Microsoft Lync 2010, Enterprise, v4.0.7577 Connecting Verizon Trunks via the Cisco Unified Border Element Release 9.0 using SIP

10/23/2012- Version 3

Table of Contents
Introduction .................................................................................................................................................. 2
Network Topology ..................................................................................................................................... 4
System Components ................................................................................................................................. 4
    Hardware Components .......................................................................................................................... 4
    Software Requirements ...................................................................................................................... 4
Features .................................................................................................................................................. 5
Features Supported .................................................................................................................................... 5
Features Not Supported ........................................................................................................................... 5
Caveats ..................................................................................................................................................... 6
Configuration ........................................................................................................................................... 7
    Configuring Cisco Unified Border Element ....................................................................................... 7
        Show version: ................................................................................................................................. 7
        License Info: ................................................................................................................................. 7
        Running Configuration on Cisco Unified Border Element: .......................................................... 8
    Configuring Microsoft Lync ................................................................................................................ 17
        Lync Topology builder: Adding PSTN Gateway ............................................................................ 17
        Lync Topology builder: Associating Gateway with Mediation pool ............................................ 18
        Lync Server: Control Panel: Adding users .................................................................................... 18
        Lync Control panel: Configuring Dial Plan ................................................................................... 22
        Lync Control panel: Configuring Voice Policy .............................................................................. 23
        Lync Control panel: Configuring Route ........................................................................................ 24
        Lync Control panel: Trunk Configuration ...................................................................................... 26
Acronyms .................................................................................................................................................. 27
Important Information .............................................................................................................................. 28
Introduction

This application note describes how to configure Microsoft Lync 2010, Enterprise Edition v4.0.7577 with a Cisco Unified Border Element (Cisco UBE), release 9.0 for connectivity to Verizon SIP trunk provider. The deployment model covered in this application note is CPE to PSTN.

- Testing was performed in accordance to Cisco’s SIP Trunk Test Plan and all features were verified. Key features verified are:
  - CPE outbound to SP Offnet gateway (PSTN) (G.729 is offered first)
  - SP Offnet gateway (PSTN) inbound to CPE (G.729 offered first)
  - CPE to CPE (place call out to the SP network and back) (G.729 is offered first)
  - CPE Calling number privacy
  - CPE Telephone Number Support – digit translations
  - CPE Calling Name Delivery
  - CPE Offset Call Conference
  - CPE Intra-Site Call Conference
  - CPE Intra-Site Attended Call Transfer
  - CPE Intra-Site Unattended Call Transfer
  - CPE Call Hold and Resume (call hold is always done on the IP PBX side)
  - CPE Voice Mail
  - CPE Find Me (CFU)
  - Simultaneous Calls
  - CPE Auto Attendant
  - CPE Find Me (Call Forward On Busy)
  - CPE Find Me (Call Forward Don’t Answer)
  - Codec mid-call re-negotiation (to be tested without transcoder)
  - PRACK with SDP (early-media cut-through with DTMF (RFC2833) navigation before 200OK)) - call 800-864-8331 - United Airlines

- The Cisco Unified Border Element configuration detailed in this document is based on a lab environment with simple dial-plan configurations used to ensure proper interoperability between Verizon SIP network and Microsoft Lync 2010. The configuration described in this document details the important commands that need to be enabled for interoperability to be successful and care must be taken, by the network administrator deploying Cisco UBE, to ensure these commands are set per each dial-peer requiring to interoperate with the Microsoft Lync.

- This Application Note uses the Cisco 3945E Integrated Services Router (ISR) G2 to run CISCO UBE feature set however other Cisco voice gateways are also an option to use since CISCO UBE implementation does not depend on the platform. Here is a list of Cisco platforms capable of CISCO UBE functionality:

  Cisco 3900 Series Integrated Services Routers
Cisco 2900 Series Integrated Services Routers
Cisco ASR 1001 Aggregated Services Router
Cisco ASR 1004 Aggregated Services Router with Route Processor-2
Cisco ASR 1006 Aggregated Services Router with Route Processor-2
Cisco AS5350XM Universal Gateway
Cisco AS5400XM Universal Gateway
Cisco 1861 Integrated Services Router
Cisco 881 Integrated Services Router
Cisco 888 Integrated Services Router
Cisco IAD880 Series Integrated Access Devices
Cisco IAD2430 Integrated Access Device
Network Topology

The network topology includes the Microsoft Lync 2010 Enterprise Edition and 2 Lync clients with the Cisco UBE published as a PSTN gateway in the Lync topology. Verizon was used as the service provider with a SIP trunk to the Cisco UBE. Outbound PSTN calls were ultimately routed into the tekVizion PSTN GW.

Figure 1. Basic Test Environment

System Components

Hardware Components
- Microsoft Lync 2010 – Windows 2008 R2
- Cisco UBE – Cisco 3945
- PSTN GW – Cisco 3845
- Switch – Cisco 6509
- Lync Clients – Windows 7 Pro
- Verizon Trunk (Third Party SIP Trunk Provider)

Software Requirements
- Cisco UBE , Release 9.0 with IOS version 15.2(3) T1
- Microsoft Lync 2010, v 4.0.7577
Features

Features Supported

- Call from/to PSTN to/from CPE – Basic and International calls, digit translations
- Hold/Resume
- DTMF
- Call transfers – attended, unattended
- Call Forwarding (CFU,CFB,CFNA)
- Support for early media

Features Not Supported

- Blind Transfer: Lync doesn’t support Blind Transfers.
- FAX: Lync doesn’t support FAX
Caveats

- CLID updates are not observed on call transfer scenarios.
- Lync doesn’t support Call Forwarding on Busy. Therefore this scenario was tested by redirecting a second incoming call to another number by Lync.
- Lync doesn’t support G729 calls. Hence all calls were tested with G711ulaw. Codec negotiation tests were done with G711u and Alaw.
Configuration

Configuring Cisco Unified Border Element

Show version:

Cisco IOS Software, C3900e Software (C3900e-UNIVERSALK9-M), Version 15.2(3)T1, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2012 by Cisco Systems, Inc.
Compiled Wed 13-Jun-12 17:56 by prod_rel_team

ROM: System Bootstrap, Version 15.1(1r)T4, RELEASE SOFTWARE (fc1)
SIPTRUNKCUBE uptime is 1 day, 5 hours, 40 minutes
System returned to ROM by power-off
System image file is "flash:c3900e-universalk9-mz.SPA.152-3.T1.bin"
Last reload type: Normal Reload
Last reload reason: power-off

This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:

If you require further assistance please contact us by sending email to export@cisco.com.

Cisco CISCO3945-CHASSIS (revision 1.0) with C3900-SPE250/K9 with 1790976K/306176K bytes of memory.
Processor board ID FTX1541A032
4 Gigabit Ethernet interfaces
DRAM configuration is 72 bits wide with parity enabled.
256K bytes of non-volatile configuration memory.
500472K bytes of ATA System CompactFlash 0 (Read/Write)

License Info:

License UDI:

-----------------------------------------------
Device# PID SN
-----------------------------------------------
*0 C3900-SPE250/K9 FOC15391VLH

Technology Package License Information for Module:'c3900e'
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<th>Type</th>
<th>Technology-package</th>
<th>Type</th>
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<td>uck9</td>
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<td>uck9</td>
<td></td>
</tr>
<tr>
<td>data</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Configuration register is 0x2102

Running Configuration on Cisco Unified Border Element:

CUBE#show run
Building configuration...

Current configuration : 16161 bytes
!
! Last configuration change at 17:06:16 UTC Tue Sep 18 2012 by administrator
version 15.2
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
service sequence-numbers
!
hostname CUBE
!
boot-start-marker
boot system flash c3900e-universalk9-mz.SPA.152-3.T1.bin
boot-end-marker
!
!
logging exception 4096
no logging queue-limit
logging buffered 900000000
no logging rate-limit
logging console guaranteed
no logging console
enable secret 5 $1$lbTj$25nxZBh5UBjnxOrx9aRvn/
!
no aaa new-model
!
no ipv6 cef
!
!
!
!
!
ip cef
multilink bundle-name authenticated
!
crypto pki trustpoint TP-self-signed-3709846528
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-3709846528
revocation-check none
rsakeypair TP-self-signed-3709846528
!
crypto pki certificate chain TP-self-signed-3709846528
certificate self-signed 01
3082022B 30820194 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
31312F30 20060355 04031326 49F532D 53656C66 2D536967 6E65642D 46357274
69666963 6174652D 33373039 38343635 3238303E 170D3131 31303039 30303538
34325A17 0D323030 31303130 30303030 30A3031 312F302D 06035504 03132F30
4F532D32 656C662D 69666963 6174652D 33373039 38343635 2D5727469 6E65642D
34363532 383019F 300D0609 2A864886 F70D0101 01050003 8180D030 81892F81
8100AF32 1ED94037 AE623623 E43626A7 42B39B06
25C99F5B C7B03256 9D971028 F863E825 47C7FF04 9DCD132D B26F0D5 883321F8
9E1ED66 69800878 EE313C88 1B1E650 0FB0E01CA 6B4EF52 0FE02FDD 4D8CEFFA
AEB71024 4E7B426E E5C5BA8F E0D61A9B 06411555 6BFF0236 A7937203 D54D19A8
D6CB202D 010001A3 53305130 0F060355 1D130101 FF040530 031301FF 301F0603
551D2304 18301680 143E4473 FBF89536 7F3209E9 929471C9 6D35FCFF FF01D606
03551D0E 04160414 3E4473FB F995367F 3209E992 9471C96D 35FCFF30 00D0603
2A864886 F70D0101 05050003 8180D030 81892F81
quit
voice-card 0
dsp services dspfarm
!
voice service voip
ip address trusted list
ipv4 10.10.0.133
ipv4 10.64.1.72
ipv4 10.64.2.228
ipv4 10.64.2.238
ipv4 10.10.0.238
ipv4 10.70.1.2
ipv4 200.50.67.0 255.255.255.0
ipv4 0.0.0.0 0.0.0.0
ipv4 10.70.19.3
ipv4 63.97.104.62
ipv4 10.85.0.17
address-hiding
mode border-element
allow-connections sip to sip
signaling forward unconditional
fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
sip
min-se 180 session-expires 180
midcall-signaling passthru;
!
midcall-signaling passthru
no pass- thru content sdp
This config is mandatory for all signaling.

voice class codec 1
codec preference 1 g729r8
voice class sip-profiles 3
request INVITE peer-header sip REFERRED-BY copy "tel:+1(.*>)" u01
request INVITE sip-header Diversion add "Diversion: <sip:1234@97.79.185.175>"
request INVITE sip-header Diversion modify "1234" "\u01"
request INVITE sip-header Diversion modify "Diversion: <sip:97.79.185.175>" "X-cisco-info:SIP call"
request INVITE sip-header Refered-By remove
!
voice class sip-copylist 3
sip-header REFERRED-BY
!
!
voice translation-rule 1
rule 1 /\+1\(\ldots\)/ /\1/
rule 2 /\+1\(\ldots\)/ /\1/
!
voice translation-rule 2
rule 1 /\+1\(\ldots\)/ /\1/
rule 2 /7192083392/ /+17192083392/
rule 3 /7192083393/ /+17192083393/
rule 4 /\1\(\ldots\)$\)/ /\1/
!
voice translation-rule 4
rule 1 /\+15192083393/ /17192083393/
!
voice translation-rule 5
rule 1 /7192083393/ /+13500350036/
!
voice translation-rule 6
rule 1 /7192083393/ /17192083393/
!
voice translation-profile 4
translate calling 1
translate called 4
!
voice translation-profile addone
translate called 6
!

2 Sip-profile config required for call forwarding scenarios – PSTN- Lync-PSTN2. This is applied to the outgoing dial peer for Lync-VZ calls.
3 Copy-list config required for call forwarding scenarios – PSTN- Lync-PSTN2. This is applied to the incoming dial peer for Lync-VZ calls.
4 Translation rule to remove the +1.
5 Specific Translation rules used for routing the calls.
6 Translation rules for converting a 5192083393 to the Lync DID 7192083393 so that Lync-Lync calls are also routed via VZ
voice translation-profile addplus
  translate called 2
!
voice translation-profile conv_intnl
  translate calling 1
  translate called 7
!
voice translation-profile conv_num
  translate called 4
!
voice translation-profile rmv_one
  translate called 3
!
voice translation-profile rmv_plus
  translate calling 1
  translate called 2
!
voice translation-profile toVM
  translate called 5
!
profile 10000
!
license udi pid C3900-SPE250/K9 sn FOC15391VLH
!

! hw-module pvdm 0/0
!
! redundancy
!
!
translation-rule 1
 Rule 1 5192083393 7192083393
 Rule 2 7192083392 3392
 Rule 3 +011918025265621 12142425996
 Rule 4 3392 7192083392
!

interface GigabitEthernet0/0
 description $ETH-LAN$$ETH-SW-LAUNCH$$INTF-INFO-GE 0/0$
 ip address 10.70.10.15 255.255.0.0
duplex full
speed 100
!
interface GigabitEthernet0/1
 ip address 97.79.185.175
255.255.255.128
duplex full
speed 100
!

7 Needed only for tc-77 where it is required to translate the 10 digit to 4 digit private extension.
8 Needed only for tc-76 where it is required to translate the 4 digit to 10 digit extension
9 LAN interface of the CUBE interfacing with Lync
10 WAN interface of the CUBE interfacing with VZ

ip forward-protocol nd
!
ip http server
ip http access-class 23
ip http authentication local
ip http secure-server
ip http timeout-policy idle 60 life 86400 requests 10000

ip route 0.0.0.0 0.0.0.0 97.79.185.129
ip route 10.10.0.0 255.255.0.0 192.168.100.1
ip route 10.64.0.0 255.255.0.0 10.70.10.1
ip route 10.70.0.0 255.255.0.0 10.70.10.1
ip route 10.85.0.0 255.255.0.0 10.70.10.1

access-list 23 permit 10.10.10.0 0.0.0.7

nls resp-timeout 1
cpd cr-id 1

control-plane

mgcp profile default

dial-peer voice 15 voip
  description Outgoing dial peer for calls from Lync to VZ/(PSTN)
  translation-profile outgoing rmv_plus
  destination-pattern +1..........
  translate-outgoing called 1
  session protocol sipv2
  session target ipv4:63.97.104.62:5073
  voice-class codec 1 offer-all
  voice-class sip profiles 3
  no voice-class sip copy-list
  dtmf-relay rtp-nte

  dial-peer voice 16 voip
  description Outgoing dial peer for calls from VZ to Lync
  translation-profile outgoing addplus
  destination-pattern 719208339[2-3]
  translate-outgoing called 1
  session protocol sipv2
  session target ipv4:10.85.0.20:5068
  session transport tcp
  no voice-class sip copy-list
  dtmf-relay rtp-nte
codecs g711ulaw
  no vad

  dial-peer voice 17 voip
  destination-pattern 1866.......:
  session protocol sipv2

---

10  IP route for public IP routing
11  IP route for routing between Lync network and CUBE.
12  Outgoing dial peer for part of the call that involves routing call from Lync towards VZ/PSTN. Includes the sip-profile config for call forwarding scenarios.
13  Outgoing dial peer for part of the call that involves routing call from VZ/PSTN towards Lync. When testing scenarios with 4digit to 10 digit translation, modify destination pattern to be only 719208393. dial-peer 3392 will handle the routing of 7192083392
Dial peer for testing the DTMF/early media number.

Incoming Dial peer for testing the CPE-CPE calls. For these calls to traverse VZ, the CPE 1 calls a fake CPE2 number i.e. +15192083393 instead of +17192083393 that is then translated to the real CPE2 Lync DID 7192083393.

Outgoing dial peer for routing the translated Lync DID for CPE-CPE calls towards Lync.

Incoming dial peer for CPE-CPE calls

Dial peer for handling the international calls that are translated to internal PSTN numbers using the voice-translation profile conv_intnl.

dial-peer voice 19 voip
description For CPE-CPE Calls incoming
translation-profile incoming rmv_plus
destination-pattern 1719208339[2-3]
session protocol sipv2
session target ipv4:63.97.104.62:5073
voice-class codec 1 offer-all
dtmf-relay rtp-nte
!
dial-peer voice 500 voip20
  description Incoming Dial peer
  session protocol sipv2
  session transport tcp
  incoming called-number 7192083392
  voice-class codec 1 offer-all
dtmf-relay rtp-nte
!
dial-peer voice 501 voip21
  description Incoming dial peer for calls from Lync-PSTN to forward calls
  session protocol sipv2
  session transport tcp
  incoming called-number +1214........
  voice-class codec 1 offer-all
  voice-class sip copy-list 3
dtmf-relay rtp-nte
!
dial-peer voice 911 voip22
  description 911 calls
  translation-profile outgoing rmv_plus
  destination-pattern +911
  session protocol sipv2
  session target ipv4:63.97.104.62:5073
  voice-class codec 1 offer-all
dtmf-relay rtp-nte
!
dial-peer voice 411 voip23
  description incoming dial peer for 411
  translation-profile incoming rmv_plus
  translation-profile outgoing rmv_plus
  destination-pattern +411
  session protocol sipv2
  session target ipv4:63.97.104.62:5073
  voice-class codec 1 offer-all
dtmf-relay rtp-nte
!

dial-peer voice 3392 voip24
description Outgoing dial peer for 10digit to 4 digit test
destination-pattern 7192083392
translate-outgoing called 1
session protocol sipv2
session target
ipv4:10.85.0.20:5068
session transport tcp
dtmf-relay rtp-nre
codec g711ulaw
no vad
!
sip-ua
!
!
gatekeeper
shutdown
!
!

Cisco Configuration Professional (Cisco CP) is installed on this device and it provides the default username "cisco" for one-time use. If you have already used the username "cisco" to login to the router and your IOS image supports the "one-time" user option, then this username has already expired. You will not be able to login to the router with this username after you exit this session.

It is strongly suggested that you create a new username with a privilege level of 15 using the following command.

username <myuser> privilege 15 secret 0 <mypassword>

Replace <myuser> and <mypassword> with the username and password you want to use.

Cisco Configuration Professional (Cisco CP) is installed on this device. This feature requires the one-time use of the username "cisco" with the password "cisco". These default credentials have a privilege level of 15.

YOU MUST USE CISCO CP or the CISCO IOS CLI TO CHANGE THESE PUBLICLY-KNOWN CREDENTIALS

Testing was conducted at tekVizion labs.
Here are the Cisco IOS commands.

```
username <myuser> privilege 15 secret 0 <mypassword>
no username cisco

Replace <myuser> and <mypassword> with the username and password you want to use.

IF YOU DO NOT CHANGE THE PUBLICLY-KNOWN CREDENTIALS, YOU WILL NOT BE ABLE TO LOG INTO THE DEVICE AGAIN AFTER YOU HAVE LOGGED OFF.

For more information about Cisco CP please follow the instructions in the QUICK START GUIDE for your router or go to http://www.cisco.com/go/ciscocp

```

```
^C
!
line con 0
 login local
line aux 0
line vty 0 4
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 login local
 transport input telnet ssh
line vty 5 15
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 login local
 transport input telnet ssh
!
scheduler allocate 20000 1000
!
end
```
Configuring Microsoft Lync

The validation of Microsoft Lync with Cisco UBE includes the following integration steps from Lync perspective:

- Adding the Cisco UBE as a PSTN Gateway on the Lync Topology Builder
- Associating Gateway with a Mediation pool
- Publishing the topology
- Adding Lync users with DIDs provided by the Service provider.
- Configuring a Dial Plan
- Configuring a Voice Policy
- Configuring a Route
- Trunk configuration to enable all relevant features required for the IVT.

Lync Topology builder: Adding PSTN Gateway

Figure 2. Lync Topology Builder- PSTN Gateway
Lync Topology builder: Associating Gateway with Mediation pool

Figure 3. Lync Topology Builder- Mediation pools

Lync Server: Control Panel: Adding users

Figure 4. Lync Server: Control Panel- Users

Two users were created on Lync for CPE-CPE calls. These DIDs were provided by Verizon.
Figure 5. Lync Server: Control Panel - User1 (with 10 digit extension)
Figure 6. Lync Server: Control Panel - User1 configured with 4 digit extension for test case 77.

User 1 configured with a 4digit extension for testing particular test case (77): Offnet to IP PBX: IP PBX must translate 10-digit called number to private extension.
Figure 7. Lync Server: Control Panel - User2 (with 10 digit extension)
Lync Control panel: Configuring Dial Plan

A dial plan with the following rules is created:

- To prefix a “+” before every incoming 11 digit number
- To accept and prefix a “+1” before the PSTN number used for test: 2142425923
- To accept 4 digit extensions eg: 3392 that was used for testing (test case 77)

Figure 8. Lync Control panel - Dial Plan
Lync Control panel: Configuring Voice Policy

**Figure 9.** Lync Control Panel- Voice Policy

The default corporate voice policy configured was used for this test.
Lync Control panel: Configuring Route

**Figure 10.** Lync Control Panel - Route (1/2)

The following route patterns were configured that included all the numbers that were used during the test.
Figure 11. Lync Control Panel - Route (2/2)
Lync Control panel: Trunk Configuration

Figure 12. Lync Control Panel - Trunk Configuration
## Acronyms

<table>
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<tr>
<th>Acronym</th>
<th>Definitions</th>
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<tr>
<td>SIP</td>
<td>Session Initiation Protocol</td>
</tr>
<tr>
<td>Cisco UBE</td>
<td>Cisco Unified Border Element</td>
</tr>
<tr>
<td>PSTN</td>
<td>Public Switched Telephone Network</td>
</tr>
</tbody>
</table>
Important Information

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS. IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.