

Comcast: Connecting Cisco Unified Communication Manager Express (CME) 12.3 (IOS-XE 16.9.3) using SIP

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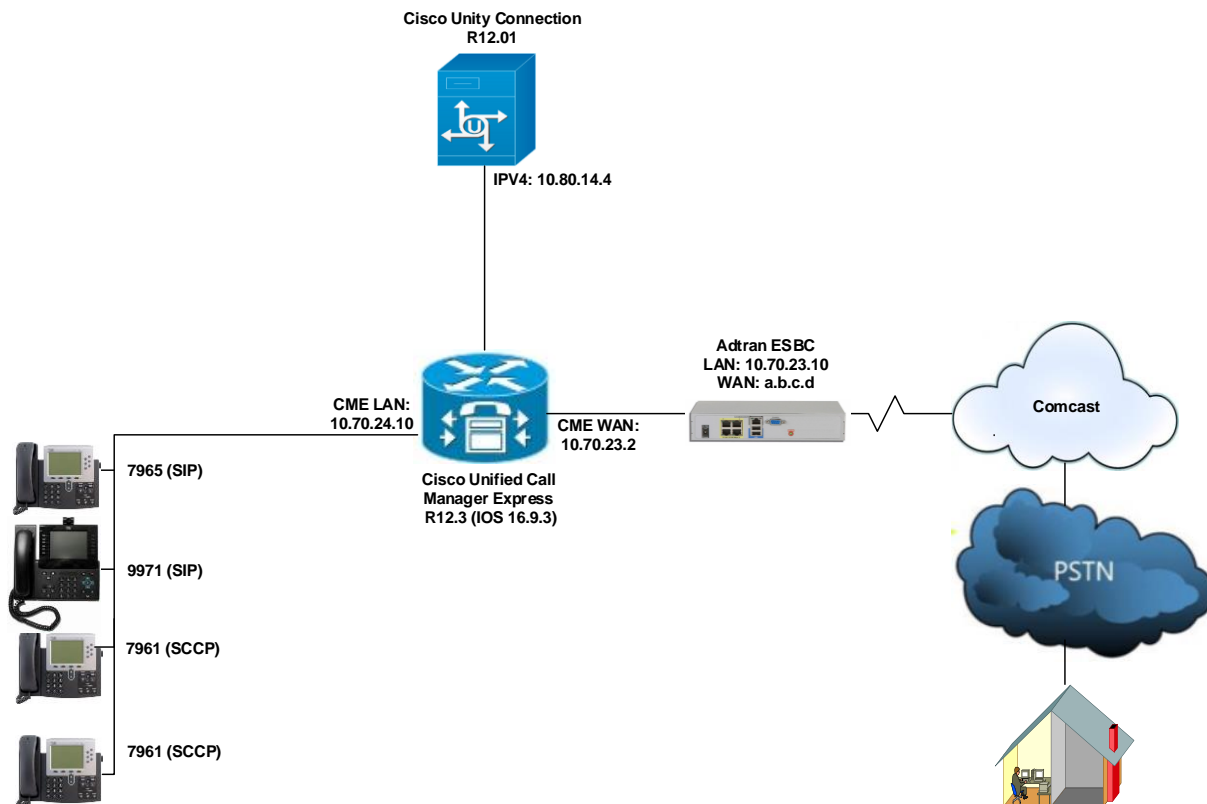
Introduction

Service Providers today, such as Comcast, 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 a centralized IP to TDM gateway to provide on-net and off-net services. Comcast is a service provider offering that allows connection to the PSTN and may offer the end customer a viable alternative to traditional PSTN connectivity via either analog or T1 lines. A demarcation device between these services and customer owned services is recommended.

- This application note describes how to configure a Cisco Unified Communications Manager Express (Cisco Unified CME) version 12.3 (IOS-XE 16.9.3), Cisco Unity Connection version 12.0.1, and Adtran ESG R12.3.4.V with connectivity to Comcast SIP trunk service. The deployment model covered in this application note is Customer Premises Equipment (Cisco Unified CME) to PSTN (Comcast). Comcast provides inbound and outbound call service.
- Testing was performed in accordance to Comcast test plan and all features were verified. Key features verified are: inbound and outbound basic call (including international calls), calling name delivery, calling number and name restriction, CODEC negotiation, intra-site transfers, intra-site conferencing, call hold and resume, call forward (forward all, busy and no answer), leaving and retrieving voicemail (Cisco Unity Connection).
- Consult your Cisco representative for the correct IOS image and for the specific application and Device Unit License and Feature License requirements for all your Cisco CME.

Network Topology

Figure 1. Basic Call Setup



The Cisco Unified CME in Figure 1

Hardware Components

- This solution was tested with Cisco ISR4321.
- Cisco IP Phones. This solution was tested with 7965, 9971, and 7961 phones, but any Cisco IP Phone model supporting RFC2833 can be used.
- Cisco ISR4321/K9 (1RU) processor with 1784679K/6147K bytes of memory. Processor board ID FLM1925D0WZ.
- 3 Gigabit Ethernet interfaces.
- Cisco Unity Connection - VMware - 1 vCPU: Intel(R) Xeon(R) CPU X5675 @ 3.07GHz.
- HDD 160 GB, Memory 4096 Mbytes RAM.

Software Requirements

- Cisco IOS-XE gateway running Cisco Unified CME Version 12.3 (IOS-XE 16.9.3), RELEASE SOFTWARE (fc2). This solution was tested with Cisco IOS image: "bootflash:isr4300-universalk9.16.09.03.SPA.bin".
- This solution was tested with Cisco Unity Connection version (Version 12.0.1.21900-10).



Features

Features - Supported

- Basic Call using G711ulaw.
- Calling Party Number Presentation and Restriction.
- Calling Name.
- Call Transfer.
- Conference.
- Call Hold and Resume (See Caveat section for details).
- Call Forward All, Busy and No Answer.
- Incoming DID Translation and Routing.
- Outbound calls and Inbound calls.
- Voicemail.
- Auto-attendant

Features Not Supported

- Cisco IP phones used in this test do not support Blind Transfer, only Semi-attendant and Attendant transfers were tested.
- Comcast does not support G729 codec.

Caveats

Fax:

- Comcast does not support Fax with VoIP service.

Configuration Considerations

- None.



Configuration

Cisco IOS Version

Comcast_CME#sh version

Cisco IOS XE Software, Version 16.09.03

Cisco IOS Software [Fuji], ISR Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version 16.9.3, RELEASE SOFTWARE (fc2)

Technical Support: <http://www.cisco.com/techsupport>

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ROM: IOS-XE ROMMON

Comcast_CME uptime is 1 week, 5 days, 18 hours, 37 minutes

Uptime for this control processor is 1 week, 5 days, 18 hours, 39 minutes

System returned to ROM by Reload Command at 14:39:18 CDT Thu Sep 5 2019

System image file is "bootflash:isr4300-universalk9.16.09.03.SPA.bin"

Last reload reason: Reload Command

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<http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

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



Suite License Information for Module:'esg'

Suite	Suite Current	Type	Suite Next reboot
FoundationSuiteK9 securityk9 appxk9	FoundationSuiteK9	EvalRightToUse	FoundationSuiteK9
AdvUCSuiteK9 uck9 cme-srst cube	AdvUCSuiteK9	EvalRightToUse	AdvUCSuiteK9

Technology Package License Information:

Technology	Technology-package Current	Type	Technology-package Next reboot
appxk9	None	None	None
uck9	None	None	uck9
securityk9	None	None	securityk9
ipbase	ipbasek9	Permanent	ipbasek9

The current throughput level is 50000 kbps

Smart Licensing Status: Smart Licensing is DISABLED

cisco ISR4321/K9 (1RU) processor with 1784679K/6147K bytes of memory.

Processor board ID FLM1925D0WZ

3 Gigabit Ethernet interfaces

32768K bytes of non-volatile configuration memory.

4194304K bytes of physical memory.

3223551K bytes of flash memory at bootflash:.

0K bytes of WebUI ODM Files at webui:.

Configuration register is 0x2102



Cisco Unified CME

Comcast_CME#sh run

```
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
no platform punt-keepalive disable-kernel-core
!
hostname Comcast_CME
!
boot-start-marker
boot system flash isr4300-universalk9.16.09.03.SPA.bin
boot-end-marker
!
!
vrf definition Mgmt-intf
!
address-family ipv4
exit-address-family
!
address-family ipv6
exit-address-family
!
no logging console
enable secret 5 $1$Rrx8$nm82keZ4yvW0V88d7JHI.0
enable password XXXXX
!
no aaa new-model
clock timezone CST -6 0
clock summer-time CDT recurring
!
ip admission watch-list expiry-time 0
!
login on-success log
!
subscriber templating
!
multilink bundle-name authenticated
!
crypto pki trustpoint TP-self-signed-1270583006
enrollment selfsigned
subject-name cn=IOS-Self-Signed-Certificate-1270583006
revocation-check none
rsakeypair TP-self-signed-1270583006
!
```




crypto pki certificate chain TP-self-signed-1270583006

certificate self-signed 01

!

voice service voip

ip address trusted list

no ip address trusted authenticate

media disable-detailed-stats

allow-connections h323 to h323

allow-connections h323 to sip

allow-connections sip to h323

allow-connections sip to sip¹

no supplementary-service sip moved-temporarily

no supplementary-service sip refer

no supplementary-service sip handle-replaces

redirect ip2ip

fax protocol pass-through g711ulaw

sip

session refresh²

registrar server expires max 600 min 60³

asserted-id pai

!

voice class codec 1⁴

codec preference 1 g711ulaw

!

voice register global

mode cme⁵

source-address 10.70.24.10 port 5060⁶

max-dn 20⁷

max-pool 10⁸

load 7965 SIP45.9-2-1S.loads⁹

load 9971 sip9971.9-3-1-33.loads

mwi stutter

voicemail 7777

tftp-path flash:¹⁰

file text

¹ This command enables Cisco Unified CME to perform basic SIP to SIP voice communication.

² Use the SIP session refresh command to send the session refresh request.

³ Enable Local SIP Registrar which is required for SIP phones in Cisco Unified CME.

⁴ This command enables multiple codec support and performs codec filtering required for correct interoperability between Comcast SIP network and Cisco Unified CME.

⁵ Enables the mode for configuring SIP IP phones in Cisco Unified CME.

⁶ This is the source address for SIP phone registration.

⁷ Configuration for maximum extensions.

⁸ Configuration for maximum phones.

⁹ Specify phone loads for each phone type.

¹⁰ Setup path for tftp files.



```
create profile sync 005544059411755411
auto-register
!
voice register dn 1
number 0425
name Comcast Phone 1
mwi
!
voice register dn 2
number 0426
name Comcast Phone 2
mwi
!
voice register pool 1
id mac 1C17.D337.D08D
type 9971
number 1 dn 1
dtmf-relay rtp-nte
voice-class codec 1
!
voice register pool 2
id mac 001D.452C.D981
type 7965
number 1 dn 2
dtmf-relay rtp-nte
voice-class codec 1
!
voice moh-group 1
moh enable-g711 "flash:music-on-hold.au"
!
voice translation-rule 112
rule 1 /\(^0...\)/ /856333\1/
!
voice translation-rule 213
rule 1 /856333\(...\)/ /\1/
!
voice translation-profile to_Comcast
translate calling 1
!
voice translation-profile to_ext
translate called 2
!
license udi pid ISR4321/K9 sn FDO19220WQ8
license accept end user agreement
```

¹¹ Create configuration files for phones.

¹² This translation rule/profile is used to modify the calling number.

¹³ This translation rule/profile is used to modify the called number.



```
license boot suite FoundationSuiteK9
license boot suite AdvUCSuiteK9
no license smart enable
diagnostic bootup level minimal
!
spanning-tree extend system-id
!
redundancy
mode none
!
interface GigabitEthernet0/0/0
description WAN
ip address 10.70.23.2 255.255.255.0
negotiation auto
!
interface GigabitEthernet0/0/1
description LAN
ip address 10.70.24.10 255.255.255.0
negotiation auto
!
interface GigabitEthernet0/1/0
no ip address
shutdown
negotiation auto
!
interface GigabitEthernet0
vrf forwarding Mgmt-intf
no ip address
shutdown
negotiation auto
!
ip forward-protocol nd
ip http server
ip http authentication local
ip http secure-server
ip http client source-interface GigabitEthernet0/0/1
ip tftp source-interface GigabitEthernet0/0/1
ip route 10.64.0.0 255.255.0.0 10.70.24.1
ip route 10.80.0.0 255.255.0.0 10.70.24.1
!
tftp-server flash:sip9971.9-3-1-33.loads
tftp-server flash:kern9971.9-3-1-33.sebn
tftp-server flash:rootfs9971.9-3-1-33.sebn
tftp-server flash:sboot9971.031610R1-9-3-1-33.sebn
tftp-server flash:skern9971.022809R2-9-3-1-33.sebn
tftp-server flash:dkern9971.100609R2-9-3-1-33.sebn
tftp-server flash:apps45.9-2-1TH1-13.sbn
tftp-server flash:cnu45.9-2-1TH1-13.sbn
```

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Note: Testing was conducted in tekVizion labs



```
tftp-server flash:cvm45sip.9-2-1TH1-13.sbn
tftp-server flash:dsp45.9-2-1TH1-13.sbn
tftp-server flash:jar45sip.9-2-1TH1-13.sbn
tftp-server flash:SIP45.9-2-1S.loads
tftp-server flash:term45.default.loads
tftp-server flash:term65.default.loads
tftp-server flash:apps41.9-2-1TH1-13.sbn
tftp-server flash:cnu41.9-2-1TH1-13.sbn
tftp-server flash:cvm41sccp.9-2-1TH1-13.sbn
tftp-server flash:dsp41.9-2-1TH1-13.sbn
tftp-server flash:jar41sccp.9-2-1TH1-13.sbn
tftp-server flash:SCCP41.9-2-1S.loads
tftp-server flash:term41.default.loads
tftp-server flash:term61.default.loads
tftp-server flash:P0030801SR02.bin
tftp-server flash:P0030801SR02.loads
tftp-server flash:P0030801SR02.sb2
tftp-server flash:P0030801SR02.sbn
tftp-server flash:P0030801SR02.txt
tftp-server flash:music-on-hold.au
!
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
!
telephony-service
conference transfer-pattern
max-ephones 20
max-dn 20
ip source-address 10.70.24.10 port 2000
load 7960-7940 P0030801SR02.loads
load 7961 SCCP41.9-2-1S.loads
load 7975 SCCP75.9-4-2SR3-1S
time-zone 8
voicemail 777714
max-conferences 8 gain -6
call-forward pattern .T
moh enable-g711 "music-on-hold.au"15
transfer-system full-consult
transfer-pattern .T
```

¹⁴ 7777 - Voice mail pilot number used in this example.

¹⁵ This is Music on Hold file configured in this example.



```
create cnf-files version-stamp Jan 01 2002 00:00:00
!
dspfarm profile 1 transcode universal16
codec g711ulaw
!
dial-peer voice 100 voip
description Outbound Call to Comcast
translation-profile outgoing to_Comcast
destination-pattern .T
session protocol sipv2
session target ipv4:10.70.23.10:506017
session transport udp
voice-class codec 118
dtmf-relay rtp-nte
no vad
!
dial-peer voice 101 voip
description inbound from Comcast
translation-profile incoming to_ext
session protocol sipv2
session transport udp
incoming called-number 856333....
voice-class codec 1
dtmf-relay rtp-nte
no vad
!
dial-peer voice 102 voip19
description to UnityConnection
destination-pattern 7777
session protocol sipv2
session target ipv4:10.80.14.4:506020
session transport udp
voice-class codec 1
dtmf-relay rtp-nte
no vad
!
sip-ua
mwi-server ipv4:10.80.14.4 expires 3600 port 5060 transport udp unsolicited
!
ephone-dn 1
number 0427
label 0427
```

¹⁶ Transcoding profile used in this example.

¹⁷ This command sets the SIP server target for outgoing SIP calls.

¹⁸ This command assigns the voice class codec setting to this dial-peer.

¹⁹ Dial peer used to route the calls to Cisco unity connection server for Voicemail access.

²⁰ This command sets the Cisco unity connection server target for voicemail calls.



```
name SCCP
moh-group 1
!
ephone-dn 2
number 0428
label 0428
name SCCP
mwi sip
moh-group 1
!
ephone 1
device-security-mode none
mac-address 001C.5856.CFE6
type 7961
mwi-line 1
button 1:1
!
ephone 2
device-security-mode none
mac-address FCFB.FBCA.533F
type 7960
mwi-line 1
button 1:2
!
line con 0
password XXXXX
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
exec-timeout 0 0
privilege level 15
password XXXXXX
login
transport input telnet ssh
line vty 5 15
exec-timeout 0 0
privilege level 15
password XXXXXX
login
transport input telnet ssh
!
ntp server 10.10.10.5
!
end
```



Cisco Unity Connection

Version Details

Cisco Unity Connection Administration

Version 12.0.1.21900-10



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A summary of U.S. laws governing Cisco cryptographic products may be found at our [Export Compliance Product Report](#) web site.

For information about Cisco Unified Communications Manager please visit our [Unified Communications System Documentation](#) web site.

For Cisco Technical Support please visit our [Technical Support](#) web site.



Cisco Unity Connection User Configuration

Navigation: Cisco Unity Connection → Users → Users

Set Alias* = 0425. This is used for this example.

Set First Name = 0425 is used to identify this User.

Set Last Name* = 0425. This is used for this example

Set Display Name = 0425. This is used in this example.

Set SMTP Address = 0425. This is used in this example.

Set Extension = 0425. This is used in this example.

Set Phone System = Comcast_CME_10.70.24.10. This is used in this example.

All other values are default.

Edit User Basics (0425)Related LinksBulk Edit

User Edit Refresh Help

SaveDeletePreviousNext

Name

Alias*0425

First Name0425

Last Name0425

Display Name, 0425

SMTP Address0425@clus24-unity.lab.tekvizion.com

Initials

Title

Employee ID

LDAP Integration Status

☐ Integrate with LDAP Directory

☒ Do Not Integrate with LDAP Directory

Phone

Extension*0425

Cross-Server Transfer Extension or URI

Outgoing Fax Number

Outgoing Fax Server--- Not Selected ---

Partitionclus24-unity Partition

Search Scopeclus24-unity Search Space

Phone SystemComcast_CME_10.70.24.10

Class of ServiceVoice Mail User COS

Active ScheduleWeekdays

View



Cisco Unity Connection User Configuration (Continued)

All other values are default.

The screenshot displays the Cisco Unity Connection Administration web interface. The top navigation bar includes the Cisco logo, the title "Cisco Unity Connection Administration", and the subtitle "For Cisco Unified Communications Solutions". The right side of the navigation bar shows the user role "administrator" and links for "Search Documentation", "About", and "Sign Out".

The left sidebar contains a tree view of the administration menu, with "Users" expanded. The main content area is titled "Cisco Unity Connection" and shows the configuration for a specific user. The "Class of Service" is set to "Voice Mail User COS" and the "Active Schedule" is "Weekdays". A "View" button is next to the schedule. Below these are several checkboxes: "Set for Self-enrollment at Next Sign-In" (unchecked), "List in Directory" (checked), "Send Non-Delivery Receipts on Failed Message Delivery" (checked), "Skip PIN When Calling From a Known Extension" (unchecked), and "Use Short Calendar Caching Poll Interval" (unchecked).

The "Recorded Name" section features a simulated phone interface. It includes a "Number or URI" field with the value "8485", a "Volume" slider, and a "Speed" dropdown set to "1x".

The "Location" section contains several text input fields: "Address", "Building", "City", "State", "Postal Code", and "Country" (set to "United States"). Below these are checkboxes for "Use System Default Time Zone" (checked) and "Use System Default Language" (checked). The "Time Zone" dropdown is set to "(GMT-06:00) America/Chicago", and the "Language" dropdown is set to "English(United States)".

The bottom section includes fields for "Department", "Manager", "Billing ID", and "Corporate Email Address".



Cisco Unity Connection Telephony Integration

Navigation: Telephony Integrations → Phone system

Set System Name* = CME. This Name used for this example.

The screenshot displays the Cisco Unity Connection Administration web interface. The left sidebar shows the navigation menu with 'Telephony Integrations' and 'Phone System' highlighted. The main content area is titled 'Phone System Basics (CME)' and includes a 'Phone System Name*' field set to 'CME'. Other sections include 'Message Waiting Indicators', 'Call Loop Detection by Using DTMF', 'Call Loop Detection by Using Extension', 'Phone View Settings', and 'Outgoing Call Restrictions'.

Cisco Unity Connection Administration
For Cisco Unified Communications Solutions

Navigation: Cisco Unity Connection Administration Go
administrator | Search Documentation | About | Sign Out

Phone System Basics (CME)
Search Phone Systems Phone System Basics (CME)
Related Links Add Port Group Go

Phone System Edit Refresh Help
Save Delete Previous Next

Phone System
Phone System Name* CME
☐ Default TRAP Phone System

Message Waiting Indicators
☐ Send Message Counts
☐ Use Same Port for Enabling and Disabling MWIs
☐ Force All MWIs Off for this Phone System
Run Synchronize All MWIs on This Phone System

Call Loop Detection by Using DTMF
☐ Enable for Supervised Transfers
☐ Enable for Forwarded Message Notification Calls (by Using DTMF)
DTMF Tone To Use A
Guard Time 2500 milliseconds

Call Loop Detection by Using Extension
☒ Enable for Forwarded Message Notification Calls (by Using Extension)

Phone View Settings
☐ Enable Phone View
CTI Phone Access Username
CTI Phone Access Password

Outgoing Call Restrictions
☒ Enable outgoing calls
☐ Disable all outgoing calls immediately
☐ Disable all outgoing calls between



Port Group

Navigation: Telephony Integration → Port Group.

Set Display Name* = CME-1. This Name used for this example.

Check Register with SIP server.

The screenshot displays the Cisco Unity Connection Administration web interface. The left sidebar shows the navigation tree with 'Port Group' highlighted under 'Telephony Integrations'. The main content area is titled 'Port Group Basics (CME-1)'. It includes a search bar, navigation buttons (Save, Delete, Previous, Next), and a 'Port Group' section with the following fields:

- Display Name*: CME-1
- Integration Method: SIP
- Reset Status: Reset Not Required

The 'Session Initiation Protocol (SIP) Settings' section is expanded, showing:

- ☒ Register with SIP Server
- ☐ Authenticate with SIP Server
- Authentication Username: [empty]
- Authentication Password: [empty]
- Contact Line Name: [empty]
- SIP Security Profile: 5060
- SIP Transport Protocol: UDP

The 'Advertised Codec Settings' section includes a table with two columns: Display Name and Packet Size.

Display Name	Packet Size
G.711 mu-law	20
G.729	20

Below the table is a 'Change Advertising' button. The 'Message Waiting Indicator Settings' section is also visible, showing:

- ☒ Enable Message Waiting Indicators
- Delay between Requests: 0 milliseconds
- Maximum Concurrent Requests: 0
- Retries After Successful Attempt: 0
- Retry Interval After Successful Attempt: 5 milliseconds

At the bottom, there are 'Save', 'Delete', 'Previous', and 'Next' buttons, and a note: 'Fields marked with an asterisk (*) are required.'



Navigation Path: Telephony Integration → Port Group → Edit → Servers.

The screenshot shows the Cisco Telephony Integration configuration interface. On the left is a sidebar with a tree view containing the following items: Users, Class of Service, Templates, Contacts, Distribution Lists, Call Management, Message Storage, Networking, Unified Messaging, Video, Dial Plan, System Settings, and Telephony Integrations. Under 'Telephony Integrations', the following items are listed: Phone System, Port Group (selected), Port, Speech Connect Port, Trunk, Security, and Tools.

The main content area is titled 'Edit Servers' and includes a 'Related Links' section with 'Check Telephony Configuration' and a 'Go' button. Below this is a 'Port Group' section with 'Edit', 'Refresh', and 'Help' buttons, and a 'Save' button.

The 'SIP Servers' section contains a 'Delete Selected' and 'Add' button, followed by a table with the following columns: Order, IPv4 Address or Host Name, IPv6 Address or Host Name, Port, and TLS Port. The first row of the table is highlighted with a red box and contains the values: 0, 10.70.24.10, (empty), 5060, and 5061. Below the table are 'Delete Selected' and 'Add' buttons.

The 'TFTP Servers' section contains a 'Delete Selected' and 'Add' button, followed by a table with the following columns: Order, IPv4 Address or Host Name, and IPv6 Address or Host Name. Below the table are 'Delete Selected' and 'Add' buttons.

At the bottom, the 'IPv6 Addressing Mode' section has two dropdown menus: 'Preference for Signaling' set to 'IPv4' and 'Preference for Media' set to 'IPv4'. A 'Save' button is located at the bottom of this section.



Port

Set Port Name = CME-1-001. This Name used for this example.

Phone System = CME.

Port Group = CME-1.

Server = unity-unity2.lab.tekvizion.com. This Name used for this example.

The screenshot displays the Cisco Unity Connection Administration web interface. The left sidebar shows the navigation menu with 'Port' highlighted under 'Telephony Integrations'. The main content area is titled 'Port Basics (CME-1-001)'. It includes a 'Phone System Port' section with the following fields: 'Enabled' (checked), 'Port Name' (CME-1-001), 'Phone System' (CME), 'Port Group' (CME-1), and 'Server' (unity-unity2.lab.tekvizion.com). A 'Restart' button is next to the Port Name field. Below this is the 'Port Behavior' section with checkboxes for 'Answer Calls', 'Perform Message Notification', 'Send MWI Requests (may also be disabled by the port group)', and 'Allow TRAP Connections'. Navigation buttons like 'Save', 'Delete', 'Previous', and 'Next' are present at the top and bottom of the configuration area.



Acronyms

SIP	Session Initiation Protocol
MGCP	Media Gateway Control Protocol
SCCP	Skinny Client Control Protocol
Cisco Unified CME	Cisco Unified Communications Manager Express
SP	Service Provider
PSTN	Public switched telephone network
DTMF	Dual Tone Multi-Frequency
CUC	Cisco Unity Connection
VOIP	Voice Over Internet Protocol
IP	Internet Protocol
TDM	Time-division multiplexing
BTN	Billed (or Billing) Telephone Number
CODEC	Coder-Decoder (in this document a device used to digitize and un digitize voice signals)



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