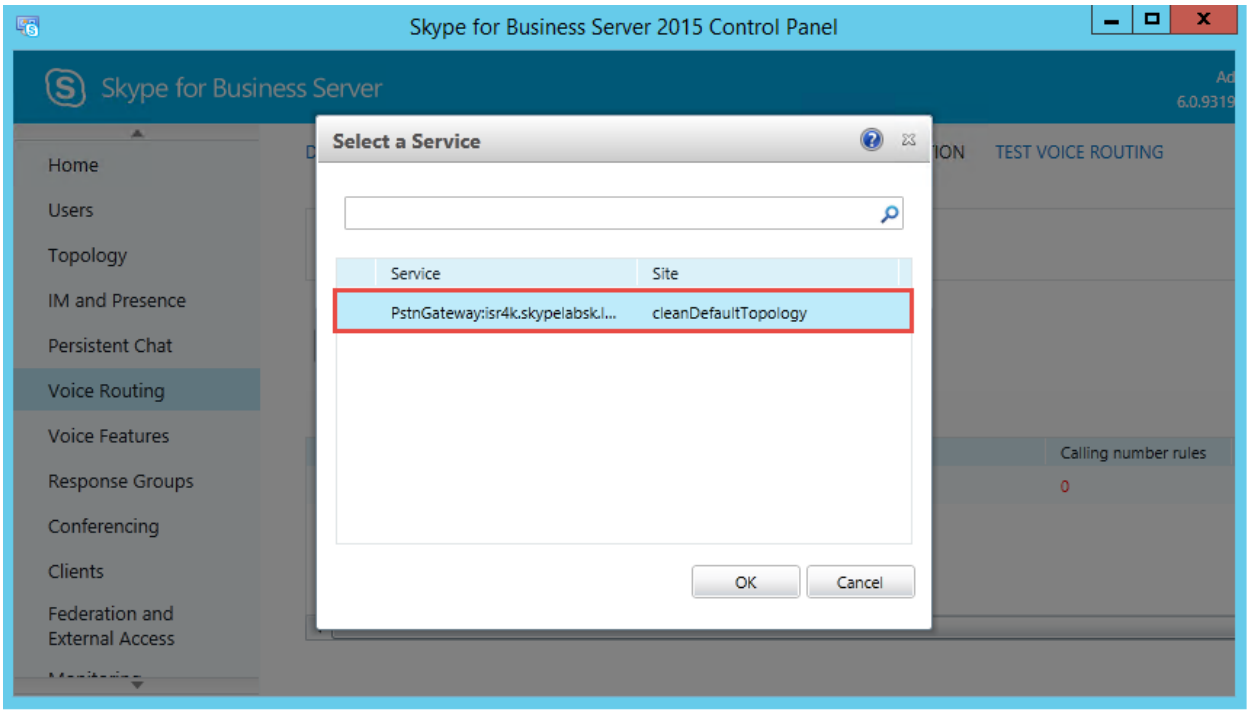

Figure 18 Select the Trunk Service

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

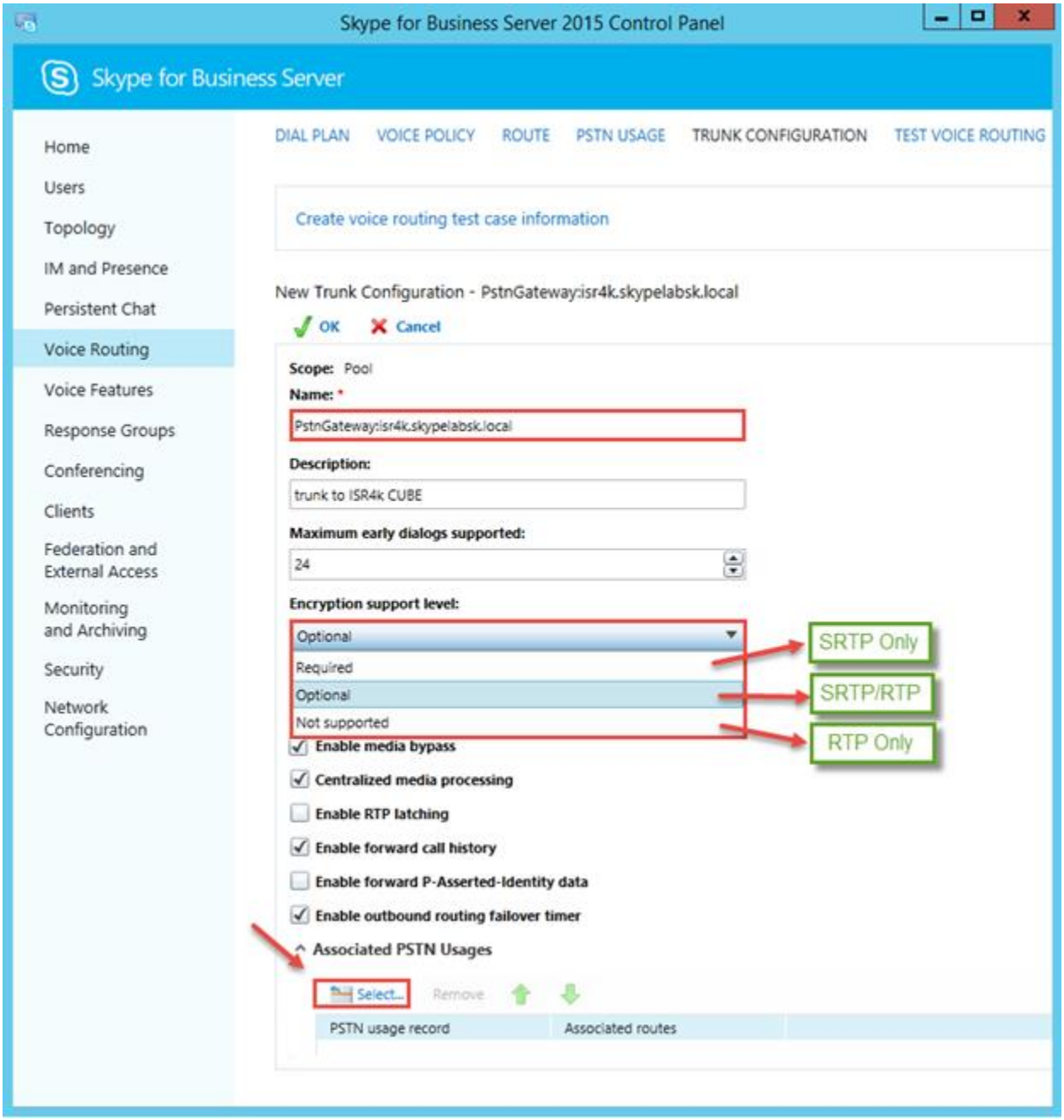

Figure 19 New Trunk Configuration

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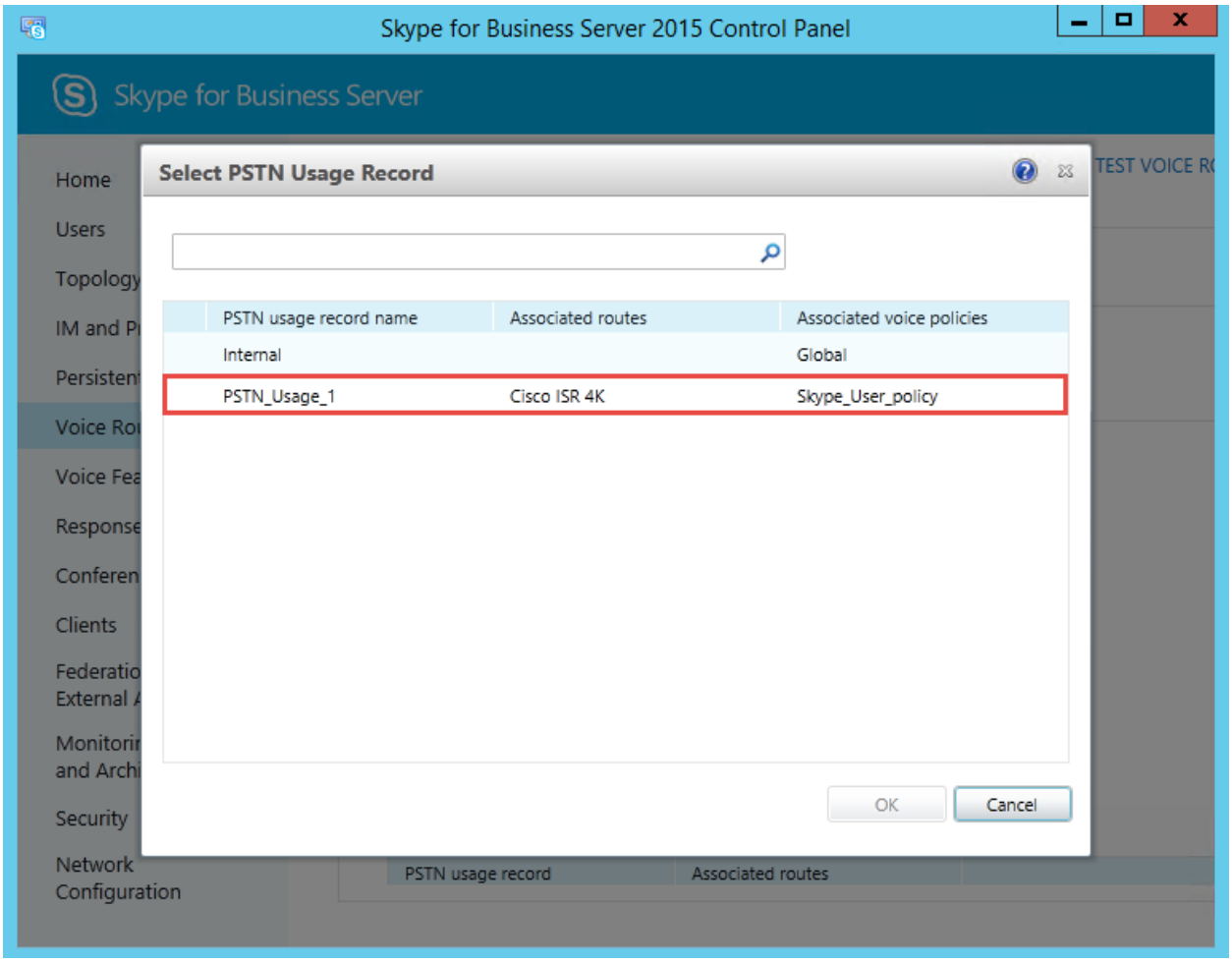

Figure 20 Associate PSTN Usage to the Trunk

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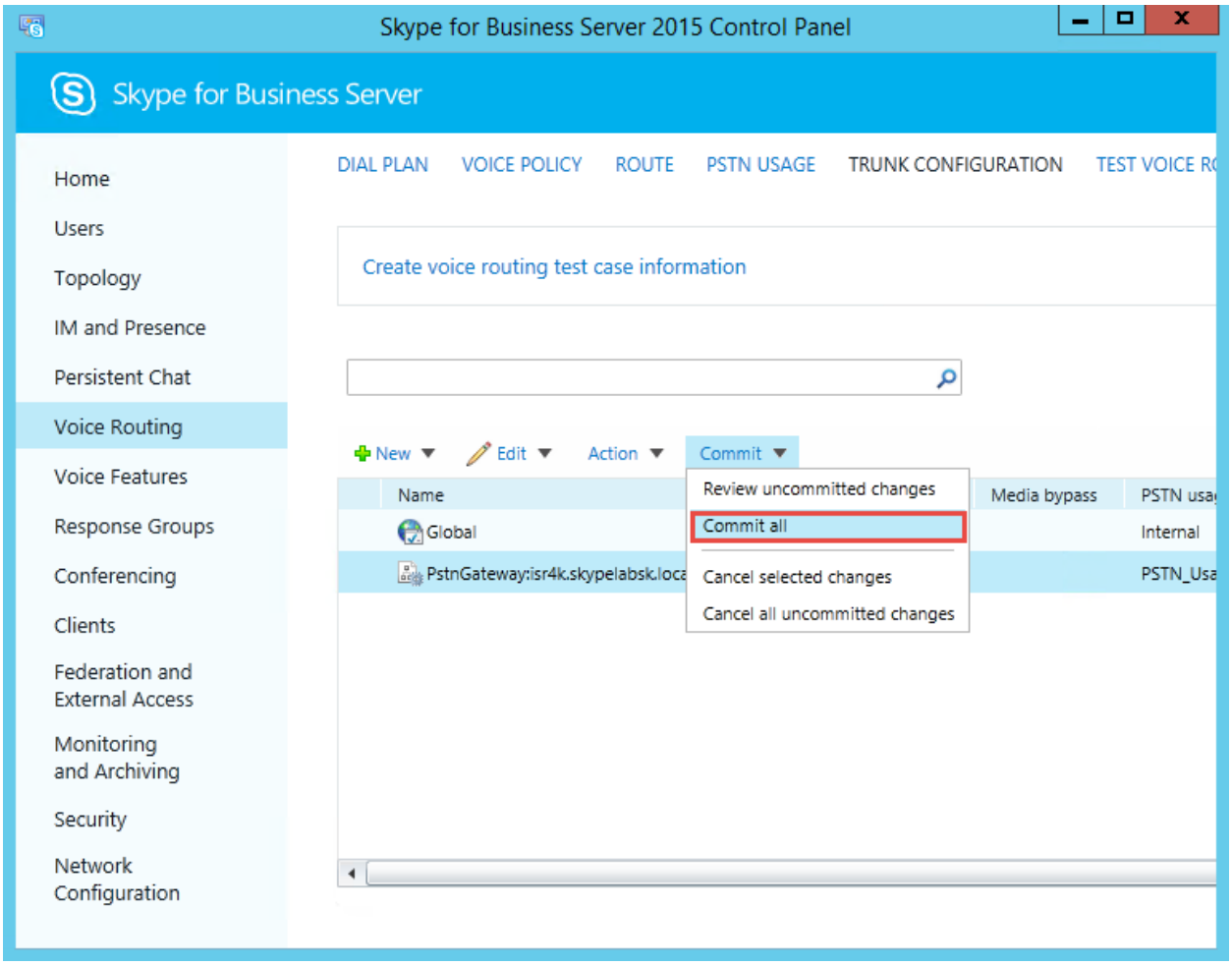

Figure 21 Commit the Changes to the Trunk

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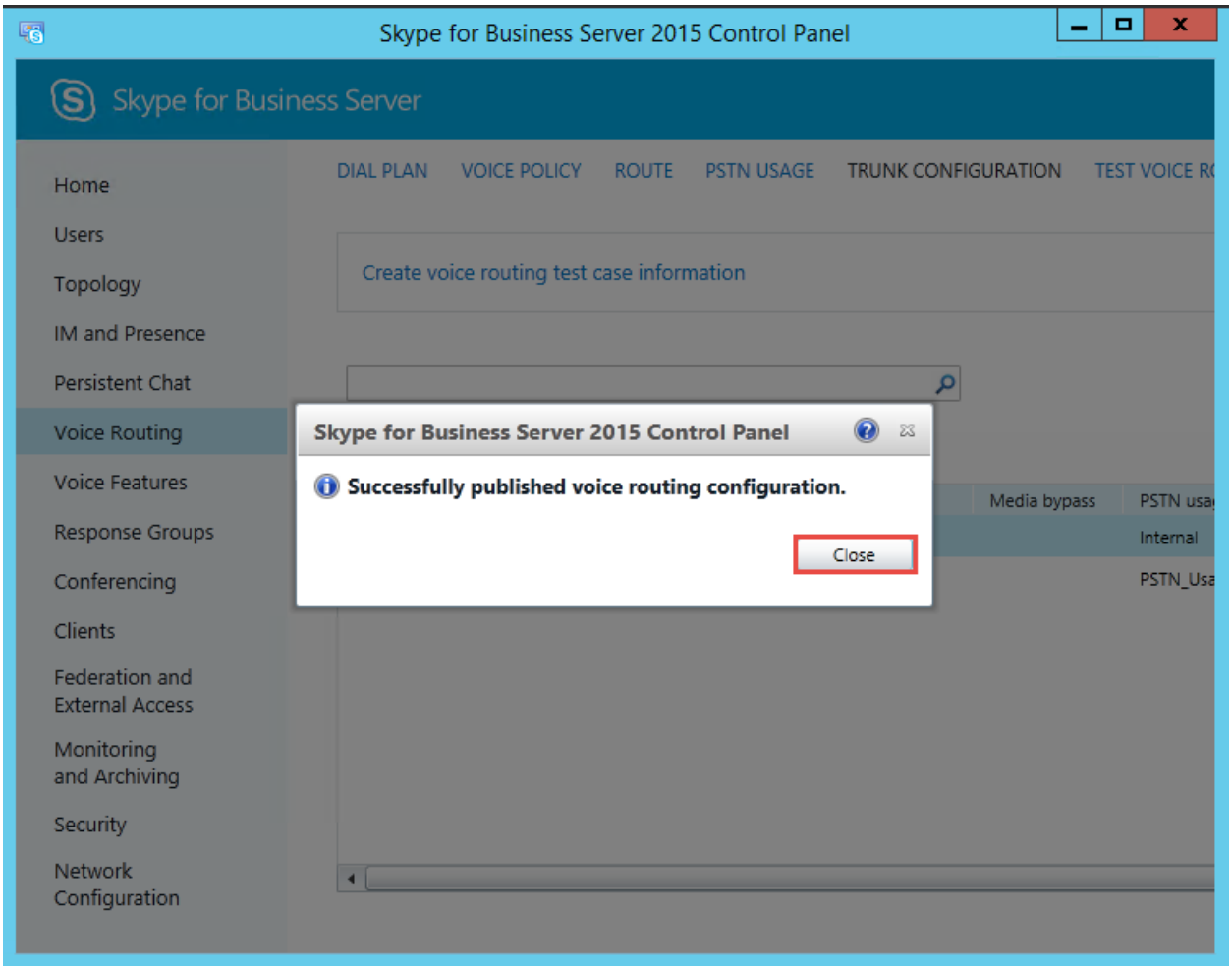

Figure 22 Trunk to CUBE added successfully

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.

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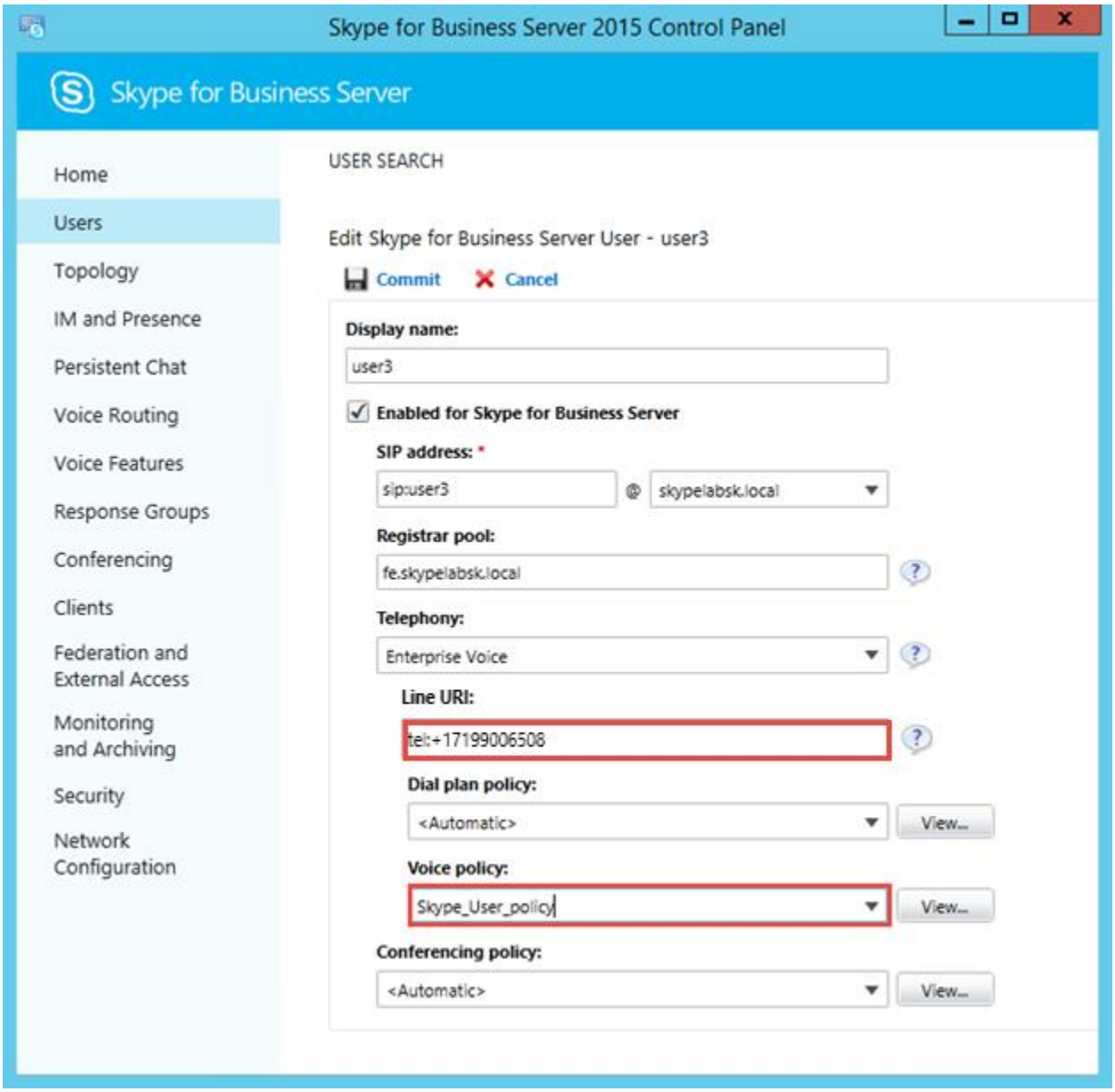

Figure 23 Skype User Configuration 1

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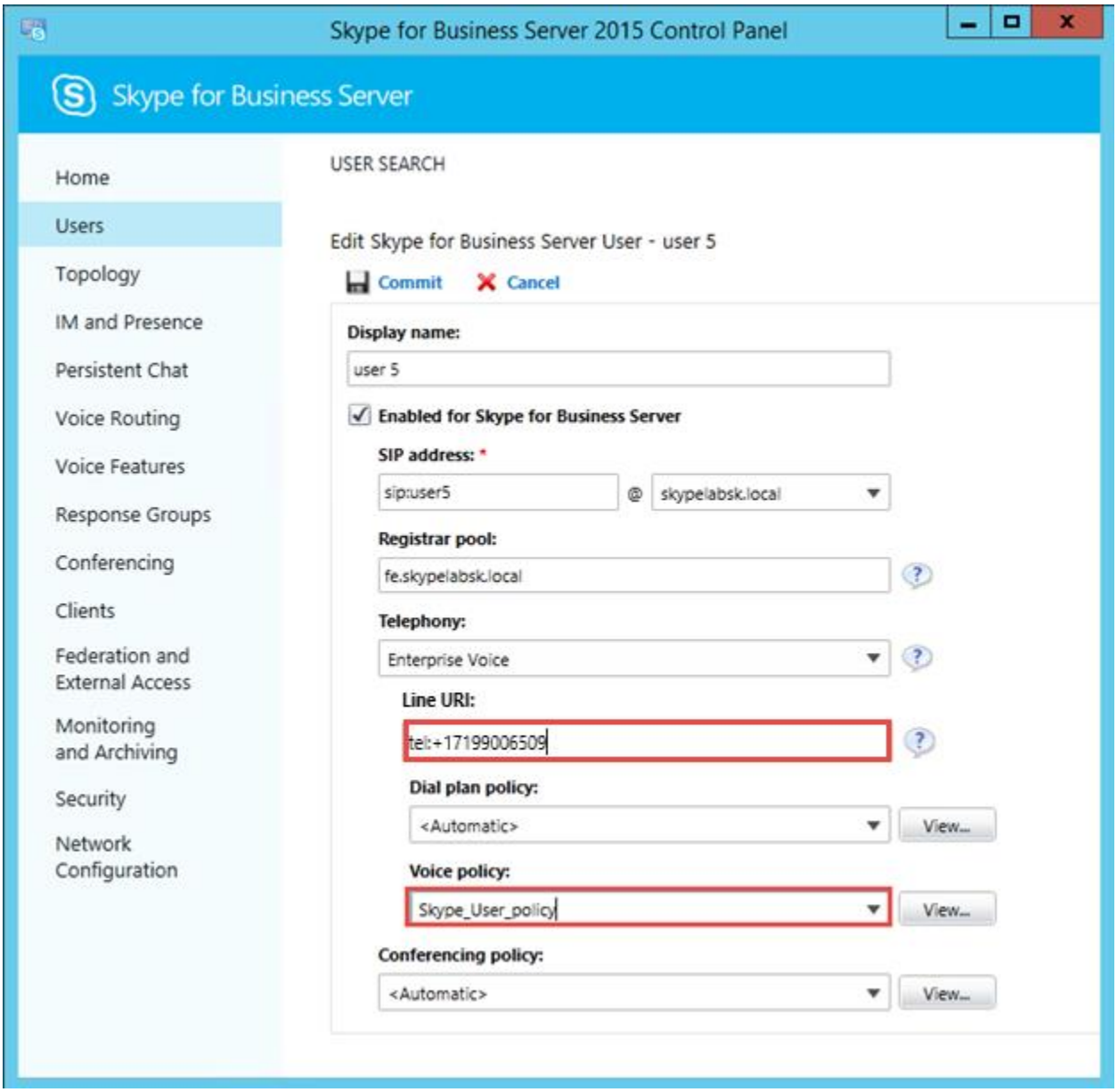

Figure 24 Skype User Configuration 2

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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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