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.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

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.

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: https://www.cisco.com/go/trademarks. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1721R)

© 2018 Cisco Systems, Inc. All rights reserved.
CONTENTS

CHAPTER 1  Read Me First  1

CHAPTER 2  New and Changed Information  3
           New and Changed Information  3

CHAPTER 3  Supported Platforms  5
           Feature Comparison on Supported Platforms  6

PART I  CUBE Fundamentals and Basic Setup  9

CHAPTER 4  Overview of Cisco Unified Border Element  11
           Information About Cisco Unified Border Element  11
           SIP/H.323 Trunking  13
           Typical Deployment Scenarios for CUBE  14
           How to Configure Basic CUBE Features  15
           Enabling the CUBE Application on a Device  16
           Verifying the CUBE Application on the Device  17
           Configuring a Trusted IP Address List for Toll-Fraud Prevention  18

CHAPTER 5  Virtual CUBE  21
           Feature Information for Virtual CUBE  21
           Prerequisites for Virtual CUBE  21
           Hardware  22
           Software  22
           Features Supported with Virtual CUBE  22
           Restrictions  23
Information about Virtual CUBE Support on Cisco CSR 1000V Series Routers 23
  High Availability 23
  Media 26
  Licensing Package Support 26
Installation 26
  Installation using OVA File 26
  Installation using ISO Image 27
How to Enable Virtual CUBE on Cisco CSR 1000V Series Router 27
Troubleshooting Virtual CUBE Support 27

CHAPTER 6 Dial-Peer Matching 29
  Dial Peers in CUBE 29
  Configuring Inbound and Outbound Dial-Peer Matching for CUBE 31
  Preference for Dial-Peer Matching 32

CHAPTER 7 DTMF Relay 35
  Feature Information for DTMF Relay 35
  Information About DTMF Relay 36
    DTMF Tones 36
    DTMF Relay 36
  Configuring DTMF Relays 39
    Interoperability and Priority with Multiple DTMF Relay Methods 39
    DTMF Interoperability Table 40
  Verifying DTMF Relay 44

CHAPTER 8 Introduction to Codecs 49
  Why CUBE Needs Codecs 49
  Voice Media Transmission 50
  Voice Activity Detection 51
  VoIP Bandwidth Requirements 51
  Supported Audio and Video Codecs 53
  How to Configure Codecs 55
    Configuring Audio and Video Codecs at the Dial Peer Level 55
    Configuring Audio Codecs Using a Codec Voice Class and Preference Lists 57
Example: Configuration to Remove an Attribute 91
Configuring SIP Profile Using Rule Tag 91
Configuring a SIP Profile for Non-standard SIP Header 93
Upgrading or Downgrading SIP Profile Configurations 94
Configuring a SIP Profile as an Outbound Profile 95
Configuring a SIP Profile as an Inbound Profile 96
Verifying SIP Profiles 98
Troubleshooting SIP Profiles 98
Examples: Adding, Modifying, Removing SIP Profiles 99
  Example: Adding a SIP, SDP, or Peer Header 99
  Example: Modifying a SIP, SDP, or Peer Header 101
  Example: Remove a SIP, SDP, or Peer Header 103
  Example: Inserting SIP Profile Rules 104
  Example: Upgrading and Downgrading SIP Profiles automatically 105
  Example: Modifying Diversion Headers 106
  Example: Sample SIP Profile Application on SIP Invite Message 107
  Example: Sample SIP Profile for Non-Standard SIP Headers 107

VoIP for IPv6 109
  Finding Feature Information 109
  Prerequisites for VoIP for IPv6 109
  Restrictions for Implementing VoIP for IPv6 110
  Information About VoIP for IPv6 111
    SIP Features Supported on IPv6 111
    SIP Voice Gateways in VoIPv6 112
    VoIPv6 Support on Cisco UBE 113
  How to Configure VoIP for IPv6 117
    Configuring VoIP for IPv6 117
      Shutting Down or Enabling VoIP6 Service on Cisco Gateways 118
      Shutting Down or Enabling VoIP6 Submodes on Cisco Gateways 119
      Configuring the Protocol Mode of the SIP Stack 119
      Verifying SIP Gateway Status 121
    RTCP Pass-Through 123
      Configuring IPv6 Support for Cisco UBE 123
CHAPTER 15

Multiple Pattern Support on a Voice Dial Peer 187
Feature Information for Multiple Pattern Support on a Voice Dial Peer 187
Restrictions for Multiple Pattern Support on a Voice Dial Peer 188
Information About Multiple Pattern Support on a Voice Dial Peer 188
Configuring Multiple Pattern Support on a Voice Dial Peer 188
Verifying Multiple Pattern Support on a Voice Dial Peer 190
Configuration Examples for Multiple Pattern Support on a Voice Dial Peer 192

CHAPTER 16

Outbound Dial-Peer Group as an Inbound Dial-Peer Destination 193
Feature Information for Outbound Dial-Peer Group as an Inbound Dial-Peer Destination 193
Restrictions 194
Information About Outbound Dial-Peer Group as an Inbound Dial-Peer Destination 194
Support for Multi-VRF 277

Feature Information for VRF 277
Information About Single-VRF 278
Information About Multi-VRF 278
Restrictions 279
Recommendations 279
Configuring VRF 280
Create a VRF 280
Assign Interface to VRF 281
Create Dial-peers 282
Bind Dial-peers 283
Configure VRF Specific RTP Port Ranges 285
Example: VRF with overlapping and non-overlapping RTP Port Range 287
Directory Number (DN) Overlap across Multiple-VRFs 288
Example: Associating Dial-peer Groups to overcome DN overlap 289
IP Overlap with VRF 291
Using Server Groups with VRF 292
Inbound Dial-Peer Matching based on Multi-VRF 293
Example: Inbound Dial-Peer Matching based on Multi-VRF 293
VRF Aware DNS for SIP Calls 295
High Availability with VRF 296
Configuration Examples 296
Example: Configuring Multi-VRF in Standalone Mode 296
Example: Configuring RG Infra High Availability with VRF 300
Example: Configuring HSRP High Availability with VRF 307

Configuring Multi-Tenants on SIP Trunks 315
Feature Information for Configuring Multi-Tenants on SIP Trunks 315
Information About Configuring Multi-Tenants on SIP Trunks 315
How to Configure Multi-Tenants on SIP Trunks 319
Configuring Multi-Tenants on SIP Trunks 319
Example: SIP Trunk Registration in Multi-Tenant Configuration 321
PART V  Codecs  

CHAPTER 24  Codec Support and Restrictions  

Feature Information for Codec Support on CUBE  
ISAC Codec Support on CUBE  
Restrictions for ISAC Codec Support on CUBE  
AAC-LD MP4A-LATM Codec Support on Cisco UBE  
Restrictions for AAC-LD MP4A-LATM Codec Support on Cisco UBE  

CHAPTER 25  Codec Preference Lists  

Feature Information for Negotiation of an Audio Codec from a List of Codecs  
Codecs configured using Preference Lists  
Prerequisites for Codec Preference Lists  
Restrictions for Codecs Preference Lists  
How to Configure Codec Preference Lists  
Configuring Audio Codecs Using a Codec Voice Class and Preference Lists  
Disabling Codec Filtering  
Troubleshooting Negotiation of an Audio Codec from a List of Codecs  
Verifying Negotiation of an Audio Codec from a List of Codecs  

PART VI  DSP Services  

CHAPTER 26  Transcoding  

Configuring LTI-based Transcoding  
Configuration Examples for LTI Based Transcoding  
Configuring SCCP-based Transcoding (ISR-G2 devices only)  
TLS for SCCP Connection for DSP Services  
Configuring Secure Transcoding  
Configuring the Certificate Authority  
Configuring a Trustpoint for the Secure Universal Transcoder  
Configuring DSPFARM Services  
Associating SCCP to the Secure DSPFARM Profile  
Registering the Secure Universal Transcoder to the CUBE
Contents

CHAPTER 31 SIPREC (SIP Recording) 401
  Feature Information for SIPREC-based Recording 401
  Prerequisites for SIPREC Recording 402
  Restrictions for SIPREC Recording 402
  Information About SIPREC Recording Using CUBE 403
    Deployment 403
    SIPREC High Availability Support 404
  How to Configure SIPREC-Based Recording 404
    Configuring SIPREC-Based Recording (with Media Profile Recorder) 404
    Configuring SIPREC-Based Recording (without Media Profile Recorder) 407
  Configuration Examples for SIPREC-based Recording 409
    Example: Configuring SIPREC-based Recording with Media Profile Recorder 409
    Example: Configuring SIPREC-based Recording without Media Profile Recorder 409
  Example of Metadata Variations with Different Mid-call Flows 409
    Example: Complete SIP Recording Metadata information sent in INVITE or Re-INVITE 409
    Example: Hold with Send-only / Recv-only Attribute in SDP 412
    Example: Hold with Inactive Attribute in SDP 415
Example: Escalation 417
Example: De-escalation 419
Example of Metadata Variations with Different Transfer Flows 422
Example: Transfer of Re-INVITE/REFER Consume Scenario 422
Example of Metadata Variations with Caller-ID UPDATE Flow 422
Example: Caller-ID UPDATE Request and Response Scenario 422
Example of Metadata Variations with Call Disconnect 424
Example: Disconnect while Sending Metadata with BYE 424

CHAPTER 32
Video Recording - Additional Configurations 425
Feature Information for Video Recording - Additional Configurations 425
Information About Additional Configurations for Video Recording 426
Full Intra-Frame Request 426
How to Configure Additional Configurations for Video Recording 426
Enabling FIR for Video Calls (Using RTCP of SIP INFO) 426
Configuring H.264 Packetization Mode 427
Monitoring Reference files or Intra Frames 428
Verifying Additional Configurations for Video Recording 429

CHAPTER 33
Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording 431
Feature Information for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording 431
Restrictions for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording 432
Information About Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording 432
How to Capture Third-Party GUID for Correlation Between Calls and SIP-based Recording 432
Verifying Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording 435
Configuration Examples for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording 436

CHAPTER 34
Cisco Unified Communications Gateway Services—Extended Media Forking 439
Feature Information for Cisco Unified Communications Gateway Services—Extended Media Forking 439
Restrictions for Unified Communications Gateway Services—Extended Media Forking 440
Information About Cisco Unified Communications Gateway Services 440
  Extended Media Forking (XMF) Provider and XMF Connection 440
  XMF Call-Based Media Forking 441
  XMF Connection-Based Media Forking 441
Cisco UC Gateway Services Media Forking API with Survivability TCL 442
  Media Forking for SRTP Calls 443
    Crypto Tag 443
    Example of SDP Data sent in an SRTP Call 444
  Multiple XMF Applications and Recording Tone 444
  Forking Preservation 446
How to Configure UC Gateway Services 447
  Configuring Cisco Unified Communication IOS Services on the Device 447
  Configuring the XMF Provider 450
  Verifying the UC Gateway Services 451
  Troubleshooting Tips 453
  Configuration Examples for UC Gateway Services 454
    Example: Configuring Cisco Unified Communication IOS Services 454
    Example: Configuring the XMF Provider 454
    Example: Configuring UC Gateway Services 454

PART IX

SIP Header Manipulation 455

CHAPTER 35

Passing Headers Unsupported by CUBE 457
  Feature Information for Copying with SIP Profiles 457
  Example: Passing a Header Not Supported by CUBE 457

CHAPTER 36

Copying SIP Headers 459
  Feature Information for Copying with SIP Profiles 459
  How to Copy SIP Header Fields to Another 460
    Copying From an Incoming Header and Modifying an Outgoing Header 460
    Copying From One Outgoing Header to Another 462
  Example: Copying the To Header into the SIP-Req-URI 463

CHAPTER 37

Manipulating SIP Status-Line Header of SIP Responses 467
PART X

CHAPTER 38

Feature Information for Manipulating SIP Responses 467
Copying Incoming SIP Response Status Line to Outgoing SIP Response 468
Modifying Status-Line Header of Outgoing SIP Response with User Defined Values 471

PAYLOAD TYPE INTEROPERABILITY 473

DYNAMIC PAYLOAD TYPE INTERWORKING FOR DTMF AND CODEC PACKETS FOR SIP-TO-SIP CALLS 475

Feature Information for Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls 475
Restrictions for Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls 476
Symmetric and Asymmetric Calls 476
High Availability Checkpointing Support for Asymmetric Payload 477
How to Configure Dynamic Payload Type Passthrough for DTMF and Codec Packets for SIP-to-SIP Calls 478
Configuring Dynamic Payload Type Passthrough at the Global Level 478
Configuring Dynamic Payload Type Passthrough for a Dial Peer 479
Verifying Dynamic Payload Interworking for DTMF and Codec Packets Support 480
Troubleshooting Tips 480
Configuration Examples for Assymetric Payload Interworking 481
Example: Asymmetric Payload Interworking—Passthrough Configuration 481
Example: Asymmetric Payload Interworking—Interworking Configuration 482

PART XI

CHAPTER 39

DYNAMIC-OFFER TO EARLY-OFFER 485

Feature Information for Delayed-Offer to Early-Offer 485
Prerequisites for Delayed-Offer to Early-Offer 486
Restrictions for Delayed-Offer to Early-Offer Media Flow-Around 486
Delayed-Offer to Early-Offer in Media Flow-Around Calls 486
Configuring Delayed Offer to Early Offer 487
Configuring Delayed Offer to Early Offer for Video Calls 488
Configuring Delayed Offer to Early Offer Media Flow-Around 489
MidCall Renegotiation Support for Delayed-Offer to Early-Offer Calls 490
Feature Information for Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices 567
Prerequisites for Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices 568
Restrictions for Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices 569
Information About Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices 569
Call Escalation with Stateful Switchover 570
Call De-escalation with Stateful Switchover 570
Media Forking with High Availability 571
High Availability Protected Mode and Box-to-Box Redundancy for ASR 572
Support for Box-to-Box High Availability with Virtual IP Addresses 572
Monitoring Call Escalation and De-escalation with Stateful Switchover 572
Monitoring Media Forking with High Availability 574
Verifying the High Availability Protected Mode 576
Support for REFER and BYE/Also after Stateful Switch-Over 577
Troubleshooting Tips 577
Example: Configuring the Interfaces for ISR-G2 Devices 579
Example: Configuring the Interfaces for ASR Devices 579
Example: Configuring SIP Binding 579

CHAPTER 48
CVP Survivability TCL support with High Availability 581
Feature Information for CVP Survivability TCL support with High Availability 581
Prerequisites 582
Restrictions 582
Recommendations 582
CVP Survivability TCL support with High Availability 582
Configuring CVP Survivability TCL support with High Availability 582

PART XIV
ICE-Lite Support on CUBE 583

CHAPTER 49
ICE-Lite Support on CUBE 585
Feature Information for ICE-Lite Support on CUBE 585
Restrictions for ICE-lite Support on CUBE 586
Information About ICE-Lite Support on CUBE 586
Characteristics 586
Restrictions 612
Information about Early Dialog UPDATE Block 612
    Important Characteristics of Early Dialog UPDATE Block 612
Configuring Early Dialog UPDATE Block 613
Configuring Early Dialog UPDATE Block Renegotiate 614
Troubleshooting Tips 615

CHAPTER 52
Consumption of Forked 18x Responses with SDP During Early Dialog 617
    Feature Information for Consumption of Multiple Forked 18x Responses with SDP During Early Dialog 617
Prerequisites 618
Restrictions 618
Information About Consumption of Forked 18x Responses with SDP During Early Dialog 618
    Characteristics of Forked 18x Responses with SDP during Early Dialog 618
Configuring Consumption of Forked 18x Responses with SDP During Early Dialog 619
Configuring Consumption of Forked 18x Responses with SDP During Early Dialog Renegotiate 620
Troubleshooting Tips 622

CHAPTER 53
Support for Pass-Through of Unsupported Content Types in SIP INFO Messages 623
    Feature Information for Support for Pass-Through of Unsupported Content Types in SIP INFO Messages 623
Prerequisites 623
Information About Pass-Through of Unsupported Content Types in SIP INFO Messages 624

CHAPTER 54
Support for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element 625
    Feature Information for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element 634
Prerequisites for Support for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element 636
Restrictions for Support for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element 636
Configuring P-Header and Random-Contact Support on the Cisco Unified Border Element 636
    Configuring P-Header Translation on a Cisco Unified Border Element 636
    Configuring P-Header Translation on an Individual Dial Peer 637
Configuring P-Called-Party-Id Support on a Cisco Unified Border Element 638
Configuring P-Called-Party-Id Support on an Individual Dial Peer 639
Configuring Privacy Support on a Cisco Unified Border Element 640
Configuring Privacy Support on an Individual Dial Peer 642
Configuring Random-Contact Support on a Cisco Unified Border Element 643
Configuring Random-Contact Support for an Individual Dial Peer 644

PART XVI
SIP Supplementary Services 647

CHAPTER 55
Dynamic Refer Handling 649
  Feature Information for Dynamic REFER Handling 649
  Prerequisites 650
  Restrictions 650
  Configuring REFER Passthrough with Unmodified Refer-to 650
  Configuring REFER Consumption 652
  Troubleshooting Tips 654

CHAPTER 56
Cause Code Mapping 655
  Feature Information for Cause Code Mapping 655
  Cause Code Mapping 656
  Configuring Cause Code Mapping 657
  Verifying Cause Code Mapping 658

PART XVII
Cisco Unified Communications Manager Line-Side Support 661

CHAPTER 57
Cisco Unified Communications Manager Line-Side Support 663
  Feature Information for Cisco Unified Communications Manager Line-Side Support 663
  Restrictions for Cisco Unified Communications Manager Line-Side Support 664
  Information About Cisco Unified Communications Manager Line-Side Support 665
    Cisco UBE Line-Side Deployment 665
    Line-Side Deployment Scenarios 665
    Line-Side Support for CUCM on CUBE 666
    Configuring a PKI Trustpoint 667
    Importing the CUCM and CAPF Key 668
Creating a CTL File 669
Configuring a Phone Proxy 670
Attaching a Phone Proxy to a Dial Peer 671
Verifying CUCM Lineside Support 673
Example: Configuring a PKI Trustpoint 675
Example: Importing the CUCM and CAPF Key 676
Example: Creating a CTL File 676
Example: Configuring a Phone Proxy 676
Example: Attaching a Phone Proxy to a Dial Peer 676
Example: Configuring CUCM Secure Line-Side 677
Example: Configuring CUCM Non-Secure Line-Side 679

---

**PART XVIII**  
**Licensing** 683

**CHAPTER 58**  
**CUBE Licensing** 685

- Information About CUBE Licensing 685
- Unified Communications Bundles 685
- Cisco Unified Border Element License Types 686
- CUBE Licenses 686
- Licensing Requirements for Customer Deployment Scenarios 688
  - Two Active CUBEes and No Redundancy 688
  - Geographic Redundancy 689
  - Layer 2 Box-to-Box Redundancy with Call Preservation 689
  - Box-to-Box Redundancy and Load Balancing Across Locations 690
  - In-box Hardware and Software Redundancy 690
- CUBE Licensing FAQs 691

---

**PART XIX**  
**Security** 693

**CHAPTER 59**  
**SIP TLS Support on CUBE** 695

- Feature Information for SIP TLS Support on CUBE 695
- Restrictions 696
- Information About SIP TLS Support on CUBE 696
- Deployment 696
CHAPTER 1

Read Me First

Important Information about Cisco IOS XE 16

Effective Cisco IOS XE Release 3.7.0E (for Catalyst Switching) and Cisco IOS XE Release 3.17S (for Access and Edge Routing) the two releases evolve (merge) into a single version of converged release—the Cisco IOS XE 16—providing one release covering the extensive range of access and edge products in the Switching and Routing portfolio.

Feature Information

Use Cisco Feature Navigator to find information about feature support, platform support, and Cisco software image support. An account on Cisco.com is not required.

Related References

- Cisco IOS Command References, All Releases

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see What's New in Cisco Product Documentation.

To receive new and revised Cisco technical content directly to your desktop, you can subscribe to the . RSS feeds are a free service.
New and Changed Information

This section provides the details of new and changed information in Cisco Unified Border Element (CUBE) Configuration Guide.

For detailed information on CUBE features supported on Cisco IOS Releases, Cisco IOS XE 3S Releases, and Cisco IOS XE Denali 16 Releases, refer to CUBE Cisco IOS Feature Roadmap, CUBE Cisco IOS-XE Feature Roadmap, and CUBE Cisco IOS XE 16 Feature Roadmap respectively.

<table>
<thead>
<tr>
<th>Description</th>
<th>Documented at</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUBE Service Scalability solution on Cisco IOS XE Fuji Release 16.8.1.</td>
<td>Service Scalability, on page 239</td>
</tr>
<tr>
<td>Support for DTMF interworking between sip-info and rtp-npe for sip-sip calls on Cisco IOS XE Everest Release 16.6.1.</td>
<td>DTMF Relay, on page 36</td>
</tr>
</tbody>
</table>
CHAPTER 3

Supported Platforms

CUBE is supported on various platforms running on Cisco IOS Software Releases and Cisco IOS XE Software Releases.

For information on migrating from existing Cisco IOS XE 3S releases to the Cisco IOS XE Denali 16.3 release, see Cisco IOS XE Denali 16.3 Migration Guide for Access and Edge Routers

The following table provides details of supported platforms:

<table>
<thead>
<tr>
<th>Cisco Router Platforms</th>
<th>Cisco Router Models</th>
<th>Cisco IOS Software Releases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Integrated Services Generation 2 Routers (ISR G2)</td>
<td>Cisco 2900 Series Integrated Services Routers Cisco 3900 Series Integrated Services Routers</td>
<td>Cisco IOS 12 M and T Cisco IOS 15 M and T</td>
</tr>
<tr>
<td>Cisco 4000 Series Integrated Services Routers (ISR G3)</td>
<td>Cisco 4321 Integrated Services Routers Cisco 4331 Integrated Services Routers Cisco 4351 Integrated Services Routers Cisco 4431 Integrated Services Routers Cisco 4451 Integrated Services Routers</td>
<td>Cisco IOS XE 3S Cisco IOS XE Denali 16.3.1 onwards</td>
</tr>
<tr>
<td>Cisco Aggregated Services Routers (ASR)</td>
<td>Cisco 1001-X Aggregated Services Routers Cisco 1002-X Aggregated Services Routers Cisco 1004 Aggregated Services Routers with RP2 Cisco 1006 Aggregated Services Routers with RP2</td>
<td>Cisco IOS XE 3S Cisco IOS XE Denali 16.3.1 onwards</td>
</tr>
<tr>
<td>Cisco Cloud Services Routers (CSR)</td>
<td>Cisco Cloud Services Router 1000V series</td>
<td>Cisco IOS XE 3.15 onwards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cisco IOS XE Denali 16.3.1 onwards</td>
</tr>
</tbody>
</table>
1 All CUBE features from 11.5.0 (Cisco IOS XE Release 3.17) and earlier versions along with the features introduced in CUBE 11.5.1 on Cisco Integrated Services Generation 2 Routers (ISR G2) are included in CUBE release 11.5.2 for the Cisco IOS XE based platforms from Cisco IOS XE Denali 16.3.1 onwards.

2 Cisco IOS XE 16 requires a minimum of ASR1001-X, 1002-X, 1004/1006 RP2, ESP20 (Embedded Service Processor), and SIP40 (SPA Interface processor).

• Feature Comparison on Supported Platforms, on page 6

## Feature Comparison on Supported Platforms

The following table provides high level details of CUBE features supported in different platforms.

<table>
<thead>
<tr>
<th>Features</th>
<th>Cisco ASR 1000 Series Routers</th>
<th>Cisco ISR G2 Series Routers</th>
<th>Cisco ISR 4000 Series Routers</th>
<th>Cisco CSR 1000V Series Routers</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Availability Implementation</td>
<td>Redundancy Group Infrastructure</td>
<td>Hot Standby Router Protocol (HSRP) Based</td>
<td>Redundancy Group Infrastructure</td>
<td>Redundancy Group Infrastructure</td>
</tr>
<tr>
<td>Media Forking</td>
<td>Yes (Cisco IOS XE Release 3.8S onwards)</td>
<td>Yes (Cisco IOS Release 15.2(1)T onwards)</td>
<td>Yes (Cisco IOS XE Release 3.10S onwards)</td>
<td>Yes</td>
</tr>
<tr>
<td>Software MTP registered to CUCM (Including HA Support)</td>
<td>Yes (Cisco IOS XE Release 3.6S onwards)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>DSP Card Type</td>
<td>SPA-DSP</td>
<td>PVDM2/PVDM3</td>
<td>PVDM4</td>
<td>No</td>
</tr>
<tr>
<td>Transcoder registered to CUCM</td>
<td>No (Exists via SCCP)</td>
<td>Yes</td>
<td>Yes (Exists via SCCP - Cisco IOS XE Release 3.11S onwards)</td>
<td>No</td>
</tr>
<tr>
<td>Transcoder—LTI</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Note: For collaboration features' support on Cisco ISR 4000 Series Routers, Cisco IOS XE Release 3.13.1S or later is recommended. Cisco Cloud Services Routers 1000V Series support is available from Cisco IOS XE Release 3.15S onwards.
## Supported Platforms

### Feature Comparison on Supported Platforms

<table>
<thead>
<tr>
<th>Features</th>
<th>Cisco ASR 1000 Series Routers</th>
<th>Cisco ISR G2 Series Routers</th>
<th>Cisco ISR 4000 Series Routers</th>
<th>Cisco CSR 1000V Series Routers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco UC Gateway Services API</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(Cisco IOS Release 15.2(2)T onwards)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise Reduction &amp; ASP</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Cisco IOS Release 15.2(3)T onwards)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Call Progress Analysis</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>(Cisco IOS Release 15.3(2)T onwards ;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended - Cisco IOS Release 15.5(2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T onwards)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRTP-RTP Interworking</td>
<td>Yes - No DSP resources required</td>
<td>Yes - DSP resources required</td>
<td>Yes - No DSP resources required</td>
<td>Yes - No DSP resources required</td>
</tr>
<tr>
<td>(Cisco IOS Release 3.7S onwards)</td>
<td>(Cisco IOS Release 3.9S onwards ;</td>
<td>(Cisco IOS Release 12.4(22)YB onwards)</td>
<td>(Cisco IOS Release 3.15S onwards)</td>
<td>(Cisco IOS Release 3.15S onwards)</td>
</tr>
<tr>
<td></td>
<td>Recommended - Cisco IOS Release 3.15S inwards)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CUBE for SP Managed and Hosted Services</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Unified SRST colocation with CUBE</td>
<td>Not supported</td>
<td>SCCP SRST is supported</td>
<td>Yes</td>
<td>Not supported</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SIP SRST is not supported</td>
<td>(Cisco IOS XE Fuji 16.7.1 Release onwards)</td>
<td></td>
</tr>
</tbody>
</table>

**Note**

For more information on Unified SRST and Unified Border Element Co-location, see [Unified SRST and Unified Border Element Co-location](#).
PART I

CUBE Fundamentals and Basic Setup

• Overview of Cisco Unified Border Element, on page 11
• Virtual CUBE, on page 21
• Dial-Peer Matching, on page 29
• DTMF Relay, on page 35
• Introduction to Codecs, on page 49
• SIP Binding, on page 61
• Media Path, on page 77
• SIP Profiles, on page 83
• VoIP for IPv6, on page 109
Overview of Cisco Unified Border Element

Cisco Unified Border Element (CUBE) is a unified communications border element that bridges voice and video connectivity between two separate VoIP networks. It is similar to a traditional voice gateway, except for the replacement of physical voice trunks with an IP connection. Traditional gateways connect VoIP networks to telephone companies using a circuit-switched connection, such as PRI. The CUBE connects VoIP networks to other VoIP networks and is often used to connect enterprise networks to Internet telephony service providers (ITSPs).

- Information About Cisco Unified Border Element, on page 11
- How to Configure Basic CUBE Features, on page 15

Information About Cisco Unified Border Element

Cisco Unified Border Element (CUBE) can terminate and originate signaling (H.323 and Session Initiation Protocol [SIP]) and media streams (Real-Time Transport Protocol [RTP] and RTP Control Protocol [RTCP]).

CUBE extends the functionality provided by conventional session border controllers (SBCs) in terms of protocol interworking, especially on the enterprise side. As shown in the chart below, the CUBE provides the following additional features:
The CUBE provides a network-to-network interface point for:

- Signaling interworking—H.323 and SIP.
- Media interworking—dual-tone multifrequency (DTMF), fax, modem, and codec transcoding.
- Address and port translations—privacy and topology hiding.
- Billing and call detail record (CDR) normalization.
- Quality-of-service (QoS) and bandwidth management—QoS marking using differentiated services code point (DSCP) or type of service (ToS), bandwidth enforcement using Resource Reservation Protocol (RSVP), and codec filtering.

CUBE functionality is implemented on devices using a special IOS feature set, which allows CUBE to route a call from one VoIP dial peer to another.

Protocol interworking is possible for the following combinations:

- H.323-to-SIP interworking
- H.323-to-H.323 interworking
- SIP-to-SIP interworking
The CUBE provides a network-to-network demarcation interface for signaling interworking, media interworking, address and port translations, billing, security, quality of service, call admission control, and bandwidth management.

The CUBE is used by enterprise and small and medium-sized organizations to interconnect SIP PSTN access with SIP and H.323 enterprise unified communications networks.

A CUBE interoperates with several different network elements including voice gateways, IP phones, and call-control servers in many different application environments, from advanced enterprise voice and/or video services with Cisco Unified Communications Manager or Cisco Unified Communications Manager Express, as well as simpler toll bypass and voice over IP (VoIP) transport applications. The CUBE provides organizations with all the border controller functions integrated into the network layer to interconnect unified communications voice and video enterprise-to-service-provider architectures.

**SIP/H.323 Trunking**

The Session Initiation Protocol (SIP) is a signaling communications protocol, widely used for controlling multimedia communication sessions such as voice and video calls over Internet Protocol (IP) networks. SIP (or H.323) trunking is the use of VoIP to facilitate the connection of a private branch exchange (PBX) to other VoIP endpoints across the Internet. To use SIP trunking, an enterprise must have a PBX (internal VoIP system) that connects to all internal end users, an Internet telephony service provider (ITSP) and a gateway that serves as the interface between the PBX and the ITSP. One of the most significant advantages of SIP and H.323
trunking is the ability to combine data, voice, and video in a single line, eliminating the need for separate physical media for each mode.

Figure 3: SIP/H.323 Trunking

SIP trunking overcomes TDM barriers, in that it:
- Improves efficiency of interconnection between networks
- Simplifies PSTN interconnection with IP end-to-end
- Enables rich media services to employees, customers, and partners
- Carries converged voice, video, and data traffic

Figure 4: SIP Trunking Overcomes TDM Barriers

Typical Deployment Scenarios for CUBE

CUBE in an enterprise environment serves two main purposes:
- External Connections—CUBE is the demarcation point within a unified communications network and provides interconnectivity with external networks. This includes H.323 and SIP voice and video connections.
- Internal Connections—When used within a VoIP network, CUBE increases flexibility and interoperability between devices.
How to Configure Basic CUBE Features

Consider a scenario where XYZ corporation uses a VoIP network to provide phone services and uses a PRI connection for telecommunications services, and the PRI trunk is controlled by MGCP. Migration from MGCP PRI to SIP trunk is provided by ITSP telecommunications. CUCM sends the telephone number, as 10 digits, to CUBE. CUCM may send only the extension (4 digits) to the CUBE. When the call is diverted (using call-forward), the requirement of the ITSP is that they need the full 10-digit number in the SIP Diversion field.
The following sections describe the basic setup of CUBE through the steps involved in migrating the XYZ corporation to CUBE using a SIP trunk.

Enabling the CUBE Application on a Device

SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. mode border-element license capacity sessions
5. allow-connections from-type to to-type
6. end
## DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enable</td>
<td>Enables privileged EXEC mode. Enter your password if prompted.</td>
</tr>
<tr>
<td></td>
<td>Example: Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>voice service voip</td>
<td>Enters global VoIP configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>mode border-element license capacity sessions</td>
<td>Enables the set of commands used in the CUBE.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(conf-voi-serv)# mode border-element license capacity 200</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>allow-connections from-type to-type</td>
<td>Allows connections between specific types of endpoints in a VoIP network.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(conf-voi-serv)# allow-connections sip to sip</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>end</td>
<td>Returns to privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Device{conf-voi-serv)# end</td>
<td></td>
</tr>
</tbody>
</table>

## Verifying the CUBE Application on the Device

### SUMMARY STEPS

1. enable
2. show cube status

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
</tbody>
</table>
Device> enable

**Step 2**  
**show cube status**

Displays the CUBE status, the software version, the license capacity, the image version, and the platform name of the device. The CUBE status display is enabled only if the `mode border-element` command is configured with call license capacity.

**Example:**

Device# show cube status

CUBE-Version : 10.0.1  
SW-Version : 15.4.2.T, Platform 3845  
HA-Type : none  
Licensed-Capacity : 200

---

**Configuring a Trusted IP Address List for Toll-Fraud Prevention**

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice service voip
4. ip address trusted list
5. ipv4 ipv4-address [network-mask]
6. ipv6 ipv6-address
7. end

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice service voip</td>
<td>Enters global VoIP configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> ip address trusted list</td>
<td>Enters IP address trusted list mode and enables the addition of valid IP addresses.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-voip-serv)# ip address trusted list</td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>Command or Action</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------</td>
</tr>
</tbody>
</table>
| 5      | ipv4 ipv4-address [network-mask] | Allows you to add up to 100 IPv4 addresses in the IP address trusted list. Duplicate IP addresses are not allowed.  
• The network-mask argument allows you to define a subnet IP address. |
| 6      | ipv6 ipv6-address | Allows you to add IPv6 addresses to the trusted IP address list. |
| 7      | end               | Returns to privileged EXEC mode. |

**Example:**

**Step 5**

```
Device(cfg-iptrust-list)# ipv4 192.0.2.1 255.255.255.0
```

**Step 6**

```
Device(cfg-iptrust-list)# ipv6 2001:DB8:0:ABCD::1/48
```

**Step 7**

```
Device(cfg-iptrust-list)# end
```
Configuring a Trusted IP Address List for Toll-Fraud Prevention
Virtual CUBE

Cisco Unified Border Element (CUBE) has been traditionally supported as an installation on physical routers such as Cisco Aggregation Services Router Series (ASR) and Cisco Integration Services Router Series (ISR). From Cisco IOS XE 3.15S release onwards, the CUBE feature set is supported on the Cisco CSR 1000V Series Cloud Services Routers (Cisco CSR 1000V) in a virtualized form factor. Virtual CUBE (vCUBE) enables the traditional CUBE features set to be deployed in cloud-based data center deployments.

- Feature Information for Virtual CUBE, on page 21
- Prerequisites for Virtual CUBE, on page 21
- Features Supported with Virtual CUBE, on page 22
- Restrictions, on page 23
- Information about Virtual CUBE Support on Cisco CSR 1000V Series Routers, on page 23
- Installation, on page 26
- How to Enable Virtual CUBE on Cisco CSR 1000V Series Router, on page 27
- Troubleshooting Virtual CUBE Support, on page 27

Feature Information for Virtual CUBE

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual CUBE Feature Support</td>
<td>Cisco IOS XE Release 3.15S</td>
<td>Provides support for virtual CUBE on Cisco Cloud Services Router, Cisco CSR 1000V Series.</td>
</tr>
</tbody>
</table>

Prerequisites for Virtual CUBE

Virtual CUBE has the following prerequisites:
Hardware

• The Virtual CUBE (vCUBE) feature set is bundled as part of the Cisco CSR 1000V Series and is supported on VMware's ESXi hypervisor and Cisco UCS servers. For more information on the Cisco CSR1000V series and their supported ESXi versions, see chapter Installing the Cisco CSR 1000v in VMware ESXi Environments.

Following table provides details on the Cisco UCS hardware and VMware ESXi hypervisor version combinations as well as vCPU and memory requirements.

<table>
<thead>
<tr>
<th>Cisco UCS</th>
<th>Hypervisor</th>
<th>Virtual CUBE Form Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>CPU</td>
</tr>
<tr>
<td>UCSC-Base-M2-C460</td>
<td>ESXi 5.5.0</td>
<td>1</td>
</tr>
<tr>
<td>UCSC-C220-M3S</td>
<td>ESXi 5.5.0</td>
<td>1</td>
</tr>
<tr>
<td>UCSC-C220-M3S</td>
<td>ESXi 5.1.0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

• We recommend that you to disable hyper threading while configuring Virtual CUBE on Cisco UCS. For more information on the best practices for setting BIOS parameters for performance, see BIOS Settings.

• A minimum of two network interfaces are required for configuring Virtual CUBE.

Software

• Obtain the relevant license for the Cisco CSR 1000V router. For details on the licensing package support, see Licensing Package Support, on page 26.

• Install the appropriate Cisco IOS image on the Cisco CSR 1000V router and configure a working VoIP network. For details on installation, see Installation, on page 26.

For details on the ESXi hypervisor support, see the section on Hardware, on page 22.

Features Supported with Virtual CUBE

Virtual CUBE supports most of the features available in CUBE. Any feature that manages the media plane is not expected to work in the Cisco CSR 1000V router. The following features are not supported in virtual CUBE:

• All DSP based features
  • Codec Transcoding, Transrating
  • DTMF interworking
  • Call Progress Analysis (CPA)
• Noise Reduction (NR), Acoustic Shock Protection (ASP), and Audio Gain

• Limited Voice Class Codec (VCC) support
  • Codec supported on peer leg will be included in offer. Other codecs will be filtered out.

• IOS Gatekeeper
• H.323 Interworking
• IOS based Hardware MTP

Restrictions

All caveats, restrictions, and limitations of Cisco ASR IOS-XE 3.15 Release are applicable to virtual CUBE.

Information about Virtual CUBE Support on Cisco CSR 1000V Series Routers

High Availability

Virtual CUBE uses Redundancy Group infrastructure for HA. HA is between two virtual CUBE CSR instances running on either the same host or across different hosts connected through a switch. Geographic stateful switchover is not supported.

Figure 7: Virtual CUBE High Availability

On the Cisco CSR 1000V, box-to-box redundancy option uses the Redundancy Group (RG) Infrastructure to form an Active and Standby pair of routers. The Active and Standby pair share the same virtual IP address.
(VIP) and continually exchange status messages. Virtual CUBE session information is check-pointed across the Active and Standby pair of routers enabling the Standby router to take over all Virtual CUBE call processing responsibilities if the Active router should go out of service. Standby router sends and receives all redundancy-related traffic (protocol packets, configuration data, keepalives, and peer status). Calls in the transient state at the time of failover are disconnected.

**Introduction of CSR 1000V Network Interfaces for HA Interaction**

Cisco CSR 1000V can run on the VMware ESXi hypervisor. To do this, install the Cisco CSR 1000V .iso file on your host and manually create the virtual machine (VM) using your hypervisor software. VMware ESXi runs on servers with x86-based CPUs. You can use the same hypervisor to run several VMs. The ESXi host is connected to a port on the physical switch. In this environment, VMware ESXi provides the virtual switch (vSwitch) functionality where it routes traffic internally between virtual machines and link to external networks.

*Figure 8: vNICs Mapped to Cisco CSR 1000V Router Interfaces*

**Stateful Switchover for Virtual CUBE**

Stateful switchover (SSO) occurs when the Cisco CSR 1000V Active router crashes and reload happens. A switchover from the active to the standby router occurs when the active Route Processor fails, or when the keepalive messages between the active and standby router is lost. In a usual scenario, the Standby router sends
RG Infra keepalive message to the Active router and expects an acknowledgment within 100 msec as per the default timer. If there is no acknowledgment of keepalive within 100 msec, the Standby router immediately sends a message to the Active router to check the HA status. If there is no keepalive message response, the Standby router declares the Active router (it goes into reload state) is dead and assumes the role of the Active router.

Key Considerations for Deploying HA on Virtual CUBE

The following are some of the key points to consider while deploying a Virtual CUBE instance in HA mode on the Cisco CSR 1000V router:

- Virtual CUBE stateful switchover will only occur due to software failures—The Active router reloads during when the Cisco CSR 1000V crashes due to software faults. When a software fault causes the active router to go to the reload state, the Standby router assumes the role of the new Active router.

- Virtual CUBE tracks only the next vSwitch interface—Virtual CUBE HA supports tracking of the interface link status. It does not support any other tracking objects. In the case of virtual CUBE, the interface is always connected to the hypervisor's vSwitch. The interface link status of the Virtual CUBE shows that it is up even when the physical link of the server is down as the vSwitch link is still active. It may be possible to configure the hypervisor vSwitch to propagate the physical link status to the Virtual CUBE interface. Here, the interface tracking will correctly reflect status of the physical interface. Refer to the software documentation of the hypervisor you are using.

- High Availability Connectivity using vSwitch Redundancy—It is recommended to use vSwitch redundancy as suggested by the Cisco CSR 1000V reference documents. See Cisco CSR 1000V Series Cloud Services Router Software Configuration Guide.

In a scenario where the physical switch is down, this results in both the Active and Standby routers becoming the active router. Here, the Active router is still up and running whereas the Standby router assumes that the Active router has gone down as it does not receive any keepalive messages or peer information from the Active router. Hence, the Standby Router also turns to the Active router. Though Virtual CUBE continues to maintain existing calls and also receive new calls while both routers are active, HA checkpointing fails.

- Virtual CUBE does not track uplink failures—Switches that are used to connect non-networking end devices or LAN should not be tracked to determine uplink failures. Basically, switches used in the aggregation layers is not tracked.

Implementation of High Availability is same for the physical CUBE and Virtual CUBE on IOS XE platforms. For more information on High Availability, see CUBE High Availability Overview, on page 557.

Configuration Example for High Availability on Virtual CUBE

Configuration on both the Virtual CUBEs must have identical physical configuration and must be running on the same type of platform and the IOS XE version. Anytime a platform is reloaded in a Virtual CUBE high availability implementation, it always boots up as the standby router.

Router> enable
Router# configure terminal
redundancy
mode none
application redundancy
group 1
  name voice-b2bha
  priority 100 failover threshold 75
  control GigabitEthernet 0/0/2 protocol 1
data GigabitEthernet 0/0/2
timers delay 30 reload 60
Media

Virtual CUBE media performance is dependent on the underlying VM platform consistently providing packet switching latency of less than 5 ms. Latency and jitter values observed on a virtual CUBE are same as the values obtained on CUBE running on a hardware platform with recommended hardware configuration and identical software configuration, under the same network conditions.

For more information on how to calculate the performance requirements, see Voice Quality Monitoring, on page 719.

Licensing Package Support

Virtual CUBE is enabled with the APPX and AX license packages. The AX license package provides access to all features supported in virtual CUBE. When the license is installed, the virtual CUBE related CLI commands such as voice and dial-peer configurations are visible. Also, relevant CUBE processes are instantiated.

The following table details the license package support for a virtual CUBE.

<table>
<thead>
<tr>
<th>Virtual CUBE Session License</th>
<th>CSR Package</th>
<th>Features</th>
<th>Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same CUBE Licensing SKUs as Cisco ASR 1000 Series</td>
<td>APPX</td>
<td>No TLS / SRTP support</td>
<td>session count * (signaling + media bandwidth)</td>
</tr>
<tr>
<td></td>
<td>AX</td>
<td>All vCUBE features</td>
<td></td>
</tr>
</tbody>
</table>

For detailed information on licensing, see Cisco CSR 1000V Series Cloud Services Router Configuration Guide.

Installation

Virtual CUBE can be installed in two ways:

- Install using an OVA file
- Install using an ISO image

Installation using OVA File

The following file type is used to install virtual CUBE on Cisco UCS:
You can use the OVA file included in the Cisco CSR 1000V router software image package to install virtual CUBE. The file is used for deploying the OVA template on the VM (in TAR format).

**Note**

Explicit subscription of CPUs and Memory is required while deploying OVA provided by Cisco CSR 1000V.

For details on how to perform the deployment, see **Cisco CSR 1000V Series Cloud Services Router Software Configuration Guide**.

**Installation using ISO Image**

The following file type is used to install virtual CUBE on Cisco UCS:

- `.iso`

You can use the `.iso` file to install virtual CUBE. This file is used for installing the software image on the VM (requires manually creating the VM).

For details on how to perform the installation, see **Cisco CSR 1000V Series Cloud Services Router Software Configuration Guide**.

**How to Enable Virtual CUBE on Cisco CSR 1000V Series Router**

For details on the steps to enable virtual CUBE on a CSR 1000V router, see **Enabling the CUBE Application on a Device**.

**Troubleshooting Virtual CUBE Support**


To troubleshoot Virtual Machine (VM) issues, see **Cisco CSR 1000V Series Cloud Services Router Software Configuration Guide**.
Dial-Peer Matching

CUBE allows VoIP-to-VoIP connection by routing calls from one VoIP dial peer to another. As VoIP dial peers can be handled by either SIP or H.323, CUBE can be used to interconnect VoIP networks of different signaling protocols. VoIP interworking is achieved by connecting an inbound dial peer with an outbound dial peer.

- Dial Peers in CUBE, on page 29
- Configuring Inbound and Outbound Dial-Peer Matching for CUBE, on page 31
- Preference for Dial-Peer Matching, on page 32

Dial Peers in CUBE

A dial peer is a static routing table, mapping phone numbers to interfaces or IP addresses.

A call leg is a logical connection between two routers or between a router and a VoIP endpoint. A dial peer is associated or matched to each call leg according to attributes that define a packet-switched network, such as the destination address.

Voice-network dial peers are matched to call legs based on configured parameters, after which an outbound dial peer is provisioned to an external component using the component's IP address. For more information, refer to the Dial Peer Configuration Guide.

Dial-peer matching can also be done based on the VRF ID associated with a particular interface. For more information, see Inbound Dial-Peer Matching based on Multi-VRF, on page 293.

In CUBE, dial peers can also be classified as LAN dial peers and WAN dial peers based on the connecting entity from which CUBE sends or receives calls.
A LAN dial peer is used to send or receive calls between CUBE and the Private Branch Exchange (PBX)—a system of telephone extensions within an enterprise. Given below are examples of inbound and outbound LAN dial peers.

**Inbound Dial-Peer for calls from CUCM to CUBE**

```
dial-peer voice 100 voip
    description *** Inbound LAN side dial-peer ***
    incoming called-number 9T
    session protocol sipv2
    codec g711ulaw
    dtmf-relay rtp-nte
```

**Outbound Dial-Peer for calls from CUBE to CUCM**

```
dial-peer voice 200 voip
    description *** Outbound LAN side dial-peer ***
    destination-pattern [2-9]...........
    session protocol sipv2
    session target ipv4:<CUCM_Address>
    codec g711ulaw
    dtmf-relay rtp-nte
```

A WAN dial peer is used to send or receive calls between CUBE and the SIP trunk provider. Given below are examples of inbound and outbound WAN dial peers.
Configuring Inbound and Outbound Dial-Peer Matching for CUBE

The following commands can be used for inbound and outbound dial peer matching in the CUBE:

**Table 3: Incoming Dial-Peer Matching**

<table>
<thead>
<tr>
<th>Command in Dial-Peer Configuration</th>
<th>Description</th>
<th>Call Setup Element</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>incoming called-number DNIS-string</strong></td>
<td>This command uses the destination number that was called to match the incoming call leg to an inbound dial peer. This number is called the dialed number identification service (DNIS) number.</td>
<td>DNIS number</td>
</tr>
<tr>
<td><strong>answer-address ANI-string</strong></td>
<td>This command uses the calling number to match the incoming call leg to an inbound dial peer. This number is called the originating calling number or automatic number identification (ANI) string.</td>
<td>ANI string</td>
</tr>
<tr>
<td><strong>destination-pattern ANI-string</strong></td>
<td>This command uses the inbound call leg to the inbound dial peer.</td>
<td>ANI string for inbound</td>
</tr>
</tbody>
</table>
### Preference for Dial-Peer Matching

The following is the order in which inbound dial-peer is matched for SIP call-legs:

<table>
<thead>
<tr>
<th>Dial-Peer Command</th>
<th>Description</th>
<th>Call Setup Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>destination-pattern <strong>DNIS-string</strong></td>
<td>This command uses DNIS string to match the outbound call leg to the outbound dial peer.</td>
<td>DNIS string for outbound ANI string for inbound</td>
</tr>
<tr>
<td>destination <strong>URI-class-identifier</strong></td>
<td>This command uses the directory URI (Uniform Resource Identifier) number to match the outgoing call leg to an outgoing dial peer. This directory URI is part of the SIP address of a device. The command actually refers to a globally defined voice class identifier where the directory URI is configured.</td>
<td>Directory URI</td>
</tr>
<tr>
<td>destination <strong>e164-pattern-map pattern-map-group-id</strong></td>
<td>This command uses a group of destination number patterns to match the outbound call leg to an outbound dial peer. The command calls a globally defined voice class identifier where the E.164 pattern groups are configured.</td>
<td>E.164 patterns</td>
</tr>
</tbody>
</table>
• voice class uri \textit{URI-class-identifier} with incoming uri \{\textit{via}\} \textit{URI-class-identifier}
• voice class uri \textit{URI-class-identifier} with incoming uri \{\textit{request}\} \textit{URI-class-identifier}
• voice class uri \textit{URI-class-identifier} with incoming uri \{\textit{to}\} \textit{URI-class-identifier}
• voice class uri \textit{URI-class-identifier} with incoming uri \{\textit{from}\} \textit{URI-class-identifier}
• incoming called-number \textit{DNIS-string}
• answer-address \textit{ANI-string}

The following is the order in which inbound dial-peer is matched for H.323 call-legs:
• incoming uri \{\textit{called}\} \textit{URI-class-identifier}
• incoming uri \{\textit{calling}\} \textit{URI-class-identifier}
• incoming called-number \textit{DNIS-string}
• answer-address \textit{ANI-string}

The following is the order in which outbound dial-peer is matched for SIP call-legs:
• destination route-string
• destination \textit{URI-class-identifier} with target carrier-id \textit{string}
• destination-pattern with target carrier-id \textit{string}
• destination \textit{URI-class-identifier}
• destination-pattern
• target carrier-id \textit{string}
Preference for Dial-Peer Matching
CHAPTER 7

DTMF Relay

The DTMF Relay feature allows CUBE to send dual-tone multi-frequency (DTMF) digits over IP.

This chapter talks about DTMF tones, DTMF relay mechanisms, how to configure DTMF relays, and interoperability and priority with multiple relay methods.

- Feature Information for DTMF Relay, on page 35
- Information About DTMF Relay, on page 36
- Verifying DTMF Relay, on page 44

Feature Information for DTMF Relay

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 5: Feature Information for DTMF Relay

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTMF Relay</td>
<td>Cisco IOS 12.1(2)T&lt;br&gt;Cisco IOS XE 2.1</td>
<td>The DTMF Relay feature allows CUBE to send DTMF digits over IP. The <code>dtmf-relay</code> command was added.</td>
</tr>
<tr>
<td>Support for <code>sip-info</code> to <code>rtp-nte</code>&lt;br&gt;DTMF relay mechanism for SIP-SIP calls</td>
<td>Cisco IOS XE Everest&lt;br&gt;16.6.1</td>
<td>This feature adds support for <code>sip-info</code> to <code>rtp-nte</code> DTMF relay mechanism for SIP-SIP calls.</td>
</tr>
</tbody>
</table>
Information About DTMF Relay

DTMF Tones

DTMF tones are used during a call to signal to a far-end device; these signals may be for navigating a menu system, entering data, or for other types of manipulation. They are processed differently from the DTMF tones sent during call setup as part of the call control. TDM interfaces on Cisco devices support DTMF by default. Cisco VoIP dial-peers do not support DTMF relay by default and require DTMF relay capabilities to be enabled.

Note

DTMF tones sent by phones do not traverse the CUBE.

DTMF Relay

Dual-tone multi-frequency (DTMF) relay is the mechanism for sending DTMF digits over IP. The VoIP dial peer can pass the DTMF digits either in band or out of band.

In-band DTMF Relay passes the DTMF digits using the RTP media stream and uses a special payload type identifier in the RTP header to distinguish DTMF digits from actual voice communication. This method is more likely to work on lossless codecs, such as G.711.

Note

The main advantage of DTMF relay is that low bandwidth codecs like G.729 and G.723 is sent with greater fidelity when sent using in-band DTMF relay. Without the use of DTMF relay, calls established with low-bandwidth codecs may have trouble accessing automated DTMF-based systems, such as voice mail, menu-based Automatic Call Distributor (ACD) systems, and automated banking systems.

Out-of-band DTMF Relay passes DTMF digits using a signaling protocol (SIP or H.323) instead of using the RTP media stream.

DTMF relay prevents loss of integrity of DTMF digits caused by VoIP compressed codecs. The relayed DTMF is then regenerated transparently on the peer side.

Figure 12: DTMF Relay Mechanism
DTMF relay mechanisms supported on VoIP dial-peers are listed below based on the keywords used to configure them. The DTMF relay mechanism can be either out-of-band (H.323 or SIP) or inband (RTP).

- **h245-alphanumeric and h245-signal**—These two methods are available only on H.323 dial peers. This is an out-of-band DTMF relay mechanism that transports the DTMF signals using H.245, which is the media control protocol of the H.323 protocol suite.

  The H245-signal method carries more information about the DTMF event (such as its actual duration) than the H245-Alphanumeric method. This addresses a potential problem with the alphanumeric method when interworking with other vendors’ systems.

- **sip-notify**—This method is available on SIP dial peers only. This is a Cisco proprietary out-of-band DTMF relay mechanism that transports DTMF signals using SIP-Notify message. The SIP Call-Info header is used to indicate the use of the SIP-Notify DTMF relay mechanism. The message is acknowledged with a 18x or 200 response message containing a similar SIP Call-Info header.

  The Call-Info header for NOTIFY-based out-of-band relay is as follows:

  ```
  Call-Info: <sip: address>; method="NOTIFY;Event=telephone-event;Duration=msec"
  ```

  DTMF relay digits are sent as 4 bytes in a binary encoded format.

  This mechanism is useful for communicating with SCCP IP phones that do not support inband DTMF digits and analog phones attached to analog voice ports (FXS) on the router.

  If multiple DTMF relay mechanisms are enabled on a SIP dial peer and are negotiated successfully, NOTIFY-based out-of-band DTMF relay takes precedence.

- **sip-kpml**—This method is available only on SIP dial peers. This is an out-of-band DTMF relay mechanism defined by RFC 4730 that registers the DTMF signals using SIP-Subscribe messages and transports the DTMF signals using SIP-Notify messages containing an XML-encoded body. This method is also known as Key Press Markup Language.

  If you configure KPML on the dial peer, the gateway sends INVITE messages with kpml in the Allow-Events header.

  This method is mostly used for SIP endpoints registered to CUCM or CME. This method is useful for non-conferencing calls and for interoperability between SIP products and SIP phones.

  If you configure rtp-nte, sip-notify, and sip-kpml, the outgoing INVITE contains an SDP with rtp-nte payload, a SIP Call-Info header, and an Allow-Events header with KPML.

  The following SIP-Notify message is a sample taken after the subscription has taken place. The endpoints transmit digits using SIP-Notify messages with KPML events through XML. In the following example, the digit “1” is being transmitted:

  ```
  NOTIFY sip:192.168.105.25:5060 SIP/2.0
  Event: kpml
  <?xml version="1.0" encoding="UTF-8"?>
  <kpml-response version="1.0" code="200" text="OK" digits="1" tag="dtmf"/>
  ```

- **sip-info**—The sip-info method is available only on SIP dial peers. This is an out-of-band DTMF relay mechanism that registers the DTMF signals using SIP-Info messages. The body of the SIP message consists of signaling information and uses the content-type application/dtmf-relay.

  The method is always enabled for SIP dial peers, and is invoked when a SIP INFO message is received with DTMF relay content.

  This following sample message shows a SIP INFO message received by the gateway with specifics about the DTMF tone to be generated. The combination of the From, To, and Call-ID headers identifies the
call leg. The signal and duration headers specify the digit, in this case 1, and duration, 160 milliseconds in the example, for DTMF tone play.

INFO sip:2143302100@172.17.2.33 SIP/2.0
Via: SIP/2.0/UDP 172.80.2.100:5060
From: <sip:9724401003@172.80.2.100>;tag=43
To: <sip:2143302100@172.17.2.33>;tag=9753.0207
Call-ID: 984072_15401962@172.80.2.100
CSeq: 25634 INFO
Supported: 100rel
Supported: timer
Content-Length: 26
Content-Type: application/dtmf-relay
Signal=1
Duration=160

- **rtp-nte**—Real-Time Transport Protocol (RTP) Named Telephone Events (NTE). This is an in-band DTMF relay mechanism defined by RFC2833. RFC2833 defines formats of NTE-RTP packets used to transport DTMF digits, hook flash, and other telephony events between two peer endpoints. DTMF tones are sent as packet data after call media has been established using the RTP stream and are distinguished from the audio by the RTP payload type field, preventing compression of DTMF-based RTP packets. For example, the audio of a call can be sent on a session with an RTP payload type that identifies it as G.711 data, and the DTMF packets are sent with an RTP payload type that identifies them as NTEs. The consumer of the stream utilizes the G.711 packets and the NTE packets separately.

The SIP NTE DTMF relay feature provides reliable digit relay between Cisco VoIP gateways when a low-bandwidth codec is used.

---

**Note**

Payload type 96 and 97 are used for fax by default in Cisco devices. A third party device may use payload type 96 and 97 for dtmf. In such scenarios, we recommend you to perform one of the following:

- Change the payload type for fax in both incoming and outgoing dial-peers using `rtp payload-type` command
- Use `assymetric payload dtmf` command

For more information on configuring rtp payload-type and assymetric payload dtmf, see Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls.

---

Payload types and attributes of this method are negotiated between the two ends at call setup using the Session Description Protocol (SDP) within the body section of the SIP message.

---

**Note**

This method should not be confused with the “Voice in-band audio/G711” transport because the latter is just the audible tones being passed as normal audio without any relay signaling method being “aware” or involved in the process. This is just plain audio passing through end-to-end using the G711Ulaw/Alaw codec.

- **cisco-rtp**—This is an in-band DTMF relay mechanism that is Cisco proprietary, where the DTMF digits are encoded differently from the audio and are identified as payload type 121. The DTMF digits are part
of the RTP data stream and distinguished from the audio by the RTP payload type field. This method is not supported by CUCM and its use has been discontinued.

Note: The cisco-rtp operates only between two Cisco 2600 series or Cisco 3600 series devices. Otherwise, the DTMF relay feature does not function, and the gateway sends DTMF tones in-band.

- **G711 audio**—This is an inband DTMF relay mechanism that is enabled by default and requires no configuration. Digits are transmitted within the audio of the phone conversation, that is, it is audible to the conversation partners; therefore, only uncompressed codecs like g711 alaw or ulaw can carry inband DTMF reliably. Female voices are known to, sometimes, trigger the recognition of a DTMF tone. Digits are passed along just like the rest of your voice as normal audio tones with no special coding or markers using the same codec as your voice does and are generated by your phone.

### Configuring DTMF Relays

You can configure DTMF relay using the `dtmf-relay method1 [...[method6]]` command in the VoIP dial peer. DTMF negotiation is performed based on the matching inbound dial-peer configuration.

The `method` variable used here can be any of the following:

- **h245-alphanumeric**
- **h245-signal**
- **sip-notify**
- **sip-kpml**
- **sip-info**
- **rtp-nte [digit-drop]**
- **cisco-rtp**

Multiple DTMF methods may be configured on CUBE simultaneously in order to minimize MTP requirements. If you configure more than one out-of-band DTMF method, preference goes from highest to lowest in the order of configuration. If an endpoint does not support any of the DTMF relay mechanism configured on CUBE, an MTP or transcoder is required.

The following table lists the DTMF relay types supported on a SIP and H.323 gateway.

<table>
<thead>
<tr>
<th></th>
<th>H.323 Gateway</th>
<th>SIP Gateway</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In-band</strong></td>
<td>cisco-rtp, rtp-nte</td>
<td>rtp-nte</td>
</tr>
<tr>
<td><strong>Out-of-band</strong></td>
<td>h245-alphanumeric, h245-signal</td>
<td>sip-notify, sip-kpml, sip-info</td>
</tr>
</tbody>
</table>

### Interoperability and Priority with Multiple DTMF Relay Methods

- CUBE negotiates both **rtp-nte** and **sip-kpml** if both are supported and advertised in the incoming INVITE. However, CUBE relies on the **rtp-nte** DTMF method to receive digits and a SUBSCRIBE if **sip-kpml**
is not initiated. CUBE still accepts SUBSCRIBEs for KPML. This prevents double-digit reporting problems at CUBE.

• CUBE negotiates to one of the following:
  • cisco-rtp
  • rtp-nte
  • rtp-nte and kpml
  • kpml
  • sip-notify

• If you configure rtp-nte, sip-notify, and sip-kpml, the outgoing INVITE contains a SIP Call-Info header, an Allow-Events header with KPML, and an sdtp with rtp-nte payload.

• If you configure more than one out-of-band DTMF method, preference goes from highest to lowest in the order of configuration.

• CUBE selects DTMF relay mechanisms using the following priority:
  • sip-notify or sip-kpml (highest priority)
  • rtp-nte
  • None—Send DTMF in-band

H.323 gateways select DTMF relay mechanisms using the following priority:

• cisco-rtp
• h245-signal
• h245-alphanumeric
• rtp-nte
• None—Send DTMF in-band

**DTMF Interoperability Table**

This table provides the DTMF interoperability information between various DTMF relay types in different call flow scenarios. For instance, if you need to configure sip-kpml on an inbound dial peer and h245-signaling on an outbound dial peer in an RTP-RTP Flow through configuration, you will refer to table 1 and the corresponding cell indicates that the combination is supported (as image information is present) and the required image is IOS 12.4(15)T or IOS XE Supported or above. The call scenarios provided are as follows:

• RTP-RTP Flow-Through
• RTP-RTP with transcoder Flow-Through
• RTP-RTP Flow Around
• RTP-RTP with high-density transcoder Flow Through
• SRTP-RTP Flow Through
Table 7: RTP-RTP Flow-Through

<table>
<thead>
<tr>
<th>dial-peer protocol</th>
<th>DTMF Relay Type</th>
<th>H.323</th>
<th>SIP</th>
<th>Inband</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.323</td>
<td>h245-alpha numeric</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>h245-signal</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>rtp-nte</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>SIP</td>
<td>rtp-nte</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>sip-kpml</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>sip-notify</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>sip-info</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
</tbody>
</table>

3 Supported from Cisco IOS XE Everest 16.6.1 onwards for calls that do not involve DSP resources.

* media resource is required (Transcoder) for IOS versions

Table 8: RTP-RTP with DSP involved Flow-Through Calls

<table>
<thead>
<tr>
<th>dial-peer protocol</th>
<th>DTMF Relay Type</th>
<th>H.323</th>
<th>SIP</th>
<th>Inband</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.323</td>
<td>h245-alpha numeric</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>h245-signal</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>rtp-nte</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td>SIP</td>
<td>rtp-nte</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>sip-kpml</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>sip-notify</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>sip-info</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
</tbody>
</table>
### Table 9: RTP-RTP Flow Around

<table>
<thead>
<tr>
<th>dial-peer protocol</th>
<th>H.323</th>
<th>SIP</th>
<th>Inband</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.323</td>
<td>h245-alpha numeric</td>
<td>h245-signal</td>
<td>rtp-nte</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>rtp-nte</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>sip-kpml</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>sip-notify</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>sip-info</td>
</tr>
<tr>
<td>Inband</td>
<td>Supported</td>
<td>Supported</td>
<td></td>
</tr>
<tr>
<td>Voice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inband (G.711)</td>
<td>Supported</td>
<td>Supported</td>
<td></td>
</tr>
</tbody>
</table>

* media resource is required (Transcoder) for IOS versions. CUBE falls back to flow-through mode if media resource is unavailable.
### Table 10: RTP-RTP with high-density transcoder Flow Through

<table>
<thead>
<tr>
<th>dial-peer protocol</th>
<th>H.323</th>
<th>SIP</th>
<th>Inband</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DTMF Relay Type</strong></td>
<td><strong>h245-alpha numeric</strong></td>
<td><strong>h245-signal</strong></td>
<td><strong>rtp-nte</strong></td>
</tr>
<tr>
<td>H.323</td>
<td>Supported</td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SIP</strong></td>
<td><strong>rtp-nte</strong></td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inband</strong></td>
<td><strong>Voice Inband (G.711)</strong></td>
<td>Supported</td>
<td>Supported</td>
</tr>
</tbody>
</table>

### Table 11: SRTP-RTP Flow Through

<table>
<thead>
<tr>
<th>dial-peer protocol</th>
<th>H.323</th>
<th>SIP</th>
<th>Inband</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DTMF Relay Type</strong></td>
<td><strong>h245-alpha numeric</strong></td>
<td><strong>h245-signal</strong></td>
<td><strong>rtp-nte</strong></td>
</tr>
<tr>
<td>H.323</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SIP</strong></td>
<td><strong>rtp-nte</strong></td>
<td>Supported</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inband</strong></td>
<td><strong>Voice Inband (G.711)</strong></td>
<td>Supported</td>
<td>Supported</td>
</tr>
</tbody>
</table>
For calls sent from an in-band (RTP-NTE) to an out-of-band method, configure the `dtmf-relay rtp-nate digit-drop` command on the inbound dial-peer and the desired out-of-band method on the outgoing dial-peer. Otherwise, same digit is sent in OOB as well as in-band, and gets interpreted as duplicate digits by the receiving end. When the digit-drop option is configured on the inbound leg, CUBE suppresses NTE packets and only relay digits using the OOB method configured on the outbound leg.

Verifying DTMF Relay

**SUMMARY STEPS**

1. `show sip-ua calls`
2. `show sip-ua calls dtmf-relay sip-info`
3. `show sip-ua history dtmf-relay kpml`
4. `show sip-ua history dtmf-relay sip-notify`

**DETAILED STEPS**

**Step 1**  `show sip-ua calls`

The following sample output shows that the DTMF method is SIP-KPML.

**Example:**

```
Device# show sip-ua calls

SIP UAC CALL INFO
Call 1
SIP Call ID : 57633F68-2BE011D6-8013D46B-B4F9B5F6@172.18.193.251
  State of the call : STATE_ACTIVE (7)
  Substate of the call : SUBSTATE_NONE (0)
  Calling Number :
  Called Number : 8888
  Bit Flags : 0xD44018 0x100 0x0
  CC Call ID : 6
  Source IP Address (Sig ) : 192.0.2.1
  Destn SIP Req Addr:Port : 192.0.2.2:5060
  Destn SIP Resp Addr:Port : 192.0.2.3:5060
  Destination Name : 192.0.2.4.250
  Number of Media Streams : 1
  Number of Active Streams: 1
  RTP Fork Object : 0x0
  Media Mode : flow-through
  Media Stream 1
    State of the stream : STREAM_ACTIVE
    Stream Call ID : 6
    Stream Type : voice-only (0)
    Negotiated Codec : g711ulaw (160 bytes)
    Codec Payload Type : 0
    Negotiated Dtmf-relay : sip-kpml
    Dtmf-relay Payload Type : 0
    Media Source IP Addr:Port : 192.0.2.5:17576
    Media Dest IP Addr:Port : 192.0.2.6:17468
```
Step 2  
**show sip-ua calls dtmf-relay sip-info**

The following sample output displays active SIP calls with INFO DTMF Relay mode.

**Example:**

```
Device# show sip-ua calls dtmf-relay sip-info

Total SIP call legs: 2, User Agent Client: 1, User Agent Server: 1

SIP UAC CALL INFO
Call 1
SIP Call ID : 9598A547-5C1311E2-8008F709-2470C996@172.27.161.122
  State of the call : STATE_ACTIVE (?)
  Calling Number : sipp
  Called Number : 3269011111
  CC Call ID : 2
  No.  Timestamp  Digit  Duration
  0 01/12/2013 17:23:25.615  2  250
  1 01/12/2013 17:23:25.967  5  300
  2 01/12/2013 17:23:26.367  6  300

Call 2
SIP Call ID : 1-29452@172.25.208.177
  State of the call : STATE_ACTIVE (?)
  Calling Number : sipp
  Called Number : 3269011111
  CC Call ID : 1
  No.  Timestamp  Digit  Duration
  0 01/12/2013 17:23:25.615  2  250
  1 01/12/2013 17:23:25.967  5  300
  2 01/12/2013 17:23:26.367  6  300

SIP UAS CALL INFO
Call 1
SIP Call ID : 1-29452@172.25.208.177
  State of the call : STATE_ACTIVE (?)
  Calling Number : sipp
  Called Number : 3269011111
  CC Call ID : 1
  No.  Timestamp  Digit  Duration
  0 01/12/2013 17:23:25.615  2  250
  1 01/12/2013 17:23:25.967  5  300
  2 01/12/2013 17:23:26.367  6  300

Call 2
SIP Call ID : 9598A547-5C1311E2-8008F709-2470C996@172.27.161.122
  State of the call : STATE_ACTIVE (?)
  Calling Number : sipp
  Called Number : 3269011111
  CC Call ID : 2
  No.  Timestamp  Digit  Duration
  0 01/12/2013 17:23:25.615  2  250
  1 01/12/2013 17:23:25.967  5  300
```
Number of SIP User Agent Server(UAS) calls: 2

Step 3  show sip-ua history dtmf-relay kpml

The following sample output displays SIP call history with KMPL DTMF Relay mode.

Example:

Device# show sip-ua history dtmf-relay kpml

Total SIP call legs:2, User Agent Client:1, User Agent Server:1
SIP UAC CALL INFO
Call 1
SIP Call ID : D0498774-F01311E3-82A0DE9F-78C438FF010.86.176.119
  State of the call : STATE_ACTIVE (?)
  Calling Number : 2017
  Called Number : 1011
  CC Call ID : 257
  No. Timestamp Digit Duration
  ---------------------------------------------------------------

Call 2
SIP Call ID : 22BC36A5-F01411E3-81808A6A-5FE95113010.86.176.142
  State of the call : STATE_ACTIVE (?)
  Calling Number : 2017
  Called Number : 1011
  CC Call ID : 256
  No. Timestamp Digit Duration
  ---------------------------------------------------------------

Number of SIP User Agent Client(UAC) calls: 2
SIP UAS CALL INFO
Call 1
SIP Call ID : 22BC36A5-F01411E3-81808A6A-5FE95113010.86.176.142
  State of the call : STATE_ACTIVE (?)
  Calling Number : 2017
  Called Number : 1011
  CC Call ID : 256
  No. Timestamp Digit Duration
  ---------------------------------------------------------------

Call 2
SIP Call ID : D0498774-F01311E3-82A0DE9F-78C438FF010.86.176.119
  State of the call : STATE_ACTIVE (?)
  Calling Number : 2017
  Called Number : 1011
  CC Call ID : 257
  No. Timestamp Digit Duration
  ---------------------------------------------------------------

Number of SIP User Agent Server(UAS) calls: 2

Step 4  show sip-ua history dtmf-relay sip-notify

The following sample output displays SIP call history with SIP Notify DTMF Relay mode.

Example:

Device# show sip-ua history dtmf-relay sip-notify
Total SIP call legs: 2, User Agent Client: 1, User Agent Server: 1

SIP UAC CALL INFO
Call 1
SIP Call ID : 29BB98C-F01311E3-8297DE9F-78C438FF810.86.176.119
  State of the call : STATE_ACTIVE (7)
  Calling Number : 2017
  Called Number : 1011
  CC Call ID : 252

No.  Timestamp  Digit  Duration
----------------------------------

Call 2
SIP Call ID : 550E973B-F01311E3-817A8A6A-5FE95113@10.86.176.142
  State of the call : STATE_ACTIVE (7)
  Calling Number : 2017
  Called Number : 1011
  CC Call ID : 251

No.  Timestamp  Digit  Duration
----------------------------------

Number of SIP User Agent Client(UAC) calls: 2

SIP UAS CALL INFO
Call 1
SIP Call ID : 550E973B-F01311E3-817A8A6A-5FE95113@10.86.176.142
  State of the call : STATE_ACTIVE (7)
  Calling Number : 2017
  Called Number : 1011
  CC Call ID : 251

No.  Timestamp  Digit  Duration
----------------------------------

Call 2
SIP Call ID : 29BB98C-F01311E3-8297DE9F-78C438FF810.86.176.119
  State of the call : STATE_ACTIVE (7)
  Calling Number : 2017
  Called Number : 1011
  CC Call ID : 252

No.  Timestamp  Digit  Duration
----------------------------------

Number of SIP User Agent Server(UAS) calls: 2
Introduction to Codecs

A codec is a device or software capable of encoding or decoding a digital data stream or signal. Audio codecs can encode or decode a digital data stream of audio and video codecs enable compression or decompression of digital video.

CUBE uses codecs to compress digital voice samples to reduce bandwidth usage per call. This chapter describes the basics of encoding of digital voice samples using codecs and how to configure them.

- Why CUBE Needs Codecs, on page 49
- Voice Media Transmission, on page 50
- Voice Activity Detection, on page 51
- VoIP Bandwidth Requirements, on page 51
- Supported Audio and Video Codecs, on page 53
- How to Configure Codecs, on page 55
- Configuration Examples for Codecs, on page 60

Why CUBE Needs Codecs

CUBE uses codecs to compress digital voice samples to reduce bandwidth usage per call. Refer to Table 13: Codec and Bandwidth Information, on page 52 to see the relationship between codec and bandwidth utilization.

Configuring codecs on a device (configured as CUBE) allows the device to act as a demarcation point on a VoIP network and allows a dial peer to be established only if the desired codec criteria are satisfied. Additionally, preferences can be used to determine which codecs are selected over others.

If codec filtering is not required, CUBE also supports transparent codec negotiations. This enables negotiations between endpoints with CUBE leaving the codec information untouched.

The illustrations below show how codec negotiation is performed on CUBE. Two VoIP clouds need to be interconnected. In this scenario, both VoIP 1 and VoIP 2 networks have G.711 a-law configured as the preferred codec.
In the first example, the CUBE router is configured to use the G.729a codec. This can be done by using the appropriate codec command on both VoIP dial peers. When a call is set up, CUBE will accept only G.729a calls, thus influencing the codec negotiation.

In the second example, the CUBE dial peers are configured with a transparent codec and this leaves the codec information contained within the call signaling untouched. Because both VoIP 1 and VoIP 2 have G.711 a-law as their first choice, the resulting call will be a G.711 a-law call.

**Voice Media Transmission**

When a VoIP call is established, using the signaling protocols, the digitized voice samples need to be transmitted. These voice samples are often called the voice media. Voice media protocols found in a VoIP environment are the following:

- **Real-Time Transport Protocol (RTP)**—RTP is a Layer 4 protocol that is encapsulated inside UDP segments. RTP carries the actual digitized voice samples in a call.
- **Real-Time Control Protocol (RTCP)**—RTCP is a companion protocol to RTP. Both RTP and RTCP operate at Layer 4 and are encapsulated in UDP. RTP and RTCP typically use UDP ports 16384 to 32767, though these ranges may vary according to hardware platform. However, RTP uses the even port numbers in that range, whereas RTCP uses the odd port numbers. While RTP is responsible for carrying the voice stream, RTCP carries information about the RTP stream such as latency, jitter, packets, and octets sent and received.
- **Compressed RTP (cRTP)**—One of the challenges with RTP is its overhead. Specifically, the combined IP, UDP, and RTP headers are approximately 40 bytes in size, whereas a common voice payload size on a VoIP network is only 20 bytes, which includes 20 ms of voice by default. In that case, the header is twice the size of the payload. cRTP is used for RTP header compression and can reduce the 40-byte header to 2 or 4 bytes in size (depending on whether UDP checksums are in use), as shown in the figure below.
Secure RTP (sRTP)—To help prevent an attacker from intercepting and decoding or possibly manipulating voice packets, sRTP supports encryption of RTP packets. In addition, sRTP provides message authentication, integrity checking, and protection against replay attacks.

VPN technology like IP Security (IPSec) may be used to protect traffic between sites. Encrypting sRTP traffic at the source of transmission results in encrypting already encrypted traffic, adding significant overhead and bandwidth needs. So it is recommended that sRTP is used for voice traffic, and that this traffic is excluded from IPSec encapsulation. sRTP uses lesser bandwidth, has the same level of security, and can be used by devices at any location because the payload is originated and terminated at the voice endpoint. Because endpoints can be mobile, the security follows the phone.

Voice Activity Detection

Voice Activity Detection (VAD) is a technology that works with the human nature of voice conversations, mainly that one person listens while the other talks. VAD classifies traffic as speech, unknown, and silence. Speech and unknown payloads are transported, but silence is dropped. This accounts for approximately 30 percent savings in bandwidth over time.

VAD can significantly reduce the amount of bandwidth required by a media stream. However, VAD has a few negative attributes that need to be considered. Because no packets are sent during silence, the listener can get the impression that the talker has been disconnected. Another characteristic is that it takes a moment for VAD to recognize the speech as having started again, and as a result, the first part of the sentence can be clipped. This can be annoying to the listening party. Music on Hold (MoH) and fax can also cause VAD to become ineffective because the media stream is constant.

VAD is enabled by default in CUBE dial peers as long as the codec selected supports it. VAD can be disabled at the VoIP dial peer using the no vad command. Some codecs, such as G.729b and G.729ab, support Comfort Noise Generation (CNG). When VAD is enabled, white noise is played to the listener during times when no packets are received. This leads the listener to believe that background noise is being heard. Cisco IP Phones and most gateways support CNG.

G.729 Annex-B and G.723.1 Annex-A include an integrated VAD function, but otherwise performs the same as G.729 and G.723.1, respectively.

VoIP Bandwidth Requirements

The amount of bandwidth required varies by the codec and the transmission media. Two events require bandwidth. The media stream itself requires bandwidth between 17 to 106 kbps depending on codec, header compression, and Layer 2 and 3 headers. In addition, call signaling must be taken into account. While bandwidth required by call signaling is much smaller, it can cause problems on a network due to irregular requirements.
Table 12: Protocol Header Size Assumptions

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Header size</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP</td>
<td>20 bytes</td>
</tr>
<tr>
<td>UDP</td>
<td>8 bytes</td>
</tr>
<tr>
<td>RTP</td>
<td>12 bytes</td>
</tr>
<tr>
<td>cRTP</td>
<td>Reduces size of IP, UDP, RTP to 2 or 4 bytes</td>
</tr>
</tbody>
</table>

The table below gives calculations for the default voice payload sizes in Cisco CallManager or CUBE. For additional calculations, including different voice payload sizes and other protocols, use the TAC Voice Bandwidth Codec Calculator (registered customers only). For an explanation of each of the column headings, see the table below.

Table 13: Codec and Bandwidth Information

<table>
<thead>
<tr>
<th>Codec &amp; Bit Rate (kbps)</th>
<th>Codec Sample Size (Bytes)</th>
<th>Codec Sample Interval (ms)</th>
<th>Mean Opinion Score (MOS)</th>
<th>Voice Payload Size (Bytes)</th>
<th>Voice Payload Size (ms)</th>
<th>Payload Size (ms) Packets Per Second (PPS)</th>
<th>Bandwidth MP or FRF.12 (kbps)</th>
<th>Bandwidth w/cRTP MP or FRF.12 (kbps)</th>
<th>Bandwidth Ethernet (kbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.711 (64 kbps)</td>
<td>80</td>
<td>10</td>
<td>4.1</td>
<td>160</td>
<td>20</td>
<td>50</td>
<td>82.8</td>
<td>67.6</td>
<td>87.2</td>
</tr>
<tr>
<td>G.729 (8 kbps)</td>
<td>10</td>
<td>10</td>
<td>3.92</td>
<td>20</td>
<td>20</td>
<td>50</td>
<td>26.8</td>
<td>11.6</td>
<td>31.2</td>
</tr>
<tr>
<td>G.723.1 (6.3 kbps)</td>
<td>24</td>
<td>30</td>
<td>3.9</td>
<td>24</td>
<td>30</td>
<td>33.3</td>
<td>18.9</td>
<td>8.8</td>
<td>21.9</td>
</tr>
<tr>
<td>G.723.1 (5.3 kbps)</td>
<td>20</td>
<td>30</td>
<td>3.8</td>
<td>20</td>
<td>30</td>
<td>33.3</td>
<td>17.9</td>
<td>7.7</td>
<td>20.8</td>
</tr>
<tr>
<td>G.726 (32 kbps)</td>
<td>20</td>
<td>5</td>
<td>3.85</td>
<td>80</td>
<td>20</td>
<td>50</td>
<td>50.8</td>
<td>35.6</td>
<td>55.2</td>
</tr>
<tr>
<td>G.726 (24 kbps)</td>
<td>15</td>
<td>5</td>
<td>60</td>
<td>20</td>
<td>50</td>
<td>42.8</td>
<td>27.6</td>
<td>47.2</td>
<td>47.2</td>
</tr>
<tr>
<td>G.728 (16 kbps)</td>
<td>10</td>
<td>5</td>
<td>3.61</td>
<td>60</td>
<td>30</td>
<td>33.3</td>
<td>28.5</td>
<td>18.4</td>
<td>31.5</td>
</tr>
<tr>
<td>G722_64k(64 kbps)</td>
<td>80</td>
<td>10</td>
<td>4.13</td>
<td>160</td>
<td>20</td>
<td>50</td>
<td>82.8</td>
<td>67.6</td>
<td>87.2</td>
</tr>
<tr>
<td>ilbc_mode_20(152 kbps)</td>
<td>38</td>
<td>20</td>
<td>NA</td>
<td>38</td>
<td>20</td>
<td>50</td>
<td>34.0</td>
<td>18.8</td>
<td>38.4</td>
</tr>
<tr>
<td>ilbc_mode_30(1333 kbps)</td>
<td>50</td>
<td>30</td>
<td>NA</td>
<td>50</td>
<td>30</td>
<td>33.3</td>
<td>25.867</td>
<td>15.73</td>
<td>28.8</td>
</tr>
</tbody>
</table>

Table 14: Explanation of Terms

<table>
<thead>
<tr>
<th>Codec Bit Rate (kbps)</th>
<th>Based on the codec, this is the number of bits per second that need to be transmitted to deliver a voice call. (codec bit rate = codec sample size / codec sample interval).</th>
</tr>
</thead>
</table>
Size (Bytes) Based on the codec, this is the number of bytes captured by the digital signal processor (DSP) at each codec sample interval. For example, the G.729 coder operates on sample intervals of 10 ms, corresponding to 10 bytes (80 bits) per sample at a bit rate of 8 kbps. (codec bit rate = codec sample size / codec sample interval).

Codec Sample Interval (ms) This is the sample interval at which the codec operates. For example, the G.729 coder operates on sample intervals of 10 ms, corresponding to 10 bytes (80 bits) per sample at a bit rate of 8 kbps. (codec bit rate = codec sample size / codec sample interval).

MOS MOS is a system of grading the voice quality of telephone connections. With MOS, a wide range of listeners judge the quality of a voice sample on a scale of one (bad) to five (excellent). The scores are averaged to provide the MOS for the codec.

Voice Payload Size (Bytes) The voice payload size represents the number of bytes (or bits) that are filled into a packet. The voice payload size must be a multiple of the codec sample size. For example, G.729 packets can use 10, 20, 30, 40, 50, or 60 bytes of voice payload size.

Voice Payload Size (ms) Payload Size (ms) The voice payload size can also be represented in terms of the codec samples. For example, a G.729 voice payload size of 20 ms (two 10 ms codec samples) represents a voice payload of 20 bytes [ (20 bytes * 8) / (20 ms) = 8 kbps ]

PPS PPS represents the number of packets that need to be transmitted every second in order to deliver the codec bit rate. For example, for a G.729 call with voice payload size per packet of 20 bytes (160 bits), 50 packets need to be transmitted every second [50 pps = (8 kbps) / (160 bits per packet) ]

## Supported Audio and Video Codecs

CUBE is required to support the codec used between endpoints. g729r8 is supported by default. All other codecs have to be configured. The following codecs can be supported:

### Table 15: Audio Codecs Supported on CUBE

<table>
<thead>
<tr>
<th>Codec Keyword</th>
<th>Codec</th>
</tr>
</thead>
<tbody>
<tr>
<td>aacld</td>
<td>AAACL D 90000 bps</td>
</tr>
<tr>
<td>clear-channel</td>
<td>Clear Channel 64000 bps (No voice capabilities: data transport only)</td>
</tr>
<tr>
<td>Codec Keyword</td>
<td>Codec</td>
</tr>
<tr>
<td>---------------</td>
<td>-------</td>
</tr>
<tr>
<td>g711alaw</td>
<td>G.711 A Law 64000 bps</td>
</tr>
<tr>
<td>g711ulaw</td>
<td>G.711 u Law 64000 bps</td>
</tr>
<tr>
<td>g722-48</td>
<td>G722-48K 64000 bps - Only supported for H.320 &lt;-&gt; H.323 calls</td>
</tr>
<tr>
<td>g722-56</td>
<td>G722-56K 64000 bps - Only supported for H.320 &lt;-&gt; H.323 calls</td>
</tr>
<tr>
<td>g722-64</td>
<td>G722-64K 64000 bps</td>
</tr>
<tr>
<td>g723ar53</td>
<td>G.723.1 ANNEX-A 5300 bps (contains built-in VAD that cannot be disabled) Not supported on PVDM3.</td>
</tr>
<tr>
<td>g723ar63</td>
<td>G.723.1 ANNEX-A 6300 bps (contains built-in VAD that cannot be disabled) Not supported on PVDM3.</td>
</tr>
<tr>
<td>g723r53</td>
<td>G.723.1 5300 bps Not supported on PVDM3.</td>
</tr>
<tr>
<td>g723r63</td>
<td>G.723.1 6300 bps Not supported on PVDM3.</td>
</tr>
<tr>
<td>g726r16</td>
<td>G.726 16000 bps</td>
</tr>
<tr>
<td>g726r24</td>
<td>G.726 24000 bps</td>
</tr>
<tr>
<td>g726r32</td>
<td>G.726 32000 bps</td>
</tr>
<tr>
<td>g728</td>
<td>G.728 16000 bps</td>
</tr>
<tr>
<td>g729br8</td>
<td>G.729 ANNEX-B 8000 bps (contains built-in VAD that cannot be disabled)</td>
</tr>
<tr>
<td>g729r8</td>
<td>G.729 8000 bps</td>
</tr>
<tr>
<td>gsmamr-nb</td>
<td>GSM AMR-NB 4750 to 12200 bps (contains built-in VAD that cannot be disabled)</td>
</tr>
<tr>
<td>ilbc</td>
<td>iLBC 13330 or 15200 bps</td>
</tr>
<tr>
<td>isac</td>
<td>iSAC 10 to 32 kbps (variable bit-rate)</td>
</tr>
<tr>
<td>mp4a-latm</td>
<td>MP4A-LATM upto 128 kbps</td>
</tr>
<tr>
<td>transparent</td>
<td>Transparent; uses the endpoint codec</td>
</tr>
</tbody>
</table>
Table 16: Video Codecs Supported on CUBE

<table>
<thead>
<tr>
<th>Codec Keyword</th>
<th>Codec</th>
</tr>
</thead>
<tbody>
<tr>
<td>h261</td>
<td>Video Codec H261</td>
</tr>
<tr>
<td>h263</td>
<td>Video Codec H263</td>
</tr>
<tr>
<td>h263+</td>
<td>Video Codec H263+</td>
</tr>
<tr>
<td>h264</td>
<td>Video Codec H264</td>
</tr>
<tr>
<td>mpeg4</td>
<td>Video Codec MPEG-4 ISO/IES 14496-2</td>
</tr>
</tbody>
</table>

How to Configure Codecs

Configuring Audio and Video Codecs at the Dial Peer Level

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `dial-peer voice number voip`
4. Enter one of the following to configure an audio codec:
   - `codec codec [bytes payload-size fixed-bytes ]`
   - `codec isac [mode {adaptive | independent} [bit-rate value framesize { 30 | 60 } [fixed] ]`
   - `codec ilbc [mode frame-size [bytes payload-size]]`
   - `codec mp4-ltm [profile tag]`
5. Do the following to configure a video codec:
   - `video codec codec`
6. (Optional) Do one of the following to configure RTP payload type:
   - `rtp payload-type cisco-codec-isac value`
   - `rtp payload-type cisco-codec-ilbc value`
   - `rtp payload-type cisco-codec-video-h263+ value`
   - `rtp payload-type cisco-codec-video-h264 value`
7. `end`

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td><code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><code>Example:</code></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Device&gt; enable</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters dial peer configuration mode for the specified VoIP dial peer.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device&gt; configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> dial-peer voice number voip</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config)# dial-peer voice 1 voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> Enter one of the following to configure an audio codec:</td>
<td>Configures an audio codec at the dial peer level.</td>
</tr>
<tr>
<td>• codec codec [bytes payload-size fixed-bytes ]</td>
<td>• g729r8, 20-byte payload is configured by default.</td>
</tr>
<tr>
<td>• codec isac [mode {adaptive</td>
<td>independent} [bit-rate value framesize { 30</td>
</tr>
<tr>
<td>• codec ilbc [mode frame-size [bytes payload-size]]</td>
<td></td>
</tr>
<tr>
<td>• codec mp4-latm [profile tag]</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> For g711alaw Codec</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# codec g711alaw</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> For ISAC Codec</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# codec isac mode independent</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> Do the following to configure a video codec:</td>
<td>Configures a video codec at the dial peer level.</td>
</tr>
<tr>
<td>• video codec codec</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> For Video Codec</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# video codec h261</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> (Optional) Do one of the following to configure RTP payload type:</td>
<td>Configures the RTP payload type.</td>
</tr>
<tr>
<td>• rtp payload-type cisco-codec-isac value</td>
<td></td>
</tr>
<tr>
<td>• rtp payload-type cisco-codec-ilbc value</td>
<td></td>
</tr>
<tr>
<td>• rtp payload-type cisco-codec-video-h263+ value</td>
<td></td>
</tr>
<tr>
<td>• rtp payload-type cisco-codec-video-h264 value</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> end</td>
<td>Returns to privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-dial-peer)# end</td>
<td></td>
</tr>
</tbody>
</table>
# Configuring Audio Codecs Using a Codec Voice Class and Preference Lists

Preferences can be used to determine which codecs will be selected over others.

A codec voice class is a construct within which a codec preference order can be defined. A codec voice class can then be applied to a dial peer, which then follows the preference order defined in the codec voice class.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice class codec tag
4. Do the following for each audio codec you want to configure in the voice class:
   - codec preference value codec-type[bytes payload-size fixed-bytes]
   - codec preference value isac [mode {adaptive | independent} [bit-rate value framesize {30 | 60} [fixed]]
   - codec preference value ilbc [mode frame-size [bytes payload-size]]
   - codec preference value mp4-latm [profile tag]
5. exit
6. dial-peer voice number voip
7. voice-class codec tag offer-all
8. end

## DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>- Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device&gt; configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice class codec tag</td>
<td>Enters voice-class configuration mode for the specified codec voice class.</td>
</tr>
<tr>
<td>Example: Device(config)# voice class codec 10</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> Do the following for each audio codec you want to configure in the voice class:</td>
<td>Configure a codec within the voice class and specifies a preference for the codec. This becomes part of a preference list</td>
</tr>
<tr>
<td>• codec preference value codec-type[bytes payload-size fixed-bytes]</td>
<td></td>
</tr>
<tr>
<td>• codec preference value isac [mode {adaptive</td>
<td>independent} [bit-rate value framesize {30</td>
</tr>
<tr>
<td>• codec preference value ilbc [mode frame-size [bytes payload-size]]</td>
<td></td>
</tr>
</tbody>
</table>
**Configuring Video Codecs Using Codec Voice Class**

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice class codec tag
4. video codec codec
5. exit
6. dial-peer voice number voip
7. voice-class codec tag offer-all
8. end

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device&gt; configure terminal</td>
<td></td>
</tr>
</tbody>
</table>
## Command or Action

**Step 3**

**voice class codec tag**

**Example:**

Device(config)# voice class codec 10

**Purpose**

Enters voice-class configuration mode for the specified codec voice class.

**Step 4**

**video codec codec**

**Example:**

video codec h261

**Purpose**

Configures a video codec within the voice class.

**Step 5**

**exit**

**Example:**

Device(config-class)# exit

**Purpose**

Exits the current mode.

- Enter your password if prompted.

**Step 6**

**dial-peer voice number voip**

**Example:**

Device(config)# dial-peer voice 1 voip

**Purpose**

Enters dial peer configuration mode for the specified VoIP dial peer.

**Step 7**

**voice-class codec tag offer-all**

**Example:**

Device(config-dial-peer)# voice-class codec 10

**Purpose**

Applies the previously configured codec voice class and associated codecs to a dial peer.

- The **offer-all** keyword allows the device to offer all codecs configured in the codec voice class.

**Step 8**

**end**

**Example:**

Device(config-dial-peer)# end

**Purpose**

Returns to privileged EXEC mode.

### Verifying an Audio Call

#### SUMMARY STEPS

1. show call active voice [compact]

#### DETAILED STEPS

**show call active voice [compact]**

Displays a compact version of call information for voice calls in progress.

**Example:**

Device# show call active voice compact

<table>
<thead>
<tr>
<th>&lt;callID&gt;</th>
<th>A/O</th>
<th>FAX</th>
<th>&lt;sec&gt;</th>
<th>Codec</th>
<th>type</th>
<th>Peer Address</th>
<th>IP</th>
<th>R&lt;ip&gt;:&lt;udp&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 ANS</td>
<td>T3</td>
<td>mp4a-latm</td>
<td>VOIP</td>
<td>Psipp</td>
<td>9.45.33.11:57210</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 ORG</td>
<td>T3</td>
<td>mp4a-latm</td>
<td>VOIP</td>
<td>P123</td>
<td>9.45.33.11:57210</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Example:**
Device# show call active voice compact

<table>
<thead>
<tr>
<th>&lt;callID&gt;</th>
<th>A/O FAX T&lt;sec&gt; Codec type Peer Address IP R&lt;ip&gt;::&lt;udp&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>58 ANS</td>
<td>T11 g711ulaw VOIP Psipp 2001:........:230A:6080</td>
</tr>
<tr>
<td>59 ORG</td>
<td>T11 g711ulaw VOIP P5000110011 10.13.37.150:6090</td>
</tr>
</tbody>
</table>

**Configuration Examples for Codecs**

**Example: Configuring a Codec at Dial-Peer Level**

Device(config)# dial-peer voice 5550199 voip
Device(config-dial-peer)# incoming called-number 5550199
Device(config-dial-peer)# codec g711ulaw
Device(config-dial-peer)# end

**Example: Configuring a Codec Preference List and Applying it to a Dial Peer**

Device(config)# voice class codec 100
Device(config-dial-peer)# codec preference 1 g711ulaw
Device(config-dial-peer)# exit
Device(config)# dial-peer voice 10 voip
Device(config-dial-peer)# voice-class codec 100
Device(config-dial-peer)# end
SIP Binding

The SIP Binding feature enables you to configure a source IP address for signaling packets and media packets.

- Feature Information for SIP Binding, on page 61
- Information About SIP Binding, on page 62
- Configuring SIP Binding, on page 68
- Verifying SIP Binding, on page 70

Feature Information for SIP Binding

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
</table>
| SIP Gateway Support for the bind Command | Cisco IOS 12.2(2)XB, 12.2(2)XB2, 12.2(8)T, 12.2(11)T, and 12.3(4)T Cisco IOS XE 3.1.0S | The SIP Gateway Support for the **bind** Command feature allows you to configure the source IP address of signaling packets and media packets. 
In 12.2(2)XB, this feature was introduced. 
In 12.3(4)T, this feature was expanded to provide the flexibility to specify different source interfaces for signaling and media, and allow network administrators a finer granularity of control on the network interfaces used for voice traffic. 
The following commands were introduced or modified: **bind**, **show dial-peer voice**, **show ip sockets**, **show sip-ua connections**, and **show sip-ua status** |
**Information About SIP Binding**

When you configure SIP on a router, the ports on all its interfaces are open by default. This makes the router vulnerable to malicious attackers who can execute toll fraud across the gateway if the router has a public IP address and a public switched telephone network (PSTN) connection. To eliminate the threat, you should bind an interface to an IP address so that only those ports are open to the outside world. In addition, you should protect any public or untrusted interface by configuring a firewall or an access control list (ACL) to prevent unwanted traffic from traversing the router.

**Benefits of SIP Binding**

- SIP signaling and media paths can advertise the same source IP address on the gateway for certain applications, even if the paths used different addresses to reach the source. This eliminates confusion for firewall applications that may have taken action on source address packets before the use of binding.

- Firewalls filter messages based on variables such as the message source, the target address, and available ports. Normally a firewall opens only certain addresses or port combination to the outside world and those addresses can change dynamically. Because VoIP technology requires the use of more than one address or port combination, the **bind** command adds flexibility by assigning a gateway to a specific interface (and therefore the associated address) for the signaling or media application.

- You can obtain a predefined and separate interface for both signaling and media traffic. After a **bind** command is in effect, the interface it limits is bound solely to that purpose. Administrators can therefore dictate the use of one network to transport the signaling and another network to transport the media. The benefits of administrator control are:
  - Administrators know the traffic that runs on specific networks, thereby making debugging easier.
  - Administrators know the capacity of the network and the target traffic, thereby making engineering and planning easier.
  - Traffic is controlled, allowing Quality of Service (QoS) to be monitored.

- The **bind media** command relaxes the constraints imposed by the **bind control** and **bind all** commands, which cannot be set during an active call. The **bind media** command works with active calls.
Source Address

In early releases of Cisco IOS software with SIP functionality, the source address of a packet going out of the gateway was never deterministic. That is, the session protocols and VoIP layers always depended on the IP layer to give the best local address. The best local address was then used as the source address (the address showing where the SIP request came from) for signaling and media packets. Using this non-deterministic address occasionally caused confusion for firewall applications, because a firewall could not be configured with an exact address and would take action on several different source address packets.

However, the bind command enables you to configure the source IP address of signaling and media packets to a specific interface’s IP address. Thus, the address that goes out on the packet is bound to the IP address of the interface specified with the bind command. Packets that are not destined to the bound address are discarded.

When you do not want to specify a bind address or if the interface is down, the IP layer still provides the best local address.

The Support Ability to Configure Source IP Address for Signaling and Media per SIP Trunk feature extends the global bind functionality to support the SIP signaling Transport Layer Socket (TLS) with UDP and TCP. The source address at the dial peer is the source address in all the signaling and media packets between the gateway and the remote SIP entity for calls using the dial-peer. Multiple SIP listen sockets with specific source address handle the incoming SIP traffic from each selected SIP entity. The order of preference for retrieving the SIP signalling and media source address for inbound and outbound calls is as follows:

- Bind configuration at dial peer level
- Bind configuration at global level
- Best local IP address to reach the destination

The table below describes the state of the system when the bind command is applied in the global or dial peer level:

Table 18: State of the System for the bind Address

<table>
<thead>
<tr>
<th>Bind State</th>
<th>System Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>No global bind</td>
<td>The best local address is used in all outbound SIP messages. Only one SIP listen socket with a wildcard source address.</td>
</tr>
<tr>
<td>Global bind</td>
<td>Global bind address used in all outbound SIP messages. Only one SIP listen socket with global bind address.</td>
</tr>
<tr>
<td>No global bind Dial peer bind</td>
<td>Dial peer bind address is used in outbound SIP messages of this dial peer. The remaining SIP messages use the best local address. One SIP listen socket with a wildcard source address. Additional SIP listen socket for each different dial peer bind listening on the specific dial peer bind address.</td>
</tr>
</tbody>
</table>
The **bind** command performs different functions based on the state of the interface (see the table below).

**Table 19: State of the Interface for the bind Command**

<table>
<thead>
<tr>
<th>Interface State</th>
<th>Result Using Bind Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shut down</td>
<td>TCP, TLS, and User Datagram Protocol (UDP) socket listeners are initially closed. (Socket listeners receive datagrams addressed to the socket.) Then the sockets are opened to listen to any IP address. If the outgoing gateway has the <strong>bind</strong> command enabled and has an active call, the call becomes a one-way call with media flowing from the outgoing gateway to the terminating gateway. The dial peer bind socket listeners of the interface are closed and the configuration turns inactive for all subsequent SIP messages.</td>
</tr>
<tr>
<td>No shut down</td>
<td>TCP, TLS, and UDP socket listeners are initially closed. (Socket listeners receive datagrams addressed to the socket.) Then the sockets are opened and bound to the IP address set by the <strong>bind</strong> command. The sockets accept packets destined for the bound address only. The dial peer bind socket listeners of the interface are reopened and the configuration turns active for all subsequent SIP messages.</td>
</tr>
<tr>
<td>No shut down</td>
<td>TCP, TLS, and UDP socket listeners are initially closed. Then the sockets are opened to listen to any IP address. The dial peer bind socket listeners of the interface are reopened and the configuration turns active for all subsequent SIP messages.</td>
</tr>
<tr>
<td>No shut down</td>
<td>TCP, TLS, and UDP socket listeners are initially closed. Then the sockets are opened to listen to any IP address. The dial peer bind socket listeners of the interface are reopened and the configuration turns active for all subsequent SIP messages.</td>
</tr>
</tbody>
</table>

The **bind** command performs different functions based on the state of the interface (see the table below).
<table>
<thead>
<tr>
<th>Interface State</th>
<th>Result Using Bind Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bound-interface IP address is removed.</td>
<td>TCP, TLS, and UDP socket listeners are initially closed. Then the sockets are opened to listen to any address, because the IP address has been removed. This happens even when SIP was never bound to an IP address. A message stating that the IP address has been deleted from the SIP bound interface is printed. If the outgoing gateway has the bind command enabled and has an active call, the call becomes a one-way call with media flowing from the outgoing gateway to the terminating gateway. The dial peer bind socket listeners of the interface are closed and the configuration turns inactive for all subsequent SIP messages.</td>
</tr>
<tr>
<td>The physical cable is pulled on the bound port or the interface layer is down.</td>
<td>TCP, TLS, and UDP socket listeners are initially closed. Then the sockets are opened and bound to listen to any address. When the pulled cable is replaced, the result is as documented for no shutdown interfaces. The dial peer bind socket listeners of the interface are closed and the configuration turns inactive for all subsequent SIP messages.</td>
</tr>
<tr>
<td>A bind interface is shut down or its IP address is changed or the physical cable is pulled while SIP calls are active.</td>
<td>The call becomes a one-way call with media flowing in only one direction. It flows from the gateway where the change or shutdown took place, to the gateway where no change occurred. Thus, the gateway with the status change no longer receives media. The call is then disconnected, but the disconnected message is not understood by the gateway with the status change, and the call is still assumed to be active. If the bind interface is shutdown, the dial peer bind socket listeners of the interface are closed. If the IP address of the interface is changed, the socket listeners representing the bind command is opened with the available IP address of the interface and the configuration turns active for all subsequent SIP messages.</td>
</tr>
</tbody>
</table>

**Note** If there are active calls, the bind command does not take effect if it is issued for the first time or if another bind command is in effect. A message reminds you that there are active calls and that the change cannot take effect.
The `bind` command applied at the dial peer level can be modified only in the following situations:

- Dial peer `bind` is disabled in the supported IOS configuration options.
- Dial peer `bind` is removed when the bound interface is removed.
- Dial peer `bind` is removed when the dial peer is removed.

**Voice Media Stream Processing**

The SIP Gateway Support Enhancements to the bind Command feature extends the capabilities of the `bind` command by supporting a deterministic network interface for the voice media stream. Before the voice media stream addition, the `bind` command supported a deterministic network interface for control (signaling) traffic or all traffic. With the SIP Gateway Support Enhancements to the bind Command feature, a finer granularity of control is achieved on the network interfaces used for voice traffic.

If multiple `bind` commands are issued in sequence—that is, if one `bind` command is configured and then another `bind` command is configured—a set interaction happens between the commands. The table below describes the expected command behavior.

**Table 20: Interaction Between Previously Set and New bind Commands**

<table>
<thead>
<tr>
<th>Interface State</th>
<th>bind Command</th>
<th>Result Using bind Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without active calls</td>
<td><code>bind all</code></td>
<td>Generated <code>bind control</code> and <code>bind media</code> commands to override existing <code>bind control</code> and <code>bind media</code> commands.</td>
</tr>
<tr>
<td></td>
<td><code>bind control</code></td>
<td>Overrides existing <code>bind control</code> command.</td>
</tr>
<tr>
<td></td>
<td><code>bind media</code></td>
<td>Overrides existing <code>bind media</code> command.</td>
</tr>
<tr>
<td>With active calls</td>
<td><code>bind all</code> or <code>bind control</code></td>
<td>Blocks the command, and the following messages are displayed:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 00:16:39: There are active calls</td>
</tr>
<tr>
<td></td>
<td><code>bind media</code></td>
<td>Succeeds and overrides any existing <code>bind media</code> command.</td>
</tr>
</tbody>
</table>

The `bind all` and `bind control` commands perform different functions based on the state of the interface.

---

**Note**

The `bind all` command only applies to global level, whereas the `bind control` and `bind media` command apply to global and dial peer. The table below applies to `bind media` only if the media interface is the same as the `bind control` interface. If the two interfaces are different, media behavior is independent of the interface state.
Table 21: bind all and bind control Functions, Based on Interface State

<table>
<thead>
<tr>
<th>Interface State</th>
<th>Result Using bind all or bind control Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shut down</td>
<td>TCP, TLS, and UDP socket listeners are initially closed. (Socket listeners receive datagrams addressed to the socket.) Then the sockets are opened to listen to any IP address. If the outgoing gateway has the <code>bind</code> command enabled and has an active call, the call becomes a one-way call with media flowing from the outgoing gateway to the terminating gateway. The dial peer bind socket listeners of the interface are closed and the configuration turns inactive for all subsequent SIP messages.</td>
</tr>
<tr>
<td>With or without active calls</td>
<td></td>
</tr>
<tr>
<td>Not shut down</td>
<td>TCP, TLS, and UDP socket listeners are initially closed. (Socket listeners receive datagrams addressed to the socket.) Then the sockets are opened and bound to the IP address set by the <code>bind</code> command. The sockets accept packets destined for the bound address only. The dial peer bind socket listeners of the interface are reopened and the configuration turns active for all subsequent SIP messages.</td>
</tr>
<tr>
<td>Without active calls</td>
<td></td>
</tr>
<tr>
<td>Not shut down</td>
<td>TCP, TLS, and UDP socket listeners are initially closed. Then the sockets are opened to listen to any IP address. The dial peer bind socket listeners of the interface are reopened and the configuration turns active for all subsequent SIP messages.</td>
</tr>
<tr>
<td>With active calls</td>
<td></td>
</tr>
<tr>
<td>Bound interface’s IP address is removed.</td>
<td>TCP, TLS, and UDP socket listeners are initially closed. Then the sockets are opened to listen to any address because the IP address has been removed. A message is printed that states the IP address has been deleted from the bound SIP interface. If the outgoing gateway has the <code>bind</code> command enabled and has an active call, the call becomes a one-way call with media flowing from the outgoing gateway to the terminating gateway. The dial peer bind socket listeners of the interface are closed and the configuration turns inactive for all subsequent SIP messages.</td>
</tr>
<tr>
<td>The physical cable is pulled on the bound port, or the interface layer goes down.</td>
<td>TCP, TLS, and UDP socket listeners are initially closed. Then the sockets are opened and bound to listen to any address. When the pulled cable is replaced, the result is as documented for interfaces that are not shut down. The dial peer bind socket listeners of the interface are closed and the configuration turns inactive for all subsequent SIP messages.</td>
</tr>
</tbody>
</table>

Cisco Unified Border Element Configuration Guide
### Configuring SIP Binding

#### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask* [*secondary*]
5. **exit**
6. Use one of the following commands to configure SIP binding:
   - **bind** {control | all} **source-interface** *interface-id* [*ipv6-address ipv6-address*] in SIP configuration mode.
   - **bind media** [*source-address ipv4 ipv4-address | source-interface** interface-id* [*ipv6-address ipv6-address]]* in SIP configuration mode.
   - **voice-class sip bind control source interface** *interface-id* [*ipv6-address ipv6-address*] in dial-peer configuration mode.
   - **voice-class sip bind media** [*source-address ipv4 ipv4-address | source-interface** interface-id* [*ipv6-address ipv6-address]]* in dial-peer configuration mode.
7. **end**

#### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> <strong>enable</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> <strong>configure terminal</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

<table>
<thead>
<tr>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configures an interface type and enters the interface configuration mode.</td>
</tr>
</tbody>
</table>

**Step 3**

**interface type number**

**Example:**

Router(config)# interface fastethernet0/0

- **type number** — Type of interface to be configured and the port, connector, or interface card number.

**Step 4**

**ip address ip-addressmask [secondary]**

**Example:**

Router(config-if)# ip address 192.168.200.33 255.255.255.0

- **Note** Secondary IP address on an interface with SIP binding is not supported for CUBE.

**Step 5**

**exit**

**Example:**

Router(config-if)# exit

- Exits the current mode.

**Step 6**

Use one of the following commands to configure SIP binding:

- **bind \{control | all\} source-interface interface-id [ipv6-address ipv6-address]** in SIP configuration mode.

- **bind media \{source-address ipv4 ipv4-address | source-interface interface-id [ipv6-address ipv6-address] \} in SIP configuration mode.

- **voice-class sip bind control source interface interface-id [ipv6-address ipv6-address]** in dial-peer configuration mode.

- **voice-class sip bind media \{source-address ipv4 ipv4-address | source-interface interface-id [ipv6-address ipv6-address] \} in dial-peer configuration mode.

**Example:**

SIP binding in SIP configuration mode:

Device(config)# voice service voip
Device(config-voi-serv)# sip
Device(config-voi-serv)# bind control source-interface FastEthernet0/0
Device(config-voi-serv)# exit
Device(config)# voice service voip
Device(config-voi-serv)# sip
Device(config-voi-serv)# bind media source-address ipv4 172.18.192.204
Device(config-voi-serv)# exit

**Example:**

Device(config)# voice service voip
Device(config-voi-serv)# sip
Device(config-voi-serv)# bind control source-interface FastEthernet0/0
Device(config-voi-serv)# exit
Device(config)# voice service voip
Device(config-voi-serv)# sip
Device(config-voi-serv)# bind media source-address ipv4 172.18.192.204
Device(config-voi-serv)# exit
### Verifying SIP Binding

**SUMMARY STEPS**

1. `show ip sockets`
2. `show sip-ua status`
3. `show sip-ua connections {tcp [tls] | udp} {brief | detail}`
4. `show dial-peer voice`
5. `show running-config`

**DETAILED STEPS**

#### Step 1 show ip sockets

Use this command to display IP socket information and indicate whether the bind address of the receiving gateway is set.

The following sample output indicates that the bind address of the receiving gateway is set:

**Example:**

```
Device# show ip sockets
Proto Remote Port Local Port In Out Stat TTY Output IF
17 0.0.0.0 0--any-- 2517 0 0 9 0
17 --listen-- 172.18.192.204 1698 0 0 1 0
17 0.0.0.0 0 172.18.192.204 67 0 0 489 0
17 0.0.0.0 0 172.18.192.204 5060 0 0 A1 0
```

**Example:**

#### Step 2 show sip-ua status

Use this command to display SIP user-agent status and indicate whether bind is enabled.
The following sample output indicates that signaling is disabled and media on 172.18.192.204 is enabled:

Example:

```
Device# show sip-ua status
SIP User Agent Status
SIP User Agent for UDP : ENABLED
SIP User Agent for TCP : ENABLED
SIP User Agent for TLS over TCP : ENABLED
SIP User Agent bind status(signaling): DISABLED
SIP User Agent bind status(media): ENABLED 172.18.192.204
SIP early-media for 180 responses with SDP: ENABLED
SIP max-forwards : 70
SIP DNS SRV version: 2 (rfc 2782)
Role in SDP: NONE
Check media source packets: DISABLED
Maximum duration for a telephone-event in NOTIFYs: 2000 ms
SIP support for ISDN SUSPEND/RESUME: ENABLED
Redirection (3xx) message handling: ENABLED
Reason Header will override Response/Request Codes: DISABLED
Out-of-dialog Refer: DISABLED
Presence support is DISABLED
protocol mode is ipv4
SDP application configuration:
  Version line (v=) required
  Owner line (o=) required
  Timespec line (t=) required
  Media supported: audio video image
  Network types supported: IN
  Address types supported: IP4 IP6
  Transport types supported: RTP/AVP udptl
```

Step 3  
```
show sip-ua connections {tcp [tls] | udp} {brief | detail}
```

Use this command to display the connection details for the UDP transport protocol. The command output looks identical for TCP and TLS.

Example:

```
Device# show sip-ua connections udp detail
Total active connections : 0
No. of send failures : 0
No. of remote closures : 0
No. of conn. failures : 0
No. of inactive conn. ageouts : 10
---------Printing Detailed Connection Report---------
Note:
  * Tuples with no matching socket entry
    - Do 'clear sip <tcp[tls]/udp> conn t ipv4:<addr>:<port>'
      to overcome this error condition
  ** Tuples with mismatched address/port entry
    - Do 'clear sip <tcp[tls]/udp> conn t ipv4:<addr>:<port> id <connid>'
      to overcome this error condition
No Active Connections Found
-------------- SIP Transport Layer Listen Sockets --------------
Conn-Id   Local-Address
---------   ----------------------------------------------
2  [9.42.28.29]:5060
```

Step 4  
```
show dial-peer voice
```
Use this command, for each dial peer configured, to verify that the dial-peer configuration is correct. The following is sample output from this command for a VoIP dial peer:

**Example:**

```
Device# show dial-peer voice 101

VoiceOverIpPeer1234
  peer type = voice, system default peer = FALSE, information type = voice,
  description = '',
  tag = 1234, destination-pattern = '',
  voice reg type = 0, corresponding tag = 0,
  allow watch = FALSE
  answer-address = '', preference=0,
  CLID Restriction = None
  CLID Network Number = ''
  CLID Second Number sent
  CLID Override RDNIS = disabled,
  rtp-ssrc mux = system
  source carrier-id = '', target carrier-id = '',
  source trunk-group-label = '', target trunk-group-label = '',
  numbering Type = 'unknown'
  group = 1234, Admin state is up, Operation state is down,
  incoming called-number = '', connections/maximum = 0/unlimited,
  DTMF Relay = disabled,
  modem transport = system,
  URI classes:
    Incoming (Request) =
    Incoming (Via) =
    Incoming (To) =
    Incoming (From) =
    Destination =
  huntstop = disabled,
  in bound application associated: 'DEFAULT'
  out bound application associated: '
  dnis-map =
  permission :both
  incoming COR list:maximum capability
  outgoing COR list:minimum requirement
  outgoing LPCOR:
  Translation profile (Incoming):
  Translation profile (Outgoing):
  incoming call blocking:
  translation-profile = ''
  disconnect-cause = 'no-service'
  advertise 0x40 capacity_update_timer 25 addrFamily 4 oldAddrFamily 4
  mailbox selection policy: none
  type = voip, session-target = '',
  technology prefix:
  settle-call = disabled
  ip media DSCP = ef, ip media rsvp-pass DSCP = ef
  ip media rsvp-fail DSCP = ef, ip signaling DSCP = af31,
  ip video rsvp-none DSCP = af41,ip video rsvp-pass DSCP = af41
  ip video rsvp-fail DSCP = af41,
  ip defending Priority = 0, ip preemption priority = 0
  ip policy locator voice:
  ip policy locator video:
  UDP checksum = disabled,
  session-protocol = sipv2, session-transport = system,
  req-qos = best-effort, acc-qos = best-effort,
  req-qos video = best-effort, acc-qos video = best-effort,
  req-qos audio def bandwidth = 64, req-qos audio max bandwidth = 0,
  req-qos video def bandwidth = 384, req-qos video max bandwidth = 0,
```
RTP dynamic payload type values: NTE = 101
Cisco: NSE=100, fax=96, fax-ack=97, dtmf=121, fax-relay=122
CAS=123, TTY=119, ClearChan=125, PCM switch over u-law=0,
A-law=8, GSMAMR-NB=117 iLBC=116, AAC-ld=114, iSAC=124
lmr_tone-0, nte_tone-0
h263+=118, h264=119
G726r16 using static payload
G726r24 using static payload
RTP comfort noise payload type = 19
fax rate - voice, payload size = 20 bytes
fax protocol = system
fax-relay ecm enable
Fax Relay ans enabled
Fax Relay SG3-to-G3 Enabled (by system configuration)
fax NSF = 0xAD0051 (default)
codec = g729r8, payload size = 20 bytes,
video codec = None
voice class codec = `
voice class sip session refresh system
voice class sip rsdp-fail-policy voice post-alert mandatory keep-alive interval 30
voice class sip rsdp-fail-policy voice post-alert optional keep-alive interval 30
voice class sip rsdp-fail-policy video post-alert mandatory keep-alive interval 30
voice class sip rsdp-fail-policy video post-alert optional keep-alive interval 30
text relay = disabled
Media Setting = forking (disabled) flow-through (global)
Expect factor = 10, Icpif = 20,
Playout Mode is set to adaptive,
Initial 60 ms, Max 1000 ms
Playout-delay Minimum mode is set to default, value 40 ms
Fax nominal 300 ms
Max Redirects = 1, signaling-type = cas,
VAD - enabled, Poor QOV Trap - disabled,
Source Interface = NONE
voice class sip url = system,
voice class sip tel-config url = system,
voice class sip relixx = system,
voice class sip anat = system,
voice class sip outbound-proxy = "system",
voice class sip associate registered-number = system,
voice class sip asserted-id system,
voice class sip privacy system
voice class sip e911 = system,
voice class sip history-info = system,
voice class sip reset timer expires 183 = system,
voice class sip pass-thru headers = system,
voice class sip pass-thru content unsupp = system,
voice class sip pass-thru content sdp = system,
voice class sip copy-list = system,
voice class sip g729 annexb-all = system,
voice class sip early-offer forced = system,
voice class sip negotiate cisco = system,
voice class sip block 180 = system,
voice class sip block 183 = system,
voice class sip block 181 = system,
voice class sip preloaded-route = system,
voice class sip random-contact = system,
voice class sip random-request-uri validate = system,
voice class sip call-route p-called-party-id = system,
voice class sip call-route history-info = system,
voice class sip privacy-policy send-always = system,
voice class sip privacy-policy passthrough = system,
voice class sip privacy-policy strip history-info = system,
voice class sip privacy-policy strip diversion = system,
voice class sip map resp-code 181 = system,
voice class sip bind control = enabled, 9.42.28.29,
voice class sip bind media = enabled, 9.42.28.29,
voice class sip bandwidth audio = system,
voice class sip bandwidth video = system,
voice class sip encap clear-channel = system,
voice class sip error-code-override options-keepalive failure = system,
voice class sip calltype-video = false
voice class sip registration passthrough = System
voice class sip authenticate redirecting-number = system,
redirect ip2ip = disabled
local peer = false
probe disabled,
Secure RTP: system (use the global setting)
voice class perms tag = `'
Time elapsed since last clearing of voice call statistics never
Connect Time = 0, Charged Units = 0,
Successful Calls = 0, Failed Calls = 0, Incomplete Calls = 0
Accepted Calls = 0, Refused Calls = 0,
Last Disconnect Cause is "",
Last Disconnect Text is "",
Last Setup Time = 0.
Last Disconnect Time = 0.

**Note** If the bind address is not configured at the dial-peer, the output of the show dial-peer voice command remains the same except for the values of the voice class sip bind control and voice class sip bind media, which display “system,” indicating that the bind is configured at the global level.

**Step 5**
**show running-config**

Although the bind all command is an accepted configuration, it does not appear in show running-config command output. Because the bind all command is equivalent to issuing the commands bind control and bind media, those are the commands that appear in the show running-config command output.

**Example:**
The following sample output shows that bind is enabled on router 172.18.192.204:

```
Building configuration...
Current configuration : 2791 bytes
!
version 12.2
service config
no service single-slot-reload-enable
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
service internal
service udp-small-servers
!
ip subnet-zero
ip ftp source-interface Ethernet0
!
voice service voip
sip
  bind control source-interface FastEthernet0
!
interface FastEthernet0
  ip address 172.18.192.204 255.255.255.0
duplex
speed auto
fair-queue 64 256 1000
ip rsvp bandwidth 75000 100
```
! voice-port 1/1/1
no supervisory disconnect lcfo
!
dial-peer voice 1 pots
application session
destination-pattern 5550111
port 1/1/1
!
dial-peer voice 29 voip
application session
destination-pattern 5550133
session protocol sipv2
session target ipv4:172.18.200.33
codec g711ulaw
!
gateway
!
line con 0
line aux 0
line vty 0 4
login
!
end
Verifying SIP Binding
Media Path

The Media Path feature allows you to configure the path taken by media after a call is established. You can configure media path in the following modes:

- Media flow-through
- Media flow-around
- Media anti-trombone

Feature Information for Media Path

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuring Media Path</td>
<td>12.4(3), 12.4(24)T, 15.0(1)M</td>
<td>The Media Path feature allows you to configure the path taken by media after a call is established. The following commands were introduced by this feature: media-flow around, media flow-through, media anti-trombone.</td>
</tr>
</tbody>
</table>
Media Flow-Through

Media Flow-Through is a media path mode where media and signaling packets terminate and originate on CUBE. As CUBE is an active participant of the call, this mode is recommended when connected outside an enterprise (untrusted endpoints).

Figure 15: Media Flow-Through Mode

Restrictions for Media Flow-Through

- Video codecs are not supported for Media Flow-Through.
- Media flow-around for Delayed-Offer to Early-Offer audio and video calls is not supported.

Configuring Media Flow-Through

**SUMMARY STEPS**

1. enable
2. configure terminal
3. Use one of the following commands to configure media flow-through:
   - media flow-through in dial-peer configuration mode
   - media flow-through in global VoIP configuration mode
4. end

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode. Enter your password if prompted.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
</tbody>
</table>
Purpose

Command or Action

Step 3
Use one of the following commands to configure media flow-through:

- **media flow-through** in dial-peer configuration mode
- **media flow-through** in global VoIP configuration mode

Example:

In dial-peer configuration mode

```plaintext
! Applying SIP profiles to one dial peer only
Device (config) dial-peer voice 10 voip
Device (config-dial-peer) media flow-through
Device (config-dial-peer) end
```

Example:

In global VoIP SIP mode

```plaintext
! Applying SIP profiles globally
Device (config)# voice service voip
Device (config-voi-serv)# media flow-through
Device (config-voi-serv)# end
```

Step 4
**end**

Exits to privileged EXEC mode.

---

## Media Flow-Around

Media Flow-Around is a media path mode where signaling packets terminate and originate on CUBE. As media bypasses CUBE and flows directly between endpoints, this mode is recommended when connected within an enterprise (trusted endpoints). Media Flow-Around is supported for both audio and video calls.

**Figure 16: Media Flow-Around**

---

### Configuring Media Flow-Around

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. Use one of the following commands to configure media flow-around:
   - **media flow-around** in dial-peer configuration mode
Media Anti-Trombone

Media Anti-Tromboning is a media path mode that allows CUBE to detect and avoid loops created by call transfers or call forwards. Loops are restricted to the SIP signaling path and removed from the RTP media path.

The user agent may initiate call forwards and call transfers that are sent towards CUBE as a new SIP INVITE dialog. CUBE considers the original call and the forwarded call as separate unrelated calls. Media

* media flow-around in global VoIP configuration mode

4. end

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables privileged EXEC mode. Enter your password if prompted.</td>
</tr>
<tr>
<td>enable</td>
<td>Device&gt; enable</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>configure terminal</td>
<td>Device# configure terminal</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Enables media packets to pass directly between the endpoints, without the intervention of the CUBE. The media packet is to flow around the gateway.</td>
</tr>
<tr>
<td>Use one of the following commands to configure media flow-around:</td>
<td></td>
</tr>
<tr>
<td>• media flow-around in dial-peer configuration mode</td>
<td></td>
</tr>
<tr>
<td>• media flow-around in global VoIP configuration mode</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>In dial-peer configuration mode</td>
<td></td>
</tr>
<tr>
<td>! Applying SIP profiles to one dial peer only</td>
<td></td>
</tr>
<tr>
<td>Device (config)# dial-peer voice 10 voip</td>
<td></td>
</tr>
<tr>
<td>Device (config-dial-peer)# media flow-around</td>
<td></td>
</tr>
<tr>
<td>Device (config-dial-peer)# end</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>In global VoIP SIP mode</td>
<td></td>
</tr>
<tr>
<td>! Applying SIP profiles globally</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# media flow-around</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# end</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Exits to privileged EXEC mode.</td>
</tr>
<tr>
<td>end</td>
<td></td>
</tr>
</tbody>
</table>
anti-tromboning allows CUBE to detect the relation between the calls and resolve the media loop by sending SDP packets back to the sender.

The figure below illustrates how CUBE needlessly loops RTP packets towards the User Agent because it fails to detect the loop.

*Figure 17: Tromboning - Needless looping of Media Packets*

The figure below illustrates how CUBE detects and avoids the loop with the anti-tromboning feature.

*Figure 18: Anti-Tromboning - Avoiding Media Loops*

### Restrictions for Media Anti-Tromboning

- When Media Anti-Tromboning media path mode is activated, CUBE does not perform supplementary services such as handling REFER-based call transfers or media services such as Secure Real-Time Transport Protocol (SRTP) and SNR.

- Anti-Tromboning does not work if one call leg is media flow-through and the other call leg is Media Flow-Around. Similarly, anti-tromboning does not work if one call leg is Session Description Protocol (SDP) passthrough and another call leg is SDP normal.

- H.323 is not supported.

### Configuring Media Anti-Tromboning

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. Enter one of the following commands to configure media anti-tromboning:
   - `media anti-trombone` in dial-peer configuration mode
   - `media anti-trombone` in global VoIP configuration mode
4. **end**
# DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><code>enable</code></td>
<td>Enables privileged EXEC mode. Enter your password if prompted.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device&gt; <code>enable</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td><code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device# <code>configure terminal</code></td>
<td></td>
</tr>
</tbody>
</table>
| **Step 3** | Enter one of the following commands to configure media anti-tromboning:  
  - `media anti-trombone` in dial-peer configuration mode  
  - `media anti-trombone` in global VoIP configuration mode |
| Example: | In dial-peer configuration mode  
  ```
  ! Applying SIP profiles to one dial peer only  
  Device (config)# dial-peer voice 10 voip  
  Device (config-dial-peer)# media anti-trombone  
  Device (config-dial-peer)# end
  ```  
| | In global VoIP SIP mode  
  ```
  ! Applying SIP profiles globally  
  Device(config)#voice service voip  
  Device(config-voi-serv)# media anti-trombone  
  Device(config-voi-serv)# end
  ``` |
| **Step 4** | `end` | Exits to privileged EXEC mode. |
SIP Profiles

Session Initiation Protocol (SIP) profiles change SIP incoming or outgoing messages so that interoperability between incompatible devices can be ensured.

SIP profiles can be configured with rules to add, remove, copy, or modify the SIP, Session Description Protocol (SDP), and peer headers that enter or leave CUBE. The rules in a SIP profile configuration can also be tagged with a unique number. Tagging the rules allows you to insert or delete rules at any position of the existing SIP profile configuration without deleting and reconfiguring the entire voice-class sip profile.

Figure 19: Incoming and Outgoing messages where SIP Profiles can be applied

You can use the following tool to test your SIP profile on an incoming message: https://cway.cisco.com/tools/SipProfileTest/

- Feature Information for SIP Profiles, on page 83
- Information About SIP Profiles, on page 84
- Restrictions for SIP Profiles, on page 86
- How to Configure SIP Profiles, on page 87

Feature Information for SIP Profiles

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
### Table 23: Feature Information for SIP Profiles

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIP Profiles (for inbound messages)</td>
<td>Cisco IOS 15.4(2)T</td>
<td>This feature extends support to inbound messages. This feature modifies the following commands: The <strong>inbound</strong> keyword was added to the sip-profiles and voice-class sip profiles commands.</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE 3.12S</td>
<td></td>
</tr>
<tr>
<td>Support for Rotary calls and Media Forking</td>
<td>Cisco IOS 15.3(1)T</td>
<td>With CSC1ty41575, this feature was enhanced to support forked and rotary calls.</td>
</tr>
<tr>
<td>Configuring SIP Profile (Add, Delete or Modify)</td>
<td>Cisco IOS 12.4(15)XZ</td>
<td>This feature allows users to change (add, delete, or modify) the standard SIP messages that are sent or received for better interworking with different SIP entities. This feature introduces the following commands: <em>voice class sip-profiles, response, request</em>.</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS 12.4(20)T</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE 2.5</td>
<td></td>
</tr>
<tr>
<td>Support for Non-Standard SIP Headers</td>
<td>Cisco IOS 15.5(2)T</td>
<td>This feature allows users to add, copy, delete, or modify non-standard (for example, X-Cisco-Recording-Participant) using SIP profiles. The <strong>word</strong> keyword was added to the sip-profiles command to allow the user to configure any non-standard SIP header.</td>
</tr>
<tr>
<td>Support for tagging rules in a SIP profile configuration</td>
<td>Cisco IOS 15.5(2)T</td>
<td>This feature allows users to tag the rules in a SIP profile configuration. Tagging the rules allows users to insert or delete rules at any position of the existing SIP profile configuration without deleting and reconfiguring the entire voice-class sip profile. The following command is introduced in voice class sip profiles configuration mode to tag and insert rules: <em>rule</em></td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE 3.15S</td>
<td>This feature also allows users to upgrade or downgrade all the existing SIP profile configurations to rule-format and non-rule format. The following commands are introduced in global configuration mode: <em>voice sip sip-profiles upgrade, voice sip sip-profiles downgrade</em></td>
</tr>
<tr>
<td>Support for Copying Unsupported SDP Headers</td>
<td>Cisco IOS 15.6(1)T</td>
<td>This feature allows for unsupported SDP headers to be copied into a SIP Profile and traverse through CUBE, for all m-lines. The feature introduces the following command: <em>pass-thru content custom-sdp</em></td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE 3.17S</td>
<td></td>
</tr>
</tbody>
</table>
of differences in how the protocol is implemented or interpreted. CUBE can customize the SIP messaging on either side to what the devices in that segment of the network expects to see by normalizing the SIP messaging on the network border, or between two non-interoperable devices within the network.

Service providers may have policies for which SIP messaging fields should be present (or what constitutes valid values for the header fields) before a SIP call enters their network. Similarly, enterprises and small businesses may have policies for the information that can enter or exit their networks for policy or security reasons from a service provider SIP trunk.

**Figure 20: SIP Profile**

In order to customize SIP messaging in both directions, you can place and configure a CUBE with a SIP profile at the boundary of these networks.

In addition to network policy compliance, the CUBE SIP profiles can be used to resolve incompatibilities between SIP devices inside the enterprise network. These are the situations in which incompatibilities can arise:

- A device rejects an unknown header (value or parameter) instead of ignoring it
- A device sends incorrect data in a SIP message
- A device does not implement (or implements incorrectly) protocol procedures
- A device expects an optional header value or parameter, or an optional protocol procedure that can be implemented in multiple ways
- A device sends a value or parameter that must be changed or suppressed before it leaves or enters the network
- Variations in the SIP standards on how to achieve certain functions

The SIP profiles feature on CUBE provides a solution to these incompatibilities and customization issues. SIP profiles can also be used to change a header name from the long form to the compact form. For example, From to f. This can be used as a way to reduce the length of a SIP message. By default, the device never sends the compact form of the SIP messages although it receives either the long or the short form.

**Important Characteristics of SIP Profiles**

Given below are a few important notes for SIP Profiles:

- Copy Variables u01 to u99 are shared by inbound and outbound SIP Profiles.
- Session Initiation Protocol (SIP) and Session Description Protocol (SDP) headers are supported. SDP can be either a standalone body or part of a Multipurpose Internet Mail Extensions (MIME) message.
• The rules configured for an INVITE message are applied only to the first INVITE of a call. A special REINVITE keyword is used to manipulate subsequent INVITEs of a CALL.
• Manipulation of SIP headers by outbound SIP profiles occurs as the last step before the message leaves the CUBE device; that is, after destination dial-peer matching has taken place. Changes to the SIP messages are not remembered or acted on by the CUBE application. The Content-length field is recalculated after the SIP Profiles rules are applied to the outgoing message.
• If the ANY keyword is used in place of a header, it indicates that a rule must be applied to any message within the specified category.
• SIP header modification can be cryptic. It is easier to remove a header and add it back (with the new value), rather than modifying it.
• To include "?" (question-mark) character as part of match-pattern or replace-pattern, you need to press "Ctrl+v" keys and then type "?". This is needed to treat ‘?’ as an input character itself instead of usual device help prompt.
• For header values used to add, modify or copy a header:
  • If a whitespace occurs, the entire value must be included between double quotes. For example, “User-Agent: CISCO CUBE”
  • If double quotes occurs, a back slash must prefix the double quotes. For example, “User-Agent: \"CISCO\" CUBE”
  • Regular expressions are supported.
• If an incoming SIP message contains certain proprietary attributes, CUBE can copy these unsupported SDP attributes or lines from incoming leg to outgoing leg using a SIP profile rule.
• The copy variable can be used in outbound profile to add or modify the outgoing message.

Inbound SIP Profile:
• If the incoming message contains multiple instances of same header, the header values are stored as a comma separated list, and this needs to be considered while modifying it.
• Modification by an inbound SIP profile takes place before regular SIP call processing happens so that behavior of CUBE would be as if it received the message directly without modification.
  If inbound dial peer matching fails as required information could not be extracted from headers (like Request-URI, Via, From or To) due to issues in them, global dial peers are applied. An example is a request with invalid SIP-Req-URI.
  • After modification by inbound SIP Profiles, the parameters in SIP message might change, which might change the inbound dial-peer matched when actual dial-peer lookup is done.
  • In the register pass-through feature, there is only one dial-peer for register and response. So both register from phone and response from registrar would go through the same inbound sip profile under the dial-peer if any.

Restrictions for SIP Profiles
• Removal or addition of mandatory headers is not supported. You can only modify mandatory headers Mandatory SIP headers include To, From, Via, CSeq, Call-Id, and Max-Forwards. Mandatory SDP headers include v, o, s, t, c, and m.
• Addition or removal of entire Multipurpose Internet Mail Extensions (MIME) or (Session Description Protocol) SDP bodies from SIP messages is not supported.
• Syntax checking is not performed on SIP messages after SIP profile rules have been applied. Changes specified in the SIP profile should result in valid SIP protocol exchanges.

• The header length (including header name) after modification should not exceed 300 characters. Max header length for add value is approximately 220 characters. Max SDP length is 2048 characters. If any header length exceeds this maximum value after applying SIP profiles, then the profile is not applied.

• If a header-name is changed to its compact form, SIP profile rules cannot be applied on that header. Thus a SIP profile rule modifying a header name to its compact form must be the last rule on that header.

• We cannot modify the "image" m-line attributes (m=image 16850 udpt t38) using SIP profiles. SIP profiles can be applied only on audio and video m-lines in SDP.

• In a high-availability (HA) scenario, SIP profiles copy variable data is not check-pointed to standby.

• Existing limitations and restrictions of outbound SIP profiles apply to inbound SIP profiles as well.

• You cannot configure more than 99 variables for the SIP profiles copy option.

• Once a SIP profile is configured using rule tag, you cannot add rules without tags in the same profile and vice-versa.

How to Configure SIP Profiles

To configure SIP Profiles, you must first configure the SIP Profile globally, and apply it at either to all dial peers (globally) or to a single dial peer (dial-peer level). After a SIP profile is configured, it can be applied as an inbound or outbound profile.

Configuring a SIP Profile to Manipulate SIP Request or Response Headers

SUMMARY STEPS

1. enable
2. configure terminal
3. voice class sip-profiles profile-id
4. Enter one of the following to add, remove, or modify SIP headers:
   • request message [sip-header | sdp-header] header-to-add add header-value-to-add
   • request message [sip-header | sdp-header] header-to-remove remove
   • request message [sip-header | sdp-header] header-to-modify modify header-value-to-match header-value-to-replace

5. Enter one of the following to add, remove, or modify SIP response headers:
   • response message [method method-type] [sip-header | sdp-header] header-to-add add header-value-to-add
   • response message [method method-type] [sip-header | sdp-header] header-to-remove remove
   • response message [method method-type] [sip-header | sdp-header] header-to-modify modify header-value-to-match header-value-to-replace

6. end
## DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| Step 1 | enable            | Enables privileged EXEC mode.  
  - Enter your password if prompted. |
| Step 2 | configure terminal| Enters global configuration mode. |
| Step 3 | voice class sip-profiles  profile-id | Creates a SIP Profiles and enters voice class configuration mode. |
  **Example:**
  ```
  Device(config)# voice class sip-profiles 10
  ```
| Step 4 | Enter one of the following to add, remove, modify SIP headers:  
  - `request message {sip-header | sdp-header} header-to-add add header-value-to-add`
  - `request message {sip-header | sdp-header} header-to-remove remove`
  - `request message {sip-header | sdp-header} header-to-modify modify header-value-to-match header-value-to-replace` | According to your choice, this step does one of the following:  
  - Adds a SIP or SDP header to a SIP request.  
  - Removes a SIP or SDP header to a SIP request.  
  - Modifies a SIP or SDP header to a SIP request.  
  - If `ANY` is used in place of a header, it indicates that a rule must be applied to any message within the specified category.  
  - For `header-value-to-add` used to add a header,  
    - `header-value-to-match` or `header-value-to-replace` used to modify a header:  
      - If a whitespace occurs, the entire value must be included between double quotes. For example, “User-Agent: CISCO CUBE”  
      - If double quotes occurs, a back slash must prefix the double quotes. For example, “User-Agent: "CISCO:” CUBE”  
      - Regular expressions are supported.  
| Step 5 | Enter one of the following to add, remove, or modify SIP response headers:  
  - `response message [method method-type] {sip-header | sdp-header} header-to-add add header-value-to-add`
  - `response message [method method-type] {sip-header | sdp-header} header-to-remove remove`
  - `response message [method method-type] {sip-header | sdp-header} header-to-modify modify header-value-to-match header-value-to-replace` | According to your choice, this step does one of the following:  
  - Adds a SIP or SDP header to a SIP response.  
  - Removes a SIP or SDP header to a SIP response.  
  - Modifies a SIP or SDP header to a SIP response.  
  - All notes from the previous step are applicable here. |
| Step 6 | end                | Exits to privileged EXEC mode |
Configuring SIP Profiles for Copying Unsupported SDP Headers

CUBE can pass across SDP attributes by defining SIP profile rules. The following steps are involved:

1. Configure CUBE to pass-through custom SDP on in-leg.
2. Define rule to Copy relevant attributes from peer SDP on out-leg.
3. Define rule to Add or Modify attributes in outbound SDP with copied data.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. To enable copying of unsupported SDP attribute from incoming leg to outbound leg, you need to enable one of the following commands:
   - In Global VoIP SIP configuration mode
     ```
     pass-thru content custom-sdp
     ```
   - In dial-peer configuration mode (The configuration is applied on the incoming dial-peer)
     ```
     voice-class sip pass-thru content custom-sdp
     ```
4. **voice class sip-profiles profile-id**
5. Enter one of the following to copy an unsupported SDP line or attribute from peer leg's SDP and add, modify, or remove in the outgoing SDP:
   - request/response ANY peer-header mline-index index COPY match-pattern copy-variable
   - request/response ANY sdp-header mline-index indexheader-name ADD copy-variable
   - request/response ANY sdp-header mline-index indexheader-name MODIFY copy-variable + replace-pattern
   - request/response ANY sdp-header mline-index indexheader-name REMOVE
6. **end**

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> To enable copying of unsupported SDP attribute from incoming leg to outbound leg, you need to enable one of the following commands:</td>
<td>Enables copying of unsupported SDP attributes per m-line to the peer leg so that it can be used in outgoing SIP messages.</td>
</tr>
<tr>
<td>• In Global VoIP SIP configuration mode</td>
<td><strong>Note</strong> Enabling this command does not enable the SDP Passthrough feature.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td>pass-thru content custom-sdp</td>
<td>• In dial-peer configuration mode (The configuration is applied on the incoming dial-peer) voice-class sip pass-thru content custom-sdp</td>
</tr>
</tbody>
</table>

**Example:**

In Global VoIP SIP configuration mode:

Device(config)# voice service voip
Device(config-voi-serv)# sip
Device(config-serv-sip)# pass-thru content custom-sdp

**Example:**

In Dial-peer configuration mode:

Device(config)# dial-peer voice 2 voip
Device(config-dial-peer)# voice-class sip pass-thru content custom-sdp

---

**Step 4**

<table>
<thead>
<tr>
<th>voice class sip-profiles profile-id</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example:</td>
</tr>
<tr>
<td>Device(config)# voice class sip-profiles 10</td>
</tr>
</tbody>
</table>

Voice class sip-profile is configured on the outbound dial-peer or as a global configuration. Creates a SIP Profile and enters voice class configuration mode.

**Step 5**

Enter one of the following to copy an unsupported SDP line or attribute from peer leg's SDP and add, modify, or remove in the outgoing SDP:

- request/response ANY peer-header sdp mline-index index COPY match-pattern copy-variable
- request/response ANY sdp-header mline-index indexheader-name ADD copy-variable
- request/response ANY sdp-header mline-index indexheader-name MODIFY copy-variable + replace-pattern
- request/response ANY sdp-header mline-index indexheader-name REMOVE

M-line Index values:

- 0 - A value of zero represents the session level.
- 1 to 6 - A value in the range of one to six represents the m-line number in SDP.

Copy: Enables copying of SDP line or attribute from peer leg SDP.
Add: Enables adding the copied SDP line or attribute in the outgoing SDP.
Modify: Enables modifying SDP line or attribute in the outgoing SDP.
Remove: Enables removing SDP line or attribute in the outgoing SDP.

**Step 6**

<table>
<thead>
<tr>
<th>end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: Configuring SIP Profile Rules (Attribute Passing)</td>
</tr>
</tbody>
</table>

response ANY peer-header sdp mline-index 4 copy "(a=ixmap:0.*)" u01
response ANY sdp-header mline-index 4 a=ixmap add "\u01"
Example: Configuring SIP Profile Rules (Parameter Passing)

response ANY peer-header sdp mline-index 2 copy "a=fmtp:126 .*(max-fps=....)" u04
response ANY sdp-header mline-index 2 a=fmtp:126 modify ";" ";\u04;"

Example: Configuration to Remove an Attribute

response ANY sdp-header mline-index 4 a=test REMOVE

Configuring SIP Profile Using Rule Tag

Configure SIP profile rules using the rule tag, enables you to performing the following tasks:

• Add SIP profile request and response headers with a rule tag.
• Modify the existing SIP profile configurations by inserting a rule at any position of the SIP profile without deleting and reconfiguring the entire SIP profile.
• Remove a rule by specifying only rule tag.

Below are the rule tag behaviors that needs to be considered while using rule tag in SIP profile configurations:

• If a rule is added with the tag of an existing rule, then the existing rule is overwritten with the new rule.
• For inserting a rule at the desired position, the SIP profile configuration should be in rule format. In case the SIP profile is in non-rule format, upgrade the SIP profiles to rule format before inserting a rule.
• If a new rule is inserted, the new rule takes the position specified in before tag. The subsequent rules are incremented sequentially.
• Once the rule is removed, the tag belonging to the removed rule remains vacant. The tags associated with the subsequent rules remain unchanged.
• If a rule is added to a vacant tag, the new rule gets associated with the vacant tag and the subsequent rules remain unchanged.

SUMMARY STEPS

1. enable
2. configure terminal
3. voice class sip-profiles profile-id
4. Enter one of the following to add, copy, modify, or remove a SIP request or response headers to a SIP profile configuration:
   • rule tag request method sdp-header | sip-header header-name add | copy | modify | remove string
   • rule tag response method sdp-header | sip-header header-name add | copy | modify | remove string
5. Enter one of the following to insert a rule in between the existing set of rules to add, remove, or modify SIP request or response headers:
**Configuring SIP Profile Using Rule Tag**

- rule before tag request  
  method  sdp-header | sip-header  header-name  
  add | copy | modify | remove  string
- rule before tag response  
  method  sdp-header | sip-header  header-name  
  add | copy | modify | remove  string

6. Enter the following to delete a rule:
   - no rule  tag

7. end

---

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1** enable | Enables privileged EXEC mode.  
  • Enter your password if prompted. |
| **Step 2** configure terminal | Enters global configuration mode. |
| **Step 3** voice class  sip-profiles  profile-id  
  Example:  
  Device(config)# voice class sip-profiles 10 | Creates a SIP Profile and enters voice class configuration mode. |
| **Step 4** Enter one of the following to add, copy, modify, or remove a SIP request or response headers to a SIP profile configuration:  
  - rule tag request  
    method  sdp-header | sip-header  header-name  
    add | copy | modify | remove  string  
  - rule tag response  
    method  sdp-header | sip-header  header-name  
    add | copy | modify | remove  string | According to your choice, this step tags the SIP request or response header with a unique number. |
| **Step 5** Enter one of the following to insert a rule in between the existing set of rules to add, remove, or modify SIP request or response headers:  
  - rule before tag request  
    method  sdp-header | sip-header  header-name  
    add | copy | modify | remove  string  
  - rule before tag response  
    method  sdp-header | sip-header  header-name  
    add | copy | modify | remove  string | According to your choice this steps inserts the rule at the position specified in the before  tag. The subsequent rules in the existing SIP profile configuration is incremented sequentially. |
| **Step 6** Enter the following to delete a rule:  
  - no rule  tag | According to your choice, this step tags the SIP request or response with a unique number. |
| **Step 7** end | Exits voice class sip-profiles configuration mode. |
Configuring a SIP Profile for Non-standard SIP Header

SUMMARY STEPS

1. enable
2. configure terminal
3. voice class sip-profiles profile-id
4. Enter one of the following to add, copy, remove, or modify non-standard SIP request headers:
   - request message {sip-header} non-standard-header-to-add add non-standard-header-value-to-add
   - request message {sip-header} non-standard-header-to-copy copy
     non-standard-header-value-to-match copy-variable
   - request message {sip-header} non-standard-header-to-remove remove
   - request message {sip-header} non-standard-header-to-modify modify
     non-standard-header-value-to-match non-standard-header-value-to-replace
5. Enter one of the following to add, copy, remove, or modify non-standard SIP response headers:
   - response message [method method-type] {sip-header} non-standard-header-to-add add
     non-standard-header-value-to-add
   - response message [method method-type] {sip-header} non-standard-header-to-copy copy
     non-standard-header-value-to-match copy-variable
   - response message [method method-type] {sip-header} non-standard-header-to-remove remove
   - response message [method method-type] {sip-header} non-standard-header-to-modify modify
     non-standard-header-value-to-match non-standard-header-value-to-replace
6. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>voice class sip-profiles profile-id</td>
<td>Creates a SIP Profiles and enters voice class configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config)# voice class sip-profiles 10</td>
</tr>
<tr>
<td>Step 4</td>
<td>Enter one of the following to add, copy, remove, or modify non-standard SIP request headers:</td>
</tr>
<tr>
<td></td>
<td>• request message {sip-header} non-standard-header-to-add add non-standard-header-value-to-add</td>
</tr>
<tr>
<td></td>
<td>• request message {sip-header} non-standard-header-to-copy copy non-standard-header-value-to-match copy-variable</td>
</tr>
<tr>
<td></td>
<td>According to your choice, this step does one of the following:</td>
</tr>
<tr>
<td></td>
<td>• Adds a non-standard SIP header to a SIP request.</td>
</tr>
<tr>
<td></td>
<td>• Copies contents from a non-standard SIP header to a SIP request.</td>
</tr>
<tr>
<td></td>
<td>• Removes a non-standard SIP header to a SIP request.</td>
</tr>
<tr>
<td></td>
<td>• Modifies a non-standard SIP header to a SIP request.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| • request message \{sip-header \}  
  non-standard-header-to-remove remove  
• request message \{sip-header \}  
  non-standard-header-to-modify modify  
  non-standard-header-value-to-match  
  non-standard-header-value-to-replace | • If ANY is used in place of a header, it indicates that a rule must be applied to any message within the specified category.  
• For non-standard-header-value-to-add used to add a non-standard header,  
  non-standard-header-value-to-match or  
  non-standard-header-value-to-replace used to modify a non-standard header:  
  • If a whitespace occurs, the entire value must be included between double quotes. For example,  
    “User-Agent: CISCO CUBE”  
  • If double quotes occurs, a back slash must prefix the double quotes. For example, “User-Agent: "CISCO"CUBE”  
  • Regular expressions are supported. |
| Step 5 Enter one of the following to add, copy, remove, or modify non-standard SIP response headers:  
  • response message \[method method-type\] \{sip-header \}  
    non-standard-header-to-add add  
  non-standard-header-value-to-add  
  • response message \[method method-type\]  
    \{sip-header\}  
    non-standard-header-to-copy copy  
    non-standard-header-value-to-match copy-variable  
  • response message \[method method-type\]  
    \{sip-header\}  
    non-standard-header-to-remove remove  
  • response message \[method method-type\]  
    \{sip-header\}  
    non-standard-header-to-modify modify  
    non-standard-header-value-to-match  
    non-standard-header-value-to-replace | According to your choice, this step does one of the following:  
  • Adds a non-standard SIP to a SIP response.  
  • Copies contents from a non-standard SIP header to a SIP response.  
  • Removes a non-standard header to a SIP response.  
  • Modifies a non-standard SIP header to a SIP response.  
  • All notes from the previous step are applicable here. |
| Step 6 end | Exits to privileged EXEC mode |

Upgrading or Downgrading SIP Profile Configurations

You can upgrade or downgrade all the SIP Profile configurations to rule-format or non-rule format automatically.

Note We recommend that you downgrade the SIP profiles to non-rule format configuration before migrating to a version below Cisco IOS Release 15.5(2)T or Cisco IOS-XE Release 3.15S. If you migrate without downgrading the SIP profile configurations, then all the SIP profile configurations is lost after migration.
SUMMARY STEPS

1. enable
2. Enter the following to upgrade SIP profiles configurations to rule-format:
   • voice sip sip-profiles upgrade
3. Enter the following to downgrade SIP profiles configurations to non-rule format:
   • voice sip sip-profiles downgrade
4. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| Step 1 | enable | Enables privileged EXEC mode.  
• Enter your password if prompted. |
| Step 2 | Enter the following to upgrade SIP profiles configurations to rule-format:  
• voice sip sip-profiles upgrade  
Example:  
In EXEC(#) mode:  
Device#voice sip sip-profiles upgrade | Upgrades all SIP Profiles to rule-format configurations. |
| Step 3 | Enter the following to downgrade SIP profiles configurations to non-rule format:  
• voice sip sip-profiles downgrade  
Example:  
In EXEC(#) mode:  
Device#voice sip sip-profiles downgrade | Downgrades all SIP Profiles from rule-format configurations to non-rule format configurations. |
| Step 4 | end | Exits privileged EXEC mode. |

What to do next

Now apply the SIP Profile as an inbound or outbound SIP profile.

Configuring a SIP Profile as an Outbound Profile

SUMMARY STEPS

1. enable
2. configure terminal
3. Apply the SIP profile to a dial peer:  
• voice-class sip profiles profile-id in the dial-peer configuration mode.
• **sip-profiles profile-id** in the global VoIP configuration mode

4. **end**

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>enable</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>configure terminal</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Apply the SIP profile to a dial peer:</td>
</tr>
<tr>
<td></td>
<td>• <strong>voice-class sip profiles</strong> profile-id in the dial-peer configuration mode.</td>
</tr>
<tr>
<td></td>
<td>• <strong>sip-profiles</strong> profile-id in the global VoIP configuration mode</td>
</tr>
</tbody>
</table>

**Example:**

In dial-peer configuration mode

```
!Applying SIP profiles to one dial peer only
Device (config)# dial-peer voice 10 voip
Device (config-dial-peer)# voice-class sip profiles 30
Device (config-dial-peer)# end
```

**Example:**

In global VoIP SIP mode

```
! Applying SIP profiles globally
Device(config)# voice service voip
Device (config-voi-serv)# sip
Device (config-voi-sip)# sip-profiles 20
Device (config-voi-sip)# end
```

| **Step 4** | **end** | Exits to privileged EXEC mode. |

### Configuring a SIP Profile as an Inbound Profile

You can configure a SIP profile as an inbound profile applied globally or to a single inbound dial peer. Inbound SIP profiles feature must be enabled before applying it to dial peers.

### SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. sip
5. sip-profiles inbound
6. Apply the SIP profile to a dial peer:
   - `voice-class sip profiles profile-id inbound` in the dial-peer configuration mode.
   - `sip-profiles profile-id inbound` in the global VoIP configuration mode

7. end

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>enable</td>
</tr>
<tr>
<td></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>configure terminal</td>
</tr>
<tr>
<td></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td><code>voice service voip</code></td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(config)# voice service voip</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td><code>sip</code></td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(config-voi-serv)# sip</td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td><code>sip-profiles inbound</code></td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(config-voi-sip)# sip-profiles inbound</td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>Apply the SIP profile to a dial peer:</td>
</tr>
<tr>
<td></td>
<td>• <code>voice-class sip profiles profile-id inbound</code> in the dial-peer configuration mode.</td>
</tr>
<tr>
<td></td>
<td>• <code>sip-profiles profile-id inbound</code> in the global VoIP configuration mode</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>In dial-peer configuration mode</td>
</tr>
<tr>
<td></td>
<td>!Applying SIP profiles to one dial peer only</td>
</tr>
<tr>
<td></td>
<td>Device (config)# dial-peer voice 10 voip</td>
</tr>
<tr>
<td></td>
<td>Device (config-dial-peer)# voice-class sip profiles 30 inbound</td>
</tr>
<tr>
<td></td>
<td>Device (config-dial-peer)# end</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>In global VoIP SIP mode</td>
</tr>
<tr>
<td></td>
<td>! Applying SIP profiles globally</td>
</tr>
<tr>
<td></td>
<td>Device(config)# voice service voip</td>
</tr>
<tr>
<td></td>
<td>Device (config-voi-serv)# sip</td>
</tr>
</tbody>
</table>
### Verifying SIP Profiles

#### SUMMARY STEPS

1. `show dial-peer voice id | include profile`

#### DETAILED STEPS

`show dial-peer voice id | include profile`

Displays information related to SIP profiles configured on the specified dial peer.

**Example:**

```
Device# show dial-peer voice 10 | include profile
```

Translation profile (Incoming):
Translation profile (Outgoing):
translation-profile = `'
voice class sip profiles = 11
voice class sip profiles inbound = 10
```

### Troubleshooting SIP Profiles

#### SUMMARY STEPS

1. `debug ccsip all`

#### DETAILED STEPS

`debug ccsip all`

This command displays the applied SIP profiles.

**Example:**

Applied SIP profile is highlighted in the example below.

```
Device# debug ccsip all
...
Oct 12 06:51:53.619: //1/735085D8F3D/SIP/Info/sipSIPGetShrlPeer:
  Try match incoming dialpeer for Calling number: 
  = sippOct 12 06:51:53.619:
```
CUBE Fundamentals and Basic Setup

Examples: Adding, Modifying, Removing SIP Profiles

Example: Adding a SIP, SDP, or Peer Header

Example: Adding "b=AS:4000" SDP header to the video-media Header of the INVITE SDP Request Messages

Device(config)# voice class sip-profiles 10
Device(config-class)# request INVITE sdp-header Video-Bandwidth-Info add "b=AS:4000"
Device(config-class)# end

Example: Adding "b=AS:4000" SDP header to the video-media Header of the INVITE SDP Request Messages in rule format

Device(config)# voice class sip-profiles 10
Device(config-class)# rule 1 request INVITE sdp-header Video-Bandwidth-Info add "b=AS:4000"
Device(config-class)# end

Example: Adding the Retry-After Header to the SIP 480 Response Messages

Device(config)# voice class sip-profiles 20

Examples: Adding, Modifying, Removing SIP Profiles
Example: Adding the Retry-After Header to the SIP 480 Response Messages in rule format

Device(config)# voice class sip-profiles 20
Device(config-class)# rule 1 response 480 sip-header Retry-After add "Retry-After: 60"
Device(config-class)# end

Example: Adding "User-Agent: SIP-GW-UA" to the User-Agent Field of the 200 Response SIP Messages

Device(config)# voice class sip-profiles 40
Device(config-class)# response 200 sip-header User-Agent add "User-Agent: SIP-GW-UA"
Device(config-class)# end

Example: Adding "User-Agent: SIP-GW-UA" to the User-Agent Field of the 200 Response SIP Messages in rule format

Device(config)# voice class sip-profiles 40
Device(config-class)# rule 1 response 200 sip-header User-Agent add "User-Agent: SIP-GW-UA"
Device(config-class)# end

Example: Adding "a=ixmap:0 ping" in M-Line number 4 of the INVITE SDP Request Messages

Device(config)# voice class sip-profiles 10
Device(config-class)# request INVITE sdp-header mline-index 4 a=ixmap add "a=ixmap:0 ping"
Device(config-class)# end

Applying the SIP Profiles

! Applying SIP profiles globally
Device(config)# voice service voip
Device(config-voi-serv)# sip
Device(config-voi-sip)# sip-profiles 20
Device(config-voi-sip)# end

! Applying SIP profiles to one dial peer only
Device(config)# dial-peer voice 10 voip
Device(config-dial-peer)# voice-class sip profiles 30
Device(config-dial-peer)# end
Example: Modifying a SIP, SDP, or Peer Header

Example: Modifying SIP-Req-URI of the Header of the INVITE and RE-INVITE SIP Request Messages to include "user=phone"

Device(config)# voice class sip-profiles 30
Device(config-class)# request INVITE sip-header SIP-Req-URI modify "; SIP/2.0" ";user=phone SIP/2.0"
Device(config-class)# request RE-INVITE sip-header SIP-Req-URI modify "; SIP/2.0" ";user=phone SIP/2.0"
Device(config-class)# end

Example: Modifying SIP-Req-URI of the Header of the INVITE and RE-INVITE SIP Request Messages to include "user=phone" in rule format

Device(config)# voice class sip-profiles 30
Device(config-class)# rule 1 request INVITE sip-header SIP-Req-URI modify "; SIP/2.0" ";user=phone SIP/2.0"
Device(config-class)# rule 2 request RE-INVITE sip-header SIP-Req-URI modify "; SIP/2.0" ";user=phone SIP/2.0"
Device(config-class)# end

Modify the From Field of a SIP INVITE Request Messages to “gateway@gw-ip-address” Format

For example, modify 2222000020@10.13.24.7 to gateway@10.13.24.7

Device(config)# voice class sip-profiles 20
Device(config-class)# request INVITE sip-header From modify "(<.*:)(.*@)" "\1gateway@"

Modify the From Field of a SIP INVITE Request Messages to “gateway@gw-ip-address” Format in rule format

For example, modify 2222000020@10.13.24.7 to gateway@10.13.24.7

Device(config)# voice class sip-profiles 20
Device(config-class)# rule 1 request INVITE sip-header From modify "(<.*:)(.*@)" "\1gateway@"

Replace "CiscoSystems-SIP-GW-UserAgent" with "-" in the Originator Header of the SDP in INVITE Request Messages

Device(config)# voice class sip-profiles 10
Device(config-class)# request INVITE sdp-header Session-Owner modify "CiscoSystems-SIP-GW-UserAgent" "-"

Replace "CiscoSystems-SIP-GW-UserAgent" with "-" in the Originator Header of the SDP in INVITE Request Messages in rule format

Device(config)# voice class sip-profiles 10
Device(config-class)# rule 1 request INVITE sdp-header Session-Owner modify "CiscoSystems-SIP-GW-UserAgent" "-"
Convert "sip uri" to "tel uri" in Req-URI, From and To Headers of SIP INVITE Request Messages

For example, modify sip:2222000020@9.13.24.6:5060 to "tel:2222000020"

```
Device(config)# voice class sip-profiles 40
Device(config-class)# request INVITE sip-header SIP-Req-URI modify "sip:(.*)@[^ \]+" "tel:\1"
Device(config-class)# request INVITE sip-header From modify "<sip:(.*)@.*>" "<tel:\1>"
Device(config-class)# request INVITE sip-header To modify "<sip:(.*)@.*>" "<tel:\1>"
```

Convert "sip uri" to "tel uri" in Req-URI, From and To Headers of SIP INVITE Request Messages in rule format

For example, modify sip:2222000020@9.13.24.6:5060 to "tel:2222000020"

```
Device(config)# voice class sip-profiles 40
Device(config-class)# rule 1 request INVITE sip-header SIP-Req-URI modify "sip:(.*)@[^ \]+" "tel:\1"
Device(config-class)# rule 2 request INVITE sip-header From modify "<sip:(.*)@.*>" "<tel:\1>"
Device(config-class)# rule 3 request INVITE sip-header To modify "<sip:(.*)@.*>" "<tel:\1>"
```

Example: Change the Audio Attribute Ptime:20 to Ptime:30

Inbound ptime:
```
a=ptime:20
```
Outbound ptime:
```
a=ptime:30
```

```
Device(config)# voice class sip-profiles 103
Device(config-class)# request ANY sdp-header Audio-Attribute modify "a=ptime:20" "a=ptime:30"
```

Example: Modify Audio direction "Audio-Attribute"

Some service providers or customer equipment reply to delay offer invites and or re-invites that contain a=inactive with a=inactive, a=recvonly, or a=sendonly. This can create an issue when trying to transfer or retrieve a call from hold. The result is normally one-way audio after hold or resume or transfer or moh is not heard. To resolve this issue changing the audio attribute to Sendrecv prevents the provider from replaying back with a=inactive, a=recvonly, or a=sendonly.

Case 1:
```
Inbound Audio-Attribute
a=inactive
```
```
Outbound Audio-Attribute
a=sendrecv
```

Case 2:
```
Inbound Audio-Attribute
a=recvonly
```
```
Outbound Audio-Attribute
a=sendrecv

Case 3

Inbound Audio-Attribute
a=sendonly

Outbound Audio-Attribute
a=sendrecv

Device(config)# voice class sip-profiles 104
Device(config-class)# request any sdp-header Audio-Attribute modify "a=inactive" "a=sendrecv"
Device(config-class)# request any sdp-header Audio-Attribute modify "a=recvonly" "a=sendrecv"
Device(config-class)# request any sdp-header Audio-Attribute modify "a=sendonly" "a=sendrecv"

Device(config-class)# response any sdp-header Audio-Attributemodify "a=inactive" "a=sendrecv"
Device(config-class)# response any sdp-header Audio-Attribute modify "a=recvonly" "a=sendrecv"
Device(config-class)# response any sdp-header Audio-Attribute modify "a=sendonly" "a=sendrecv"

Example: Modifying Packetization Mode in a=fmtp line of M-line number 2 of the INVITE SDP Request Messages

Device(config)# voice class sip-profiles 10
Device(config-class)# request INVITE sdp-header mline-index 2 a=fmtp modify "packetization-mode=1" "packetization-mode=0"
Device(config-class)# end

Applying the SIP Profiles to Dial Peers

! Applying SIP Profiles globally
Device(config)# voice service voip
Device (config-voi-serv) sip-profiles 20
Device (config-voi-serv) sip-profiles 10
Device (config-voi-serv) sip-profiles 40
Device (config-voi-serv) sip-profiles 103
Device (config-voi-serv) sip-profiles 104
Device (config-voi-serv) exit

! Applying SIP Profiles to one dial peer only
Device (config) dial-peer voice 90 voip
Device (config-dial-peer) voice-class sip profiles 30

Example: Remove a SIP, SDP, or Peer Header

Remove Cisco-Guid SIP header from all Requests and Responses

Device(config)# voice class sip-profiles 20
Device(config-class)# request ANY sip-header Cisco-Guid remove
Example: Inserting SIP Profile Rules

Example: Inserting a SIP Profile Rule

Inserting a SIP profile rule to a SIP Profile

```bash
Device(config-class)# response ANY sip-header Cisco-Guid remove
Device(config-class)# end

Remove Server Header from 100 and 180 SIP Response Messages

```bash
Device(config)# voice class sip-profiles 20
Device(config-class)# response 100 sip-header Server remove
Device(config-class)# response 180 sip-header Server remove
Device(config-class)# end

Removing a SIP Profile rule in rule format configuration

SIP Profile configuration in rule format

```bash
Device(config)# voice class sip-profiles 10
Device(config-class)# rule 1 request any sdp-header Audio-Attribute "a=inactive"
Device(config-class)# rule 2 request any sdp-header Audio-Attribute "a=recvonly"
Device(config-class)# end

Removing the rule using rule tag

```bash
Device(config)# voice class sip-profiles 10
Device(config-class)# no rule 1
Device(config-class)# end

Once the rule is removed, the tag belonging to the removed rule remains vacant. The tags associated with the subsequent rules are unchanged.

The SIP Profile configuration after removing the rule

```bash
Device(config)# voice class sip-profiles 10
Device(config-class)# rule 2 request any sdp-header Audio-Attribute "a=recvonly"
Device(config-class)# end

Example: Removing "a=ixmap" in M-Line number 4 of the INVITE SDP Request Messages

```bash
Device(config)# voice class sip-profiles 10
Device(config-class)# response ANY sdp-header mline-index 4 a=ixmap REMOVE
Device(config-class)# end

Example: Inserting SIP Profile Rules

```bash

```
Example: Upgrading and Downgrading SIP Profiles automatically

Upgrading SIP Profiles to rule-format

The following is a snippet from `show running-config` command showing the SIP profiles in non-rule format:

```
Device# show running-config
! request INVITE sip-header Contact Modify "(.*)" "\1;temp=xyz"
request INVITE sip-header Supported Add "Supported: ":
!
```

Execute the following command in EXEC (#) mode to upgrade the SIP Profiles to rule-format:

```
Device# voice sip sip-profiles upgrade
```

Downgrading SIP Profiles to non-rule format

The following is a snippet from `show running-config` command showing SIP profiles in rule-format:

```
Device# show running-config
! rule 1 request INVITE sip-header Contact Modify "(.*)" "\1;temp=xyz"
rule 2 request INVITE sip-header Supported Add "Supported: ":
!
```

Execute the following command in EXEC(#{) mode to downgrade SIP Profiles to non-rule format:

```
Device# voice sip sip-profiles downgrade
```

The following is a snippet from `show running-config` command showing SIP profiles after downgrading to non-rule format:
Example: Modifying Diversion Headers

Example: Modify Diversion Headers from Three-Digit Extensions to Ten Digits.

Most service providers require a ten digit diversion header. Prior to Call manager 8.6, Call manager would only send the extension in the diversion header. A SIP profile can be used to make the diversion header ten digits.

Call manager version 8.6 and above has the field “Redirecting Party Transformation CSS” which lets you expand the diversion header on the call manager.

The SIP profile will look for a diversion header containing "<sip:5...", where ... stands for the three-digit extension and then concatenates 9789365 with these three digits.

Original Diversion Header:
Diversion:<sip:5100@161.44.77.193>;privacy=off;reason=unconditional;counter=1;screen=no

Modified Diversion Header:
Diversion: <sip:9789365100@10.86.176.19>;privacy=off;reason=unconditional;counter=1;screen=no

Device(config)# voice class sip-profiles 101
Device(config-class)# request Invite sip-header Diversion modify "<sip:5(...)@"
"<sip:9789365\1@"
Device(config-class)# end

Example: Create a Diversion header depending on the area code in the From field

Most service providers require a redirected call to have a diversion header that contains a full 10 digit number that is associated with a SIP trunk group. Sometimes, a SIP trunk may cover several different area codes, states, and geographic locations. In this scenario, the service provider may require a specific number to be placed in the diversion header depending on the calling party number.

In the below example, if the From field has an area code of 978 "<sip:978", the SIP profile leaves the From field as is and adds a diversion header.

Device(config)# voice class sip-profiles 102
Device(config-class)# request INVITE sip-header From modify "From:(.*)<sip:978(.*)@(.*)"
"From:\1<sip:978\2@\3\x0ADiversion:
<sip:9789365000@10.86.176.19:5060;privacy=off;reason=unconditional;counter=1;screen=no"

The below diversion header is added. There was no diversion header before this was added:

Diversion: <sip:9789365000@10.86.176.19:5060;transport=udp>"
Example: Sample SIP Profile Application on SIP Invite Message

The SIP profile configured is below:

```plaintext
voice class sip-profiles 1
  request INVITE sdp-header Audio-Bandwidth-Info add "b=AS:1600"
  request ANY sip-header Cisco-Guid remove
  request INVITE sdp-header Session-Owner modify "CiscoSystems-SIP-GW-UserAgent" "-"
```

The SIP INVITE message before the SIP profile has been applied is shown below:

```
INVITE sip:2222000020@9.13.40.250:5060 SIP/2.0
Via: SIP/2.0/UDP 9.13.40.249:5060;branch=z9hG4bK1A203F
From: "sipp " <sip:1111000010@9.13.40.249>;tag=F11AE0-1D8D
To: <sip:2222000020@9.13.40.250>
Date: Mon, 29 Oct 2007 19:02:04 GMT
Call-ID: 4561B116-858811DC-804DEF2E-4CF2D71B@9.13.40.249
Cisco-Guid: 1163870326-2240287196-2152197934-1290983195
Content-Length: 290
```

The SIP INVITE message after the SIP profile has been applied is shown below:

- The Cisco-Guid has been removed.
- CiscoSystemsSIP-GW-UserAgent has been replaced with -. 
- The Audio-Bandwidth SDP header has been added with the value b=AS:1600.

```
INVITE sip:2222000020@9.13.40.250:5060 SIP/2.0
Via: SIP/2.0/UDP 9.13.40.249:5060;branch=z9hG4bK1A203F
From: "sipp " <sip:1111000010@9.13.40.249>;tag=F11AE0-1D8D
To: <sip:2222000020@9.13.40.250>
Date: Mon, 29 Oct 2007 19:02:04 GMT
Call-ID: 4561B116-858811DC-804DEF2E-4CF2D71B@9.13.40.249
Content-Length: 279
```

Example: Sample SIP Profile for Non-Standard SIP Headers

Prior to Cisco IOS Release 15.5(2)T, there was no method to add, copy, delete, or modify any non-standard SIP headers like 'X-Cisco-Recording-Participant' using SIP profiles. The SIP profile will look for the new option "WORD" that allows the user to change any non-standard SIP header.
voice class sip-profiles 1
request INVITE sip-header X-Cisco-Recording-Participant copy "sip:(.*)@" u01
request INVITE sip-header X-Cisco-Recording-Participant modify "sip:sipp@" "sip:1000@"
request INVITE sip-header My-Info add "My-Info: MF Call"
request INVITE sip-header My-Info remove
CHAPTER 12

VoIP for IPv6

This document describes VoIP in IPv6 (VoIPv6), a feature that adds IPv6 capability to existing VoIP features. This feature adds dual-stack (IPv4 and IPv6) support on voice gateways and media termination points (MTPs), IPv6 support for Session Initiation Protocol (SIP) trunks, and support for Skinny Client Control Protocol (SCCP)-controlled analog voice gateways. In addition, the Session Border Controller (SBC) functionality of connecting a SIP IPv4 or H.323 IPv4 network to a SIP IPv6 network is implemented on a Cisco UBE to facilitate migration from VoIPv4 to VoIPv6.

• Finding Feature Information, on page 109
• Prerequisites for VoIP for IPv6, on page 109
• Restrictions for Implementing VoIP for IPv6, on page 110
• Information About VoIP for IPv6, on page 111
• How to Configure VoIP for IPv6, on page 117
• Configuration Examples for VoIP over IPv6, on page 140
• Troubleshooting Tips for VoIP for IPv6, on page 141
• Verifying and Troubleshooting Tips, on page 141
• Feature Information for VoIP for IPv6, on page 159

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for VoIP for IPv6

• Cisco Express Forwarding for IPv6 must be enabled.
• Virtual routing and forwarding (VRF) is not supported in IPv6 calls.

Cisco Unified Border Element

• Cisco IOS Release 12.4(22)T or a later release must be installed and running on your Cisco UBE.
Cisco Unified Border Element (Enterprise)

- Cisco IOS XE Release 3.3S or a later release must be installed and running on your Cisco ASR 1000 Series Router.

Restrictions for Implementing VoIP for IPv6

The following are the restrictions for Cisco UBE features:

**Media Flow–Through**

- Video call flows with Alternative Network Address Types (ANAT) are not supported.
- WebEx call flow with ANAT are not supported (Cisco UBE does not support ANAT on Video and Application media types).

**SDP Pass-Through**

- Supports only Early Offer (EO)–Early Offer (EO) and Delayed Offer (DO)–Delayed Offer (DO) call flows.
- Delayed Offer–Early Offer call flow falls back to Delayed Offer–Delayed Offer call flow.
- Supplementary services are not supported on SDP Pass-Through.
- Transcoding and DTMF interworking are not supported.

**Note**

The above SDP Pass–Through restrictions are applicable for both IPv4 and IPv6.

- SDP Pass–Through does not support the dual-stack functionality.
- ANAT call flows does not support IPv4-to-IPv6 and IPv6-to-IPv4 Media interworking.

**UDP Checksum**

- CEF and process options are not supported on ASR1000 series routers.
- None option is partially supported on ISR–G2.

**Media Anti–Trombone**

- Media Anti–Trombone is not enabled if the initial call before tromboning is in Flow–Around (FA) mode.
- Media Anti–Trombone supports only symmetric media address type interworking (IPv4-IPv4 or IPv6-IPv6 media) with or without ANAT.
- Does not provide support for IPv4-IPv6 interworking cases with or without ANAT because Cisco UBE cannot operate in FA mode post tromboning.
Information About VoIP for IPv6

SIP Features Supported on IPv6

The Session Initiation Protocol (SIP) is an alternative protocol developed by the Internet Engineering Task Force (IETF) for multimedia conferencing over IP.

The Cisco SIP functionality enables Cisco access platforms to signal the setup of voice and multimedia calls over IP networks. SIP features also provide advantages in the following areas:

- Protocol extensibility
- System scalability
- Personal mobility services
- Interoperability with different vendors

A SIP User Agent (UA) operates in one of the following three modes:

- IPv4-only: Communication with only IPv6 UA is unavailable.
- IPv6-only: Communication with only IPv4 UA is unavailable.
- Dual-stack: Communication with only IPv4, only IPv6 and dual-stack UAs are available.

Dual-stack SIP UAs use Alternative Network Address Transport (ANAT) grouping semantics:

- Includes both IPv4 and IPv6 addresses in the Session Description Protocol (SDP).
- Is automatically enabled in dual-stack mode (can be disabled if required).
- Requires media to be bound to an interface that have both IPv4 and IPv6 addresses.
- Described in RFC 4091 and RFC 4092 (RFC 5888 describes general SDP grouping framework).

SIP UAs use “sdp-anat” option tag in the Required and Supported SIP header fields:

- Early Offer (EO) INVITE using ANAT semantics places “sdp-anat” in the Require header.
- Delayed Offer (DO) INVITE places “sdp-anat” in the Supported header.

SIP Signaling and Media Address Selection:

- Source address for SIP signaling is selected based on the destination signaling address type configured in the session-target of the outbound dial-peer:
  - If signaling bind is configured, source SIP signaling address is chosen from the bound interface.
  - If signaling bind is not configured, source SIP signaling address is chosen based on the best address in the UA to reach the destination signaling address.

SDP may or may not use ANAT semantics:
• When ANAT is used, media addresses in SDP are chosen from the interface media that is configured. When ANAT is not used, media addresses in SDP are chosen from the interface media that is configured OR based on the best address to reach the destination signaling address (when no media bind is configured).

SIP Voice Gateways in VoIPv6

Session Initiation Protocol (SIP) is a simple, ASCII-based protocol that uses requests and responses to establish communication among the various components in the network and to ultimately establish a conference between two or more endpoints.

In addition to the already existing features that are supported on IPv4 and IPv6, the SIP Voice Gateways support the following features:

• **History–Info**: The SIP History–info Header Support feature provides support for the history-info header in SIP INVITE messages only. The SIP gateway generates history information in the INVITE message for all forwarded and transferred calls. The history-info header records the call or dialog history. The receiving application uses the history-info header information to determine how and why the call has reached it.

  For more information, refer to the “SIP History INFO” section in the *Cisco Unified Border Element (Enterprise) SIP Support Configuration Guide*.

• **Handling 181/183 Responses with/without SDP**: The Handling 181/183 Responses with/without SDP feature provides support for SIP 181 (Call is Being Forwarded) and SIP 183 (Session Progress) messages either globally or on a specific dial-peer. Also, you can control when the specified SIP message is dropped based on either the absence or presence of SDP information.

  For more information, refer to “SIP–Enhanced 180 Provisional Response Handling” section in the *Cisco Unified Border Element Configuration Guide*.

• **Limiting the Rate of Incoming SIP Calls per Dial-Peer (Call Spike)**: The call rate-limiting feature for incoming SIP calls starts working after a switch over in a SIP call. The rate–limiting is done for new calls received on the new Active. The IOS timers that track the call rate limits runs on active and standby mode and does not require any checkpoint. However, some statistics for calls rejected requires to be checked for the show commands to be consistent before and after the switchover.

  For more information, refer to the “Support for PAI/PPID Privacy PCPID and PAURI Headers on Cisco UBE” section in the *Cisco Unified Border Element SIP Support Configuration Guide*.

• **PPI/PAI/Privacy and RPID Passing**: For incoming SIP requests or response messages, when the PAI or PPI privacy header is set, the SIP gateway builds the PAI or PPI header into the common SIP stack, thereby providing support to handle the call data present in the PAI or PPI header. For outgoing SIP requests or response messages, when the PAI or PPI privacy header is set, privacy information is sent using the PAI or PPI header.

  For more information, refer to the “Support for PAI/PPID Privacy PCPID and PAURI Headers on Cisco UBE” section in the *Cisco Unified Border Element SIP Support Configuration Guide*.

• **SIP VMWI for FXS phones**: SIP provides visible message waiting indication (VMWI) on FXS phones. This feature provides users with the option to enable one message waiting indication (MWI): audible, visible, or both. The VMWI mechanism uses SIP Subscribe or Notify to get MWI updates from a virtual machine (VM) system, and then forwards updates to the FXS phone on the port.

  For more information, refer to the “Configuring SIP MWI Features” section in the *SIP Configuration Guide*.

• **SIP Session timer (RFC 4028)**: This feature allows for a periodic refresh of SIP sessions through a re-INVITE or UPDATE request. The refresh allows both user agents and proxies to determine whether
the SIP session is still active. Two header fields can be defined: Session-Expires, which conveys the lifetime of the session, and Min-SE, which conveys the minimum allowed value for the session timer.

For more information, refer to the “SIP Session Timer Support” section in the Cisco Unified Border Element SIP Support Configuration Guide.

• **SIP Media Inactivity Detection**: The SIP Media Inactivity Detection Timer feature enables Cisco gateways to monitor and disconnect VoIP calls if no Real-Time Control Protocol (RTCP) packets are received within a configurable time period.

For more information, refer to the SIP Media Inactivity Timer section.

The SIP Voice Gateways feature is supported for analog endpoints that are connected to Foreign Exchange Station (FXS) ports or a Cisco VG224 Analog Phone Gateway and controlled by a Cisco call-control system, such as a Cisco Unified Communications Manager (Cisco Unified CM) or a Cisco Unified Communications Manager Express (Cisco Unified CME).

For more information on SIP Gateway features and information about configuring the SIP voice gateway for VoIPv6, see the Configuring VoIP for IPv6.

**VoIPv6 Support on Cisco UBE**

Cisco UBE in VoIPv6 adds IPv6 capability to VoIP features. This feature adds dual-stack support on voice gateways, IPv6 support for SIP trunks, support for SCCP-controlled analog voice gateways, support for real-time control protocol (RTCP) pass-through, and support for T.38 fax over IPv6.

For more information on these features, refer to the following:

• “Configuring Cisco IOS Gateways” section in the Deploying IPv6 in Unified Communications Networks with Cisco Unified Communications Manager

• “Trunks” section in Deploying IPv6 in Unified Communications Networks with Cisco Unified Communications Manager

• “SCCP-controlled analog voice gateways” section in the SCCP Controlled Analog (FXS) Ports with Supplementary Features in Cisco IOS Gateways

• “RTCP Pass-Through” section in Cisco UBE RTCP Voice Pass-Through for IPv6

• “T.38 fax over IPv6” section in Fax, Modem, and Text Support over IP Configuration Guide

Support has been added for audio calls in media Flow–Through (FT) and Flow–Around (FA) modes, High Density (HD) transcoding, Local Transcoding Interface (LTI), along with Voice Class Codec (VCC) support, support for Hold/Resume, REFER, re-INVITE, 302 based services, and support for media anti-trombone have been added to Cisco UBE.

Cisco UBE being a signaling proxy processes all signaling messages for setting up media channels. This enables Cisco UBE to affect the flow of media packets using the media flow-through and the media flow-around modes.

• Media FT and Media FA modes support the following call flows:
  • EO–to–EO
  • DO–to–DO
  • DO–to–EO
• **Media Flow-Through (FT):** In a media flow–through mode, between two endpoints, both signaling and media flows through the IP-to-IP Gateway (IPiPGW). The IPiPGW performs both signaling and media interworking between H.323/SIP IPv4 and SIP IPv6 networks.

*Figure 21: H.323/SIP IPv4 – SIP IPv6 interworking in media flow-through mode*

- **Media Flow-Around (FA):** Media flow–around provides the ability to have a SIP video call whereby signaling passes through Cisco UBE and media pass directly between endpoints bypassing the Cisco UBE.

*Figure 22: H.323/SIP IPv4 - SIP IPv6 interworking in media flow-around mode*

• **Assisted RTCP (RTCP Keepalive):** Assisted Real-time Transport Control Protocol (RTCP) enables Cisco UBE to generate RTCP keepalive reports on behalf of endpoints; however, endpoints, such as second generation Cisco IP phones (7940/7960) and Nortel Media Gateways (MG 1000T) do not generate any RTCP keepalive reports. Assisted RTCPs enable customers to use Cisco UBE to interoperate between endpoints and call control agents, such as Microsoft OCS/Lync so that RTCP reports are generated to indicate session liveliness during periods of prolonged silence, such as call hold or call on mute.

The assisted RTCP feature helps Cisco UBE to generate standard RTCP keepalive reports on behalf of endpoints. RTCP reports determine the liveliness of a media session during prolonged periods of silence, such as a call on hold or a call on mute.

• **SDP Pass–Through:** SDP is configured to pass through transparently at the Cisco UBE, so that both the remote ends can negotiate media independently of the Cisco UBE.

SDP pass-through is addressed in two modes:

- **Flow-through**—Cisco UBE plays no role in the media negotiation, it blindly terminates and re-originates the RTP packets irrespective of the content type negotiated by both the ends. This supports address hiding and NAT traversal.

- **Flow-around**—Cisco UBE neither plays a part in media negotiation, nor does it terminate and re-originator media. Media negotiation and media exchange is completely end-to-end.
For more information, refer to the “Configurable Pass-through of SIP INVITE Parameters” section in the Cisco Unified Border Element SIP Support Configuration Guide.

• **UDP Checksum for IPv6**: User Datagram Protocol (UDP) checksums provide data integrity for addressing different functions at the source and destination of the datagram, when a UDP packet originates from an IPv6 node.

• **IP Toll Fraud**: The IP Toll Fraud feature checks the source IP address of the call setup before routing the call. If the source IP address does not match an explicit entry in the configuration as a trusted VoIP source, the call is rejected.

  For more information, refer to the “Configuring Toll Fraud Prevention” section in the Cisco Unified Communications Manager Express System Administrator Guide.

• **RTP Port Range**: Provides the capability where the port range is managed per IP address range. This feature solves the problem of limited number of RTP ports for more than 4000 calls. It enables combination of an IP address and a port as a unique identification for each call.

• **Hold/Resume**: Cisco UBE supports supplementary services such as Call Hold and Resume. An active call can be put in held state and later the call can be resumed.

  For more information, refer to the “Configuring Call Hold/Resume for Shared Lines for Analog Ports” section in Supplementary Services Features for FXS Ports on Cisco IOS Voice Gateways Configuration Guide.

• **Call Transfer (re-INVITE, REFER)**: Call transfer is used for conference calling, where calls can transition smoothly between multiple point-to-point links and IP level multicasting.

  For more information, refer to the “Configurable Pass-through of SIP INVITE Parameters” section in the Cisco Unified Border Element SIP Support Configuration Guide.

• **Call Forward (302 based)**: SIP provides a mechanism for forwarding or redirecting incoming calls. A Universal Access Servers (UAS) can redirect an incoming INVITE by responding with a 302 message (moved temporarily).

  • Consumption of 302 at stack level is supported for EO-EO, DO-DO and DO-EO calls for all combination of IPv4/IPv6/ANAT.

  • Consumption of 302 at stack level is supported for both FT and FA calls.

  For more information, refer to the “Configuring Call Transfer and Forwarding” section in Cisco Unified Communications Manager Express System Administrator Guide.

• **Media Antitrombone**: Antitromboning is a media signaling service in SIP entity to overcome the media loops. Media Trombones are media loops in a SIP entity due to call transfer or call forward. Media loops in Cisco UBE are not detected because Cisco UBE looks at both call types as individual calls and not calls related to each other.

  Antitrombone service has to be enabled only when no media interworking is required in both legs. Media antitrombone is supported only when the initial call is in IPv4 to IPv4 or IPv6 to IPv6 mode only.

  For more information, refer to the “Configuring Media Antitrombone” section in the Cisco Unified Border Element Protocol-Independent Features and Setup Configuration Guide.

• **RE-INVITE Consumption**: The Re-INVITE/UPDATE consumption feature helps to avoid interoperability issues by consuming the mid-call Re-INVITEs/UPDATEs from Cisco UBE. As Cisco
UBE blocks RE-INVITE / mid-call UPDATE, remote participant is not made aware of the SDP changes, such as Call Hold, Call Resume, and Call transfer.

For more information, refer to the “Cisco UBE Mid-call Re-INVITE/UPDATE Consumption” section in the Cisco Unified Border Element Protocol-Independent Features and Setup Configuration Guide.

• **Address Hiding:** The address hiding feature ensures that the Cisco UBE is the only point of signaling and media entry/exit in all scenarios. When you configure address-hiding, signaling and media peer addresses are also hidden from the endpoints, especially for supplementary services when the Cisco UBE passes REFER/3xx messages from one leg to the other.

For more information, refer to the “Configuring Address Hiding” section in the SIP-to-SIP Connections on a Cisco Unified Border Element.

• **Header Passing:** Header Pass through enables header passing for SIP INVITE, SUBSCRIBE and NOTIFY messages; disabling header passing affects only incoming INVITE messages. Enabling header passing results in a slight increase in memory and CPU utilization.

For more information, refer to the “SIP-to-SIP Connections on a Cisco Unified Border Element” section in the SIP-to-SIP Connections on Cisco Unified Border Element.

• **Refer–To Passing:** The Refer-to Passing feature is enabled when you configure refer-to-passing in Refer Pass through mode and the supplementary service SIP Refer is already configured. This enables the received refer-to header in Refer Pass through mode to move to the outbound leg without any modification. However, when refer-to-passing is configured in Refer Consumption mode without configuring the supplementary-service SIP Refer, the received Refer-to URI is used in the request-URI of the triggered invite.

For more information, refer to the “Configuring Support for Dynamic REFER Handling on Cisco UBE” section in the Cisco Unified Border Element SIP Configuration Guide.

• **Error Pass-through:** The SIP error message pass through feature allows a received error response from one SIP leg to pass transparently over to another SIP leg. This functionality will pass SIP error responses that are not yet supported on the Cisco UBE or will preserve the Q.850 cause code across two sip call-legs.

For more information, refer to the “Configuring SIP Error Message Passthrough” section in the Cisco Unified Border Element SIP Support Configuration Guide.

• **SIP UPDATE Interworking:** The SIP UPDATE feature allows a client to update parameters of a session (such as, a set of media streams and their codecs) but has no impact on the state of a dialog. UPDATE with SDP will support SDP Pass through, media flow around and media flow through. UPDATE with SDP support for SIP to SIP call flows is supported in the following scenarios:
  • Early Dialog SIP to SIP media changes.
  • Mid Dialog SIP to SIP media changes.

For more information, refer to the “SIP UPDATE Message per RFC 3311” section in the Cisco Unified Border Element SIP Support Configuration Guide.

• **SIP OPTIONS Ping:** The OPTIONS ping mechanism monitors the status of a remote Session Initiation Protocol (SIP) server, proxy or endpoints. Cisco UBE monitors these endpoints periodically.

For more information, refer to the “Cisco UBE Out-of-dialog OPTIONS Ping for Specified SIP Servers or Endpoints” section in the Configuration of SIP Trunking for PSTN Access (SIP-to-SIP) Configuration Guide.
**Configurable Error Response Code in OPTIONS Ping**: Cisco UBE provides an option to configure the error response code when a dial peer is busied out because of an Out-of-Dialog OPTIONS ping failure.

For more information, refer to the “Configuring an Error Response Code upon an Out-of-Dialog OPTIONS Ping Failure” section in the Cisco Unified Border Element SIP Support Configuration Guide.

**SIP Profiles**: SIP profiles create a set of provisioning properties that you can apply to SIP trunk.

**Dynamic Payload Type Interworking (DTMF and Codec Packets)**: The Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls feature provides dynamic payload type interworking for dual tone multifrequency (DTMF) and codec packets for Session Initiation Protocol (SIP) to SIP calls. The Cisco UBE interworks between different dynamic payload type values across the call legs for the same codec. Also, Cisco UBE supports any payload type value for audio, video, named signaling events (NSEs), and named telephone events (NTEs) in the dynamic payload type range 96 to 127.

For more information, refer to the “Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls” section in the Cisco Unified Border Element (Enterprise) Protocol-Independent Features and Setup Configuration Guide.

**Audio Transcoding using Local Transcoding Interface (LTI)**: Local Transcoding Interface (LTI) is an interface created to remove the requirement of SCCP client for Cisco UBE transcoding.

For information, refer to Cisco Unified Border Element 9.0 Local Transcoding Interface (LTI).

**Voice Class Codec (VCC) with or without Transcoding**: The Voice Class Codec feature supports basic and all Re-Invite based supplementary services like call-hold/resume, call forward, call transfer, where if any mid-call codec changes, Cisco UBE inserts/removes/modifies the transcoder as needed.

Support for negotiation of an Audio Codec on each leg of a SIP–SIP call on the Cisco UBE feature supports negotiation of an audio codec using the Voice Class Codec (VCC) infrastructure on Cisco UBE. VCC supports SIP-SIP calls on Cisco UBE and allows mid-call codec change for supplementary services.

---

**How to Configure VoIP for IPv6**

**Configuring VoIP for IPv6**

SIP is a simple, ASCII-based protocol that uses requests and responses to establish communication among the various components in the network and to ultimately establish a conference between two or more endpoints.

Users in a SIP network are identified by unique SIP addresses. A SIP address is similar to an e-mail address and is in the format of sip:userID@gateway.com. The user ID can be either a username or an E.164 address. The gateway can be either a domain (with or without a hostname) or a specific Internet IPv4 or IPv6 address.

A SIP trunk can operate in one of three modes: SIP trunk in IPv4-only mode, SIP trunk in IPv6-only mode, and SIP trunk in dual-stack mode, which supports both IPv4 and IPv6.

A SIP trunk uses the Alternative Network Address Transport (ANAT) mechanism to exchange multiple IPv4 and IPv6 media addresses for the endpoints in a session. ANAT is automatically enabled on SIP trunks in dual-stack mode. The ANAT Session Description Protocol (SDP) grouping framework allows user agents (UAs) to include both IPv4 and IPv6 addresses in their SDP session descriptions. The UA is then able to use any of its media addresses to establish a media session with a remote UA.
A Cisco Unified Border Element can interoperate between H.323/SIP IPv4 and SIP IPv6 networks in media flow-through mode. In media flow-through mode, both signaling and media flows through the Cisco Unified Border Element, and the Cisco Unified Border Element performs both signaling and media interoperation between H.323/SIP IPv4 and SIP IPv6 networks (see the figure below).

Figure 23: H.323/SIP IPv4--SIP IPv6 Interoperating in Media Flow-Through Mode

Shutting Down or Enabling VoIPv6 Service on Cisco Gateways

**SUMMARY STEPS**

1. *enable*
2. *configure terminal*
3. *voice service voip*
4. *shutdown [ forced]*

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice service voip</td>
<td>Enters voice service VoIP configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> shutdown [ forced]</td>
<td>Shuts down or enables VoIP call services.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# shutdown forced</td>
<td></td>
</tr>
</tbody>
</table>
Shutting Down or Enabling VoIPv6 Submodes on Cisco Gateways

SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. sip
5. call service stop [forced]

DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td>- Enter your password if prompted.</td>
</tr>
<tr>
<td></td>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>voice service voip</td>
<td>Enters voice service VoIP configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>sip</td>
<td>Enters SIP configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>call service stop [forced]</td>
<td>Shuts down or enables VoIPv6 for the selected submode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-serv-sip)# call service stop</td>
<td></td>
</tr>
</tbody>
</table>

Configuring the Protocol Mode of the SIP Stack

Before you begin

SIP service should be shut down before configuring the protocol mode. After configuring the protocol mode as IPv6, IPv4, or dual-stack, SIP service should be reenabled.

SUMMARY STEPS

1. enable
2. configure terminal
3. sip-ua
4. protocol mode ipv4 | ipv6 | dual-stack [preference {ipv4 | ipv6}]

DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Step 2</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>sip-ua</td>
<td>Enters SIP user agent configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config)# sip-ua</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td>protocol mode ipv4</td>
<td>Configures the Cisco IOS SIP stack in dual-stack mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-sip-ua)# protocol mode dual-stack</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ipv6</td>
<td>ipv6</td>
</tr>
<tr>
<td>Disabling ANAT Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example: Configuring the SIP Trunk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>This example shows how to configure the SIP trunk to use dual-stack mode, with IPv6 as the preferred mode. The SIP service must be shut down before any changes are made to protocol mode configuration.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device(config)# sip-ua</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device(config-sip-ua)# protocol mode dual-stack preference ipv6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Disabling ANAT Mode | |
ANAT is automatically enabled on SIP trunks in dual-stack mode. Perform this task to disable ANAT in order to use a single-stack mode. | |

SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. sip
### DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>voice service voip</td>
<td>Enters voice service VoIP configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td>sip</td>
<td>Enters SIP configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td>Step 5</td>
<td>no anat</td>
<td>Disables ANAT on a SIP trunk.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(conf-serv-sip)# no anat</td>
<td></td>
</tr>
</tbody>
</table>

### Verifying SIP Gateway Status

**Before you begin**

To verify the status of SIP Gateway, use the following commands

**SUMMARY STEPS**

1. show sip-ua calls
2. show sip-ua connections
3. show sip-ua status

**DETAILED STEPS**

Step 1 show sip-ua calls

The **show sip-ua calls** command displays active user agent client (UAC) and user agent server (UAS) information on SIP calls:
Verifying SIP Gateway Status

Device# show sip-ua calls
SIP UAC CALL INFO
Call 1
SIP Call ID : 8368ED08-1C2A11DD-80078908-BA2972D0@2001::21B:D4FF:FED7:B000
State of the call : STATE_ACTIVE (7)
Substate of the call : SUBSTATE_NONE (0)
Calling Number : 2000
Called Number : 1000
Bit Flags : 0xC04018 0x100 0x0
CC Call ID : 2
Source IP Address (Sig) : 2001:DB8:0:ABCD::1
Destn SIP Req Addr:Port : 2001:DB8:0:1:FFFF:5060
Destn SIP Resp Addr:Port: 2001:DB8:0:FFFF:5060
Destination Name : 2001::21B:D5FF:FE1D:6C00
Number of Media Streams : 1
Number of Active Streams: 1
RTP Fork Object : 0x0
Media Mode : flow-through
Media Stream 1
State of the stream : STREAM_ACTIVE
Stream Call ID : 2
Stream Type : voice-only (0)
Stream Media Addr Type : 1709707780
Negotiated Codec : (20 bytes)
Codec Payload Type : 18
Negotiated Dtmf-relay : inband-voice
Dtmf-relay Payload Type : 0
Media Source IP Addr:Port: [2001::21B:D4FF:FED7:B000]:16504
Media Dest IP Addr:Port : [2001::21B:D5FF:FE1D:6C00]:19548
Options-Ping ENABLED:NO ACTIVE:NO
Number of SIP User Agent Client(UAC) calls: 1
SIP UAS CALL INFO
Number of SIP User Agent Server(UAS) calls: 0

Step 2 show sip-ua connections

Use the show sip-ua connections command to display SIP UA transport connection tables:

Example:

Device# show sip-ua connections udp brief
Total active connections : 1
No. of send failures : 0
No. of remote closures : 0
No. of conn. failures : 0
No. of inactive conn. ageouts : 0

Router# show sip-ua connections udp detail
Total active connections : 1
No. of send failures : 0
No. of remote closures : 0
No. of conn. failures : 0
No. of inactive conn. ageouts : 0
---------Printing Detailed Connection Report---------
Note:
** Tuples with no matching socket entry
  - Do 'clear sip <tcp[<tls>]>/udp conn t ipv4:<addr>:<port>'
  to overcome this error condition
++ Tuples with mismatched address/port entry
  - Do 'clear sip <tcp[<tls>]>/udp conn t ipv4:<addr>:<port> id <connid>'
  to overcome this error condition
Remote-Agent:2001::21B:D5FF:FE1D:6C00, Connections-Count:1
Remote-Port Conn-Id Conn-State WriteQ-Size
Step 3  show sip-ua status

Use the **show sip-ua status** command to display the status of the SIP UA:

**Example:**

```
Device# show sip-ua status
SIP User Agent Status
SIP User Agent for UDP : ENABLED
SIP User Agent for TCP : ENABLED
SIP User Agent for TLS over TCP : ENABLED
SIP User Agent bind status(signaling): DISABLED
SIP User Agent bind status(media): DISABLED
SIP early-media for 180 responses with SDP: ENABLED
SIP max-forwards : 70
SIP DNS SRV version: 2 (rfc 2782)
NAT Settings for the SIP-UA
Role in SDP: NONE
Check media source packets: DISABLED
Maximum duration for a telephone-event in NOTIFYs: 2000 ms
SIP support for ISDN SUSPEND/RESUME: ENABLED
Redirection (3xx) message handling: ENABLED
Reason Header will override Response/Request Codes: DISABLED
Out-of-dialog Refer: DISABLED
Presence support is DISABLED
protocol mode is ipv6
SDP application configuration:
  Version line (v=) required
  Owner line (o=) required
  Timespec line (t=) required
  Media supported: audio video image
  Network types supported: IN
  Address types supported: IP4 IP6
  Transport types supported: RTP/AVP udptl
```

**RTCP Pass-Through**

IPv4 and IPv6 addresses embedded within RTCP packets (for example, RTCP CNAME) are passed on to Cisco UBE without being masked. These addresses are masked on the Cisco UBE ASR 1000.

The Cisco UBE ASR 1000 does not support printing of RTCP debugs.

**Note**

RTCP is passed through by default. No configuration is required for RTCP pass-through.

**Configuring IPv6 Support for Cisco UBE**

In Cisco UBE, IPv4-only and IPv6-only modes are not supported when endpoints are dual-stack. In this case, Cisco UBE must also be configured in dual-stack mode.
Verifying RTP Pass-Through

To enable RTCP packet-related debugging, use the following command

SUMMARY STEPS

1. debug voip rtcp packets
**DETAILED STEPS**

**debug voip rtcp packets**

**Example:**

```
Device# debug voip rtcp packets
```

```
*Feb 14 06:24:58.799: //1/xxxxxxxxxxxx/RTP//Packet/voip_remote_rtcp_packet: Received RTCP packet
*Feb 14 06:24:58.799: SR: ssrc=0x1F7A35F0 sr_ntp_h=0xD10346B4 sr_ntp_l=0x13173DF8 sr_timestamp=0x0 sr_npackets=381 sr_nbytes=62176
*Feb 14 06:24:58.799: RR: ssrc=0x1A1752F0 rr_loss=0x0 rr_ehsr=5748 rr_jitter=0 rr_lsr=0x0 rr_dlsr=0x0
*Feb 14 06:24:58.799: SDES: ssrc=0x1F7A35F0 name=1 len=39 data=0.0.0@2001:DB8:C18:5:21B:D4FF:FEDD:35F0
```

**Configuring the Source IPv6 Address of Signaling and Media Packets**

Users can configure the source IPv4 or IPv6 address of signaling and media packets to a specific interface’s IPv4 or IPv6 address. Thus, the address that goes out on the packet is bound to the IPv4 or IPv6 address of the interface specified with the `bind` command.

The `bind` command also can be configured with one IPv6 address to force the gateway to use the configured address when the bind interface has multiple IPv6 addresses. The bind interface should have both IPv4 and IPv6 addresses to send out ANAT.

When you do not specify a bind address or if the interface is down, the IP layer still provides the best local address.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice service voip
4. sip
5. bind {control | media | all} source interface interface-id [ipv6-address ipv6-address]
**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
</tr>
<tr>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
</tr>
<tr>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td></td>
</tr>
<tr>
<td>voice service voip</td>
<td>Enters voice service VoIP configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td></td>
</tr>
<tr>
<td>sip</td>
<td>Enters SIP configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td></td>
</tr>
<tr>
<td>bind {control</td>
<td>media</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-serv-sip)# bind control source-interface FastEthernet 0/0</td>
<td></td>
</tr>
</tbody>
</table>

**Example: Configuring the Source IPv6 Address of Signaling and Media Packets**

```
Device(config)# voice service voip
Device(config-voi-serv)# sip
Device(config-serv-sip)# bind control source-interface fastEthernet 0/0
```

**Configuring the SIP Server**

**SUMMARY STEPS**

1. enable
2. configure terminal
3. sip-ua
4. sip-server {dns: host-name} | ipv4: ipv4-address | ipv6: ipv6-address | [port-nums]}
5. keepalive target {[ipv4: address | ipv6: address]: [port] | dns: hostname} [tcp | tls]] | udp] [secondary]
## DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>sip-ua</td>
<td>Enters SIP user agent configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config)# sip-ua</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>sip-server {dns: host-name}</td>
<td>Configures a network address for the SIP server interface.</td>
</tr>
<tr>
<td></td>
<td>ipv4: ipv4-address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ipv6: [ipv6-address]::{port-nums}</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-sip-ua)# sip-server ipv6: 2001:DB8:0:0:8:800:200C:417A</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>keepalive target {ipv4: address</td>
<td>Identifies SIP servers that will receive keepalive packets from the SIP gateway.</td>
</tr>
<tr>
<td></td>
<td>ipv6: address}[{port}</td>
<td>\dns: hostname}[tcp [ts]]</td>
</tr>
<tr>
<td></td>
<td>[udp] [secondary]</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-sip-ua)# keepalive target ipv6: 2001:DB8:0:0:8:800:200C:417A</td>
<td></td>
</tr>
</tbody>
</table>

### Example: Configuring the SIP Server

Device(config)# sip-ua
Device(config-sip-ua)# sip-server ipv6: 2001:DB8:0:0:8:800:200C:417A

### Configuring the Session Target

#### SUMMARY STEPS

1. enable
2. configure terminal
3. dial-peer voice tag \{mnoip | pots | vofr | voip\}
4. destination pattern \[+ string T\]
### Configuring SIP Register Support

#### SUMMARY STEPS

1. `enable`

---

#### Example: Configuring the Session Target

```bash
Device(config)# dial-peer voice 29 voip
Device(config-dial-peer)# destination-pattern 7777
Device(config-dial-peer)# session target ipv6:2001:DB8::800:200C:417A
```
2. configure terminal
3. sip-ua
4. registrar {dns: address | ipv4: destination-address [: port] | ipv6: destination-address : port} aor-domain expires seconds [tcp tls] type [secondary] [scheme string]
5. retry register retries
6. timers register milliseconds

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> sip-ua</td>
<td>Enters SIP user agent configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# sip-ua</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> registrar {dns: address</td>
<td>ipv4: destination-address [: port]</td>
</tr>
<tr>
<td>Example: Device(config-sip-ua)# registrar ipv6: 2001:DB8::1:20F:FFFF:FE0B:2972 expires 3600 secondary</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> retry register retries</td>
<td>Configures the total number of SIP register messages that the gateway should send.</td>
</tr>
<tr>
<td>Example: Device(config-sip-ua)# retry register 10</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> timers register milliseconds</td>
<td>Configures how long the SIP UA waits before sending register requests.</td>
</tr>
<tr>
<td>Example: Device(config-sip-ua)# timers register 500</td>
<td></td>
</tr>
</tbody>
</table>

**Example: Configuring SIP Register Support**

Device(config)# sip-ua
Configuring Outbound Proxy Server Globally on a SIP Gateway

### SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. sip
5. outbound-proxy \{ipv4: ipv4-address | ipv6: ipv6-address | dns: host: domain\} [: port-number]

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice service voip</td>
<td>Enters voice service VoIP configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> sip</td>
<td>Enters sip configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> outbound-proxy {ipv4: ipv4-address</td>
<td>ipv6: ipv6-address</td>
</tr>
<tr>
<td>Example: Device(config-serv-sip)# outbound-proxy ipv6: 2001:DB8:0:0:8:800:200C:417A</td>
<td></td>
</tr>
</tbody>
</table>
# Configuring UDP Checksum

## SUMMARY STEPS

1. enable
2. configure terminal
3. ipv6 udp checksum [process | cef | none]
4. exit

## DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1** enable | Enables privileged EXEC mode.  
Example: 
Device> enable |
| **Step 2** configure terminal | Enters global configuration mode.  
Example: 
Device# configure terminal |
| **Step 3** ipv6 udp checksum [process | cef | none] | Configures UDP checksum for Cisco UBE so that when you enable UDP checksum, it is computed and added for outgoing media packets. Similarly, disable the command to ignore the checksum calculation.  
Example: 
Device(config)# ipv6 udp checksum process |
| **Step 4** exit | Exits global configuration mode and returns to privileged EXEC mode.  
Example: 
Device(config)# exit |

Use the following keywords with the `ipv6 udp checksum` command:

- **process**: Packets are punted to the process switching path for checksum validation.
- **cef**: The UDP checksum validation is done in the CEF path.
- **none**: UDP checksum validation is not done for received media packets in the CEF path and there is no UDP checksum computation for transmitted media packets.
Configuring IP Toll Fraud

SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. ip address trusted list
5. ipv6 $X.X.X.X::X$
6. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3 voice service voip</td>
<td>Enters voice service VoIP configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td>Step 4 ip address trusted list</td>
<td>Enters IP address trusted list configuration mode. You can add unique and multiple IP addresses for incoming VoIP (H.323/SIP) calls to a list of trusted IP addresses.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# ip address trusted list</td>
<td></td>
</tr>
<tr>
<td>Step 5 ipv6 $X.X.X.X::X$</td>
<td>Enters IPv6 addresses for toll fraud prevention.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(cfg-iptrust-list)# ipv6 2001:DB8::/48</td>
<td></td>
</tr>
<tr>
<td>Step 6 end</td>
<td>Exits trusted list configuration mode and returns to global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(cfg-iptrust-list)# end</td>
<td></td>
</tr>
</tbody>
</table>
## Configuring the RTP Port Range for an Interface

### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `voice service voip`
4. `allow-connections sip to sip`
5. `media-address range range`
6. `rtp-port range range`
7. `exit`
8. `dial-peer voice tag voip`
9. `voice–class sip bind media source–interface interface`
10. `end`

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice service voip</td>
<td>Enters voice service VoIP configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> allow-connections sip to sip</td>
<td>Allows sip-to-sip connections under voice service voip configuration mode for Cisco UBE.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(conf-voi-serv)# allow-connections sip to sip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> media-address range range</td>
<td>Configures the media-address range, which enables the media gateway to allocate the available free port for a given IP address within the address range.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-voi-serv)# media-address range 2001:DB8::/48</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> rtp-port range range</td>
<td>Configures the RTP port range.</td>
</tr>
</tbody>
</table>
Configuring Message Waiting Indicator Server Address

SUMMARY STEPS

1. enable
2. configure terminal
3. sip-ua
4. mwi-server {ipv4: destination-address | ipv6: destination-address | dns: host-name} peer-tag [output-dial-peer-tag]
5. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>• Enter your password if prompted.</td>
</tr>
</tbody>
</table>

Device> enable
## Configuring Voice Ports

### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `voice-port port number`
4. `vmwi [fsk | dc-voltage]`
5. `end`

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
</tbody>
</table>

*Example:*  
Device> `enable`

---

### Purpose

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
</tbody>
</table>

*Example:*  
Device# `configure terminal`

---

### Purpose

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 3</strong></td>
<td>Enters SIP user-agent configuration mode.</td>
</tr>
</tbody>
</table>

*Example:*  
Device(config)# `sip-ua`

---

### Purpose

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 4</strong></td>
<td>Configures voice-mail server settings on a voice gateway or user agent.</td>
</tr>
</tbody>
</table>

*Example:*  
Device(config-sip-ua)# `mwi-server ipv6 2001:DB8::/48 peer-tag 3`

### Purpose

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 5</strong></td>
<td>Enters SIP user-agent configuration mode and returns to global configuration mode.</td>
</tr>
</tbody>
</table>

*Example:*  
Device(config-sip-ua)# `end`
### Configuring Cisco UBE Mid-call Re-INVITE Consumption

#### Configuring Passthrough of Mid-call Signalling

Perform this task to configure passthrough of mid-call signaling (as Re-invites) only when bidirectional media is added.

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. Configure passthrough of mid-call signaling changes only when bidirectional media is added.
   - In Global VoIP SIP configuration mode
     
     ```
     midcall-signaling passthru media-change
     ```
   - In dial-peer configuration mode
     
     ```
     voice-class sip mid-call signaling passthru media-change
     ```
4. `end`

---

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><code>configure terminal</code>&lt;br/&gt;<strong>Example:</strong>&lt;br/&gt;Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Enters voiceport configuration mode.</td>
</tr>
<tr>
<td><code>voice-port port number</code>&lt;br/&gt;<strong>Example:</strong>&lt;br/&gt;Device(config)# voice-port 3</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Enables either Frequency–Shift Keying (FSK) visible message waiting indication (VMWI) or DC voltage on a Cisco VG224 onboard analog FXS voice port. VMWI is configured automatically when MWI is configured on the voice port.</td>
</tr>
<tr>
<td>`vmwi [fsk</td>
<td>dc-voltage]`&lt;br/&gt;<strong>Example:</strong>&lt;br/&gt;Device(config-voiceport)# vmwi fsk</td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Exits voice-port configuration mode and returns to privileged EXEC mode.</td>
</tr>
<tr>
<td><code>end</code>&lt;br/&gt;<strong>Example:</strong>&lt;br/&gt;Device(config-voiceport)# end</td>
<td></td>
</tr>
</tbody>
</table>
DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
</tbody>
</table>

**Step 3**
Configure passthrough of mid-call signaling changes only when bidirectional media is added:
- In Global VoIP SIP configuration mode
  midcall-signaling passthru media-change
- In dial-peer configuration mode
  voice-class sip mid-call signaling passthru media-change

Example:
In Global VoIP SIP configuration mode:
Device(config)# voice service voip
Device(conf-voi-serv)# sip
Device(conf-serv-sip)# midcall-signaling passthru media-change

Example:
In Dial-peer configuration mode:
Device(config)# dial-peer voice 2 voip
Device(config-dial-peer)# voice-class sip mid-call signaling passthru media-change

**Step 4** end
Exits to privileged EXEC mode.

**Configuring Passthrough SIP Messages at Dial Peer Level**

Perform this task to configure passthrough SIP messages at the dial-peer level. You need to perform this task at the dial-peer level to consume all media-related mid-call Re-INVITEs/UPDATEs.

**Note**
If the Cisco UBE Mid-call Re-INVITE/UPDATE consumption feature is configured on global and dial-peer level, dial-peer level takes precedence.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. dial-peer voice dial-peer tag voip
4. voice-class sip mid-call signaling passthru media-change
5. exit

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> dial-peer voice <strong>dial-peer tag</strong> voip</td>
<td>Enters dial-peer voice configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# dial-peer voice 2 voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> voice-class sip mid-call signaling passthru media-change</td>
<td>Passes through SIP messages that involve media change.</td>
</tr>
<tr>
<td>Example: Device(config-dial-peer)# voice-class sip mid-call signaling passthru media-change</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> exit</td>
<td>Exits dial-peer voice configuration mode and returns to global configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config-dial-peer)# exit</td>
<td></td>
</tr>
</tbody>
</table>

**Configuring H.323 IPv4-to-SIPv6 Connections in a Cisco UBE**

An organization with an IPv4 network can deploy a Cisco UBE on the boundary to connect with the service provider’s IPv6 network (see the figure below).
A Cisco UBE can interoperate between H.323/SIP IPv4 and SIP IPv6 networks in media flow-through mode. In media flow-through mode, both signaling and media flows through the Cisco UBE, and the Cisco UBE performs both signaling and media interoperation between H.323/SIP IPv4 and SIP IPv6 networks (see the figure below).

**Figure 25: IPv4 to IPv6 Media Interoperating Through Cisco IOS MTP**

The Cisco UBE feature adds IPv6 capability to existing VoIP features. This feature adds dual-stack support on voice gateways and MTP, IPv6 support for SIP trunks, and SCCP-controlled analog voice gateways. In addition, the SBC functionality of connecting SIP IPv4 or H.323 IPv4 network to a SIP IPv6 network is implemented on an Cisco UBE to facilitate migration from VoIPv4 to VoIPv6.

**Before you begin**
Cisco UBE must be configured in IPv6-only or dual-stack mode to support IPv6 calls.

---

**Note**
A Cisco UBE interoparates between H.323/SIP IPv4 and SIP IPv6 networks only in media flow-through mode.
**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice service voip
4. allow-connections from type to to type

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td>Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Enters voice service VoIP configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Allows connections between specific types of endpoints in a VoIPv6 network.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# allow-connections h323 to sip</td>
<td>Arguments are as follows:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>* from-type -- Type of connection. Valid values: h323, sip.</td>
</tr>
<tr>
<td></td>
<td>* to-type -- Type of connection. Valid values: h323, sip.</td>
</tr>
</tbody>
</table>

**Example: Configuring H.323 IPv4-to-SIPv6 Connections in a Cisco UBE**

```
Device(config)# voice service voip
Device(config-voi-serv)# allow-connections h323 to sip
```

**Configuration Examples for VoIP over IPv6**

**Example: Configuring the SIP Trunk**

This example shows how to configure the SIP trunk to use dual-stack mode, with IPv6 as the preferred mode. The SIP service must be shut down before any changes are made to protocol mode configuration.
Troubleshooting Tips for VoIP for IPv6

**Media Flow-Through**
To enable all Session Initiation Protocol (SIP)-related debugging, use the `debug ccsip all` command in privileged EXEC mode.

To trace the execution path through the call control application programming interface (CCAPI), use the `debug voip ccap inout` command.

**Media Flow-Around**
To enable all Session Initiation Protocol (SIP)-related debugging, use the `debug ccsip all` command.

To trace the execution path through the call control application programming interface (CCAPI), use the `debug voip ccap inout` command.

**SDP Pass-Through**
To enable all Session Initiation Protocol (SIP)-related debugging (when the call is active in Pass through mode), use the `debug ccsip all` command.

**RTP Port Range**
To enable all Session Initiation Protocol (SIP)-related debugging, use the `debug ccsip all` command.

To enable debugging for Real-Time Transport Protocol (RTP) named event packets, use the `debug voip rtp` command.

**VMWI SIP**
To collect debug information only for signaling events, use the `debug vpm signal` command.

To show all Session Initiation Protocol (SIP) Service Provider Interface (SPI) message tracing, use the `debug ccsip messages` command.

Verifying and Troubleshooting Tips

**Verifying Cisco UBE ANAT Call Flows**
To verify that media settings are enabled in the media flowthrough and media flow-around feature, use the following commands:

**SUMMARY STEPS**

1. `show call active voice brief`
2. show call active voice compact
3. show voip rtp connections

DETAILED STEPS

Step 1 show call active voice brief

Example:

```
Device# show call active voice brief

<ID>: <CallID> <start>ms.<index> (<start>) +<connect> pid:<peer_id> <dir> <addr> <state>
dur hh:mm:ss tx:<packets>/bytes rx:<packets>/bytes dscp:<packets violation> media:<packets violation>
audio tos:<audio tos value> video tos:<video tos value>
IP <ip>:udp rtt:<time>ms pl:<play>/gap)ms lost:<lost>/early)/late
delay:<last>/min><max>ms <codec> <textrelay> <transcoded>
media inactive detected:<y/n> media cntrl rcvd:<y/n> timestamp:<time>

long duration call detected:<y/n> long duration call duration :<sec> timestamp:<time>
LostPacketRate:<%> OutOfOrderRate:<%
MODEMPASS <method> buf:<fills>/drains> loss <overall> <multipkt>/corrected>
last <buf event time>s dur:<Min>'<Max>s
FR <protocol> [int dcli cid] vad:<y/n> dtmf:<y/n> seq:<y/n>
<codec> (payload size)
ATM <protocol> [int vpi/vci cid] vad:<y/n> dtmf:<y/n> seq:<y/n>
<codec> (payload size)
Tele <int> (callID) [channel_id] tx:<tot>/vkHz ms <codec> noise:<i> acom:<i> i/o:<i> dBm
MODEREMOTE info:<rcvd'/sent'/resent'> xid:<rcvd'/sent'/total':rcvd'/sent'/<drops>
speeds:bps: local <rx>/tx remote <rx>/tx
Proxy <ip>:audio udp,video udp/tcp0/,tcp1/,tcp2/,tcp3/ endpt: <type>/<manf>
bw: <reg'> <act'< codec: <audio' <video'>

rx: <audio pkts'<audio bytes'>,<video pkts'<video bytes'>,<t120 pkts'<t120 bytes'>

Telephony call-legs: 0
SIP call-legs: 2
H323 call-legs: 0
Call agent controlled call-legs: 0
SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 2
```

Cisco Unified Border Element Configuration Guide
SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 2

Step 2  show call active voice compact

Example:

Device# show call active voice compact

<callID> A/O FAX T<sec> Codec type Peer Address IP R<ip>:<udp>
Total call-legs: 2
987 ANS T61 g711ulaw VOIP P1005 2001:......:1012:38356
988 ORG T61 g711ulaw VOIP P2005 2001:......:1012:26827

Step 3  show voip rtp connections

Example:

Device# show voip rtp connections

VoIP RTP Port Usage Information:
Max Ports Available: 24273, Ports Reserved: 303, Ports in Use: 2
Port range not configured, Min: 16384, Max: 32767

*Jun 7 09:17:41.135: //-1/xxxxxxxxxxxx/SIP/Msg/ccsipDisplayMsg:
Received:

Verifying and Troubleshooting Cisco UBE ANAT Flow-Through Call

To verify and troubleshoot Cisco UBE ANAT Flow-Through calls, use the following commands:

SUMMARY STEPS

1. debug ccsip message
2. show voip rtp connections

DETAILED STEPS

Step 1  debug ccsip message

Example:

Device# show logging

Verifying and Troubleshooting Cisco UBE ANAT Flow-Through Call
Verifying and Troubleshooting Cisco UBE ANAT Flow-Through Call

Via: SIP/2.0/UDP [2001:DB8:C18:2:219:219:2FF:FE89:7928]:5060;branch=z9hG4bK1CA8CD
Date: Thu, 07 Jun 2012 10:47:17 GMT
Supported: 100rel,timer,resource-priority,replaces
Require: sdp-anat
Min-SE: 1800
Cisco-Guid: 4231321369-2948862433-2168455193-0797538600
User-Agent: Cisco-SIPGateway/IOS-12.x
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
CSeq: 101 INVITE
Max-Forwards: 70
Timestamp: 1339066037
Expires: 180
Allow-Events: telephone-event
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 441

v=0
s=SIP Call
c=IN IP4 9.44.30.10
a=group:ANAT 1 2
m=audio 16970 RTP/AVP 18 19
c=IN IP4 9.44.30.10
a=mid:1
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:19 CN/8000
a=ptime:20
m=audio 17066 RTP/AVP 18 19
c=IN IP6 2001:DB8:C18:2:219:2FF:FE89:7928
a=mid:2
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:19 CN/8000
a=ptime:20

*Jun 7 09:17:41.159: //31/FC34D7198140/SIP/Msg/ccsipDisplayMsg:
Sent:
SIP/2.0 100 Trying
Via: SIP/2.0/UDP [2001:DB8:C18:2:219:2FF:FE89:7928]:5060;branch=z9hG4bK1CA8CD
Date: Thu, 07 Jun 2012 09:17:41 GMT
Timestamp: 1339066037
CSeq: 101 INVITE
Allow-Events: telephone-event
Server: Cisco-SIPGateway/IOS-15.2.20120528.102328.
Content-Length: 0

*Jun 7 09:17:41.159: //32/FC34D7198140/SIP/Msg/ccsipDisplayMsg:
Sent:
INVITE sip:6000@9.44.30.11:5060 SIP/2.0
Via: SIP/2.0/UDP 9.44.30.14:5060;branch=z9hG4bK2688E
Remote-Party-ID: <sip:1001@9.44.30.14>;party=calling;screen=no;privacy=off
From: <sip:1001@9.44.30.14>;tag=6EDAC1D0-F25
To: <sip:6000@9.44.30.11>
Verifying and Troubleshooting Cisco UBE ANAT Flow-Through Call

Allow-Events: telephone-event
Remote-Party-ID: <sip:6000@9.44.30.11>;party=called;screen=no;privacy=off
Contact: <sip:6000@9.44.30.11:5060>
Server: Cisco-SIPGateway/IOS-15.2.2.5.T
Content-Length: 0

*Jun 7 09:17:41.207: //31/FC34D7198140/SIP/Msg/ccsipDisplayMsg:
Sent:
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP [2001:DB8:C18:2:219:2FF:FE89:7928]:5060;branch=z9hG4bK1CA8CD
Date: Thu, 07 Jun 2012 09:17:41 GMT
Timestamp: 1339060637
CSeq: 101 INVITE
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
Allow-Events: telephone-event
Server: Cisco-SIPGateway/IOS-15.2.2.5.T
Content-Length: 0

*Jun 7 09:17:41.219: //32/FC34D7198140/SIP/Msg/ccsipDisplayMsg:
Received:
SIP/2.0 200 OK
Via: SIP/2.0/UDP 9.44.30.14:5060;branch=z9hG4bK2688E
From: <sip:1001@9.44.30.14>;tag=6D0FC0-1428
To: <sip:6000@9.44.30.11>;tag=93D1F9D4-9E2
Date: Thu, 07 Jun 2012 10:40:14 GMT
Call-ID: 7780227E-AFB811E1-8060F4DD-5665AA1B@9.44.30.14
Timestamp: 1339060661
CSeq: 101 INVITE
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
Allow-Events: telephone-event
Remote-Party-ID: <sip:6000@9.44.30.11>;party=called;screen=no;privacy=off
Contact: <sip:6000@9.44.30.11:5060>
Supported: replaces
Require: sdp-anat
Server: Cisco-SIPGateway/IOS-15.2.2.5.T
Supported: timer
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 435
v=0
o=CiscoSystemsSIP-GW-UserAgent 8213 2783 IN IP4 9.44.30.11
s=SIP Call
c=IN IP6 2001:DB8:C18:2:217:59FF:FEDE:8898
t=0 0
a=group:ANAT 1
m=audio 17200 RTP/AVP 18 19
c=IN IP6 2001:DB8:C18:2:217:59FF:FEDE:8898
a-mid:1
a-rtpmap:18 G729/8000
a-fmtp:18 annexb=no
a-rtpmap:19 CN/8000
a-ptime:20
m=audio 0 RTP/AVP 18 19
c=IN IP4 9.44.30.11
a-mid:2
a-rtpmap:18 G729/8000
a-fmtp:18 annexb=no
Verifying Cisco UBE ANAT Flow-Around Calls

To verify Cisco UBE ANAT Flow-Around calls, use the debug ccsip message commands:

**SUMMARY STEPS**

1. debug ccsip message
2. show voip rtp connections

**DETAILED STEPS**

**Step 1**

**debug ccsip message**

*Example:*

```bash
Device# Show logging
```

```plaintext
*Jun 7 17:26:30.681: //1/xxxxxxxxxxxx/SIP/Msg/ccsipDisplayMsg: Received:
Via: SIP/2.0/UDP [2001:DB8:C18:2:223:33FF:FEDE:8898]:5060;branch=z9hG4bK1CB1E77
```

** Step 2    show voip rtp connections**

*Example:*

```bash
Device# show voip rtp connections
```

VoIP RTP Port Usage Information:
Max Ports Available: 8091, Ports Reserved: 101, Ports in Use: 3
Port range not configured, Min: 16384, Max: 32767

<table>
<thead>
<tr>
<th>Media-Address Range</th>
<th>Ports Available</th>
<th>Ports Reserved</th>
<th>Ports In-use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Address-Range</td>
<td>8091</td>
<td>101</td>
<td>3</td>
</tr>
</tbody>
</table>

VoIP RTP active connections:
<table>
<thead>
<tr>
<th>No.</th>
<th>CallId</th>
<th>dstCallId</th>
<th>LocalRTP</th>
<th>RmtRTP</th>
<th>LocalIP</th>
<th>RemoteIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31</td>
<td>32</td>
<td>16436</td>
<td>16970</td>
<td>9.44.30.14</td>
<td>9.44.30.10</td>
</tr>
</tbody>
</table>

Found 2 active RTP connections
Date: Thu, 07 Jun 2012 17:35:05 GMT
Supported: 100rel,timer,resource-priority,replaces
Require: sdp-anat
Min-SE: 1800
Cisco-Uid: 1170397766-2953384417-2170945561-0797538600
User-Agent: Cisco-SIPGateway/IOS-12.x
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
CSeq: 101 INVITE
Max-Forwards: 70
Timestamp: 1339090505
Expires: 180
Allow-Events: telephone-event
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 465

v=0
s=SIP Call
c=IN IP4 9.44.30.13
t=0 0
a=group:ANAT 1 2
m=audio 18706 RTP/AVP 18 0 19
c=IN IP4 9.44.30.13
a=mid:1
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=rtpmap:19 CN/8000
m=audio 16384 RTP/AVP 18 0 19
c=IN IP6 2001:DB8:C18:2:223:33FF:FEB1:B440
a=mid:2
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:0 PCMU/8000
a=rtpmap:19 CN/8000

*Jun 7 17:26:30.705: //106/45C2DA468166/SIP/Msg/ccsipDisplayMsg:
Sent:
SIP/2.0 100 Trying
Date: Thu, 07 Jun 2012 17:26:30 GMT
Timestamp: 1339090505
CSeq: 101 INVITE
Allow-Events: telephone-event
Server: Cisco-SIPGateway/IOS-15.2.20120528.102328.
Content-Length: 0

*Jun 7 17:26:30.705: //107/45C2DA468166/SIP/Msg/ccsipDisplayMsg:
Sent:
INVITE sip:600089.44.30.11:5060 SIP/2.0
Via: SIP/2.0/UDP 9.44.30.14:5060;branch=z9hG4bK90BB
Remote-Party-ID: <sip:1001@9.44.30.14>;party=calling;screen=no;privacy=off
From: <sip:1001@9.44.30.14>;tag=22C984C-970
Verifying Cisco UBE ANAT Flow-Around Calls

To: <sip:6000@9.44.30.11>
Date: Thu, 07 Jun 2012 17:26:30 GMT
Call-ID: C145AF07-AFFC11E1-813EF4DD-5665AA1B@9.44.30.14
Supported: timer, resource-priority, replaces
Require: sdp-anat
Min-SE: 1800
Cisco-Guid: 1170397766-2953384417-2170945561-0797538600
User-Agent: Cisco-SIPGateway/IOS-15.2.20120528.102328.
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
CSeq: 101 INVITE
Timestamp: 1339089990
Contact: <sip:1001@9.44.30.14:5060>
Expires: 180
Allow-Events: telephone-event
Max-Forwards: 69
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 418

v=0
c=CiscoSystemsSIP-GW-UserAgent 9582 2407 IN IP4 9.44.30.14
s=SIP Call
c=IN IP4 9.44.30.13
t=0 0
a=group:ANAT 1 2
m=audio 18706 RTP/AVP 18 19
c=IN IP4 9.44.30.13
a-mid:1
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:19 CN/8000
a=ptime:20
m=audio 16384 RTP/AVP 18 19
c=IN IP6 2001:DB8:C18:2:223:33FF:FEB1:B440
a-mid:2
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:19 CN/8000
a=ptime:20

*Jun 7 17:26:30.729: //107/45C2DA468166/SIP/Msg/ccsipDisplayMsg:
Received:
SIP/2.0 100 Trying
Via: SIP/2.0/UDP 9.44.30.14:5060;branch=z9hG4bk90BB
From: <sip:1001@9.44.30.14>;tag=22C984C-970
To: <sip:6000@9.44.30.11>
Date: Thu, 07 Jun 2012 18:49:04 GMT
Call-ID: C145AF07-AFFC11E1-813EF4DD-5665AA1B@9.44.30.14
Timestamp: 1339089990
CSeq: 101 INVITE
Allow-Events: telephone-event
Server: Cisco-SIPGateway/IOS-15.2.2.5.T
Content-Length: 0

*Jun 7 17:26:30.753: //107/45C2DA468166/SIP/Msg/ccsipDisplayMsg:
Received:
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP 9.44.30.14:5060;branch=z9hG4bk90BB
From: <sip:1001@9.44.30.14>;tag=22C984C-970
To: <sip:6000@9.44.30.11>
Date: Thu, 07 Jun 2012 18:49:04 GMT
Call-ID: C145AF07-AFFC11E1-813EF4DD-5665AA1B@9.44.30.14
Timestamp: 1339089990
CSeq: 101 INVITE
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
Allow-Events: telephone-event
Remote-Party-ID: <sip:6000@9.44.30.11>;party=called;screen=no;privacy=off
Contact: <sip:6000@9.44.30.11:5060>
Server: Cisco-SIPGateway/IOS-15.2.2.5.T
Content-Length: 0

*Jun 7 17:26:30.753: //106/45C2DA468166/SIP/Msg/ccsipDisplayMsg:
Sent:
SIP/2.0 180 Ringing
Date: Thu, 07 Jun 2012 17:26:30 GMT
Timestamp: 1339090505
CSeq: 101 INVITE
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
Allow-Events: telephone-event
Server: Cisco-SIPGateway/IOS-15.2.2.5.T
Content-Length: 0

*Jun 7 17:26:30.765: //106/45C2DA468166/SIP/Msg/ccsipDisplayMsg:
Received:
SIP/2.0 200 OK
Via: SIP/2.0/UDP 9.44.30.14:5060;branch=z9hG4bK90BB
From: <sip:1001@9.44.30.14>;tag=22C984C-970
To: <sip:6000@9.44.30.11>;tag=959183D0-2073
Date: Thu, 07 Jun 2012 18:49:04 GMT
Call-ID: C145AF07-AFFC11E1-813EF4DD-5665AA1B@9.44.30.14
Timestamp: 1339089990
CSeq: 101 INVITE
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
Allow-Events: telephone-event
Remote-Party-ID: <sip:6000@9.44.30.11>;party=called;screen=no;privacy=off
Contact: <sip:6000@9.44.30.11:5060>
Server: Cisco-SIPGateway/IOS-15.2.2.5.T
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 412

v=0
o=CiscoSystemsSIP-GW-UserAgent 2764 5975 IN IP4 9.44.30.11
s=IN IP4 9.44.30.11
t=0 0
a=group:ANAT 1
m=audio 17278 RTP/AVP 18 19
c=IN IP4 9.44.30.11
a=mid:1
a=rtpmap:18 G729/8000
a=fmt:18 annexb=no
a=rtpmap:19 CN/8000
a=ptime:20
m=audio 0 RTP/AVP 18 19
Verifying Cisco UBE ANAT Flow-Around Calls

```
a-mid:2
a-rtpmap:18 G729/8000
a-fmtp:18 annexb=no
a-rtpmap:19 CN/8000
a-ptime:20

*Jun 7 17:26:30.777: //107/45C2DA468166/SIP/Msg/ccsipDisplayMsg:
Sent:
ACK sip:6000@9.44.30.11:5060 SIP/2.0
Via: SIP/2.0/UDP 9.44.30.14:5060;branch=z9hG4bK91207D
From: <sip:1001@9.44.30.14>;tag=22C984C-970
To: <sip:6000@9.44.30.11>;tag=959183D0-2073
Date: Thu, 07 Jun 2012 17:26:30 GMT
Call-ID: C145AF07-4FCC11E1-813EF4DD-5665AA1B@9.44.30.14
Max-Forwards: 70
CSeq: 101 ACK
Allow-Events: telephone-event
Content-Length: 0

*Jun 7 17:26:30.785: //106/45C2DA468166/SIP/Msg/ccsipDisplayMsg:
Sent:
SIP/2.0 200 OK
Date: Thu, 07 Jun 2012 17:26:30 GMT
Timestamp: 1339090505
CSeq: 101 INVITE
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
Allow-Events: telephone-event
Contact: <sip:6000@[2001:DB8:C18:2:223:4FF:FEAC:4540]>;party=originated;screen=no;privacy=off
Supported: replaces
Require: sdp-anat
Server: Cisco-SIPGateway/IOS-15.2.20120528.102328.
Supported: timer
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 421

v=0
s=SIP Call
c=IN IP4 9.44.30.11
t=0 0
a-group:ANAT 1
m=audio 17278 RTP/AVP 18 19
c=IN IP4 9.44.30.11
a-mid:1
a-rtpmap:18 G729/8000
a-fmtp:18 annexb=no
a-rtpmap:19 CN/8000
a-ptime:20
m=audio 0 RTP/AVP 18 19
c=IN IP6 2001:DB8:C18:2:217:59FF:FEDE:8898
a-mid:2
a-rtpmap:18 G729/8000
a-fmtp:18 annexb=no
a-rtpmap:19 CN/8000
```
Verifying VMWI SIP

**SUMMARY STEPS**

1. show sip-ua mwi
2. debug vpm signal
3. debug ccsip messages

**DETAILED STEPS**

### Step 1  show sip-ua mwi

**Example:**

```
Device# show sip-ua mwi
MWI type: 2
MWI server: 2001:10:12:1::2006 //IPv6 MWI Server Address/
MWI expires: 3600
MWI port: 5060
MWI dial peer tag: 0 //Shows the MWI-Server binding dial-peer tag. Tag "0" is default.//
MWI solicited //MWI type is solicited by default. Subscription of voice-port is required in this case only.//
MWI ipaddr cnt 1:
MWI ipaddr idx 0:
MWI server: 2001:10:12:1::2006, port 5060, transport 1 //IPv6 MWI Server Address//
MWI server dns lookup retry cnt: 0
```
**Step 2**

**debug vpm signal**

**Example:**

Device# debug vpm signal

Process vmwi. vmwi state: OFF

The phone is not on hook (1). Delay the vmwi processing. //Phone is offhook//

Process dc-voltage vmwi. State: OFF //VMWI state is off//

*Mar 2 02:33:34.841: [2/0] c2400_dc_volt_mwi: on=0

The phone is not onhook (1). Delay the vmwi processing. Process vmwi. vmwi state: ON //VMWI state is on//

Voice port 0/2/1 subscribed MWI //Subscription of port for MWI (Solicited)//

**Step 3**

**debug ccsip messages**

**Example:**

Device# debug ccsip messages

**Note**  The `debug ccsip messages` command shows the SIP Messages, such as Subscribe and Notify.

---

**Verifying SDP Passthrough Configuration**

**SUMMARY STEPS**

1. debug ccsip all
2. show voip rtp connection

**DETAILED STEPS**

**Step 1**

**debug ccsip all**

**Example:**

Device# show logging

Received:
Via: SIP/2.0/UDP [2001:DB8:C18:2:223:33FF:FEAC:4540]:5060;branch=z9hG4bK20277F
Date: Fri, 08 Jun 2012 11:01:48 GMT
Call-ID: 2D6EEC84-B9011E1-8235D9DB-F669887E@2001:DB8:C18:2:223:33FF:FEAC:4540
Supported: 100rel,timer,resource-priority,replaces
Require: sdp-anat
Min-SE: 1800
Cisco-Guid: 2131649325-2962952673-2175336473-0797538600
User-Agent: Cisco-SIPGateway/IOS-12.x
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
CSeq: 101 INVITE
Max-Forwards: 70
Timestamp: 1339153308
Expires: 180
Allow-Events: telephone-event
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 488

v=0
s=SIP Call
c=IN IP6 2001:DB8:C18:2:223:33FF:FEB1:B440
t=0
a=group:ANAT 1 2
m=audio 16406 RTP/AVP 18 0 19
c=IN IP6 2001:DB8:C18:2:223:33FF:FEB1:B440
a=mid:1
a=rtpmap:18 G729/8000
a=frmt:18 annexb-no
a=rtpmap:0 PCMU/8000
a=rtpmap:19 CN/8000
m=audio 18024 RTP/AVP 18 0 19
c=IN IP4 9.44.30.13
a=mid:2
a=rtpmap:18 G729/8000
a=frmt:18 annexb-no
a=rtpmap:0 PCMU/8000
a=rtpmap:19 CN/8000

Sent:
SIP/2.0 100 Trying
Via: SIP/2.0/UDP [2001:DB8:C18:2:223:33FF:FEB1:B440]:5060;branch=z9hG4bK20277F
Date: Fri, 08 Jun 2012 10:53:14 GMT
Call-ID: 2D6EEC84-B09011E1-8235D9DB-F669887E@2001:DB8:C18:2:223:33FF:FEB1:B440
Timestamp: 1339153308
CSeq: 101 INVITE
Allow-Events: telephone-event
Server: Cisco-SIPGateway/IOS-15.2.20120528.102328.
Content-Length: 0

Sent:
INVITE sip:6000@[2001:DB8:C18:2:223:33FF:FEB1:B440]:5060;branch=z9hG4bK20277F SIP/2.0
Via: SIP/2.0/UDP [2001:DB8:C18:2:223:33FF:FEB1:B440]:5060;branch=z9hG4bK15D1013
Date: Fri, 08 Jun 2012 10:53:14 GMT
Call-ID: FB05CC74-B08E11E1-82C1F4DD-5665AA1B@2001:DB8:C18:2:223:33FF:FEB1:B440
Timestamp: 1339153308
CSeq: 101 INVITE
Allow-Events: telephone-event
Server: Cisco-SIPGateway/IOS-15.2.20120528.102328.
Content-Length: 0

Supported: timer,resource-priority,replaces,sdp-anat
Min-SE: 1800
Cisco-Guid: 2131649325-2962952673-2175336473-0797538600
User-Agent: Cisco-SIPGateway/IOS-15.2.20120528.102328.
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
CSeq: 101 INVITE
Timestamp: 1539152794
Expires: 180
Allow-Events: telephone-event
Max-Forwards: 69
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 443

v=0
s=SIP Call
Verifying SDP Passthrough Configuration

Jun 8 10:53:14:137: /243/7F0E632D81A9/SIP/Msg/ccsipDisplayMsg:

Received:
SIP/2.0 100 Trying
Via: SIP/2.0/UDP [2001:DB8:C18:2:223:4FF:FEAC:4540]:5060;branch=z9hG4bK15D1013
Date: Fri, 08 Jun 2012 12:15:49 GMT
Call-ID: FB05CC74-B08E11E1-82C1F4DD-5665AA1B@2001:DB8:C18:2:223:4FF:FEAC:4540
Timestamp: 1339152794
CSeq: 101 INVITE
Allow-Events: telephone-event
Server: Cisco-SIPGateway/IOS-15.2.2.5.T
Content-Length: 0

Received:
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP [2001:DB8:C18:2:223:4FF:FEAC:4540]:5060;branch=z9hG4bK15D1013
Date: Fri, 08 Jun 2012 12:15:49 GMT
Call-ID: FB05CC74-B08E11E1-82C1F4DD-5665AA1B@2001:DB8:C18:2:223:4FF:FEAC:4540
Timestamp: 1339152794
CSeq: 101 INVITE
Allow-Events: telephone-event
Server: Cisco-SIPGateway/IOS-15.2.2.5.T
Content-Length: 0

Sent:
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP [2001:DB8:C18:2:223:4FF:FEAC:4540]:5060;branch=z9hG4bK15D1013
Date: Fri, 08 Jun 2012 10:53:14 GMT
Call-ID: 2d6EEC84-B09011E1-82C1F4DD-669887E02001:DB8:C18:2:223:3FF:FEA1:B440
 Timestamp: 1339153308
CSeq: 101 INVITE
Allow-Events: telephone-event
Server: Cisco-SIPGateway/IOS-15.2.2.5.T
Content-Length: 0

Received:
SIP/2.0 200 OK
Via: SIP/2.0/UDP [2001:DB8:C18:2:223:4FF:FEAC:4540]:5060;branch=z9hG4bK15D1013
Date: Fri, 08 Jun 2012 12:15:49 GMT
Call-ID: FH05CC74-B08E11E1-82C1F4DD-5665AA1B@2001:DB8:C18:2:223:4FF:FEAC:4540
Timestamp: 1339152794
CSeq: 101 INVITE
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
Allow-Events: telephone-event
Supported: replaces
Require: sdp-anat
Server: Cisco-SIPGateway/IOS-15.2.2.5.T
Supported: timer
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 434

v=0
u=SIP Call
c=IN IP6 2001:DB8:C18:2:217:59FF:FEDE:8898
t=0 0
group:ANAT 1
m=audio 17424 RTP/AVP 18 19
c=IN IP6 2001:DB8:C18:2:217:59FF:FEDE:8898
a=mid:1
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
m=audio 0 RTP/AVP 18 19
c=IN IP4 9.44.30.11
a=mid:2
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:19 CN/8000

Sent:
Via: SIP/2.0/UDP [2001:DB8:C18:2:223:4FF:FEAC:4540]:5060;branch=z9hG4bK20277F
Date: Fri, 08 Jun 2012 10:53:14 GMT
Call-ID: FB05CC74-B08E11E1-82C1F4DD-5665AA1B@2001:DB8:C18:2:223:4FF:FEAC:4540
Max-Forwards: 70
CSeq: 101 ACK
Allow-Events: telephone-event
Content-Length: 0

Sent:
SIP/2.0 200 OK
Via: SIP/2.0/UDP [2001:DB8:C18:2:223:4FF:FEAC:4540]:5060;branch=z9hG4bK20277F
Date: Fri, 08 Jun 2012 10:53:14 GMT
Call-ID: 2D6EEC84-B09011E1-8235D9DB-F669887E@2001:DB8:C18:2:223:4FF:FEAC:4540
Timestamp: 1339153308
CSeq: 101 INVITE
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
Allow-Events: telephone-event
Supported: replaces
Supported: sdp-anat
Server: Cisco-SIPGateway/IOS-15.2.2.20120528.102328.
Supported: timer
Content-Type: application/sdp
Content-Disposition: session;handling-required
Content-Length: 389

v=0
s=SIP Call
t=0 0
a=group:ANAT 1
m=audio 16710 RTP/AVP 18 19
a=mid:1
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:19 CN/8000
m=audio 0 RTP/AVP 18 19
o=IN IP4 9.44.30.14
a=mid:2
a=rtpmap:18 G729/8000
a=fmtp:18 annexb=no
a=rtpmap:19 CN/8000

Received:
Via: SIP/2.0/UDP [2001:DB8:C18:2:223:33FF:FEB1:B440]:5060;branch=z9hG4bK203700
Date: Fri, 08 Jun 2012 11:01:48 GMT
Call-ID: 2D6EEC84-B09011E1-8235D9DB-F669887E@2001:DB8:C18:2:223:4FF:FEAC:4540
Max-Forwards: 70
CSeq: 101 ACK
Allow-Events: telephone-event
Content-Length: 0

Step 2  show voip rtp connection

Example:
Device# show voip rtp connection

VoIP RTP Port Usage Information:
Max Ports Available: 8091, Ports Reserved: 101, Ports in Use: 2
Port range not configured, Min: 16384, Max: 32767

<table>
<thead>
<tr>
<th>Media-Address Range</th>
<th>Ports Available</th>
<th>Ports Reserved</th>
<th>Ports In-use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Address-Range</td>
<td>8091</td>
<td>101</td>
<td>2</td>
</tr>
</tbody>
</table>

VoIP RTP active connections:
No. CallId dstCallId LocalRTP RmtRTP LocalIP RemoteIP
Found 2 active RTP connections
# Feature Information for VoIP for IPv6

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
</table>
| Cisco UBE support for IPv6 | 12.4(22)T | Cisco Unified Border Element (Cisco UBE) support for SIP IPv4-IPv6 dual stack and IPv4 and IPv6 capability provides the following functionality:  
• Translation of SIP IPv4 to IPv6 addresses  
• Administration and enforcement of policies for the IPv4/IPv6 mode of operation of each component.  
• Supports the following scenarios: H.323 IPv4 to SIP IPv6; SIP IPv4 to SIP IPv6, SIP IPv6 to SIP IPv6  
• DTMF: Interworking capability on Cisco UBE (H.245 Signal, RFC 2833, SIP Notify, Key Press Markup Language, H.323 to SIP, RFC 2833 to G.711 Inband)  
• IPv6 topology hiding and demarcation  
• SIP Options-ping  
The VoIP for IPv6 feature describes the Session Border Controller (SBC) functionality of connecting a SIP IPv4 or H.323 IPv4 network to a SIP IPv6 network that is implemented on a Cisco UBE to facilitate migration from VoIPv4 to VoIPv6. |
### Feature Information for VoIP for IPv6

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco UBE support for IPv6</td>
<td>15.3(2)T</td>
<td></td>
</tr>
<tr>
<td>Feature Name</td>
<td>Releases</td>
<td>Feature Information</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The following features are supported on Cisco UBE for 15.3(2)T:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Assisted RTCP (RTCP Keepalive)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Audio Transcoding using Local Transcoding Interface (LTI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Address Hiding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Call Transfer (re-INVITE, REFER)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Call Forward (302 based)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• IP Toll Fraud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Hold/Resume</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Media Flow-Through (FT)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Media Flow-Around (FA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• RE-INVITE Consumption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• RTP Port Range</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SDP Pass-Through</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• UDP Checksum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Media Anti-Trombone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Header Passing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Refer-To Passing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Error Pass-through</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SIP UPDATE Interworking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SIP Session timer (RFC 4028)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SIP OPTIONS Ping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Configurable Error Response Code in OPTIONS Ping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Limiting the Rate of Incoming SIP Calls per Dial-Peer (aka Call Spike)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SIP Profiles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SIP Media Inactivity Detection</td>
</tr>
<tr>
<td>Feature Name</td>
<td>Releases</td>
<td>Feature Information</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Dynamic Payload Type Interworking (DTMF and Codec Packets)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voice Class Codec (VCC) with or without Transcoding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPI/PAI/Privacy and RPID Passing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPv6 supports this feature.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSCP-Based QoS Support</td>
<td>12.4(22)T</td>
<td>Adds IPv6 capability to existing VoIP features on the Cisco UBE. Additionally, the SBC functionality of connecting SIP IPv4 or H.323 IPv4 network to SIP IPv6 network is implemented on a Cisco UBE to facilitate migration from VoIPv4 to VoIPv6. The following commands were introduced or modified: None</td>
</tr>
<tr>
<td>IPv6 Dual Stack</td>
<td>12.4(22)T</td>
<td>RTP stack supports the ability to create IPv6 connections using IPv6 unicast and multicast addresses as well as IPv4 connections.</td>
</tr>
<tr>
<td>RTP/RTCP over IPv6</td>
<td>12.4(22)T</td>
<td></td>
</tr>
<tr>
<td>Feature Name</td>
<td>Releases</td>
<td>Feature Information</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>IPv6 support this feature.</td>
<td></td>
<td>- Session Initiation Protocol Features Supported on IPv6</td>
</tr>
<tr>
<td>• Cisco UBE features Supported on IPv6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• SIP Gateway Generic Features</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apart from the SIP Gateway features already supported on IPv4 and IPv6 for 12.4(24)T release, the following features are also supported on IPv6:</td>
<td></td>
<td>• SIP VMWI for FXS phones</td>
</tr>
<tr>
<td></td>
<td>12.4(24)T</td>
<td>• History-Info</td>
</tr>
<tr>
<td></td>
<td>15.3(2)T</td>
<td>• Handling 181/183 Responses with/without SDP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SIP Session Timer (4028)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SIP Media Inactivity Detection</td>
</tr>
<tr>
<td>TDM-SIP GW for IPv6</td>
<td></td>
<td>• PPI/PAI &amp; Privacy (RFC3323/RFC3325) Headers</td>
</tr>
</tbody>
</table>
Feature Information for VoIP for IPv6
PART II

Dial Peer Enhancements

- Matching Inbound Dial Peers by URI, on page 167
- URI-Based Dialing Enhancements, on page 173
- Multiple Pattern Support on a Voice Dial Peer, on page 187
- Outbound Dial-Peer Group as an Inbound Dial-Peer Destination, on page 193
- Inbound Leg Headers for Outbound Dial-Peer Matching, on page 203
- Server Groups in Outbound Dial Peers, on page 213
- Domain-Based Routing Support on the Cisco UBE, on page 221
- ENUM Enhancement per Kaplan Draft RFC, on page 229
CHAPTER 13

Matching Inbound Dial Peers by URI

The Matching Inbound Dial Peers by URI feature allows you to configure selection of inbound dial peers by matching parts of the URI sent by remote (neighboring) SIP entity. The match can be done on different parts of the URI like hostname, IP address, DNS name. This feature can be used to configure configuration policies, enforcement of specific call-treatment, security, and routing policies on each SIP trunk by originating SIP entity.

In a scenario where multiple SIP hops are involved in a call, there would be multiple via headers involved, and the topmost via header of an incoming SIP invite represents the last hop that forwarded the SIP request, and the bottom-most via header would represent the originator of the SIP request. This feature supports matching by the last hop that forwarded the request (neighboring SIP entity), which is the topmost via header.

For incoming dial-peer match based on URI, if there are multiple dial-peer matches, then the longest matching dial-peer is chosen (similar to multiple dial-peer match based on incoming called number). However for URI pattern match, there is no match length and hence this is the least preferred.

Feature Information for Matching Inbound Dial Peers by URI

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note

- Feature Information for Matching Inbound Dial Peers by URI, on page 167
- Configuring an Inbound Dial Peer to Match on URI, on page 168
- Examples for Configuring an Inbound Dial Peer to Match on a URI, on page 170
<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbound Dial-peer Match Based on Remote IP Address on SIP Trunks</td>
<td>15.1(2)T Cisco IOS XE Release 3.8S</td>
<td>The Inbound Dial-peer Match Based on Remote IP Address on SIP Trunks feature supports the expansion of inbound dial-peer matching logic to include matching based on the source IP address of inbound signaling on a SIP trunk. This feature enables enforcement of specific call-treatment, security, and routing policies on each SIP trunk. In Cisco IOS Release 15.1(2)T this feature was implemented on the Cisco Unified Border Element. The following commands were introduced or modified: <code>dial-peer voice</code>, <code>voice-class uri</code>.</td>
</tr>
</tbody>
</table>

### Configuring an Inbound Dial Peer to Match on URI

#### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `voice class uri voice-class-uri-tag`
4. Specify a URI field for the voice class:
   - `host hostname-pattern`
   - `host ipv4: ipv4-address`
   - `host ipv6: ipv6-address`
   - `host dns: dns-address`
   - `pattern uri-pattern`
   - `user-id username-pattern`
5. `exit`
6. `dial-peer voice tag voip`
7. `session protocol sipv2`
8. `incoming uri { from | request | to | via} voice-class-uri-tag`
9. `end`

#### DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
</tbody>
</table>
### Purpose

**Command or Action** | **Example** | **Purpose**
--- | --- | ---
[Step 2](#) | **configure terminal**<br>**Example:**<br>Device> configure terminal | Enters global configuration mode.

**Step 3** | **voice class uri voice-class-uri-tag**<br>**Example:**<br>Device(config)# voice class uri 200 | Creates a voice class for matching SIP dial peers and enters voice URI class configuration mode.

**Step 4** | Specify a URI field for the voice class:<br>• **host hostname-pattern**<br>• **host ipv4: ipv4-address**<br>• **host ipv6: ipv6-address**<br>• **host dns: dns-address**<br>• **pattern uri-pattern**<br>• **user-id username-pattern**<br>**Example:**<br>Device(config-voice-uri-class)# host server1<br>**Example:**<br>Device(config-voice-uri-class)# host ipv4:10.0.0.0<br>**Example:**<br>Device(config-voice-uri-class)# host dns:xxx.yyy.com | • You can specify up to ten instances of the **host ipv4**, **host ipv6**, and **host dns** commands.<br>• You can specify only one instance of the **host hostname-pattern** commands.<br>• Length of **uri-pattern**, **username-pattern**, and **hostname-pattern** should be less than 32.<br>• **username-pattern** is matched against the username field of the URI.<br>• **hostname-pattern** is matched against the host field of the URI.<br>• **uri-pattern** is matched against the entire URI.<br>• Only one instance of the **pattern** and **host** commands are possible.

**Step 5** | **exit**<br>**Example:**<br>Device(config-voice-uri-class)# exit | Enters global configuration mode.

**Step 6** | **dial-peer voice tag voip**<br>**Example:**<br>Device(config)# dial-peer voice 6000 voip | Enters dial peer voice configuration mode.

**Step 7** | **session protocol sipv2**<br>**Example:**<br>Device(config-dial-peer)# session protocol sipv2 | Configures SIP as the session protocol type.
Examples for Configuring an Inbound Dial Peer to Match on a URI

Matching Against IPv4 Address and VIA
CUBE is configured to use incoming dial-peer 101 for incoming SIP calls from remote SIP endpoint having an IP address of 10.10.10.1

```
voice class uri 201 sip
host ipv4:10.10.10.1

dial-peer voice 101 voip
session protocol sipv2
incoming uri via 201
```

Incoming INVITE that can be matched against this dial peer.

```
INVITE sip:123@1.2.3.4:5060 SIP/2.0
Via: SIP/2.0/TCP 10.10.10.1:5093;branch=z9hG4bK-17716-1-0
Via: SIP/2.0/TCP 10.10.14.20:5093;branch=z9hG4bK-28280-1-0
```

Matching Against DNS Name and VIA
CUBE is configured to use incoming dial-peer 102 for incoming SIP calls from sample.com or an IP address that represents one of the resolved IP address of sample.com.

```
voice class uri 202 sip
host dns:sample.com

dial-peer voice 101 voip
session protocol sipv2
incoming uri via 202
```

Incoming INVITE that can be matched against this dial peer.

```
INVITE sip:123@1.2.3.4:5060 SIP/2.0
Via: SIP/2.0/TCP sample.com;branch=z9hG4bK-17716-1-0
```

```
INVITE sip:123@1.2.3.4:5060 SIP/2.0
Via: SIP/2.0/TCP 10.10.10.25:5093;branch=z9hG4bK-17716-1-0
```

10.10.10.25 is a resolved IP address of sample.com.
Matching Against Multiple Attributes and VIA

CUBE is configured to use incoming dial-peer 103 for incoming SIP calls from xxx.yyy.com, abc.def.com and IP addresses 10.10.10.10, 10.9.10.11 and 10.10.10.10.

voice class uri 203 sip
host dns:xxx.yyy.com
host dns:abc.def.com
host ipv4:10.10.10.10
host ipv4:10.9.10.11
host ipv4:10.10.10.10

dial-peer voice 103 voip
session protocol sipv2
incoming uri via 203

Incoming INVITE that can be matched against this dial peer.

INVITE sip:123@1.2.3.4:5060 SIP/2.0
Via: SIP/2.0/TCP 10.10.10.10:5093;branch=z9hG4bK-17716-1-0
Via: SIP/2.0/TCP 10.10.14.20:5093;branch=z9hG4bK-28280-1-0

10.10.10.25 is a resolved IP address of sample.com.
Examples for Configuring an Inbound Dial Peer to Match on a URI
CHAPTER 14

URI-Based Dialing Enhancements

The URI-Based Dialing Enhancements feature describes the enhancements made to Uniform Resource Identifier (URI)-based dialing on Cisco Unified Border Element (Cisco UBE) for Session Initiation Protocol (SIP) calls. The URI-Based Dialing Enhancements feature includes support for call routing on Cisco UBE when the user part of the incoming Request-URI is non-E164 (for example, INVITE sip:user@abc.com).

- Finding Feature Information, on page 173
- Information About URI-Based Dialing Enhancements, on page 173
- How to Configure URI-Based Dialing Enhancements, on page 177
- Configuration Examples for URI-Based Dialing Enhancements, on page 184
- Additional References for URI-Based Dialing Enhancements, on page 185
- Feature Information for URI-Based Dialing Enhancements, on page 186

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About URI-Based Dialing Enhancements

Cisco Unified Communications Manager (CUCM) supports dialing using directory Uniform Resource Identifiers (URIs) for call addressing. Directory URIs follow the username@host format where the host portion is an IPv4 address or a fully qualified domain name. A directory URI is a string of characters that can be used to identify a directory number. If that directory number is assigned to a phone, CUCM can route calls to that phone using the directory URI. URI dialing is available for Session Initiation Protocol (SIP) and Signaling Connection Control Part (SCCP) endpoints that support directory URIs.

The primary use of URI-based dialing is peer-to-peer calling between enterprises using complete URI addresses (that is, ‘username@host’). The host part of the URI identifies the destination to which the call should be routed. In earlier Cisco Unified Border Element (Cisco UBE) URI routing, the URI was replaced in the SIP header with the destination server IP address. Then routing of calls was based on the following restrictions:
• The user part of the incoming Request-URI must be an E164 number.
• The outgoing Request-URI is always set to the session target information of the outbound dial peer.

The URI-Based Dialing Enhancements feature extends support for Cisco UBE URI-based routing of calls. With these enhancements Cisco UBE supports:

• URI-based routing when the user part of the incoming Request-URI is non-E164 (for example, INVITE sip:user@abc.com).
• URI-based routing when the user part is not present. The user part is an optional parameter in the URI (for example, INVITE sip:abc.com).
• Copying the outgoing Request-URI and To header from the inbound Request-URI and To header respectively.
• Deriving (optionally) the session target for the outbound dial peer from the host portion of the inbound URI.
• URI-based routing for 302, Refer, and Bye Also scenarios.
• Call hunting where the subsequent dial peer is selected based on URI.
• Pass through of 302, with the host part of Contact: unmodified.

**Call Flows for URI-Based Dialing Enhancements**

**Case 1:** URI dialing with username being E164 or non-E164 number and Request-URI host copied from the inbound leg.

**Case 2:** Incoming Request-URI does not contain user part. The To: header information is also copied from the peer leg when the `requiri-passing` command is enabled.
Case 3: The old behavior of setting the outbound Request-URI to session target is retained when the `requiri-passing` command is not enabled.

Case 4: The session target derived from the host part of the URI. The outgoing INVITE is sent to resolved IP address of the host part of the URI.

Case 5: Pass through of contact URI to request URI.

Case 6: In 302 pass-through, contact header can be passed through from one leg to another by using the `contact-passing` command.
Case 7: Pass through of refer-to URI to request URI.

Case 8: URI routing based on BYE Also header.
How to Configure URI-Based Dialing Enhancements

Configuring Pass Through of SIP URI Headers

Perform these to configure the pass through of the host part of the Request-Uniform Resource Identifier (URI) and To Session Initiation Protocol (SIP) headers. By default, Cisco Unified Border Element (Cisco UBE) sets the host part of the URI to the value configured under the session target of the outbound dial peer. For more information, see Case 1 in the "Call Flows for URI-based Dialing Enhancements" section.

Configuring Pass Though of Request URI and To Header URI (Global Level)

SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. sip
5. requiri-passing
6. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice service voip</td>
<td>Specifies VoIP encapsulation and enters voice service configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> sip</td>
<td>Enters the Session Initiation Protocol (SIP) configuration mode.</td>
</tr>
<tr>
<td>Example: Device(conf-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> requiri-passing</td>
<td>Enables pass through of the host part of the Request-URI and To SIP headers. By default, Cisco UBE sets the host part of the URI to the value configured under the session target of the outbound dial peer.</td>
</tr>
<tr>
<td>Example: Router(conf-serv-sip)# requiri-passing</td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td><strong>end</strong></td>
<td>Ends the current configuration session and returns to privileged EXEC mode.</td>
</tr>
</tbody>
</table>

**Example:**

Router(conf-serv-sip)# end

---

### Configuring Pass Through of Request URI and To Header URI (Dial Peer Level)

#### SUMMARY STEPS

1. enable
2. configure terminal
3. voice class uri tag sip
4. host hostname-pattern
5. exit
6. dial-peer voice tag voip
7. session protocol sipv2
8. destination uri tag
9. session target ipv4:ip-address
10. voice-class sip requri-passing [system]
11. end

#### DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>enable</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td><strong>configure terminal</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td><strong>voice class uri tag sip</strong></td>
<td>Creates a voice class for matching dial peers to a Session Initiation Protocol (SIP) and enters voice URI class configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# voice class uri mydesturi sip</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td><strong>host hostname-pattern</strong></td>
<td>Matches a call based on the host field in a SIP Uniform Resource Identifier (URI).</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-voice-uri-class)# host example.com</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td><strong>exit</strong></td>
<td>Exits voice URI class configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-voice-uri-class)# exit</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> dial-peer voice tag voip</td>
<td>Defines a VoIP dial peer and enters dial peer configuration mode.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config)# dial-peer voice 22 voip</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> session protocol sipv2</td>
<td>Specifies a session protocol for calls between local and remote routers using the Internet Engineering Task Force (IETF) SIP.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-dial-peer)# session protocol sipv2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong> destination uri tag</td>
<td>Specifies the voice class used to match a dial peer to the destination URI of an outgoing call.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config)# destination uri mydesturi</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 9</strong> session target ipv4:ip-address</td>
<td>Designates a network-specific address to receive calls from a VoIP.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-dial-peer)# session target ipv4:10.1.1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 10</strong> voice-class sip requri-passing [system]</td>
<td>Enables the pass through of SIP URI headers.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-dial-peer)# voice-class sip requri-passing system</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 11</strong> end</td>
<td>Ends the current configuration session and returns to privileged EXEC mode.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-dial-peer)# end</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Configuring Pass Through of 302 Contact Header

**Configuring Pass Through of 302 Contact Header (Global Level)**

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice service voip
4. sip
5. contact-passing
6. end
# DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Device&gt; enable</td>
<td>▶ Enter your password if prompted.</td>
</tr>
<tr>
<td>2.</td>
<td><code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td><code>voice service voip</code></td>
<td>Specifies VoIP encapsulation and enters voice service configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td><code>sip</code></td>
<td>Enters voice service SIP configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(conf-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td><code>contact-passing</code></td>
<td>Enables pass through of the contact header from one leg to the other leg in 302 pass through scenario.</td>
</tr>
<tr>
<td></td>
<td>Example: Router(conf-serv-sip)# contact-passing</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td><code>end</code></td>
<td>Ends the current configuration session and returns to privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Router(conf-serv-sip)# end</td>
<td></td>
</tr>
</tbody>
</table>

## Configuring Pass Through of 302 Contact Header (Dial Peer Level)

### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `voice class uri destination-tag sip`
4. `user-id id-tag`
5. `exit`
6. `voice service voip`
7. `allow-connections sip to sip`
8. `dial-peer voice tag voip`
9. `session protocol sipv2`
10. `destination uri destination-tag`
11. `voice-class sip contact-passing`
12. `end`
### DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>enable</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><strong>configure terminal</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><strong>voice class uri destination-tag sip</strong></td>
<td>Creates a voice class for matching dial peers to a Session Initiation Protocol (SIP) and enters voice URI class configuration mode.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# voice class uri mydesturi sip</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><strong>user-id id-tag</strong></td>
<td>Matches a call based on the User ID portion of the Uniform Resource Identifier (URI).</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-voice-uri-class)# user-id 5678</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><strong>exit</strong></td>
<td>Exits voice URI class configuration mode.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-voice-uri-class)# exit</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><strong>voice service voip</strong></td>
<td>Specifies Voice over IP (VoIP) as the voice encapsulation type and enters voice service configuration mode.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><strong>allow-connections sip to sip</strong></td>
<td>Allows connections between SIP endpoints in a VoIP network.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(conf-voi-serv)# allow-connections sip to sip</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><strong>dial-peer voice tag voip</strong></td>
<td>Defines a VoIP dial peer and enters dial peer configuration mode.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# dial-peer voice 200 voip</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>session protocol sipv2</strong></td>
<td>Specifies a session protocol for calls between local and remote routers using the Internet Engineering Task Force (IETF) SIP.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# session protocol sipv2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><strong>destination uri destination-tag</strong></td>
<td>Specifies the voice class used to match a dial peer to the destination URI of an outgoing call.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# destination uri mydesturi</td>
<td></td>
</tr>
</tbody>
</table>
### Deriving of Session Target from URI

Perform this task to derive the session target from the host part of the Uniform Resource Identifier (URI). The outgoing INVITE is sent to the resolved IP address of the host part of the URI. For more information, see Case 4 in the "Call Flows for URI-Based Dialing Enhancements" section.

#### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `voice class uri destination-tag sip`
4. `host hostname-pattern`
5. `exit`
6. `dial-peer voice tag voip`
7. `session protocol sipv2`
8. `destination uri destination-tag`
9. `session target sip-uri`
10. `exit`
11. `voice class uri source-tag sip`
12. `host hostname-pattern`
13. `end`

#### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice class uri destination-tag sip</td>
<td>Creates or modifies a voice class for matching dial peers to a Session Initiation Protocol (SIP) or telephone (TEL)</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Device(config)# voice class uri mydesturi sip</td>
<td>Uniform Resource Identifier (URI) and enters voice URI class configuration mode.</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Matches a call based on the host field in a SIP URI.</td>
</tr>
<tr>
<td><strong>host</strong> hostname-pattern</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-voice-uri-class)# host destination.com</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Exits voice URI class configuration mode.</td>
</tr>
<tr>
<td>exit</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-voice-uri-class)# exit</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>Defines a VoIP dial peer and enters dial peer configuration mode.</td>
</tr>
<tr>
<td>dial-peer voice tag voip</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config)# dial-peer voice 25 voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td>Specifies a session protocol for calls between local and remote routers using the Internet Engineering Task Force (IETF) SIP.</td>
</tr>
<tr>
<td>session protocol sipv2</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-dial-peer)# session protocol sipv2</td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong></td>
<td>Specifies the voice class used to match a dial peer to the destination URI of an outgoing call.</td>
</tr>
<tr>
<td>destination uri destination-tag</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-dial-peer)# destination uri mydesturi</td>
<td></td>
</tr>
<tr>
<td><strong>Step 9</strong></td>
<td>Derives session target from incoming URI.</td>
</tr>
<tr>
<td>session target sip-uri</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-dial-peer)# session target sip-uri</td>
<td></td>
</tr>
<tr>
<td><strong>Step 10</strong></td>
<td>Exits dial peer voice configuration mode.</td>
</tr>
<tr>
<td>exit</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-dial-peer)# exit</td>
<td></td>
</tr>
<tr>
<td><strong>Step 11</strong></td>
<td>Creates or modifies a voice class for matching dial peers to a SIP or TEL URI and enters voice URI class configuration mode.</td>
</tr>
<tr>
<td>voice class uri source-tag sip</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config)# voice class uri mysourceuri sip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 12</strong></td>
<td>Matches a call based on the host field in a SIP URI.</td>
</tr>
<tr>
<td>host hostname-pattern</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-voice-uri-class)# host abc.com</td>
<td></td>
</tr>
<tr>
<td><strong>Step 13</strong></td>
<td>Ends the current configuration session and returns to privileged EXEC mode.</td>
</tr>
<tr>
<td>end</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-voice-uri-class)# end</td>
<td></td>
</tr>
</tbody>
</table>
Configuration Examples for URI-Based Dialing Enhancements

Example: Configuring Pass Though of Request URI and To Header URI

Example: Configuring Pass Though of Request URI and To Header URI (Global Level)

```
Device> enable
Device# configure terminal
Device(config)# voice service voip
Device(config-voi-serv)# sip
Device(config-serv-sip)# requri-passing
Device(config-serv-sip)# end
```

Example: Configuring Pass Though of Request URI and To Header URI (Dial Peer Level)

```
! Configuring URI voice class destination
Device(config)# voice class uri mydesturi sip
Device(config-voice-uri-class)# host xyz.com
Device(config-voice-uri-class)# exit

! Configuring outbound dial peer
Device(config)# dial-peer voice 13 voip
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# destination uri mydesturi
Device(config-dial-peer)# session target ipv4:10.1.1.1
Device(config-dial-peer)# voice-class sip requri-passing system
Device(config-dial-peer)# end
```

Example: Configuring Pass Through of 302 Contact Header

Example: Configuring Pass Through of 302 Contact Header (Global Level)

```
Device> enable
Device# configure terminal
Device(config)# voice service voip
Device(config-voi-serv)# sip
Device(config-serv-sip)# contact-passing
Device(config-serv-sip)# end
```

Example: Configuring Pass Through of 302 Contact Header (Dial Peer Level)

```
! Configuring URI voice class destination
Device> enable
Device# configure terminal
Device(config)# voice class uri mydesturi sip
Device(config-voice-uri-class)# user-id 5678
Device(config-voice-uri-class)# exit

! Configuring outbound dial peer
Device(config)# voice service voip
```
Example: Deriving Session Target from URI

Device> enable
Device# configure terminal
Device(config)# voice class uri mydesturi sip
Device(config-voice-uri-class)# host destination.com
Device(config-voice-uri-class)# exit
!
Device(config)# dial-peer voice 25 voip
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# destination uri mydesturi
Device(config-dial-peer)# session target sip-uri
Device(config-dial-peer)# exit
!
Device(config)# voice class uri mysourceuri sip
Device(config-voice-uri-class)# host abc.com
Device(config-voice-uri-class)# end

Additional References for URI-Based Dialing Enhancements

Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice commands</td>
<td>Cisco IOS Voice Command Reference</td>
</tr>
<tr>
<td>Cisco IOS commands</td>
<td>Cisco IOS Master Command List, All Releases</td>
</tr>
<tr>
<td>SIP configuration tasks</td>
<td>SIP Configuration Guide, Cisco IOS Release 15M&amp;T</td>
</tr>
</tbody>
</table>

Technical Assistance

<table>
<thead>
<tr>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cisco Support website provides extensive online resources, including</td>
<td><a href="http://www.cisco.com/support">http://www.cisco.com/support</a></td>
</tr>
<tr>
<td>documentation and tools for troubleshooting and resolving technical issues</td>
<td></td>
</tr>
<tr>
<td>with Cisco products and technologies.</td>
<td></td>
</tr>
<tr>
<td>To receive security and technical information about your products, you can</td>
<td></td>
</tr>
<tr>
<td>subscribe to various services, such as the Product Alert Tool (accessed from</td>
<td></td>
</tr>
<tr>
<td>Field Notices), the Cisco Technical Services Newsletter, and Really Simple</td>
<td></td>
</tr>
<tr>
<td>Syndication (RSS) Feeds.</td>
<td></td>
</tr>
<tr>
<td>Access to most tools on the Cisco Support website requires a Cisco.com user</td>
<td></td>
</tr>
<tr>
<td>ID and password.</td>
<td></td>
</tr>
</tbody>
</table>
Feature Information for URI-Based Dialing Enhancements

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 25: Feature Information for URI-Based Dialing Enhancements

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>URI-Based Dialing Enhancements</td>
<td></td>
<td>The URI-Based Dialing Enhancements feature includes support for call routing on Cisco UBE when the user-part of the incoming Request-URI is non-E164 (for example, INVITE sip:<a href="mailto:user@abc.com">user@abc.com</a>).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The following commands were introduced or modified: <strong>contact-passing</strong>, <strong>requri-passing</strong>, <strong>session target sip-uri</strong> and <strong>voice-class sip requiri-passing</strong></td>
</tr>
</tbody>
</table>
Multiple Pattern Support on a Voice Dial Peer

The Multiple Pattern Support on a Voice Dial Peer feature enables you to configure multiple patterns on a VoIP dial peer using an E.164 pattern map. A dial peer can be configured to match multiple patterns to an incoming calling or called number or an outgoing destination number.

- Feature Information for Multiple Pattern Support on a Voice Dial Peer, on page 187
- Restrictions for Multiple Pattern Support on a Voice Dial Peer, on page 188
- Information About Multiple Pattern Support on a Voice Dial Peer, on page 188
- Configuring Multiple Pattern Support on a Voice Dial Peer, on page 188
- Verifying Multiple Pattern Support on a Voice Dial Peer, on page 190
- Configuration Examples for Multiple Pattern Support on a Voice Dial Peer, on page 192

Feature Information for Multiple Pattern Support on a Voice Dial Peer

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuring Multiple Pattern Support on a Voice Dial Peer (Inbound Calls)</td>
<td>Cisco IOS 15.4 (1)T</td>
<td>This feature was extended for inbound VoIP dial peers for incoming calling and called numbers.</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE 3.11S</td>
<td>The following commands were introduced or modified: <strong>incoming called e164-pattern-map</strong>, <strong>incoming calling e164-pattern-map</strong></td>
</tr>
</tbody>
</table>
### Feature Information

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuring Multiple Pattern Support on a Voice Dial Peer (Outbound Calls)</td>
<td>Cisco IOS 15.2(4)M Cisco IOS XE 3.7S</td>
<td>This feature allows you to add more than one E.164 destination pattern inside a pattern map and configure that pattern map for one or more VoIP dial peers. This feature is supported for outbound peers only. The following commands were introduced or modified: destination e164-pattern-map, e164, show voice class e164-pattern-map-url, voice class e164-pattern-map load, voice class e164-pattern-map.</td>
</tr>
</tbody>
</table>

### Restrictions for Multiple Pattern Support on a Voice Dial Peer

- This feature is supported only on a VoIP dial peer.
- Duplicate patterns cannot be added to a pattern map.

### Information About Multiple Pattern Support on a Voice Dial Peer

Matching an incoming or outgoing call using a pattern defined in a VoIP dial peer is an existing feature on the Cisco Unified Border Element (Enterprise) and Session Initiation Protocol (SIP) Gateway. You can now support multiple patterns on a VoIP dial peer using an E.164 pattern map. You can create a E.164 pattern map and then link it to one or more VoIP dial peers.

When a pattern is the only source to enable a dial peer, a valid E.164 pattern map enables the linked dial peers, whereas an invalid E.164 pattern map disables the linked dial peers. Additionally, whenever an E.164 pattern map is created or reloaded, one or more dial peers linked with an E.164 pattern map is enabled or disabled based on the validation of a pattern map.

You can match a pattern map to an incoming calling or called number or an outgoing destination number.

When a dial peer has multiple patterns, the pattern with the longest prefix is considered as the matching criteria.

### Configuring Multiple Pattern Support on a Voice Dial Peer

**SUMMARY STEPS**

1. `enable`
2. configure terminal
3. voice class e164-pattern-map pattern-map-id
4. Do one of the following:
   • e164 pattern-map-tag
   • url url
5. (Optional) description string
6. exit
7. dial-peer voice dial-peer-id voip
8. \{ destination | incoming called | incoming calling \} e164-pattern-map pattern-map-group-id
9. end
10. (Optional) voice class e164-pattern-map load pattern-map-group-id
11. show dial-peer voice [summary | dial-peer-id]

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td>enable</td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Creates a pattern map for configuring one or multiple E.164 patterns on a dial peer and enters voice class configuration mode.</td>
</tr>
<tr>
<td>voice class e164-pattern-map pattern-map-id</td>
<td>Creates a pattern map for configuring one or multiple E.164 patterns on a dial peer and enters voice class configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Creates a pattern map for configuring one or multiple E.164 patterns on a dial peer and enters voice class configuration mode.</td>
</tr>
<tr>
<td>Device(config)# voice class e164-pattern-map 1111</td>
<td>Creates a pattern map for configuring one or multiple E.164 patterns on a dial peer and enters voice class configuration mode.</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Configure one or more E.164 telephone number prefix match patterns for the pattern map.</td>
</tr>
<tr>
<td>Do one of the following:</td>
<td>Configure one or more E.164 telephone number prefix match patterns for the pattern map.</td>
</tr>
<tr>
<td>• e164 pattern-map-tag</td>
<td>Configure one or more E.164 telephone number prefix match patterns for the pattern map.</td>
</tr>
<tr>
<td>• url url</td>
<td>Configure one or more E.164 telephone number prefix match patterns for the pattern map.</td>
</tr>
<tr>
<td>Example:</td>
<td>Configure one or more E.164 telephone number prefix match patterns for the pattern map.</td>
</tr>
<tr>
<td>Using URL text file:</td>
<td>Configure one or more E.164 telephone number prefix match patterns for the pattern map.</td>
</tr>
<tr>
<td>Device(voice-class)# url <a href="http://http-host/config-files/pattern-map.cfg">http://http-host/config-files/pattern-map.cfg</a></td>
<td>Configure one or more E.164 telephone number prefix match patterns for the pattern map.</td>
</tr>
<tr>
<td>Directly specifying match patterns:</td>
<td>Configure one or more E.164 telephone number prefix match patterns for the pattern map.</td>
</tr>
<tr>
<td>Device(voice-class)# e164 5557123</td>
<td>Configure one or more E.164 telephone number prefix match patterns for the pattern map.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td></td>
</tr>
</tbody>
</table>
(Optional) **description** *string*  
Example:  
Device(voice-class)# **description** *It has 1 entry* | Provides a description for the pattern map. |
| **Step 6** | 
**exit**  
Example:  
Device(voice-class)# **exit** | Exits voice class configuration mode and enters global configuration mode. |
| **Step 7** | 
**dial-peer voice dial-peer-id voip**  
Example:  
Device(config)# **dial-peer voice 2222 voip** | Defines a VoIP dial peer and enters dial peer configuration mode. |
| **Step 8** | 
*{destination | incoming called | incoming calling}*  
e164-pattern-map *pattern-map-group-id*  
Example:  
Device(config-dial-peer)# **incoming calling e164-pattern-map 1111** | Links a pattern-map group with a dial peer.  
• Use the **destination** keyword for outbound dial peers.  
• Use the **incoming called** or **incoming calling** keywords for inbound dial peers using called or calling numbers. |
| **Step 9** | 
**end**  
Example:  
Device(config-dial-peer)# **end** | Exits dial peer configuration mode and enters privileged EXEC mode. |
| **Step 10** | 
(Optional) **voice class e164-pattern-map load pattern-map-group-id**  
Example:  
Device# **voice class e164-pattern-map load 1111** | Loads the specified pattern map with E.164 match patterns from a text file configured in the pattern map.  
• This step is required only if patterns have been defined for the specified pattern map using a file URL in Step 4. |
| **Step 11** | 
**show dial-peer voice [summary | dial-peer-id]**  
Example:  
Device# **show dial-peer voice 1111** | Displays the status of a pattern map when the pattern map is associated with a dial peer. |

**Verifying Multiple Pattern Support on a Voice Dial Peer**

**SUMMARY STEPS**

1. **show voice class e164-pattern-map [summary | pattern-map-id]**  
2. **show dial-peer voice [summary | dial-peer-id]**
3. show dialplan incall {sip | h323} {calling | called} e164-pattern

DETAILED STEPS

Step 1  show voice class e164-pattern-map  [summary | pattern-map-id]
Displays the status and contents of a specified pattern map or a status summary of all pattern maps.

Example:
Device# show voice class e164-pattern-map 200

  e164-pattern-map 200
  -----------------------------------------
  It has 1 entries
  It is not populated from a file.
  Map is valid.

E164 pattern
--------------
200

Step 2  show dial-peer voice  [summary | dial-peer-id]
Displays the status of pattern maps associated with all or a specified dial peer.

Example:
Device# show dial-peer voice | include e164-pattern-map

  incoming calling e164-pattern-map tag = '200' status = valid,
  destination e164-pattern-map tag = 3000 status = valid,

Device# show dial-peer voice 2222 | include e164-pattern-map

  incoming calling e164-pattern-map tag = '200' status = valid,

Step 3  show dialplan incall {sip | h323} {calling | called} e164-pattern
Displays inbound dial peer details and associated pattern maps based on an incoming calling or called number.

Example:
Device# show dialplan incall voip calling 23456

VoiceOverIpPeer1234567
  peer type = voice, system default peer = FALSE, information type = voice,
  description = '',
  tag = 1234567, destination-pattern = '',
  destination e164-pattern-map tag = 200 status = valid,
  destination dpg tag = 200 status = valid,
  voice reg type = 0, corresponding tag = 0,
  allow watch = FALSE
  answer-address = '', preference=0,
  incoming calling e164-pattern-map tag = '200' status = valid,
  CLID Restriction = None
Configuration Examples for Multiple Pattern Support on a Voice Dial Peer

Example: Configuring Multiple Patterns for Outbound Dial Peers Using a File URL

Device# voice class e164-pattern-map 1111
Device(voice-class)# url http://http-host/config-files/pattern-map.cfg
Device(voice-class)# description For Outbound Dial Peer
Device(voice-class)# exit
Device(config)# dial-peer voice 2222 voip
Device(voice-dial-peer)# destination e164-pattern-map 1111
Device(voice-dial-peer)# exit
Device(config)# voice class e164-pattern-map load 1111
Device(config)# end

Example: Configuring Multiple Patterns for Outbound Dial Peers by Specifying Each E164 Pattern

Device# voice class e164-pattern-map 1112
Device(voice-class)# e164 5557456
Device(voice-class)# e164 5557455
Device(voice-class)# e164 5557454
Device(voice-class)# e164 5557453
Device(voice-class)# e164 5557452
Device(voice-class)# description For Outbound Dial Peer
Device(voice-class)# exit
Device(config)# dial-peer voice 2222 voip
Device(config)# destination e164-pattern-map 1112
Device(config)# end

Example: Configuring Multiple Patterns for Inbound Dial Peer

Device# voice class e164-pattern-map 1113
Device(voice-class)# url http://http-host/config-files/pattern-map.cfg
Device(voice-class)# description For Inbound Dial Peer
Device(voice-class)# exit
Device(config)# dial-peer voice 2222 voip
Device(config)# incoming calling e164-pattern-map 1113
Device(config)# exit
Device(config)# voice class e164-pattern-map load 1113
Device(config)# end
Outbound Dial-Peer Group as an Inbound Dial-Peer Destination

This feature can group multiple outbound dial peers into a dial-peer group and configure this dial-peer group as the destination of an inbound dial peer.

- Feature Information for Outbound Dial-Peer Group as an Inbound Dial-Peer Destination, on page 193
- Restrictions, on page 194
- Information About Outbound Dial-Peer Group as an Inbound Dial-Peer Destination, on page 194
- Configuring Outbound Dial-Peer Group as an Inbound Dial-Peer Destination, on page 195
- Verifying Outbound Dial-Peer Groups as an Inbound Dial-Peer Destination, on page 197
- Troubleshooting Tips, on page 198
- Configuration Examples for Outbound Dial Peer Group as an Inbound Dial-Peer Destination, on page 199

Feature Information for Outbound Dial-Peer Group as an Inbound Dial-Peer Destination

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

| Feature Name                  | Releases     | Feature Information                                                                 |
|-------------------------------|--------------|====================================================================================|
| Support for POTS dial-peer    | Cisco IOS 15.5(1)T  
                              | Cisco IOS XE 3.14S              | An outgoing POTS dial peer can be part of a dial-peer group. An inbound POTS dial peer can have a dial-peer group as the destination. |
### Feature Information

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outbound Dial-Peer Group as an Inbound Dial-Peer Destination</td>
<td>Cisco IOS 15.4(1)T Cisco IOS XE 3.11S</td>
<td>This feature groups multiple outbound dial-peers into a dial-peer group and configures this dial-peer group as a destination of an inbound dial peer. The following commands were introduced or modified: <code>voice class dpg</code>, <code>description</code>, <code>dial-peer preference</code>, <code>destination dpg</code>, <code>show voice class dpg</code>.</td>
</tr>
</tbody>
</table>

### Restrictions

- If a dial-peer group is in the shutdown state, regular dial-peer search occurs.
- If all dial peers in an active dial-peer group are unavailable, call is disconnected.
- The number of matched digits is zero.
- The `destination-pattern` command is required on the outbound dial peer even matching is not done based on this command.
- The outgoing call setup is deferred until inter-digit timer expires or a terminator is entered.

For POTS dial peers:

- Two-stage dialing is not supported.
- Overlapping dialing is not supported.
- TCL and VXML routing changes are not supported.
- Digit-stripping is not supported.

### Information About Outbound Dial-Peer Group as an Inbound Dial-Peer Destination

You can group up to 20 outbound (H.323, SIP or POTS) dial peers into a dial-peer group and configure this dial-peer group as the destination of an inbound dial peer. Once an incoming call is matched by an inbound dial peer with an active destination dial-peer group, dial peers from this group are used to route the incoming call. No other outbound dial-peer provisioning to select outbound dial peers is used.

A preference can be defined for each dial peer in a dial-peer group. This preference is used to decide the order of selection of dial peers from the group for the setup of an outgoing call.

You can also specify various dial-peer hunt mechanism using the existing `dial-peer hunt` command.
Configuring Outbound Dial-Peer Group as an Inbound Dial-Peer Destination

Perform this task to configure a dial-peer group with multiple outbound peers and an inbound dial peer referencing this dial-peer group as a destination.

Before you begin

- Configure SIP, H.323 or POTS outbound dial peers to be associated with a dial-peer group.
- For an outbound POTS dial peer, ensure that destination-pattern .T and no digit-strip are configured to avoid unexpected dialed digit strip.

SUMMARY STEPS

1. enable
2. configure terminal
3. dial-peer voice outbound-dial-peer-id [voip | pots]
4. destination-pattern pattern
5. no digit-strip for POTS dial peers.
6. exit
7. (Optional) dial-peer hunt hunt-order-number
8. voice class dpg dial-peer-group-id
9. dial-peer outbound-dial-peer-id [preference preference-order]
10. (Optional) description string
11. exit
12. dial-peer voice inbound-dial-peer-id [voip | pots]
13. destination dpg dial-peer-group-id
14. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>enable</td>
</tr>
<tr>
<td>Example:</td>
<td>Device&gt; enable</td>
</tr>
<tr>
<td></td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>configure terminal</td>
</tr>
<tr>
<td>Example:</td>
<td>Device# configure terminal</td>
</tr>
<tr>
<td></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>dial-peer voice outbound-dial-peer-id [voip</td>
</tr>
<tr>
<td>Example:</td>
<td>Defines a dial peer and enters dial peer configuration mode.</td>
</tr>
</tbody>
</table>
### Configuring Outbound Dial-Peer Group as an Inbound Dial-Peer Destination

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>For VoIP dial peer:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config)# dial-peer voice 123 voip</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>For POTS dial peer:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# dial-peer voice 345 pots</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td></td>
</tr>
<tr>
<td>destination-pattern pattern</td>
<td>Configures a destination pattern. This step is required even though the value is not used for dial-peer matching.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>For VoIP Dial Peers</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# destination-pattern 100</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>For POTS Dial Peers</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# destination-pattern .T</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td></td>
</tr>
<tr>
<td>no digit-strip for POTS dial peers.</td>
<td>Disable unexpected dialed digit strip.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# no digit-strip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td></td>
</tr>
<tr>
<td>exit</td>
<td>Exits to global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# exit</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td></td>
</tr>
<tr>
<td>(Optional) dial-peer hunt hunt-order-number</td>
<td>Specifies a hunt selection mechanism for dial peers.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config)# dial-peer hunt 0</td>
<td>• The default mechanism is random selection.</td>
</tr>
<tr>
<td><strong>Step 8</strong></td>
<td></td>
</tr>
<tr>
<td>voice class dpg dial-peer-group-id</td>
<td>Creates a dial-peer group for grouping multiple outbound dial peers and enters voice class configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice class dpg 181</td>
<td>• You can use the shutdown command to resume regular outbound dial-peer provisioning in dial-peers with this dial-peer group as destination.</td>
</tr>
<tr>
<td><strong>Step 9</strong></td>
<td></td>
</tr>
<tr>
<td>dial-peer outbound-dial-peer-id [preference preference-order]</td>
<td>Associates a configured outbound dial peer with this dial-peer group and configures a preference value.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-class)# dial-peer 123 preference 1</td>
<td>• Repeat this step for all outbound dial-peers that need to be added to this dial-peer group.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Step 10</strong></td>
<td>If preference is not specified, the order of selection is random or as specified by the <code>dial-peer hunt</code> command.</td>
</tr>
<tr>
<td><code>(Optional) description string</code></td>
<td>Provides a description for the dial-peer group.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-class)# description Boston Destination</td>
</tr>
<tr>
<td><strong>Step 11</strong></td>
<td>Exits voice class configuration mode and enters global configuration mode.</td>
</tr>
<tr>
<td><code>exit</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-class)# exit</td>
</tr>
<tr>
<td><strong>Step 12</strong></td>
<td>Defines a dial peer and enters dial peer configuration mode.</td>
</tr>
<tr>
<td>`dial-peer voice inbound-dial-peer-id [voip</td>
<td>pots]`</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>For VoIP dial peer:</td>
</tr>
<tr>
<td></td>
<td>Device(config)# dial-peer voice 789 voip</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>For POTS dial peer:</td>
</tr>
<tr>
<td></td>
<td>Device(config)# dial-peer voice 678 pots</td>
</tr>
<tr>
<td><strong>Step 13</strong></td>
<td>Specifies a dial peer group from which an outbound dial peer can be chosen.</td>
</tr>
<tr>
<td><code>destination dpg dial-peer-group-id</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-dial-peer)# destination dpg 181</td>
</tr>
<tr>
<td><strong>Step 14</strong></td>
<td>Exits dial peer configuration mode and enters privileged EXEC mode.</td>
</tr>
<tr>
<td><code>end</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-dial-peer)# end</td>
</tr>
</tbody>
</table>

## Verifying Outbound Dial-Peer Groups as an Inbound Dial-Peer Destination

### SUMMARY STEPS
1. `show voice class dpg dial-peer-group-id`
2. `show dial-peer voice inbound-dial-peer-id`
DETAILED STEPS

Step 1  show voice class dpg  dial-peer-group-id
Displays the configuration of an outbound dial-peer group.

Example:
Device# show voice class dpg 200

Voice class dpg: 200  AdminStatus: Up
Description: Boston Destination
Total dial-peer entries: 4

<table>
<thead>
<tr>
<th>Peer Tag</th>
<th>Pref</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>1</td>
</tr>
<tr>
<td>1002</td>
<td>2</td>
</tr>
<tr>
<td>1004</td>
<td>0</td>
</tr>
<tr>
<td>1003</td>
<td>1</td>
</tr>
</tbody>
</table>

Step 2  show dial-peer voice  inbound-dial-peer-id
Displays the referencing of destination dial-peer group from an inbound dial peer.

Example:
Device# show dial-peer voice 100 | include destination dpg

destination dpg tag = 200 status = valid,

Troubleshooting Tips

SUMMARY STEPS

1. Enter the following:
   • debug voip dialpeer inout
   • debug voip ccapi inout

DETAILED STEPS

Enter the following:
   • debug voip dialpeer inout
   • debug voip ccapi inout

Displays the configuration of an outbound dial-peer group.

Example:
Incoming dial peer is first matched:

Result=Success(); **Incoming Dial-peer=600 Is Matched**
*Jul 19 10:15:53.310 IST: //~/ED647BD1B0F9/DPM/dpMatchCore:
    Dial String=4001, Expanded String=4001, Calling Number=
    Timeout=TRUE, Is Incoming=TRUE, Peer Info Type=DIALPEER_INFO_SPEECH
*Jul 19 10:15:53.310 IST: //~/xxxxxxxxxxxx/DPM/vepm_match_pattern_map:
    DEPM 1000 use caching dialstring 4001 status 0
*Jul 19 10:15:53.310 IST: //~/ED647BD1B0F9/DPM/MatchNextPeer:

The dial-peer group associated with a dial peer is selected:

*Jul 19 10:15:53.311 IST: //~/ED647BD1B0F9/DPM/dpMatchPeersCore:
    Outbound Destination DPG Group Request; Destination DPG=1
*Jul 19 10:15:53.311 IST: //~/ED647BD1B0F9/DPM/dpMatchDestDPGroup:
    Result=0
*Jul 19 10:15:53.311 IST: //~/ED647BD1B0F9/DPM/dpMatchPeersCore:
    Result=SUCCESS() after DestDPGroup
*Jul 19 10:15:53.311 IST: //~/ED647BD1B0F9/DPM/dpMatchSafModulePlugin:
    dialstring=NULL, saf_enabled=0, saf_dndb_lookup=1, dp_result=0

List of active Dial-peers configured within the DPG, sorted by preference:

*Jul 19 10:15:53.311 IST: //~/ED647BD1B0F9/DPM/dpMatchPeersMoreArg:
    Result=SUCCESS()
    List of Matched Outgoing Dial-peer(s):
    1: Dial-peer Tag=1004
    2: Dial-peer Tag=1001
    3: Dial-peer Tag=1003
    4: Dial-peer Tag=1002

---

**Configuration Examples for Outbound Dial Peer Group as an Inbound Dial-Peer Destination**

Device> enable
Device# configure terminal
    ! Configuring outbound dial peers that are to be grouped.
Device(config)# dial-peer voice 1001 voip
Device(config)# destination-pattern 1001
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target ipv4:10.1.1.1
Verifying Outbound Dial-Peer Group Configuration

Device# show voice class dpg 200

Voice class dpg: 200   AdminStatus: Up
Description: Boston Destination
Total dial-peer entries: 4

<table>
<thead>
<tr>
<th>Peer Tag</th>
<th>Pref</th>
</tr>
</thead>
<tbody>
<tr>
<td>--------</td>
<td>----</td>
</tr>
<tr>
<td>1001</td>
<td>1</td>
</tr>
<tr>
<td>1002</td>
<td>2</td>
</tr>
<tr>
<td>1004</td>
<td>0</td>
</tr>
<tr>
<td>1003</td>
<td>1</td>
</tr>
</tbody>
</table>
Verifying Inbound Dial-Peer Referencing Outbound Dial-Peer Group

Device# `show dial-peer voice 100 | include destination dpg`

  destination dpg tag = 200 status = valid,

Device# `show dial-peer voice 600 | include destination dpg`

  destination dpg tag = 200 status = valid,
Configuration Examples for Outbound Dial Peer Group as an Inbound Dial-Peer Destination
Inbound Leg Headers for Outbound Dial-Peer Matching

The Inbound Leg Headers for Outbound Dial-Peer Matching feature allows you to match and provision an outbound dial peer for an outbound call leg using the headers from an inbound call leg. The following headers of an incoming call leg can be used for outbound dial-peer matching:

- VIA (SIP Header)
- FROM (SIP Header)
- TO (SIP Header)
- DIVERSION (SIP Header)
- REFERRED BY (SIP Header)
- Called Number
- Calling Number
- Carrier ID

- Feature Information for Inbound Leg Headers for Outbound Dial-Peer Matching, on page 203
- Prerequisites for Inbound Leg Headers for Outbound Dial-Peer Matching, on page 204
- Restrictions for Inbound Leg Headers for Outbound Dial-Peer Matching, on page 204
- Information About Inbound Leg Headers for Outbound Dial-Peer Matching, on page 204
- Configuring Inbound Leg Headers for Outbound Dial-Peer Matching, on page 205
- Verifying Inbound Leg Headers for Outbound Dial-Peer Matching, on page 208
- Configuration Example: Inbound Leg Headers for Outbound Dial-Peer Matching, on page 210

Feature Information for Inbound Leg Headers for Outbound Dial-Peer Matching

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
Table 28: Feature Information for Inbound Leg Headers for Outbound Dial-Peer Matching

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbound Leg Headers for Outbound Dial-Peer Matching</td>
<td>15.4(2)T, Cisco IOS XE Release 3.12S</td>
<td>The Inbound Leg Headers for Outbound Dial-Peer Matching feature allows you to match and provision an outbound call leg using the headers of an inbound call leg. The following commands were introduced by this feature: destination provision-policy, destination uri-via, destination uri-to, destination uri-from, destination uri-diversion, destination uri-referred-by, show voice class dial-peer provision-policy. The following commands were modified. show command incall, show dialplan dialpeer.</td>
</tr>
</tbody>
</table>

Prerequisites for Inbound Leg Headers for Outbound Dial-Peer Matching

• CUBE or Voice Gateway must be configured.

Restrictions for Inbound Leg Headers for Outbound Dial-Peer Matching

• The existing header-passing command supports modification of SIP headers of INVITE message by the Tool Command Language (TCL) application. If the above SIP headers are modified by the TCL application, they cannot be used for outbound dial-peer provisioning.

• If multiple SIP via headers and diversion headers are found in an incoming INVITE or REFER message, only the top-most via header and top-most diversion header of an incoming INVITE or REFER message are used for outbound dial-peer provisioning.

• When an incoming call is matched to an inbound dial peer with an associated provision profile without rules, outbound dial-peer provisioning is disabled and the incoming call is disconnected by CUBE or voice gateway with cause code "unassigned number (1)".

Information About Inbound Leg Headers for Outbound Dial-Peer Matching

This feature allows you to match headers of an inbound call leg and provision an outbound dial peer for an outbound call leg. The following SIP headers of an incoming call leg can be used for outbound dial-peer matching:

• VIA (SIP Header)
The above headers are retrieved from an incoming INVITE or REFER message and used for outbound dial-peer provisioning.

SIP headers of an INVITE message are saved to an associated call leg. For example, an INVITE message is received for a new call leg A. Then, SIP headers are saved to call leg A itself for outbound dial-peer lookup.

On the other hand, SIP headers of a REFER message are saved to the peer call leg of the associated call leg. For example, call leg A and call leg B are connected in CUBE. The party at Call Leg B makes a blind transfer to the party at Call Leg C. A REFER message is received in CUBE for call leg B (transferor). But, SIP headers of the REFER message are saved under call leg A (transferee) for an outbound dial-peer lookup for Party C.

### Configuring Inbound Leg Headers for Outbound Dial-Peer Matching

#### Before you begin

Necessary pattern maps have been configured.

#### SUMMARY STEPS

1. enable
2. configure terminal
3. voice class dial-peer provision-policy *tag*
4. (Optional) description *string*
5. preference *preference-order* first-attribute second-attribute
6. exit
7. dial-peer voice *inbound-dial-peer-tag* *voip*
8. destination provision-policy *tag*
9. exit
10. dial-peer voice *outbound-dial-peer-tag* *voip*
11. Configure a match command for an outbound dial peer according to the provision policy rule attribute configured.
12. end

#### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
</tbody>
</table>
### Purpose

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device&gt; enable</td>
<td>Enters global configuration mode.</td>
</tr>
</tbody>
</table>

#### Step 2

**Command:** configure terminal

**Example:**

Device# configure terminal

#### Step 3

**Command:** voice class dial-peer provision-policy *tag*

**Example:**

Device(config)# voice class dial-peer provision-policy 200

- Creates a provision policy profile in which a set of attributes for dial-peer matching can be defined.
- You can use the **shutdown** command to deactivate the provision policy and allow normal outbound dial-peer provisioning.

#### Step 4

**Command:** (Optional) description *string*

**Example:**

Device(voice-class)# description match both calling and called

- Provides a description for the provision policy profile.

#### Step 5

**Command:** preference *preference-order first-attribute second-attribute*

<table>
<thead>
<tr>
<th>First Attribute</th>
<th>Second Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>diversion</td>
<td>from, referred-by, to, uri, via</td>
</tr>
<tr>
<td>from</td>
<td>diversion, referred-by, to, uri, via</td>
</tr>
<tr>
<td>referred-by</td>
<td>diversion, from, to, uri, via</td>
</tr>
<tr>
<td>to</td>
<td>diversion, referred-by, from, uri, via</td>
</tr>
<tr>
<td>uri</td>
<td>diversion, referred-by, to, from, via, carrier-id</td>
</tr>
<tr>
<td>via</td>
<td>diversion, referred-by, to, uri, via</td>
</tr>
<tr>
<td>called</td>
<td>calling, carrier-id</td>
</tr>
<tr>
<td>calling</td>
<td>called</td>
</tr>
<tr>
<td>carrier-id</td>
<td>called, uri</td>
</tr>
</tbody>
</table>

**Example:**

Device(voice-class)# preference 2 calling called

- Configures a provision policy rule.
  - You can configure up to two rules. This means up to four attributes can be configured for matching outbound dial peers.
  - If rules are not configured, outbound dial-peer provisioning is disabled, and an incoming call matched to an inbound dial peer associated with this profile is disconnected by CUBE or voice gateway with cause code “unassigned number (1)”.

#### Step 6

**Command:** exit

**Example:**

Device(voice-class)# exit

- Exits voice class configuration mode and enters global configuration mode.
<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td><code>dial-peer voice inbound-dial-peer-tag voip</code></td>
<td>Enters dial peer configuration mode for an inbound dial peer.</td>
</tr>
</tbody>
</table>
| 8    | `destination provision-policy tag` **Example:**
Device(config)# dial-peer voice 100 voip
Device(config-dial-peer)# destination provision-policy 200
Device(config)# exit | Associates a provision policy profile with an inbound dial peer. |
| 9    | `exit` | Exits dial peer configuration mode. |
| 10   | `dial-peer voice outbound-dial-peer-tag voip` | Enters dial peer configuration mode for an outbound dial peer. |
| 11   | Configure a match command for an outbound dial peer according to the provision policy rule attribute configured. | Configure a match command based on any of the four attributes defined in the provision policy rule. |

<table>
<thead>
<tr>
<th>Provision Policy Rule Attribute</th>
<th>Dial-peer Match command</th>
</tr>
</thead>
</table>
| called                          | `destination-pattern pattern`
|                                 | `destination e164-pattern-map`
|                                 | `pattern-map-class-id`
| calling                         | `destination calling e164-pattern-map`
|                                 | `pattern-map-class-id`
| carrier-id                      | `carrier-id target`
| uri                             | `destination uri uri-class-tag`
| via                             | `destination uri-via uri-class-tag`
| to                              | `destination uri-to uri-class-tag`
| from                            | `destination uri-from uri-class-tag`
| diversion                       | `destination uri-diversion uri-class-tag`
| referred-by                     | `destination uri-referred-by uri-class-tag`

**Example:**
Device(config)# dial-peer voice 300 voip
Device(config-dial-peer)# destination uri-from 200
Device(config)# exit

| Step 12 | `end` | Exits dial peer configuration mode and enters privileged EXEC mode. |

**Example:**

- Enters dial peer configuration mode for an inbound dial peer.
- Associates a provision policy profile with an inbound dial peer.
- Exits dial peer configuration mode.
- Enters dial peer configuration mode for an outbound dial peer.
- Configures a match command based on any of the four attributes defined in the provision policy rule.
- Exits dial peer configuration mode and enters privileged EXEC mode.
Verifying Inbound Leg Headers for Outbound Dial-Peer Matching

SUMMARY STEPS

1. `show dialplan incall {sip | h323} {calling | called} e164-pattern | include voice`
2. `show dialplan dialpeer inbound-dial-peer-id number e164-pattern [timeout] | include Voice`
3. `show voice class dial-peer provision-policy`

DETAILED STEPS

Step 1  `show dialplan incall {sip | h323} {calling | called} e164-pattern | include voice`

Displays inbound dial peers based on an incoming calling or called number. Once you have the dial peer number, you can use it to search for the complete dial-peer details in the running-config.

Example:

```
Device# show dialplan incall sip calling 3333 | include Voice
VoiceOverIpPeer1

Device# show dialplan incall sip calling 4444 | include Voice
VoiceOverIpPeer1

Device# show running-config | section dial-peer voice 1 voip
dial-peer voice 1 voip
  destination dp 10000
  incoming calling e164-pattern-map 100
dtmf-relay rtp-nte
  codec g711ulaw

Device# show dialplan incall sip called 6000 timeout | include Voice
VoiceOverIpPeer100

Device# show running-config | section dial-peer voice 100 voip
dial-peer voice 100 voip
  incoming called e164-pattern-map 1
  incoming calling e164-pattern-map 1
dtmf-relay rtp-nte
  codec g711ulaw

Device# show dialplan incall voip calling 23456
VoiceOverIpPeer1234567
  peer type = voice, system default peer = FALSE, information type = voice,
  description = '',
  tag = 1234567, destination-pattern = '',
  destination e164-pattern-map tag = 200 status = valid,
```
Step 2  
show dialplan dialpeer inbound-dial-peer-id number e164-pattern (timeout) | include Voice
Displays a list of outbound dial peers based on a specified inbound dial peer. This command line will be helpful find a list of outbound dial peer of a destination dial-peer group.

Example:
Device# show dialplan dialpeer 1 number 23457 timeout | include Voice
VoiceOverIpPeer100013
VoiceOverIpPeer100012

Example:
voice class dial-peer provision-policy 2000
  preference 2 diversion to
  !
  ...
  !
dial-peer voice 32555 voip
  session protocol sipv2
  session target ipv4:1.5.14.9
  destination uri-diversion 1
  destination uri-to test2
  !
dial-peer voice 32991 voip
  destination provision-policy 2000
  incoming called-number 1234
  !
Device# show dialplan dialpeer 32991 number 2234 timeout
Macro Exp.: 2234
Enter Diversion header:sip:1234@cisco.com
Enter To header:sip:2234@10.0.0.0
VoiceOverIpPeer32134
  peer type = voice, system default peer = FALSE, information type = voice,
  description = "",

Step 3  
show voice class dial-peer provision-policy
Displays a list of configured provision policies and associated rules.

Example:
Device# show voice class dial-peer provision-policy
Voice class dial-peer provision-policy: 100  AdminStatus: Up
Description: match only called

Pref  Policy Rule
----  ------------
1     called

Voice class dial-peer provision-policy: 101  AdminStatus: Up
Description: match both calling and called

Pref  Policy Rule
Configuration Example: Inbound Leg Headers for Outbound Dial-Peer Matching

Example: Configuring Inbound Called or Calling Numbers Used for Outbound Dial-Peer Matching

Device> enable
Device# configure terminal

Device(config)# voice class dial-peer provision-policy 200
Device(config)# description match both calling and called
Device(config)# preference 2 calling called
Device(config)# exit

Device(config)# voice class e164-pattern-map 300
Device(config)# description patterns
Device(config)# e164 5557123
Device(config)# e164 5558123
Device(config)# e164 5559123
Device(config)# exit

!Associating the Provision Policy with an Inbound Dial Peer
Device(config)# dial-peer voice 100 voip
Device(config-dial-peer)# destination provision-policy 200
Device(config-dial-peer)# end

!Associates a Pattern Map with an Outbound Dial Peer.
! The called number in the SIP headers of the inbound leg is matched to select the below
outbound dial peer.
Device(config)# dial-peer voice 200 voip
Device(config-dial-peer)# destination e164-pattern-map 300
Device(config-dial-peer)# end

Example: Configuring Inbound SIP Headers for Outbound Dial-Peer Matching

Device> enable
Device# configure terminal

Device(config)# voice class dial-peer provision-policy 200
Device(voice-class)# description match both calling and called
Device(voice-class)# preference 2 via from
Device(voice-class)# exit

!Associating the Provision Policy with an Inbound Dial Peer
Device(config)# dial-peer voice 100 voip
Device(config-dial-peer)# destination provision-policy 200
Device(config-dial-peer)# end

Device(config)# voice class uri 200 sip
Device(config-voice-uri-clas)# pattern 25054..

!Associates a Provision Policy with an Outbound Dial Peer.
The FROM SIP headers of the inbound leg is matched to select the below outbound dial peer.
Device(config)# dial-peer voice 200 voip
Device(config-dial-peer)# destination uri-from 200
Device(config-dial-peer)# end
Configuration Example: Inbound Leg Headers for Outbound Dial-Peer Matching
CHAPTER 18

Server Groups in Outbound Dial Peers

This feature configures a server group (group of server addresses) that can be referenced from an outbound dial peer.

- Feature Information for Configuring Server Groups in Outbound Dial Peers, on page 213
- Information About Server Groups in Outbound Dial Peers, on page 214
- How to Configure Server Groups in Outbound Dial Peers, on page 214
- Configuration Examples for Server Groups in Outbound Dial Peers, on page 217

Feature Information for Configuring Server Groups in Outbound Dial Peers

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 29: Feature Information for Configuring Server Groups in Outbound Dial Peers

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuring Server Groups in Outbound Dial Peers</td>
<td>Cisco IOS XE Release 3.11S 15.4(1)T</td>
<td>This feature configures server groups (groups of IPv4 and IPv6 addresses) which can be referenced from an outbound SIP dial peer. The following commands were introduced or modified: voice class server-group, description, ipv4 port preference, ipv6 port preference, hunt-scheme, show voice class server-group, shutdown (Server Group).</td>
</tr>
</tbody>
</table>
Information About Server Groups in Outbound Dial Peers

You can now group IPv4 and IPv6 addresses of servers and configure it as in an outbound SIP dial-peer destination. A server group is first created and associated with a SIP outbound dial peer. When a call matches an outbound dial peer, a connection is made to one of the servers of the group, which can then route the call to the destination.

You can associate a preference with each of the servers in the group, which decides the order of selection for outgoing call setup.

You can also configure the round-robin selection of servers in the group.

You can configure up to five servers per server group.

If neither round robin nor preference order is configured, the selection of servers is random.

If the specified server-group is in shutdown mode, the referenced dial peers are not selected to route outgoing calls.

How to Configure Server Groups in Outbound Dial Peers

Configuring Server Groups in Outbound Dial Peers

SUMMARY STEPS

1. enable
2. configure terminal
3. voice class server-group server-group-id
4. {ipv4 | ipv6} address [port port] [preference preference-order]
5. (Optional) hunt-scheme round-robin
6. (Optional) description string
7. exit
8. dial-peer voice dial-peer-id voip
9. session protocol sipv2
10. destination-pattern [+| string [T]
11. session server-group server-group-id
12. end
13. show voice class server-group server-group-id

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| **Step 2** configure terminal  
  Example:  
  Device# configure terminal | Enters global configuration mode. |
| **Step 3** voice class server-group server-group-id  
  Example:  
  Device(config)# voice class server-group 171 | Configures a voice class server group and enters voice class configuration mode.  
  - You can use the **shutdown** command to make the server group inactive. |
| **Step 4** {ipv4 | ipv6} address [port port] [preference preference-order]  
  Example:  
  Device(config-class)# ipv4 10.1.1.1 preference 3 | Configures a server IP address as a part of this server group along with an optional port number and preference order.  
  - Repeat this step to add up to five servers to the server group.  
  - The servers are not selected by the preference value if round robin is configured in the next step.  
  - Default and highest value of preference is zero. |
| **Step 5** (Optional) hunt-scheme round-robin  
  Example:  
  Device(config-class)# hunt-scheme round-robin | Defines a hunt method for the order of selection of target server IP addresses (from the IP addresses configured for this server group) for the setting up of outgoing calls.  
  - If a hunt scheme is not defined, an available IP address of highest preference value is selected. If neither a round-robin hunt scheme nor a preference values is configured, the selection of servers is random. |
| **Step 6** (Optional) description string  
  Example:  
  Device(config-class)# description It has 3 entries | Provides a description for the server group. |
| **Step 7** exit  
  Example:  
  Device(config-class)# exit | Exits voice class mode and enters global configuration mode. |
| **Step 8** dial-peer voice dial-peer-id voip  
  Example:  
  Device(config)# dial-peer voice 123 voip | Defines a VoIP dial peer and enters dial peer configuration mode. |
| **Step 9** session protocol sipv2  
  Example:  
  Device(config)# session protocol sipv2 | Specifies SIP version 2 as the session protocol for calls between local and remote routers using the packet network. |
### Command or Action

```
Device(config-dial-peer)# session protocol sipv2
```

### Purpose

Specifies either the prefix or the full E.164 telephone number to be used for a dial peer.

### Step 10

**destination-pattern**  
`[+] string [T]`

**Example:**

```
Device(config-dial-peer)# destination-pattern +5550179
```

### Step 11

**session server-group**  
`server-group-id`

**Example:**

```
Device(config-dial-peer)# session server-group 171
```

### Step 12

**end**

**Example:**

```
Device(config-dial-peer)# end
```

### Step 13

**show voice class server-group**  
`server-group-id`

**Example:**

```
Device# show voice class server-group 171
```

### Verifying Server Groups in Outbound Dial Peers

#### SUMMARY STEPS

1. `show voice class server-group [server-group-id]`
2. `show voice class server-group dialpeer dial-peer-id`

#### DETAILED STEPS

**Step 1**

`show voice class server-group [server-group-id]`

Displays the configurations for all configured server groups or a specified server group.

**Example:**

```
Device# show voice class server-group 171
```

---

**Voice class server-group: 171**

<table>
<thead>
<tr>
<th>AdminStatus: Up</th>
<th>OperStatus: Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunt-Scheme: preference</td>
<td>Last returned server: 10.1.1.1</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>Total server entries: 3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pref</th>
<th>Type</th>
<th>IP Address</th>
<th>IP Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ipv4</td>
<td>10.1.1.1</td>
<td></td>
</tr>
</tbody>
</table>
Step 2  show voice class server-group dialpeer dial-peer-id

Displays the configurations for dial peers associated with server groups.

Example:
Device# show voice class server-group dialpeer 181

Voice class server-group: 171  AdminStatus: Up  
Hunt-Scheme: round-robin  
Total Remote Targets: 3

<table>
<thead>
<tr>
<th>Pref</th>
<th>Type</th>
<th>IP Address</th>
<th>IP Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ipv4</td>
<td>10.1.1.2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>ipv4</td>
<td>10.5.0.1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>ipv4</td>
<td>10.1.1.1</td>
<td></td>
</tr>
</tbody>
</table>

Configuration Examples for Server Groups in Outbound Dial Peers

Server Groups in Outbound Dial Peers (Preference-Based Selection)

! Configuring the Server Group  
Device(config)# voice class server-group 171  
Device(config-class)# ipv4 10.1.1.1 preference 1  
Device(config-class)# ipv4 10.1.1.2 preference 2  
Device(config-class)# ipv4 10.1.1.3 preference 3  
Device(config-class)# description It has 3 entries  
Device(config-class)# exit

! Configuring an outbound SIP dial peer.  
Device(config)# dial-peer voice 181 voip  
!Associate a destination pattern  
Device(config-dial-peer)# destination-pattern 3001  
Device(config-dial-peer)# session protocol sipv2  
!Associate a server group with the dial peer  
Device(config-dial-peer)# session server-group 171  
Device(config-dial-peer)# end

! Displays the configurations made for the outbound dial peer 181 associated with a server group  
Device# show voice class server-group dialpeer 181

Voice class server-group: 171  AdminStatus: Up  
Hunt-Scheme: preference  
Total Remote Targets: 3

<table>
<thead>
<tr>
<th>Pref</th>
<th>Type</th>
<th>IP Address</th>
<th>IP Port</th>
</tr>
</thead>
</table>
Server Groups in Outbound Dial Peers (Round-Robin-Based Selection)

! Configuring the Server Group
Device(config)# voice class server-group 171
Device(config-class)# ipv4 10.1.1.1
Device(config-class)# ipv4 10.1.1.2
Device(config-class)# ipv4 10.1.1.3
Device(config-class)# hunt-scheme round-robin
Device(config-class)# description It has 3 entries
Device(config-class)# exit

! Configuring an outbound SIP dial peer.
Device(config)# dial-peer voice 181 voip
! Associate a destination pattern
Device(config-dial-peer)# destination-pattern 3001
Device(config-dial-peer)# session protocol sipv2
! Associate a server group with the dial peer
Device(config-dial-peer)# session server-group 171
Device(config-dial-peer)# end

! Displays the configurations made for the outbound dial peer 181 associated with a server group
Device# show voice class server-group dialpeer 181

Voice class server-group: 171 AdminStatus: Up
Hunt-Scheme: round-robin
Total Remote Targets: 3

<table>
<thead>
<tr>
<th>Pref</th>
<th>Type</th>
<th>IP Address</th>
<th>IP Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ipv4</td>
<td>10.1.1.1</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>ipv4</td>
<td>10.1.1.2</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>ipv4</td>
<td>10.1.1.3</td>
<td></td>
</tr>
</tbody>
</table>

! Displays the configurations made for the server group.
Device# show voice class server-group 171

Voice class server-group: 171
AdminStatus: Up  OperStatus: Up
Hunt-Scheme: round-robin  Last returned server: 10.1.1.1
Description: It has 3 entries
Total server entries: 3

<table>
<thead>
<tr>
<th>Pref</th>
<th>Type</th>
<th>IP Address</th>
<th>IP Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ipv4</td>
<td>10.1.1.1</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>ipv4</td>
<td>10.1.1.2</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>ipv4</td>
<td>10.1.1.3</td>
<td></td>
</tr>
</tbody>
</table>
The Domain-based routing feature provides support for matching an outbound dial peer based on the domain name or IP address provided in the request URI of the incoming SIP message or an inbound dial peer.

Domain-based routing enables for calls to be routed on the outbound dialpeer based on the domain name or IP address provided in the request Uniform Resource Identifier (URI) of incoming Session IP message.

- Feature Information for Domain-Based Routing Support on the Cisco UBE, on page 221
- Restrictions for Domain-Based Routing Support on the Cisco UBE, on page 222
- Information About Domain-Based Routing Support on the Cisco UBE, on page 222
- How to Configure Domain-Based Routing Support on the Cisco UBE, on page 222
- Configuration Examples for Domain-Based Routing Support on the Cisco UBE, on page 228

Feature Information for Domain-Based Routing Support on the Cisco UBE

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.
### Table 30: Feature Information for Domain-Based Routing Support on the Cisco UBE

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain Based Routing Support on the Cisco UBE</td>
<td>15.2(1)T</td>
<td>The domain-based routing enables for calls to be routed on the outbound dial peer based on the domain name or IP address provided in the request URI (Uniform Resource Identifier) of incoming SIP message. The following commands were introduced or modified: <code>call-route</code>, <code>voice-class sip call-route</code>.</td>
</tr>
<tr>
<td>Domain Based Routing Support on the Cisco UBE</td>
<td>Cisco IOS XE Release 3.8S</td>
<td>The domain-based routing enables for calls to be routed on the outbound dial peer based on the domain name or IP address provided in the request URI (Uniform Resource Identifier) of incoming SIP message. The following commands were introduced or modified: <code>call-route</code>, <code>voice-class sip call-route</code>.</td>
</tr>
</tbody>
</table>

Any Internet Protocol (IP) addresses used in this document are not intended to be actual addresses. Any examples, command display output, and figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses in illustrative content is unintentional and coincidental. © 2011 Cisco Systems, Inc. All rights reserved

### Restrictions for Domain-Based Routing Support on the Cisco UBE

Domain-based routing support is available only for SIP-SIP call flows.

### Information About Domain-Based Routing Support on the Cisco UBE

When a dial peer has an application configured as a session application, then only the user parameter of the request URI is used and is sent from the inbound SIP SPI to the application. The session application performs a match on an outbound dial peer based on the user parameter of the request URI sent from the inbound dial peer. In the figure below, 567 is the user portion of the request-URI that is passed from the inbound dial peer to the application and the matching outbound dial-peer found is 1000.
With the introduction of the domain-based routing feature, all parameters including the domain name of the request URI will be sent to the application and the outbound dial peer can be matched with any parameter. In Figure 1, when the domain name example.com is used to match an outbound dial peer the resulting dial peer is 2000. The `call route url` command is used for configuring domain-based routing.

**How to Configure Domain-Based Routing Support on the Cisco UBE**

**Configuring Domain-Based Routing at Global Level**

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice service voip
4. sip
5. call-route url
6. exit

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
</tbody>
</table>
### Command or Action | Purpose
--- | ---
**Step 2**
configure terminal  
**Example:**  
Device# configure terminal  
Enters global configuration mode.

**Step 3**
voice service voip  
**Example:**  
Device(config)# voice service voip  
Enters voice service configuration mode.

**Step 4**
sip  
**Example:**  
Device(conf-voi-serv)# sip  
Enters voice service SIP configuration mode.

**Step 5**
call-route url  
**Example:**  
Device(conf-serv-sip)# call-route url  
Routes calls based on the URL.

**Step 6**
ext  
**Example:**  
Device(conf-serv-sip)# exit  
Exits the current mode.

---

## Configuring Domain-Based Routing at Dial Peer Level

**SUMMARY STEPS**

1. enable  
2. configure terminal  
3. dial-peer voice dial-peer tag voip  
4. voice-class sip call-route url  
5. exit

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
**Step 1**
enable  
**Example:**  
Device> enable  
Enables privileged EXEC mode.  
- Enter your password if prompted.

**Step 2**
configure terminal  
**Example:**  
Device# configure terminal  
Enters global configuration mode.
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 3</strong></td>
<td>Enter dial peer voice configuration mode.</td>
</tr>
<tr>
<td>dial-peer voice  dial-peer tag  voip</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config)# dial-peer voice 2 voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Routes calls based on the URL</td>
</tr>
<tr>
<td>voice-class sip call-route url</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)#</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Routes calls based on the URL</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td>exit</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# exit</td>
<td></td>
</tr>
</tbody>
</table>

**Verifying and Troubleshooting Domain-Based Routing Support on the Cisco UBE**

**SUMMARY STEPS**

1. enable
2. debug ccsip all
3. debug voip dialpeer in/out

**DETAILED STEPS**

**Step 1**

**enable**

Enables privileged EXEC mode.

**Example:**

Device> enable

**Step 2**

**debug ccsip all**

Enables all SIP-related debugging.

**Example:**

Device# debug ccsip all

Received:
Via: SIP/2.0/UDP [2208:1:1:1:1:1:1:1115]:5060;branch=z9hG4bK83AE3
Date: Tue, 01 Mar 2011 08:49:48 GMT
Supported: 100rel,timer,resource-priority,replaces
Verifying and Troubleshooting Domain-Based Routing Support on the Cisco UBE

require: sdp-anat
min-se: 1800
Cisco-Guid: 2948477781-1125585376-2396638033-3925258737
User-Agent: Cisco-SIPGateway/IOS-15.1(3.14.2)PIA16
allow: invite, options, bye, cancel, ack, prack, update, refer, subscribe, notify, info, register
CSeq: 101 invite
max-forwards: 70
timestamp: 1298969388
expires: 180
allow-events: telephone-event
content-type: application/sdp
content-disposition: session;handling=required
content-length: 495

v=0
s=SIP Call
c=IN IP6 2208:1:1:1:1:1:1:1115
t=0 0
a=group:ANAT 1 2
m=audio 17836 RTP/AVP 0 101 19
a=mid:1
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20
m=audio 18938 RTP/AVP 0 101 19
a=mid:1
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20

"received:
via: SIP/2.0/UDP [2208:1:1:1:1:1:1:1116]:5060;branch=z9hG4bK38ACE
date: Thu, 10 Feb 2011 12:15:08 GMT
call-id: 5DEDB77E-ADC11208-808BE770-8FCACF34@2208:1:1:1:1:1:1:1117
supported: 100rel,timer,resource-priority,replaces,sdp-anat
min-se: 1800
Cisco-Guid: 1432849350-0876876256-2424621905-3925258737
User-Agent: Cisco-SIPGateway/IOS-15.1(3.14.2)PIA16
allow: invite, options, bye, cancel, ack, prack, update, refer, subscribe, notify, info, register
CSeq: 101 invite
max-forwards: 70
timestamp: 1297340108
expires: 180
allow-events: telephone-event
content-type: application/sdp
content-length: 424
v=0
s=SIP Call
c=IN IP6 2208:1:1:1:1:1:1:1116
t=0 0
m=image 17278 udptl t38

Step 3  debug voip dialpeer inout

The **debug ccsip all** and **debug voip dialpeer inout** commands can be entered in any order and any of the commands can be used for debugging depending on the requirement.

**Example:**

Displays information about the voice dial peers

```
Device# debug voip dialpeer inout
voip dialpeer inout debugging is on
```

The following event shows the calling and called numbers:

**Example:**

```
*May 1 19:32:11.731: //1/6372E2598012/DPM/dpAssociateIncomingPeerCore: Calling Number=4085550111, Called Number=3600, Voice-Interface=0x0, Timeout=TRUE, Peer Encap Type=ENCAP_VOIP, Peer Search Type=PEER_TYPE_VOICE, Peer Info Type=DIALPEER_INFO_SPEECH
The following event shows the incoming dial peer:

**Example:**

```
*May 1 19:32:11.731: //1/6372E2598012/DPM/dpAssociateIncomingPeerCore: Calling Number=4085550111, Called Number=3600, Voice-Interface=0x0, Timeout=TRUE, Peer Encap Type=ENCAP_VOIP, Peer Search Type=PEER_TYPE_VOICE, Peer Info Type=DIALPEER_INFO_SPEECH
*May 1 19:32:11.731: //1/6372E2598012/DPM/dpAssociateIncomingPeerCore: Result=Success(0) after DP_MATCH_INCOMING_DNIS; Incoming Dial-peer=100
```

The following event shows the matched dial peers in the order of priority:

**Example:**

```
List of Matched Outgoing Dial-peer(s):
1: Dial-peer Tag=3600
2: Dial-peer Tag=36
```
Configuration Examples for Domain-Based Routing Support on the Cisco UBE

Example Configuring Domain-Based Routing Support on the Cisco UBE

The following example shows how to enable domain-based routing support on the Cisco UBE:

```
Device> enable
Device# configure terminal
Device(config)# voice service voip
Device(conf-voi-serv)# sip
Device(conf-serv-sip)# call-route url
Device(conf-serv-sip)# exit
Device(config)# dial-peer voice 2 voip
Device(config-dial-peer)# voice-class sip call-route url
Device(config-dial-peer)# exit
```
CHAPTER 20

ENUM Enhancement per Kaplan Draft RFC

The Cisco Unified Border Element (CUBE) facilitates the mapping of E.164 called numbers to Session Initiation Protocol (SIP) Uniform Resource Identifiers (URIs). The SIP ENUM technology allows the traditional telephony part of the network (using E.164 numbering to address destinations) to interwork with the SIP telephony part of the network, generally using SIP URIs. From the Public Switched Telephone Network (PSTN) network, if an end user dials an E.164 called party, the number can be translated by an ENUM gateway into the corresponding SIP URI. This SIP URI is then used to look up the Domain Name System (DNS) Naming Authority Pointer (NAPTR) Resource Records (RR). The NAPTR RR (as defined in RFC 2915) describes how the call should be forwarded or terminated and records information, such as email addresses, a fax number, a personal website, a VoIP number, mobile telephone numbers, voice mail systems, IP-telephony addresses, and web pages. Alternately, when the calling party is a VoIP endpoint and dials an E.164 number, then the originator's SIP user agent (UA) converts it into a SIP URI to be used to look up at the ENUM gateway DNS and fetch the NAPTR RR.

The ENUM enhancement per Kaplan draft RFC provides source-based routing, that is, SIP-to-SIP calls can be routed based on the source SIP requests. To provide source-based routing and to interact with the Policy Server, an EDNS0 OPT pseudo resource record with source URI, incoming SIP call ID, outbound SIP call ID, and Call Session Identification are added to the ENUM DNS query, according to draft-kaplan-enum-sip-routing-04. The incoming SIP call ID, outbound SIP call ID, and Call Session Identification are automatically included with an EDNS0 OPT pseudo resource record in the ENUM DNS query only if “source-uri no-cache” is enabled and XCC service is registered. This feature also provides the flexibility to disable route caching.

* Feature Information for ENUM Enhancement per Kaplan Draft RFC, on page 229
* Restrictions for ENUM Enhancement per Kaplan Draft RFC, on page 230
* Information About ENUM Enhancement per Kaplan Draft RFC, on page 231
* How to Configure ENUM Enhancement per Kaplan Draft RFC, on page 231
* Troubleshooting Tips, on page 234
* Configuration Examples for ENUM Enhancement per Kaplan Draft RFC, on page 234

Feature Information for ENUM Enhancement per Kaplan Draft RFC

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.
Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 31: Feature Information for ENUM Enhancement per Kaplan Draft RFC

<table>
<thead>
<tr>
<th>Feature Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENUM Enhancement per Kaplan Draft RFC</td>
</tr>
<tr>
<td>Releases</td>
</tr>
<tr>
<td>Cisco IOS XE 3.14S</td>
</tr>
<tr>
<td>Cisco IOS 15.5(1)T</td>
</tr>
<tr>
<td>Feature Information</td>
</tr>
<tr>
<td>The ENUM enhancement per Kaplan draft RFC provides source-based routing, that is, SIP-to-SIP calls can be routed based on the source SIP requests. To provide this source-based routing, an EDNS0 OPT pseudo resource record with source URI is added to the ENUM DNS query, according to \texttt{draft-kaplan-enum-sip-routing-04}. This feature also provides the flexibility to disable route caching.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feature Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support to include inbound call ID, outbound call ID and Call Session Identification to ENUM DNS query</td>
</tr>
<tr>
<td>Releases</td>
</tr>
<tr>
<td>Cisco IOS 15.5(2)T</td>
</tr>
<tr>
<td>Cisco IOS XE 3.15S</td>
</tr>
<tr>
<td>Feature Information</td>
</tr>
<tr>
<td>This feature allows you to add incoming SIP call ID, outbound SIP call ID, and Call Session Identification to an EDNS0 OPT pseudo resource record in the ENUM DNS query.</td>
</tr>
</tbody>
</table>

Restrictions for ENUM Enhancement per Kaplan Draft RFC

- Supported only for SIP-to-SIP calls.
- The full command of \texttt{voice enum-match-table}, including the options, needs to be specified whenever being referenced by its subcommand. If not, the defaults, \texttt{no source-uri} and \texttt{no no-cached (or caching)} will take effect.
- As the maximum number of characters of the host shown in the \texttt{show host} command is 25, the source URI may not be displayed completely.
- The source URI is displayed in a separate line below, starting with “source-uri="”. Refer to the \texttt{show} command outputs in this chapter.
- If \texttt{no-cache} is configured in the \texttt{voice enum-match-table}, no cache table look-up would be made and hence an ENUM query would be made regardless of what is in the cache table.
- Both the target and source, where the source can be null/undefined or defined, need to be matched when looking up the cache table.
- The OPT RR will be added to the query for a SIP-to-SIP call only if the \texttt{source-uri} is configured for the outbound \texttt{enum-match-table}.
- The route will not be cached if the server does not support the OPT RR (it is recommended to remove the \texttt{source-uri} for this scenario if caching is preferred).
- The source URL can be prefixed with a host/target in the host name field in a double quote in the \texttt{show host host} command to display routes for the host specific with this source.
- A wild card, “*”, can be used to denote “all” hosts in the \texttt{show host} command. It can be by itself or any host matched with its prefix. The prefix can be a host name, partial or complete, or a domain name with partial or complete source URL.
Information About ENUM Enhancement per Kaplan Draft RFC

SIP-to-SIP calls can be routed based on the source SIP requests, using the ENUM enhancement feature. To provide source-based routing and to interact with Policy Server, an EDNS0 OPT pseudo resource record with source URI, incoming SIP call ID, outbound SIP call ID, and Call session Identification are added to the ENUM DNS query. The DNS server filters its response based on the source URI and call ID information and returns the appropriate NAPTR entries. To enable this feature, you must use the source-uri option in the voice enum-match-table <table-number> command. In addition, you can use the no-cache option to disable caching.

Refer to RFC 3761 and draft-kaplan-enum-sip-routing-04 for more information about routing SIP requests with ENUM.

How to Configure ENUM Enhancement per Kaplan Draft RFC

Enabling Source-Based Routing

SUMMARY STEPS

1. enable
2. configure terminal
3. voice enum-match-table match-table-index [source-uri] [no-cache]
4. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>enable</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>Device&gt; enable</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>configure terminal</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>Device# configure terminal</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Enables source URI filtering for the enum match table entry. You can use the no-cache option to disable the caching to the voice enum command.</td>
</tr>
<tr>
<td>voice enum-match-table match-table-index [source-uri] [no-cache]</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config)# voice enum-match-table 5 source-uri no-cache</td>
</tr>
</tbody>
</table>
Testing the ENUM Request

To test the ENUM request, you can use the `source-url` option so that the source-based routing enum can be tested.

**SUMMARY STEPS**

1. `enable`
2. `test enum match-table-index input-pattern source-url source-url more parameter`
3. `end`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> <code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> <code>Device# enable</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> <code>test enum match-table-index input-pattern source-url source-url more parameter</code></td>
<td>Tests the source-based routing ENUM.</td>
</tr>
<tr>
<td><strong>Example:</strong> <code>Device# test enum 1117777 source sip:1166666@10.1.50.16 more &quot;ibcall-id=1-23735@10.1.50.16; obcall-id=7b190DF-F1AA3CF1@10.1.110.222; sbc-id=1</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> <code>end</code></td>
<td>Returns to privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> <code>Device# end</code></td>
<td></td>
</tr>
</tbody>
</table>

Verifying the ENUM Request

The following `show` commands can be used to verify the operation of the test command. If the `no-cache` option is enabled, the `show host` command does not display the enum entry. Some sample outputs of the `show` command are shown below. The `show` commands can be entered in any order.

**SUMMARY STEPS**

1. `show host *`
2. `show host 1.0.9.3.e164-test*`
3. `show host 1*`
4. show host "1.0.9.3.e164-test sip*"

**DETAILED STEPS**

**Step 1**

**show host ***

Example:

<table>
<thead>
<tr>
<th>Host</th>
<th>Port</th>
<th>Flags</th>
<th>Age Type</th>
<th>Address(es)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ns.e164-test</td>
<td>0</td>
<td>None (temp, OK)</td>
<td>0 IP</td>
<td>127.0.0.1</td>
</tr>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
</tbody>
</table>

**Step 2**

**show host 1.0.9.3.e164-test**

Example:

<table>
<thead>
<tr>
<th>Host</th>
<th>Port</th>
<th>Flags</th>
<th>Age Type</th>
<th>Address(es)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
</tbody>
</table>

**Step 3**

**show host 1**

Example:

<table>
<thead>
<tr>
<th>Host</th>
<th>Port</th>
<th>Flags</th>
<th>Age Type</th>
<th>Address(es)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
</tbody>
</table>

**Step 4**

**show host "1.0.9.3.e164-test sip*"**

Example:

<table>
<thead>
<tr>
<th>Host</th>
<th>Port</th>
<th>Flags</th>
<th>Age Type</th>
<th>Address(es)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ns.e164-test</td>
<td>0</td>
<td>None (temp, OK)</td>
<td>0 IP</td>
<td>127.0.0.1</td>
</tr>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
<tr>
<td>1.0.9.3.e164-test</td>
<td>540</td>
<td>NAPTR 0 0 U sip+E2U /^.*$/sip:3901@10.1.18.28/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source-uri</td>
<td></td>
<td></td>
<td></td>
<td>1.4.65.5</td>
</tr>
</tbody>
</table>
Troubleshooting Tips

Use the following commands for debugging information:

- `debug voip enum detail`
- `debug ip domain`
- `debug ccsip message`
- `debug voip ccapi in/out`
- `clear voip fpi session correlator-id`—This command is used to clear the hung FPI sessions. After the hung session is identified using the existing `show` commands and its correlator is obtained, the `clear voip fpi session correlator-id` command can be used to clear the session.

Use the following `show` command that is helpful for debugging:

- `show host [all | * | host-name | partial-host-name*]`

Below is an extract of a sample ENUM DNS query containing the EDNS0 OPT psedor source record fields as per Kaplan Draft that is helpful in debugging. In the below query the values corresponding to ibcall-id, obcall-id, and sbc-id represent the incoming SIP call ID, outbound SIP call ID and Call Session Identification respectively.

```
7.7.7.7.1.1.1.e164.arpa sip:1116666810.1.50.16enum_dns_query: name = 7.7.7.7.1.1.1.e164.arpa sip:1116666810.1.50.16 type = 35, ns_server = 0x0 no_cache 1 more_data ;ibcall-id=1-23735@10.1.50.16; obcall-id=7190DF-39DD11E4-8008EDAD-F1AA3CF1@10.1.110.222; sbc-id=1
```

Configuration Examples for ENUM Enhancement per Kaplan Draft RFC

```
voice enum-match-table 1 source-uri //The source URI is sent to the DNS server to filter the route.//
   description enable source-uri
   rule 2 1 /^\d+$/ /\1/ e164.arpa

voice enum-match-table 2 source-uri no-cache
rule 1 1 /^\d+$/ /\1/ e164-test

voice enum-match-table 3 no-cache //The cache table is not looked up and the route is not cached.//
rule 1 1 /^\d+$/ /\1/ e164-test

The following is a sample configuration for the ENUM enhancement feature:

dial-peer voice 1 voip
   description ENUM Inbound dialpeer
   session protocol sipv2
   incoming called-number 111666

dial-peer voice 2 voip
```

Cisco Unified Border Element Configuration Guide
description ENUM Outbound dialpeer
destination-pattern 1117777
session protocol sipv2
session target enum:1 //Session target configured to look up ENUM table 1.//
PART III

CUBE Service Scalability

• Service Scalability, on page 239
Service Scalability

The Service Scalability solution enables Cisco Unified Border Element (CUBE) to provide adequate session capacity even when supporting advanced session border controller (SBC) services.

- Feature Information for Service Scalability, on page 239
- Prerequisites for Service Scalability, on page 239
- Information About Service Scalability, on page 240
- SBE Installation, on page 242
- Scaling Requirements, on page 243
- MBE Installation, on page 243
- How to Configure Service Scalability, on page 243
- Monitoring and Troubleshooting, on page 252
- Troubleshooting Tips, on page 272
- Features Supported, on page 273

Feature Information for Service Scalability

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Scalability</td>
<td>Cisco IOS XE Fuji 16.8.1</td>
<td>The Service Scalability solution enables Cisco Unified Border Element (CUBE) to provide adequate session capacity even when supporting advanced session border controller (SBC) services.</td>
</tr>
</tbody>
</table>

Prerequisites for Service Scalability

Service scalability has the following prerequisites:
• Hardware Requirements
• Software Requirements

**Hardware Requirements**
• Signaling Border Element (SBE): Virtual CUBE integrated into the Cisco CSR 1000V routers runs on a hypervisor on the Cisco UCS C-series server.
• Cisco Unified Sip Proxy (CUSP): Virtual CUSP on the Cisco UCS C-series server.
• Media Border Element (MBE): Cisco Aggregation Services Routers (ASR 1004-RP2 and ASR 1006-RP2) with ESP-40 or ESP-20.

**Software Requirements**
• Obtain the relevant licenses for the Cisco CSR 1000V, Cisco ASR routers, and virtual CUSP.
• Install the appropriate Cisco IOS image on the Cisco CSR 1000V and Cisco ASR routers. The required Cisco IOS and CUSP image version details are as follows:
  • Cisco IOS image version: Cisco IOS XE Fuji Release 16.8.1
  • Virtual CUSP version: Cisco Unified SIP Proxy Release 9.1.5
• Ensure that the SBEs and MBE use the same IOS XE version.

**Information About Service Scalability**

**Service Scalability Overview**

The service scalability solution is achieved by adopting a distributed architecture wherein the CUBE functions are broken down into two logically distinct call processing entities:
• Signaling Border Element (SBE)
• Media Border Element (MBE)
Signaling Border Element (SBE)

SBEs support signaling functions and interworking between various signaling protocols, such as Session Initiation Protocol (SIP), call admission control, advanced routing policy management, network attack detection, or call billing using RADIUS. As part of the call admission control function, an SBE informs the media border element (MBE) of the various quality of service (QoS) requirements for the call. These functions are achieved by collocated modified virtual CUBEs and virtual CUSP arrays running on the Cisco UCS servers. An SBE typically communicates with one MBE at any given time.

Virtual Cisco Unified SIP Proxy (CUSP) is co-located with the SBE, and is used for load balancing across the SBEs.

An SBE comprises one or more virtual CUBEs along with one or multiple virtual CUSPs.

Media Border Element (MBE)

The MBE performs media switching and processing functions, including controlled access of media packets to the network, processing, and forwarding of media RTP packets. In addition, the MBE provides differentiated services and quality of service (QoS) for different media streams, and prevents service theft. The MBE consists of a set of data path functions and responds to the requests made by the SBE. An MBE typically communicates with one or more SBEs at any given time.

Figure 27: Distributed CUBE Solution for Contact Center shows an example of a distributed CUBE solution for contact center sessions.
Advantages of Service Scalability

• Scalable to a larger number of sessions with the contact center call flows having 40 messages per call.
• Operational advantages, because the SBE can be upgraded or serviced separately from the MBE.

SBE Installation

SBE installation includes the following:

Install Virtual CUBE

Virtual CUBE works with the VMware ESXi hypervisors supported by Cisco CSR 1000V Series routers. The recommended configuration on the virtual CUBE is 1 vCPU with 4 GB RAM.

The number of virtual CUBE instances to be installed depends on the service scaling requirements. For more information on the recommended number of virtual CUBE instances for various service profiles, see Scaling Requirements, on page 243.

For information on how to install a virtual CUBE, see Installation.

Install Cisco Unified Sip Proxy

Cisco Unified SIP Proxy supports operating within a VMware ESXi virtualized environment. The software is packaged as an OVA for installation within the ESXi environment (5.1 and above).
For information on how to install a Cisco Unified SIP Proxy, see Installing CUSP.

**Scaling Requirements**

The service scalability solution supports scaling of the SBE-MBE bundle gradually based on the supported flows.

The following table lists the scaling requirements:

<table>
<thead>
<tr>
<th>Flows Supported</th>
<th>No. of SBEs required for Max scale (64000 calls at 350 cps)</th>
<th>No. of MBEs required</th>
<th>No. of Virtual CUBE(s) required for Step Scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of SBEs required</td>
<td>No. of MBE(s) required</td>
<td>25% of Max scale (16000 calls at 100 cps)</td>
</tr>
<tr>
<td>Collaboration flows</td>
<td>14</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Inbound Contact Center flows</td>
<td>21</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

**MBE Installation**

For the MBE, you can install the Cisco IOS XE image containing CUBE software directly on the ASR 1004 or the ASR 1006 routers. You can also install multiple MBEs based on the requirement.

For more information on installing the Cisco IOS XE image on the ASR 1000 series routers, see Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide.

**How to Configure Service Scalability**

**Configure SBE**

To configure SBE, perform the following steps:

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice service voip
4. mode sbe
5. source-address ip-address [port port-number]
6. mbe ip-address [port port-number]
7. transport udp
8. end
## DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1** | **enable**<br>**Example:**<br>Device> enable | Enables privileged EXEC mode.  
- Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>Device# configure terminal | Enters global configuration mode. |
| **Step 3** | **voice service voip**<br>**Example:**<br>Device(config)# voice service voip | Enters voice service VoIP configuration mode. |
| **Step 4** | **mode sbe**<br>**Example:**<br>Device(config-voi-serv)# mode sbe | Enters sbe configuration mode. |
| **Step 5** | **source-address ip-address [port port-number]**<br>**Example:**<br>Device(config-mode-sbe)# source-address 198.51.100.0 port 1111 | Defines the source IP address and port number.  
- Default port number: 2251 |
| **Step 6** | **mbe ip-address [port port-number]**<br>**Example:**<br>Device(config-mode-sbe)# mbe 198.51.100.8 port 2222 | Defines the IP address and port number of MBE.  
- Default port number: 2251 |
| **Step 7** | **transport udp**<br>**Example:**<br>Device(config-mode-sbe)# transport udp | (Optional) Configures the User Datagram Protocol (UDP) as the underlying transport layer protocol.  
- Default transport protocol: UDP |
| **Step 8** | **end**<br>**Example:**<br>Device(config-mode-sbe)# end | Exits to privileged EXEC mode. |

**Example**

Use this command to verify the SBE configuration.

Device# show run all | sec mode sbe

mode sbe
source-address 198.51.100.0 port 1111
transport udp
Configure RTP Port Range and Media Bind

Configure the port range and media bind on each SBE. This configuration defines the media IP-address and RTP ports to be used by the MBE, for all the sessions established by the SBE.

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `voice service voip`
4. `rtp-port range extended port-range`
5. `media-address range mbe-ip-address-range port-range port-range`
6. `exit`
7. `dial-peer voice tag voip`
8. `voice-class sip bind media source-address ipv4 ipv4-address`
9. `end`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice service voip</td>
<td>Enters voice service VoIP configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> rtp-port range extended port-range</td>
<td>Configures the RTP port range.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# rtp-port range extended 5500 20500</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> media-address range mbe-ip-address-range port-range port-range</td>
<td>Configures the media-address range, which enables the media gateway to allocate the available free port for a given IP address within the address range.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
</tbody>
</table>

mbe 198.51.100.8 port 2222
Configure Media-Inactivity

Configure media-inactivity criteria at the SBE and the MBE. The media-inactivity configuration should be the same across all SBEs and MBE.

SUMMARY STEPS

1. enable
2. configure terminal
3. ip rtpc report interval rtcp-interval
4. gateway
5. media-inactivity-criteria all
6. timer receive-rtp timer
7. timer receive-rtp seconds
8. end

Note: You need to configure multiple MBE interfaces to accommodate 64000 calls. A single IP address can only serve a maximum of 16000 calls.
## DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><strong>enable</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td>- Enter your password if prompted.</td>
</tr>
<tr>
<td></td>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td><strong>configure terminal</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td><strong>ip rtcp report interval</strong> <em>rtcp-interval</em></td>
<td>Enters the minimum interval of RTCP report transmissions in milliseconds. The valid range is 1 to 65,535.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device (config)# ip rtcp report interval 60</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td><strong>gateway</strong></td>
<td>Enters gateway configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device (config)# gateway</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td><strong>media-inactivity-criteria all</strong></td>
<td>Configures the mechanism for detecting media inactivity on a call.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td>- all—media-inactivity detection is performed by means of RTP and RTCP.</td>
</tr>
<tr>
<td></td>
<td>Device (config-gateway)# media-inactivity-criteria all</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td><strong>timer receive-rtcp</strong> <em>timer</em></td>
<td>Enables the RTCP timer and configures a multiplication factor for the timer interval. The argument <em>timer</em> is multiplied by the interval that is set with the <strong>ip rtcp report interval</strong> command. The valid range for the <em>timer</em> argument is 2 to 1,000. The default is 5.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device (config-gateway)# timer receive-rtcp 10</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td><strong>timer receive-rtp</strong> <em>seconds</em></td>
<td>Configures the Real-Time Transport Protocol (RTP) timeout interval to clear connections that pause indefinitely.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device (config-gateway)# timer receive-rtp 1200</td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong></td>
<td><strong>end</strong></td>
<td>Exits gateway configuration mode and returns to global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device (config-gateway)# end</td>
<td></td>
</tr>
</tbody>
</table>
# Configure DTMF-Interworking

## SUMMARY STEPS

1. enable
2. configure terminal
3. dial-peer voice tag voip
4. dtmf-relay rtp-nte digit-drop
5. dtmf-interworking standard
6. end

## DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1** enable | Enables privileged EXEC mode.  
Example:  
Device> enable |
| **Step 2** configure terminal | Enters global configuration mode.  
Example:  
Device# configure terminal |
| **Step 3** dial-peer voice tag voip | Enters dial peer configuration mode.  
Example:  
Device(config)# dial-peer voice 300 voip |
| **Step 4** dtmf-relay rtp-nte digit-drop | Enables CUBE to suppress NTE packets and only relay digits using the out-of-band (OOB) method configured on the outbound leg.  
Example:  
Device (config-dial-peer)# dtmf-relay rtp-nte digit-drop |
| **Step 5** dtmf-interworking standard | Generates RTP NTE packets that are RFC 4733 compliant.  
Example:  
Device (config-dial-peer)# dtmf-interworking standard |
| **Step 6** end | Exits dial peer configuration mode and returns to global configuration mode.  
Example:  
Device(config-dial-peer)# end |
Example

Example:
The following is a sample configuration on SBE:

```
voice service voip
no ip address trusted authenticate
rtp-port range extended 5500 20500
mode sbe
  source-address 198.51.100.0
  mbe 198.51.100.8
media disable-detailed-stats
media-address range 192.0.2.0 192.0.2.4
  port-range 5500 20500
media-address range 192.0.2.5 192.0.2.6
  port-range 5500 20500
allow-connections sip to sip
sip
  re1lx disable
  no call service stop
! monitor event-trace voip ccsip msg size 50
monitor event-trace voip ccsip fsm size 100
monitor event-trace voip ccsip global size 100
monitor event-trace voip ccsip dump all
monitor event-trace voip ccsip dump-file
ftp://test:test123@8.41.17.71/pradiga/dcube-event-trace/
!
voice class codec 111
  codec preference 1 g711ulaw
  codec preference 2 g711alaw
  codec preference 3 g729r8
  codec preference 4 ilbc
  codec preference 5 g722-64
!
!
interface GigabitEthernet1
  ip address 192.0.2.7 255.0.0.0
  negotiation auto
  no mop enabled
  no mop sysid
  hold-queue 10000 in
  hold-queue 10000 out
!
interface GigabitEthernet2
  ip address 192.0.2.8 255.0.0.0
  negotiation auto
  no mop enabled
  no mop sysid
  hold-queue 10000 in
  hold-queue 10000 out
!
interface GigabitEthernet3
  ip address 192.0.2.9 255.0.0.0
  negotiation auto
  no mop enabled
  no mop sysid
  ip rtcp report interval 60
```
Configure MBE

To configure MBE, perform the following steps:

SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. mode mbe
5. source-address ip-address [port port-number]
6. transport udp
7. dtmf-interworking refresh-forward
8. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
</tbody>
</table>
### Configure MBE

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice service voip</td>
<td>Enters voice service VoIP configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> mode mbe</td>
<td>Enters mbe configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config-voi-serv)# mode mbe</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> source-address ip-address [port port-number]</td>
<td>Defines the source IP address and port number.</td>
</tr>
<tr>
<td>Example: Device(config-mode-mbe)# source-address 198.51.100.3 port 2222</td>
<td>• Default port number: 2251</td>
</tr>
<tr>
<td><strong>Step 6</strong> transport udp</td>
<td>(Optional) Configures the User Datagram Protocol (UDP) as the underlying transport layer protocol.</td>
</tr>
<tr>
<td>Example: Device(config-mode-mbe)# transport udp</td>
<td>• Default transport protocol: UDP</td>
</tr>
<tr>
<td><strong>Step 7</strong> dtmf-interworking refresh-forward</td>
<td>Enables communication of DTMF NTE refresh packets details also to SBE through the control channel.</td>
</tr>
<tr>
<td>Example: Device(config-mode-mbe)# dtmf-interworking refresh-forward</td>
<td>This option is disabled by default.</td>
</tr>
<tr>
<td></td>
<td>By default, MBE communicates about only DTMF NTE digit begin and end details to SBE.</td>
</tr>
<tr>
<td><strong>Step 8</strong> end</td>
<td>Exits to privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device(config-mode-mbe)# end</td>
<td></td>
</tr>
</tbody>
</table>

### Example

The following is a sample configuration on MBE:

```
ip rtcp report interval 60
!
voice service voip
  no ip address trusted authenticate
  rtp-port range extended 5500 65498
  mode mbe
  source-address 198.51.100.3
  media disable-detailed-stats
  media-address range 192.0.2.0 192.0.2.4
```
port-range 5500 65498
media-address range 192.0.2.5 192.0.2.6
port-range 5500 65498
media-address range 192.0.2.7 192.0.2.8
port-range 5500 65498
media-address range 192.0.2.11 192.0.2.12
port-range 5500 65498
allow-connections sip to sip
no supplementary-service sip handle-replaces sip
!
interface GigabitEthernet0/0/0
ip address 198.51.100.3 255.255.255.0
negotiation auto
plim ethernet vlan filter disable
!
interface GigabitEthernet0/0/1
ip address 198.51.100.3 255.255.255.0
negotiation auto
plim ethernet vlan filter disable
!

Monitoring and Troubleshooting

Use the following show commands to debug and troubleshoot any issues that you may encounter when you configure the Service scalability solution. These show commands need not be executed in any specific order.

**Step 1**

```bash
show voip {sbe | mbe} connections
```

Displays the control channel connections statistics for SBE or MBE.

**Example:**

1. Sample output with an active connection

```bash
Device# show voip sbe connections
LISTEN : UDP 198.51.100.0:8888 Uptime (sec): 3934
Number of active connections: 1
```

```
        UDP        3901     198.51.100.0:4400  7/5/0/0  1/3/0/0
```

**Example:**

2. Sample output without an active connection

```bash
Device# show voip sbe connections
LISTEN : UDP 198.51.100.0:8888 Uptime (sec): 7
```
No active connections found

For information on how to clear the connections statistics, go to Step 6, on page 270.

**Step 2**

```
show voip {sbe | mbe} {message-rate | data-rate} {inbound | outbound} {table | detail}
```

Displays control channel message and data rates for incoming and outgoing messages between SBE and MBE.

- **table**—Displays the output in tabular format.
- **detail**—Displays the output in histogram format.

**Example:**

```
Device# show voip sbe message-rate inbound table
```

<table>
<thead>
<tr>
<th>Period</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>220</td>
<td>44</td>
</tr>
<tr>
<td>6-10</td>
<td>195</td>
<td>39</td>
</tr>
<tr>
<td>11-15</td>
<td>168</td>
<td>34</td>
</tr>
<tr>
<td>16-20</td>
<td>135</td>
<td>27</td>
</tr>
<tr>
<td>21-25</td>
<td>110</td>
<td>22</td>
</tr>
<tr>
<td>26-30</td>
<td>85</td>
<td>17</td>
</tr>
<tr>
<td>31-35</td>
<td>60</td>
<td>12</td>
</tr>
<tr>
<td>36-40</td>
<td>35</td>
<td>7</td>
</tr>
<tr>
<td>41-45</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>46-50</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>51-55</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>56-60</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>Average</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>6-10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11-15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16-20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21-25</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26-30</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31-35</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36-40</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>41-45</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>46-50</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>51-55</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>56-60</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>Average</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6-10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11-15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16-20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21-25</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26-30</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31-35</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36-40</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>41-45</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
### Example:

Device# `show voip sbe data-rate inbound table`

<table>
<thead>
<tr>
<th>Period</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>186</td>
<td>37</td>
</tr>
<tr>
<td>6-10</td>
<td>167</td>
<td>33</td>
</tr>
<tr>
<td>11-15</td>
<td>147</td>
<td>29</td>
</tr>
<tr>
<td>16-20</td>
<td>129</td>
<td>26</td>
</tr>
<tr>
<td>21-25</td>
<td>111</td>
<td>22</td>
</tr>
<tr>
<td>26-30</td>
<td>92</td>
<td>18</td>
</tr>
<tr>
<td>31-35</td>
<td>73</td>
<td>15</td>
</tr>
<tr>
<td>36-40</td>
<td>54</td>
<td>11</td>
</tr>
<tr>
<td>41-45</td>
<td>36</td>
<td>7</td>
</tr>
<tr>
<td>46-50</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>51-55</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>56-60</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>Average</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>2</td>
<td>27</td>
</tr>
<tr>
<td>6-10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11-15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16-20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21-25</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26-30</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31-35</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36-40</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>41-45</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>46-50</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>51-55</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>56-60</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>Average</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6-10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11-15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16-20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21-25</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26-30</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31-35</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36-40</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>41-45</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>46-50</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>51-55</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>56-60</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Example:

Device# show voip sbe message-rate inbound detail

```
55555544444443333333222222222111111111
5432109896541210987654309876543210987654321
100
90
80
70
60 *
50 ***********
40 *****************
30 **********************
20 ***********************
10 ***********************

0....5....1....2....3....4....5....6

inbound message rate (last 60 seconds)
# = average inbound messages/s

3
9
110
100
90
80
70
60
50
40 *
30 *
20 *
10 #

0....5....1....2....3....4....5....6

inbound message rate (last 60 minutes)
* = maximum inbound messages/s  # = average inbound messages/s

10
9
8
7
6
5
4
3
2
1

0....5....1....2....3....4....5....6....7...

inbound message rate (last 72 hours)
* = maximum inbound messages/s  # = average inbound messages/s

Example:

Device# show voip sbe data-rate inbound detail

```
33333333333332222222222222111111111
9876654321098765432110987655432210987654321
100
90
80
70

```
Step 3  

Use one of the following commands to view the summary of global calls statistics for SBE or MBE.

- **show voip sbe calls summary**
- **show voip mbe calls [sbe sbe-ip-address [sbe-port-number]] summary**

Displays the summary of global calls statistics for SBE or MBE.

**Example:**

Device# show voip sbe calls summary

FPI Side Statistics (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

```
CREATE : 50/50/0/0/0/0/0
MODIFY : 20/20/0/0/0/0/0
DELETE : 50/50/0/0/0/0/0
STATS : 3000/3000/0/0/0/0/0
DETAIL STATS : 0/0/0/0/0/0/0
MEDIA (up/down) : 100/0
DTMF Punt(B/E/R) : 0/0/0
```
DTMF Inject (B/E/R) : 10/10/0
DTMF Local (NDE/E/R) : 0/0/0

Network Side Statistics (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)
---------------------------------------------------------------------------
CREATE : 50/50/0/50/0/0/0
MODIFY : 20/20/0/0/0/0/0
DELETE : 50/50/0/50/0/0/0
STATS : 3000/3000/0/3000/0/0/0
DETAI STAT : 0/0/0/0/0/0/0
MEDIA (up/down) : 100/0
DTMF Punt (B/E/R) : 0/0/0
DTMF Inject (B/E/R) : 10/10/0
DTMF Local (NDE/E/R) : 0/0/0

The table below describes the significant fields under Forwarding Plane Interface (FPI) side statistics on SBE.

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Req</td>
<td>Number of request messages received from the FPI side.</td>
</tr>
<tr>
<td>Rsp-Ok</td>
<td>Number of response OK messages sent to the FPI side.</td>
</tr>
<tr>
<td>Rsp-Fail</td>
<td>Number of response FAIL messages sent to the FPI side.</td>
</tr>
<tr>
<td>Send-Ok</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>Send-Fail</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>Timeout</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>Err</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>MEDIA (up/down)</td>
<td>Number of media up or down notifications sent to the FPI side.</td>
</tr>
<tr>
<td>DTMF Punt (B/E/R)</td>
<td>Number of RTP NTE DTMF packets punted towards the FPI side.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
<tr>
<td>DTMF Inject (B/E/R)</td>
<td>Number of RTP NTE DTMF packets injected towards the FPI side.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
</tbody>
</table>
The table below describes the significant fields under network side statistics on SBE.

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTMF Local (NDD/E/R)</td>
<td>Number of RTP NTE DTMF packets locally generated towards the FPI side.</td>
</tr>
<tr>
<td></td>
<td>• NDD—No Digit Drop</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Req</td>
<td>Number of request messages sent to the network side.</td>
</tr>
<tr>
<td>Rsp-Ok</td>
<td>Number of Response-OK messages received from the network side.</td>
</tr>
<tr>
<td>Rsp-Fail</td>
<td>Number of Response-FAIL messages received from the network side.</td>
</tr>
<tr>
<td>Send-Ok</td>
<td>Number of request messages successfully sent over the physical network.</td>
</tr>
<tr>
<td>Send-Fail</td>
<td>Number of request messages that are failed to be sent.</td>
</tr>
<tr>
<td>Timeout</td>
<td>Number of requests that timed out.</td>
</tr>
<tr>
<td>Err</td>
<td>Number of errors in the processing of requests or responses.</td>
</tr>
<tr>
<td>MEDIA (up/down)</td>
<td>Number of media up or down notifications received from the network side.</td>
</tr>
<tr>
<td>DTMF Punt (B/E/R)</td>
<td>Number of RTP NTE DTMF packets punted towards the network side.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
<tr>
<td>DTMF Inject (B/E/R)</td>
<td>Number of RTP NTE DTMF packets injected towards the network side.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
</tbody>
</table>
### Options

<table>
<thead>
<tr>
<th>Description</th>
<th>Number of RTP NTE DTMF packets locally generated towards the network side.</th>
</tr>
</thead>
</table>
| NDD/E/R     | - NDD—No Digit Drop
               - E—End
               - R—Refresh |

#### Example:

```
Device# show voip mbe calls summary
```

---

**FPI Side Statistics** (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

<table>
<thead>
<tr>
<th>Action</th>
<th>CREATE</th>
<th>MODIFY</th>
<th>DELETE</th>
<th>STATS</th>
<th>DETAIL STATS</th>
<th>MEDIA (up/down)</th>
<th>DTMF Punt (B/E/R)</th>
<th>DTMF Inject (B/E/R)</th>
<th>DTMF Local (NDD/E/R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>85/85</td>
<td>20/20</td>
<td>85/85</td>
<td>5100</td>
<td>0/0/0/0/0/0</td>
<td>170/0</td>
<td>10/10</td>
<td>0/0</td>
<td>0/0</td>
</tr>
</tbody>
</table>

**Network Side Statistics** (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

<table>
<thead>
<tr>
<th>Action</th>
<th>CREATE</th>
<th>MODIFY</th>
<th>DELETE</th>
<th>STATS</th>
<th>DETAIL STATS</th>
<th>MEDIA (up/down)</th>
<th>DTMF Punt (B/E/R)</th>
<th>DTMF Inject (B/E/R)</th>
<th>DTMF Local (NDD/E/R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>85/85</td>
<td>20/20</td>
<td>85/85</td>
<td>2100</td>
<td>0/0/0/0/0/0</td>
<td>70/0</td>
<td>10/10</td>
<td>0/0</td>
<td>0/0</td>
</tr>
</tbody>
</table>

**FPI Side Statistics** (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

<table>
<thead>
<tr>
<th>Action</th>
<th>CREATE</th>
<th>MODIFY</th>
<th>DELETE</th>
<th>STATS</th>
<th>DETAIL STATS</th>
<th>MEDIA (up/down)</th>
<th>DTMF Punt (B/E/R)</th>
<th>DTMF Inject (B/E/R)</th>
<th>DTMF Local (NDD/E/R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>35/35</td>
<td>20/20</td>
<td>35/35</td>
<td>2100</td>
<td>0/0/0/0/0/0</td>
<td>70/0</td>
<td>10/10</td>
<td>0/0</td>
<td>0/0</td>
</tr>
</tbody>
</table>

**Network Side Statistics** (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

<table>
<thead>
<tr>
<th>Action</th>
<th>CREATE</th>
<th>MODIFY</th>
<th>DELETE</th>
<th>STATS</th>
<th>DETAIL STATS</th>
<th>MEDIA (up/down)</th>
<th>DTMF Punt (B/E/R)</th>
<th>DTMF Inject (B/E/R)</th>
<th>DTMF Local (NDD/E/R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>35/35</td>
<td>20/20</td>
<td>35/35</td>
<td>2100</td>
<td>0/0/0/0/0/0</td>
<td>70/0</td>
<td>10/10</td>
<td>0/0</td>
<td>0/0</td>
</tr>
</tbody>
</table>

SBE: 198.51.100.0:8888
DTMF Inject (B/E/R) : 0/0/0
DTMF Local (NDD/E/R) : 0/0/0

SBE: 198.51.100.2:3333

---

### FPI Side Statistics
(Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

<table>
<thead>
<tr>
<th>Action</th>
<th>CREATE</th>
<th>MODIFY</th>
<th>DELETE</th>
<th>STATS</th>
<th>DETAIL STATS</th>
<th>MEDIA (up/down)</th>
<th>DTMF Punt (B/E/R)</th>
<th>DTMF Inject (B/E/R)</th>
<th>DTMF Local (NDD/E/R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50/50</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
</tr>
</tbody>
</table>

### Network Side Statistics
(Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

<table>
<thead>
<tr>
<th>Action</th>
<th>CREATE</th>
<th>MODIFY</th>
<th>DELETE</th>
<th>STATS</th>
<th>DETAIL STATS</th>
<th>MEDIA (up/down)</th>
<th>DTMF Punt (B/E/R)</th>
<th>DTMF Inject (B/E/R)</th>
<th>DTMF Local (NDD/E/R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50/50</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
</tr>
</tbody>
</table>

**Example:**

Device# show voip mbe calls sbe 198.51.100.3 3333 summary

SBE: 198.51.100.3:3333

---

### FPI Side Statistics
(Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

<table>
<thead>
<tr>
<th>Action</th>
<th>CREATE</th>
<th>MODIFY</th>
<th>DELETE</th>
<th>STATS</th>
<th>DETAIL STATS</th>
<th>MEDIA (up/down)</th>
<th>DTMF Punt (B/E/R)</th>
<th>DTMF Inject (B/E/R)</th>
<th>DTMF Local (NDD/E/R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50/50</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
</tr>
</tbody>
</table>

### Network Side Statistics
(Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

<table>
<thead>
<tr>
<th>Action</th>
<th>CREATE</th>
<th>MODIFY</th>
<th>DELETE</th>
<th>STATS</th>
<th>DETAIL STATS</th>
<th>MEDIA (up/down)</th>
<th>DTMF Punt (B/E/R)</th>
<th>DTMF Inject (B/E/R)</th>
<th>DTMF Local (NDD/E/R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50/50</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
</tr>
</tbody>
</table>

The table below describes the significant fields under FPI side statistics on MBE.
The table below describes the significant fields under network side statistics on MBE.

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Req</td>
<td>Number of request messages received from the network side.</td>
</tr>
<tr>
<td>Rsp-Ok</td>
<td>Number of response OK messages sent to the network side.</td>
</tr>
<tr>
<td>Send-Ok</td>
<td>Not applicable for the network side statistics.</td>
</tr>
<tr>
<td>Send-Fail</td>
<td>Not applicable for the network side statistics.</td>
</tr>
<tr>
<td>Timeout</td>
<td>Number of request messages sent to the FPI side.</td>
</tr>
<tr>
<td>Err</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>MEDIA (up/down)</td>
<td>Number of media up or down notifications received from the FPI side.</td>
</tr>
<tr>
<td>DTMF Punt (B/E/R)</td>
<td>Number of RTP NTE DTMF packets punted towards the FPI side.</td>
</tr>
<tr>
<td>DTMF Inject (B/E/R)</td>
<td>Number of RTP NTE DTMF packets injected towards the FPI side.</td>
</tr>
<tr>
<td>DTMF Local (NDD/E/R)</td>
<td>Number of RTP NTE DTMF packets locally generated towards the FPI side.</td>
</tr>
</tbody>
</table>
### Options

<table>
<thead>
<tr>
<th>Description</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of responses</td>
<td>Rsp-Fail</td>
</tr>
<tr>
<td>Number of successes</td>
<td>Send-Ok</td>
</tr>
<tr>
<td>Number of failures</td>
<td>Send-Fail</td>
</tr>
<tr>
<td>Not applicable</td>
<td>Timeout</td>
</tr>
<tr>
<td>Number of errors</td>
<td>Err</td>
</tr>
<tr>
<td>Number of media</td>
<td>MEDIA (up/down)</td>
</tr>
<tr>
<td>Number of packets</td>
<td>DTMF Punt (B/E/R)</td>
</tr>
<tr>
<td>Number of packets</td>
<td>DTMF Inject (B/E/R)</td>
</tr>
<tr>
<td>Number of packets</td>
<td>DTMF Local (NDD/E/R)</td>
</tr>
</tbody>
</table>

For information on how to clear the calls statistics, go to Step 5, on page 270.

### Step 4

Use one of the following commands to view the calls statistics for SBE or MBE.

- `show voip sbe calls [inactive | correlator correlator-id | summary]`
- `show voip mbe calls [sbe sbe-ip-address [ sbe-port-number]] [inactive | correlator correlator-id | summary]`

Displays calls statistics for SBE or MBE.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>calls</td>
<td>Displays call information for all calls.</td>
</tr>
<tr>
<td>Option</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>sbe</td>
<td>(Optional) Displays call information for calls belonging to a specific SBE.</td>
</tr>
<tr>
<td>inactive</td>
<td>(Optional) Displays call information for calls with inactive media, that is, calls where media down event was reported.</td>
</tr>
<tr>
<td>correlator</td>
<td>(Optional) Displays detailed call information for a call based on the correlator ID.</td>
</tr>
<tr>
<td>summary</td>
<td>(Optional) Displays the summary of global calls statistics for SBE or MBE.</td>
</tr>
</tbody>
</table>

**Example:**

Sample output without a call on SBE

```
Device# show voip sbe calls
No. of calls : 0
No. of inactive calls : 0
```

**Example:**

Sample output with an active call on SBE

```
Device# show voip sbe calls
No. of calls : 2
No. of inactive calls : 1 (Indicated by *)

Correlator  UpTime(sec)  FPI (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err/Up/Down/
Dtmf-Punt(B/E/R)/Dtmf-Inject(B/E/R)/Dtmf-Local(NDD/E/R))
NW (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err/Up/Down/
Dtmf-Punt(B/E/R)/Dtmf-Inject(B/E/R)/Dtmf-Local(NDD/E/R))

15* 56 57/57/0/0/0/0/0/0/2/0/0/(0/0/0)/(0/0/0)/(0/0/0)
16 26 27/27/0/0/0/0/0/0/0/0/0/(0/0/0)/(0/0/0)/(0/0/0)
```

**Example:**

```
Device # show voip sbe calls inactive
No. of calls : 1
No. of inactive calls : 1 (Indicated by *)

Correlator  UpTime(sec)  FPI (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err/Up/Down/
Dtmf-Punt(B/E/R)/Dtmf-Inject(B/E/R)/Dtmf-Local(NDD/E/R))
NW (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err/Up/Down/
Dtmf-Punt(B/E/R)/Dtmf-Inject(B/E/R)/Dtmf-Local(NDD/E/R))
```

Note

- The correlator ID defined in the `show voip mbe calls correlator` command refers to MBE correlator.
- The correlator ID defined in the `show voip mbe calls sbe [sbe-ip-address [sbe-port-number]]` command refers to SBE correlator.
Example:

Device # show voip sbe calls correlator 2

SBE Correlator: 2 SBE ConfID: 2

Media Details:

<table>
<thead>
<tr>
<th>Side</th>
<th>Local-IP:Port</th>
<th>Remote-IP:Port</th>
<th>DtmfIW</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>198.51.100.4:8004</td>
<td>198.51.100.3:6001</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>198.51.100.4:8006</td>
<td>198.51.100.3:6000</td>
<td>1</td>
</tr>
</tbody>
</table>

FPI Side Statistics (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CREATE</td>
<td>Number of request messages received from the FPI side for a call.</td>
</tr>
<tr>
<td>MODIFY</td>
<td>Number of response OK messages sent to the FPI side for a call.</td>
</tr>
<tr>
<td>DELETE</td>
<td>Number of response FAIL messages sent to the FPI side for a call.</td>
</tr>
<tr>
<td>STATS</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>DETAIL STATS</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>MEDIA (up/down)</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>DTMF Punt(B/E/R)</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>DTMF Inject(B/E/R)</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>DTMF Local(NDD/E/R)</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
</tbody>
</table>

Network Side Statistics (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CREATE</td>
<td>Number of request messages received from the FPI side for a call.</td>
</tr>
<tr>
<td>MODIFY</td>
<td>Number of response OK messages sent to the FPI side for a call.</td>
</tr>
<tr>
<td>DELETE</td>
<td>Number of response FAIL messages sent to the FPI side for a call.</td>
</tr>
<tr>
<td>STATS</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>DETAIL STATS</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>MEDIA (up/down)</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>DTMF Punt(B/E/R)</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>DTMF Inject(B/E/R)</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>DTMF Local(NDD/E/R)</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
</tbody>
</table>

The table below describes the significant fields under FPI side statistics on SBE.
<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDIA (up/down)</td>
<td>Number of media up or down notifications sent to the FPI side for a call.</td>
</tr>
<tr>
<td>DTMF Punt (B/E/R)</td>
<td>Number of RTP NTE DTMF packets punted towards the FPI side for a call.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
<tr>
<td>DTMF Inject (B/E/R)</td>
<td>Number of RTP NTE DTMF packets injected towards the FPI side for a call.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
<tr>
<td>DTMF Local (NDD/E/R)</td>
<td>Number of RTP NTE DTMF packets locally generated towards the FPI side for a call.</td>
</tr>
<tr>
<td></td>
<td>• NDD—No Digit Drop</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
</tbody>
</table>

The table below describes the significant fields under network side statistics on SBE.

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Req</td>
<td>Number of request messages sent to the network side for a call.</td>
</tr>
<tr>
<td>Rsp-Ok</td>
<td>Number of Response-OK messages received from the network side for a call.</td>
</tr>
<tr>
<td>Rsp-Fail</td>
<td>Number of Response-FAIL messages received from the network side for a call.</td>
</tr>
<tr>
<td>Send-Ok</td>
<td>Number of request messages successfully sent over the physical network for a call.</td>
</tr>
<tr>
<td>Send-Fail</td>
<td>Number of request messages that are failed to be sent for a call.</td>
</tr>
<tr>
<td>Timeout</td>
<td>Number of requests that timed out for a call.</td>
</tr>
<tr>
<td>Err</td>
<td>Number of errors in the processing of requests or responses for a call.</td>
</tr>
<tr>
<td>Options</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MEDIA (up/down)</td>
<td>Number of media up or down notifications received from the network side for a call.</td>
</tr>
<tr>
<td>DTMF Punt (B/E/R)</td>
<td>Number of RTP NTE DTMF packets punted towards the network side for a call.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
<tr>
<td>DTMF Inject (B/E/R)</td>
<td>Number of RTP NTE DTMF packets injected towards the network side for a call.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
<tr>
<td>DTMF Local (NDD/E/R)</td>
<td>Number of RTP NTE DTMF packets locally generated towards the network side for a call.</td>
</tr>
<tr>
<td></td>
<td>• NDD—No Digit Drop</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
</tbody>
</table>

**Example:**

Sample output without a call on MBE

```
Device# show voip mbe calls
No. of calls : 0
No. of inactive calls : 0
```

Sample output with an active call on MBE

```
Device# show voip mbe calls
No. of calls : 2
No. of inactive calls : 1 (Indicated by *)
SBE: 198.51.100.3:8888

Correlator UpTime(sec) FPI (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err/Up/Down/ Dtmf-Punt(B/E/R)/Dtmf-Inject(B/E/R)/Dtmf-Local(NDD/E/R))
NW (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err/Up/Down/
Dtmf-Punt(B/E/R)/Dtmf-Inject(B/E/R)/Dtmf-Local(NDD/E/R))

<table>
<thead>
<tr>
<th>No</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>53</td>
</tr>
<tr>
<td>15</td>
<td>23</td>
</tr>
</tbody>
</table>

Example:

Device# show voip mbe calls inactive

No. of calls : 3
No. of inactive calls : 1 (Indicated by *)
SBE: 198.51.100.4:8888

Example:

Device# show voip mbe calls correlator 2

MBE Correlator: 2 MBE ConfID: 2
SBE Correlator: 3 SBE ConfID: 3

Media Details:

<table>
<thead>
<tr>
<th>Side</th>
<th>Local-IP:Port</th>
<th>Remote-IP:Port</th>
<th>DtmfIW</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>198.51.100.4:8008</td>
<td>198.51.100.3:6001</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>198.51.100.4:8010</td>
<td>198.51.100.3:6000</td>
<td>1</td>
</tr>
</tbody>
</table>

FPI Side Statistics  (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

CREATE : 1/1/0/0/0/0/0
MODIFY : 1/1/0/0/0/0/0
DELETE : 0/0/0/0/0/0/0
STATS  : 20/20/0/0/0/0/0
DETAIL STATS : 0/0/0/0/0/0/0
MEDIA (up/down)  : 0/0
DTMF Punt(B/E/R) : 0/0/0
DTMF Inject(B/E/R) : 0/0/0
DTMF Local(NDD/E/R) : 0/0/0

Network Side Statistics (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

CREATE : 1/1/0/1/0/0/0
MODIFY : 1/1/0/0/0/0/0
DELETE : 0/0/0/0/0/0/0
STATS  : 20/20/0/20/0/0/0
DETAIL STATS : 0/0/0/0/0/0/0
MEDIA (up/down)  : 0/0
DTMF Punt(B/E/R) : 0/0/0
DTMF Inject(B/E/R) : 0/0/0
The correlator ID defined in the `show voip mbe calls correlator` command refers to MBE correlator.

Example:

Device# `show voip mbe calls sbe 198.51.100.4 8888 correlator 4`

MBE Correlator: 3  MBE ConfID: 3

SBE Correlator: 4  SBE ConfID: 4

Media Details:

<table>
<thead>
<tr>
<th>Side</th>
<th>Local-IP:Port</th>
<th>Remote-IP:Port</th>
<th>DtmfIW</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>198.51.100.4:8012</td>
<td>198.51.100.3:6004</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>198.51.100.4:8014</td>
<td>198.51.100.3:6000</td>
<td>1</td>
</tr>
</tbody>
</table>

FPI Side Statistics (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

CREATE : 1/1/0/0/0/0/0
MODIFY : 1/1/0/0/0/0/0
DELETE : 0/0/0/0/0/0/0
STATS  : 43/43/0/0/0/0/0
DETAIL STATS : 0/0/0/0/0/0/0
MEDIA (up/down) : 0/2
DTMF Punt (B/E/R) : 0/0/0
DTMF Inject (B/E/R) : 0/0/0
DTMF Local (NDD/E/R) : 0/0/0

Network Side Statistics (Req/Rsp-Ok/Rsp-Fail/Send-Ok/Send-Fail/Timeout/Err)

CREATE : 1/1/0/1/0/0/0
MODIFY : 1/1/0/0/0/0/0
DELETE : 0/0/0/0/0/0/0
DETAIL STATS : 43/43/0/0/0/0/0
MEDIA (up/down) : 0/2
DTMF Punt (B/E/R) : 0/0/0
DTMF Inject (B/E/R) : 0/0/0
DTMF Local (NDD/E/R) : 0/0/0

The correlator ID defined in the `show voip mbe calls sbe [sbe-ip-address [sbe-port-number]] correlator` command refers to SBE correlator.

The table below describes the significant fields under FPI side statistics on MBE:

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Req</td>
<td>Number of request messages sent to the FPI side for a call.</td>
</tr>
<tr>
<td>Rsp-Ok</td>
<td>Number of response OK messages received from the FPI side for a call.</td>
</tr>
<tr>
<td>Rsp-Fail</td>
<td>Number of response FAIL messages received from the FPI side for a call.</td>
</tr>
<tr>
<td>Send-Ok</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>Send-Fail</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>Timeout</td>
<td>Number of requests that timed out for a call.</td>
</tr>
<tr>
<td>Options</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Err</td>
<td>Not applicable for the FPI side statistics.</td>
</tr>
<tr>
<td>MEDIA (up/down)</td>
<td>Number of media up or down notifications received from the FPI side for a call.</td>
</tr>
<tr>
<td>DTMF Punt (B/E/R)</td>
<td>Number of RTP NTE DTMF packets punted towards the FPI side for a call.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
<tr>
<td>DTMF Inject (B/E/R)</td>
<td>Number of RTP NTE DTMF packets injected towards the FPI side for a call.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
<tr>
<td>DTMF Local (NDD/E/R)</td>
<td>Number of RTP NTE DTMF packets locally generated towards the FPI side for a call.</td>
</tr>
<tr>
<td></td>
<td>• NDD—No Digit Drop</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
</tbody>
</table>

The table below describes the significant fields under network side statistics on MBE.

<table>
<thead>
<tr>
<th>Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Req</td>
<td>Number of request messages received from the network side for a call.</td>
</tr>
<tr>
<td>Rsp-Ok</td>
<td>Number of response OK messages sent to the network side for a call.</td>
</tr>
<tr>
<td>Rsp-Fail</td>
<td>Number of response FAIL messages sent to the network side for a call.</td>
</tr>
<tr>
<td>Send-Ok</td>
<td>Number of response or notification messages sent successfully over the physical network for a call.</td>
</tr>
<tr>
<td>Send-Fail</td>
<td>Number of response or notification messages that are failed to be sent for a call.</td>
</tr>
<tr>
<td>Timeout</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Options</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Err</td>
<td>Number of errors in the processing of requests or responses for a call.</td>
</tr>
<tr>
<td>MEDIA (up/down)</td>
<td>Number of media up or down notifications sent to the network side for a call.</td>
</tr>
<tr>
<td>DTMF Punt (B/E/R)</td>
<td>Number of RTP NTE DTMF packets punted towards the network side for a call.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
<tr>
<td>DTMF Inject (B/E/R)</td>
<td>Number of RTP NTE DTMF packets injected towards the network side for a call.</td>
</tr>
<tr>
<td></td>
<td>• B—Begin</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
<tr>
<td>DTMF Local (NDD/E/R)</td>
<td>Number of RTP NTE DTMF packets locally generated towards the network side for a call.</td>
</tr>
<tr>
<td></td>
<td>• NDD—No Digit Drop</td>
</tr>
<tr>
<td></td>
<td>• E—End</td>
</tr>
<tr>
<td></td>
<td>• R—Refresh</td>
</tr>
</tbody>
</table>

For information on how to clear the calls statistics, go to Step 5, on page 270.

**Step 5**  
`clear voip {sbe | mbe} calls stats`  
Resets all the calls statistics to zero.

**Example:**
```
Device# clear voip sbe calls stats
```

**Step 6**  
`clear voip {sbe | mbe} connections stats`  
Resets all the connections statistics to zero.

**Example:**
```
Device# clear voip sbe connections stats
```

**Step 7**  
`clear voip {sbe | mbe} connection connection-id`  
Clears the control channel connection based on the connection ID.
**Example:**

Device# clear voip sbe connection 1

For information on how to view the connection details, go to Step 1, on page 252.

**Step 8**

`clear voip sbe calls {all | inactive | correlator correlator-id}`

Clears one or multiple calls on SBE. The associated calls on MBE are cleared as well.

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>all</td>
<td>Clears all calls on SBE. The associated calls on MBE are cleared as well.</td>
</tr>
<tr>
<td>inactive</td>
<td>Clears calls with inactive media on SBE. The associated calls on MBE are cleared as well.</td>
</tr>
<tr>
<td>correlator</td>
<td>correlation-ID</td>
</tr>
</tbody>
</table>

**Example:**

Device# clear voip sbe calls all
Device# clear voip sbe calls inactive
Device# clear voip sbe calls correlator 2

For information on how to view the SBE calls statistics, go to Step 4, on page 262.

**Step 9**

`clear voip mbe calls {all | inactive | correlator correlator-id | sbe sbe-ip-address [sbe-port-number] {all | inactive | correlator correlator-id}}`

Clears one or multiple calls on MBE.

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>all</td>
<td>Clears all calls on MBE.</td>
</tr>
<tr>
<td>sbe sbe-ip-address [sbe-port-number]</td>
<td>Clears all calls on MBE that are associated with the specific SBE.</td>
</tr>
<tr>
<td>inactive</td>
<td>Clears calls with inactive media.</td>
</tr>
<tr>
<td>correlator</td>
<td>correlation-ID</td>
</tr>
</tbody>
</table>

**Note**

- The correlator ID defined in the `clear voip mbe calls correlator` command refers to MBE correlator.
- The correlator ID defined in the `clear voip mbe calls sbe sbe-ip-address [sbe-port-number] correlator` command refers to SBE correlator.

**Example:**

Device# clear voip mbe calls all
Device# clear voip mbe calls correlator 4
Device# clear voip mbe calls sbe 198.51.100.4 8888 all
Device# clear voip mbe calls sbe 198.51.100.4 8888 inactive
Device# clear voip mbe calls sbe 198.51.100.4 8888 correlator 4

For information on how to view the MBE calls statistics, go to Step 4, on page 262.

Troubleshooting Tips

Use the following commands to set debug levels for different categories.

- `debug voip {sbe | mbe} all {default | error | info | verbose}
- `debug voip {sbe | mbe} call {default | error | info | verbose}
- `debug voip {sbe | mbe} config {default | error | info | verbose}
- `debug voip {sbe | mbe} control {default | error | info | verbose}
- `debug voip {sbe | mbe} tlv {default | error | info | verbose}
- `debug voip {sbe | mbe} transport {default | error | info | verbose}

Note

The above commands do not enable logging. To enable logging, use the `debug voip {sbe | mbe} enable` command.

The following table provides a description of different debug levels.

Table 33: Debug Levels

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>default</td>
<td>Configures logging level to default. For more information on the default level for different categories, see Table 34: Debug Categories.</td>
</tr>
<tr>
<td>error</td>
<td>Configures logging level to display error messages.</td>
</tr>
<tr>
<td>info</td>
<td>Configures logging level to display error and informational messages.</td>
</tr>
<tr>
<td>verbose</td>
<td>Configures logging level to display all debug messages including error and informational messages.</td>
</tr>
</tbody>
</table>

The following table provides a description of different debug categories and their default levels.

Table 34: Debug Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Default Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>debug voip {sbe</td>
<td>mbe} all {default</td>
<td>error</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
<td>Default Level</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>debug voip {sbe</td>
<td>Configures call related logs.</td>
<td>error</td>
</tr>
<tr>
<td></td>
<td>mbe} call {default</td>
<td>error</td>
</tr>
<tr>
<td>debug voip {sbe</td>
<td>Configures logs related to CLI configurations.</td>
<td>info</td>
</tr>
<tr>
<td></td>
<td>mbe} config {default</td>
<td>error</td>
</tr>
<tr>
<td>debug voip {sbe</td>
<td>Configures logs related to control layer.</td>
<td>error</td>
</tr>
<tr>
<td></td>
<td>mbe} control {default</td>
<td>error</td>
</tr>
<tr>
<td>debug voip {sbe</td>
<td>Configures logs related to communication messages between</td>
<td>error</td>
</tr>
<tr>
<td></td>
<td>mbe} tlv {default</td>
<td>error</td>
</tr>
<tr>
<td></td>
<td>transport {default</td>
<td>error</td>
</tr>
</tbody>
</table>

Note: Use the no form of debug commands to disable all the logging levels of the given category.

Features Supported

The advanced features that are supported for Service scalability solution are as follows:

- OPTIONS Keep-alive
- SIP Binding
- Mid-call signaling block, Mid-call signaling passthrough (including media-change)
- DTMF Interworking (NTE - OOB)
- Dynamic Payload Interworking
- Fax (T.38 and passthrough)
- Media inactivity
- Media re-negotiate
- SDP Passthrough
- Signaling Forking
- Dynamic payload interworking
- Midcall media negotiation failures 488/491
- Voice Class Codec (VCC) without DSP
- Media Statistics
- Voice Quality Monitoring
• 18x with SDP consume
• Early Dialog UPDATE
• DO-EO, EO-EO, DO-EO renegotiate, Early and reliable media
• RTCP passthrough
• Hunting, DPG
• Server-group
• E164 maps
• ENUM
• SIP Normalization
• Session refresh
• Transport layer packet fragmentation
• Call Admission Control (CAC)
• SYSLOG, IEC
• Domain Name System (DNS)
• Event trace
PART IV

Multi-Tenancy

• Support for Multi-VRF, on page 277
• Configuring Multi-Tenants on SIP Trunks, on page 315
Support for Multi-VRF

Virtual Routing and Forwarding (VRF) feature allows Cisco Unified Border Element (CUBE) to have multiple instances of routing and forwarding tables to co-exist on the same device at the same time.

With multi-VRF feature, each interface or sub-interface can be associated with a unique VRF.

Note

The information in this chapter is specific to Multi-VRF feature beginning in Cisco IOS Release 15.6(2)T. However, there is some information on Single-VRF feature for reference purpose only. For detailed information on Single-VRF feature, see http://www.cisco.com/c/en/us/td/docs/ios/12_4t/12_4t15/vrfawvgw.html.

- Feature Information for VRF, on page 277
- Information About Single-VRF, on page 278
- Information About Multi-VRF, on page 278
- Restrictions, on page 279
- Recommendations, on page 279
- Configuring VRF, on page 280
- Configure VRF Specific RTP Port Ranges, on page 285
- Directory Number (DN) Overlap across Multiple-VRFs, on page 288
- IP Overlap with VRF, on page 291
- Using Server Groups with VRF, on page 292
- Inbound Dial-Peer Matching based on Multi-VRF, on page 293
- VRF Aware DNS for SIP Calls, on page 295
- High Availability with VRF, on page 296
- Configuration Examples, on page 296

Feature Information for VRF

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
Table 35: Feature Information for VRF

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for Single-VRF (VRF-Aware)</td>
<td>Cisco IOS 12.4(11)XJ</td>
<td>This feature provides support to configure a VRF specific to voice traffic.</td>
</tr>
<tr>
<td>Support for Multi-VRF</td>
<td>Cisco IOS 15.6(2)T</td>
<td>This feature allows CUBE to have multiple instances of VRF to co-exist on the same device at the same time. The following commands are introduced: media-address voice-vrf name port-range min-max, show voice vrf</td>
</tr>
<tr>
<td>Enhancement to support up to 54 VRF instances</td>
<td>Cisco IOS 15.6(3)M</td>
<td>This feature enhancement provides support for up to 54 VRFs. Each of the VRFs supports up to 10 different RTP port ranges.</td>
</tr>
<tr>
<td>Enhancement to support up to 54 VRF instances</td>
<td>Cisco IOS XE Denali 16.3.1</td>
<td></td>
</tr>
<tr>
<td>Support for Inbound Dial-peer Matching using VRF-ID</td>
<td>Cisco IOS 15.6(3)M</td>
<td>This feature supports inbound dial-peer matching using VRF ID.</td>
</tr>
<tr>
<td>Support for Inbound Dial-peer Matching using VRF-ID</td>
<td>Cisco IOS XE Denali 16.3.1</td>
<td></td>
</tr>
</tbody>
</table>

**Information About Single-VRF**

Support for single-VRF (also known as VRF-Aware) was introduced in Cisco IOS Release 12.4(11)XJ to provide support for configuring a VRF specific to voice traffic. Single-VRF can be configured using `voice vrf vrf-name` command. For more information on Single-VRF, see [http://www.cisco.com/c/en/us/td/docs/ios/12_4t/12_4t15/vrfawvgw.html](http://www.cisco.com/c/en/us/td/docs/ios/12_4t/12_4t15/vrfawvgw.html).

If you are currently using single-VRF feature on CUBE and intend to upgrade to multi-VRF feature, you must perform the following:

- Remove the configurations specific to single-VRF
- Configure Multi-VRF support

**Information About Multi-VRF**

The Multi-VRF feature allows you to configure and maintain more than one instance of routing and forwarding tables within the same CUBE device and segregate voice traffic based on the VRF.

Multi-VRF uses input interfaces to distinguish calls for different VRFs and forms VRF tables by associating with one or more Layer 3 interfaces. Interface can be physical interface (such as FastEthernet ports, Gigabit Ethernet ports) or sub-interface. CUBE supports bridging calls on both intra-VRF and inter-VRF.
Note

One physical interface or sub-interface can be associated with one VRF only. One VRF can be associated with multiple interfaces.

As per the Multi-VRF feature, the dial-peer configuration must include the use of the interface bind functionality. This is mandatory. It allows dial-peers to be mapped to a VRF via the interface bind.

The calls received on a dial-peer are processed based on the interface to which it is associated with. The interface is in turn associated with the VRF. So, the calls are processed based on the VRF table associated with that particular interface.

Restrictions

• Supports only SIP-SIP calls.
• Cisco Unified Communications Manager Express (Unified CME) and CUBE co-located with VRF is not supported.
• Cisco Unified Survivability Remote Site Telephony (Unified SRST) and CUBE co-location is not supported prior to IOS XE Fuji 16.7.1 Release.
• Multi-VRF call across CUBE is supported in Flow-through mode only.
• IPv6 on VRF is not supported.
• SDP pass-through is not supported prior to IOS Release 15.6(3)M and IOS XE Denali 16.3.1.
• Calls are not supported when incoming dial-peer matched is default dial-peer (dial-peer 0).
• Media Anti-trombone is not supported with VRF.
• Cisco UC Services API with VRF is not supported.
• Multi-VRF is not supported on TDM-SIP gateway.
• Single-VRF (configuring VRF using `voice vrf vrf-name`) and Multi-VRF cannot co-exist. You must remove `voice vrf vrf-name` command in order to use Multi-VRF feature.
• VRF aware matching is applicable only for inbound dial-peer matching and not for outbound dial-peer matching.
• Invoking TCL scripts via a dial-peer is not supported with the Multi-VRF feature.

Recommendations

• For new deployments, we recommend a reboot of the router once all VRFs' are configured under interfaces.
• No VRF Route leaks are required on CUBE to bridge VoIP calls across different VRFs.
• High Availability(HA) with VRF is supported where VRF IDs are check-pointed in the event of fail-over. Ensure that same VRF configuration exists in both the HA boxes.
Whenever destination server group is used with VRF, ensure that the server group should have the session targets, belonging to the same network as that of sip bind on the dial-peer, where the server-group is configured. This is because, dial-peer bind is mandatory with VRF and only one sip bind can be configured on any given dial-peer.

If there are no VRF configuration changes at interface level, then reload of the router is not required.

### Configuring VRF

**Note**

We recommend you NOT to modify VRF settings on the interfaces in a live network as it requires CUBE reload to resume VRF functionality.

This section provides the generic configuration steps for creating a VRF. For detailed configuration steps specific to your network scenario (Multi-VRF and Multi-VRF with HA), refer to Configuration Examples section.

### Create a VRF

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **ip vrf vrf-name**
4. **rd route-distinguisher**
5. **exit**

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1** enable | Enables privileged EXEC mode  
  Example: Device> enable  
  • Enter your password if prompted. |
| **Step 2** configure terminal | Enters global configuration mode.  
  Example: Device# configure terminal |
| **Step 3** ip vrf vrf-name | Creates a VRF with the specified name. In the example, VRF name is VRF1.  
  Example: Device(config)# ip vrf VRF1  
  **Note** Space is not allowed in VRF name. |
### Assign Interface to VRF

#### Purpose
- **Purpose**: Creates a VRF table by specifying a route distinguisher.
- **Command or Action**: `rd route-distinguisher`
- **Example**: `Device(config)# rd 1:1`

#### Example:
- **Step 4**: `exit`
- **Example**: `Device(config)# exit`

---

#### Summary Steps
1. enable
2. configure terminal
3. interface interface-name
4. ip vrf forwarding vrf-name
5. ip address ip address subnet mask
6. exit

---

#### Detailed Steps

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td></td>
<td>Device&gt; enable</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device# configure terminal</td>
</tr>
<tr>
<td><strong>Step 3</strong> interface interface-name</td>
<td>Enters the interface configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config)# interface GigabitEthernet 0/1</td>
</tr>
</tbody>
</table>

---

**Note**
- If an IP address is already assigned to an interface, then associating a VRF with interface will disable the interface and remove the existing IP address. An error message (sample error message shown below) is displayed on the console. Assign the IP address to proceed further.

`% Interface GigabitEthernet0/1 IPv4 disabled and address(es) removed due to enabling VRF VRF1`
### Create Dial-peers

**SUMMARY STEPS**

1. enable
2. configure terminal
3. dial-peer voice number voip
4. session protocol protocol
5. Create dial-peer:
   - To create inbound dial-peer:
     incoming called number number
   - To create outbound dial-peer:
     destination pattern number
6. codec codec-name
7. exit

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Command or Action</td>
</tr>
<tr>
<td>-------</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td><strong>dial-peer voice number voip</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td><strong>Device(config)# dial-peer voice 1111 voip</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 4</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>session protocol protocol</strong></td>
<td>Specifies the protocol associated with the dial-peer.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td><strong>Device(config-dial-peer)# session protocol sipv2</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 5</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Create dial-peer:</td>
<td>Creates inbound and outbound dial-peer.</td>
</tr>
<tr>
<td></td>
<td>• To create inbound dial-peer:</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>incoming called number number</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• To create outbound dial-peer:</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>destination pattern number</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Inbound dial-peer:</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Device(config-dial-peer)# incoming called-number 1111</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Outbound dial-peer:</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Device(config-dial-peer)# destination pattern 3333</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 6</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>codec codec-name</strong></td>
<td>Specifies the codec associated with this dial-peer.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td><strong>Device(config-dial-peer)# codec g711ulaw</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 7</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>exit</strong></td>
<td>Exits present mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td><strong>Device(config-dial-peer)# exit</strong></td>
<td></td>
</tr>
</tbody>
</table>

## Bind Dial-peers

You can configure SIP binding at global level as well as at dial-peer level.

- Control and Media on a dial-peer have to bind with same VRF. Else, while configuring, the CLI parser will display an error.
Whenever a global sip bind interface associated with a VRF is added, modified, or removed, you should restart the sip services under 'voice service voip > sip' mode so that the change in global sip bind comes into effect with associated VRF ID.

CUBE(config)# voice service voip
CUBE(conf-voi-serv)# sip
CUBE(conf-serv-sip)# call service stop
CUBE(conf-serv-sip)# no call service stop
CUBE(conf-serv-sip)# end

**SUMMARY STEPS**

1. enable
2. configure terminal
3. Bind control and media to the interface
   - At dial-peer level:
     - dial-peer voice number voip
     - voice-class sip bind control source-interface interface-name
     - voice-class sip bind media source-interface interface-name
   - At global configuration level
     - voice service voip
     - sip
     - bind control source-interface interface-name
     - bind media source-interface interface-name
4. exit

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>Enter your password if prompted.</td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3 Bind control and media to the interface</td>
<td>Interface bind associates VRF to the specified dial-peer.</td>
</tr>
<tr>
<td>- At dial-peer level:</td>
<td></td>
</tr>
<tr>
<td>- dial-peer voice number voip</td>
<td></td>
</tr>
<tr>
<td>- voice-class sip bind control source-interface interface-name</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td>voice-class sip bind media source-interface interface-name</td>
<td>• At global configuration level</td>
</tr>
<tr>
<td>voice service voip</td>
<td></td>
</tr>
<tr>
<td>sip</td>
<td></td>
</tr>
<tr>
<td>bind control source-interface interface-name</td>
<td></td>
</tr>
<tr>
<td>bind media source-interface interface-name</td>
<td></td>
</tr>
</tbody>
</table>

**Example:**

At dial-peer level:

```bash
Device(config)# dial-peer voice 1111 voip
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/1
Device(config-dial-peer)# voice-class sip bind media source-interface GigabitEthernet0/1
```

**Example:**

At global configuration level:

```bash
Device(config)# voice service voip
Device(conf-voi-serv)# sip
Device(conf-voi-sip)# bind control source-interface GigabitEthernet0/1
Device(conf-voi-sip)# bind media source-interface GigabitEthernet0/1
```

**Step 4**

exit

**Example:**

```bash
Device(config-dial-peer)# exit
```

Exits present mode.

---

**Configure VRF Specific RTP Port Ranges**

You can configure each VRF to have its own set of RTP port range for VoIP RTP connections under voice service voip. A maximum of ten VRF port ranges are supported. Different VRFs can have overlapping RTP port range. VRF based RTP port range limits (min, max port numbers) are same as global RTP port range. All three port ranges (global, media-address, VRF based) can coexist on CUBE and the preference order of RTP port allocation is as follows:

- VRF based port range
- Media-address based port range
- Global RTP port range
### SUMMARY STEPS
1. `enable`
2. `configure terminal`
3. `voice service voip`
4. `media-address voice-vrf vrf-name port-range min max`
5. `exit`

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables privileged EXEC mode</td>
</tr>
<tr>
<td><code>enable</code></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device&gt; enable</code></td>
<td></td>
</tr>
</tbody>
</table>

| **Step 2**        | Enters global configuration mode. |
| `configure terminal` |         |
| **Example:**      |         |
| `Device# configure terminal` |         |

| **Step 3**        | Enters voice service voip mode. |
| `voice service voip` |         |
| **Example:**      |         |
| `Device(config)# voice service voip` |         |

| **Step 4**        | Associates the RTP Port range with the VRF. |
| `media-address voice-vrf vrf-name port-range min max` |         |
| **Example:**      | If the RTP port range is not configured per each VRF, the default RTP port range is used across the VRFs used. You can configure up to ten port ranges per media address. |
| `Device(conf-voi-serv)# media-address voice-vrf VRF1 port 16000 32000` | The default port range is **8000-48198** for ASR and ISR G3 platforms, and **16384-32766** for ISR G2 platforms. |

**Note** From Cisco IOS 15.6(3)M and Cisco IOS XE Denali Release 16.3.1 onwards, you can configure 54 VRFs for up to 10 different RTP port ranges (that is, 10 different port ranges per each VRF).
Example: VRF with overlapping and non-overlapping RTP Port Range

Example 1 - Non-overlapping Port Range

The following is example shows two VRFs with non-overlapping RTP port range:

```
Device(conf)# voice service voip
Device(conf-voi-serv)# no ip address trusted authenticate
Device(conf-voi-serv)# media bulk-stats
Device(conf-voi-serv)# media-address voice-vrf vrf1 port-range 25000 28000
Device(conf-voi-serv)# media-address voice-vrf vrf2 port-range 29000 32000
Device(conf-voi-serv)# allow-connections sip to sip
Device(conf-voi-serv)# redundancy-group 1
Device(conf-voi-serv)# sip
```

The output for command `show voip rtp connections` shows as follows:

```
Device# show voip rtp connections
VoIP RTP Port Usage Information:
Max Ports Available: 23001, Ports Reserved: 101, Ports in Use: 2
                         Min  Max  Ports  Ports
Ports  Media-Address Range  Port  Port  Available  Reserved  In-use
-----------------------------------------------
Global Media Pool          8000  48198 19999   101   0
VRF 1D Based Media Pool
```

MULTI-TENANCY

Example: VRF with overlapping and non-overlapping RTP Port Range

Example 3

CUBE supports a maximum of 54 VRFs. Hence, you can configure up to 54 media address instances, that is, one instance per voice-vrf.

```
Device(conf-voi-serv)#
media-address voice-vrf VRF1 port-range 8000 48000
media-address voice-vrf VRF2 port-range 8000 48000
media-address voice-vrf VRF3 port-range 8000 48000
media-address voice-vrf VRF4 port-range 8000 48000
media-address voice-vrf VRF5 port-range 8000 48000
```

Step 5

Exit

```
Device(conf-voi-serv)# exit
```

**Purpose**

- `no ip address trusted authenticate`
- `media-address voice-vrf VRF1 port-range 6000 7000`
- `port-range 8000 10000`
- `port-range 11000 20000`

*In this case, multiple port range lines are configured under the media address.*
Directory Number (DN) Overlap across Multiple-VRFs

CUBE has the capability to bridge calls across VRFs without the need for route leaks to be configured.
If multiple dial-peers on two different VRFs have the same destination-pattern and preference, CUBE will randomly choose a dial-peer and route the call using the session target of the selected dial-peer. Due to this, the call intended for one VRF may be routed to another VRF.

Dial-peer group feature allows you to route calls within the same VRF and not across VRFs. Configuring dial-peer group, routes the call to a specific VRF even if multiple dial-peers on two different VRFs have the same destination-pattern and preference.

To use dial-peer group feature, configure dial-peers such that there is a unique inbound dial-peer match for calls related to each VRF. Configuring dial-peer group, limits the outbound dial-peer search within the VRF.

**Example: Associating Dial-peer Groups to overcome DN overlap**

If a call is received on VRF1 and there are two dial-peers with same destination-pattern (one dial-peer bind to VRF1 and second dial-peer bind to VRF2), then by default, CUBE picks the VRF in random to route the call.

If you intended to route this call only to VRF1 dial-peer, then dial-peer group can be applied on inbound dial-peer which will restrict the CUBE to route the call only across the dial-peers within the dial-peer group and not pick a dial-peer bind to a different VRF.

**Figure 28: Associating Dial-peer Group to overcome DN overlap**

The following scenario is considered in the below example:

- VRF1 associated with Gigabitethernt Interface 0/0 and 0/1
- VRF 2 associated with Gigabitethernt Inetrface 0/2
- Dial-peer Group: dpg1
- VRF1 is associated with dial-peer group - dpg 1
- Outbound dial-peer 300 is selected as preference 1
- Inbound dial-peer 3000 associated with VRF 1 and dial-peer group 1 (dpg1)
- Outbound Dial-peer: 300 – destination pattern “3001” associated with VRF1
- Outbound dial-peer: 301 – destination pattern “3001” associated with VRF2

Configure a dial-peer group and set the outbound dial-peer preference.

```bash
Device# enable
Device# configure terminal
Device(config)# voice class dpg 1
```
Create inbound dial-peer and associated with dial-peer group 1 (dpg1)

```
Device(config)# dial-peer voice 3000 voip
Device(config-dial-peer)# video codec h264
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session transport udp
Device(config-dial-peer)# destination dpg 1
Device(config-dial-peer)# incoming called-number 3001
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/1
Device(config-dial-peer)# voice-class sip bind media source-interface GigabitEthernet0/1
Device(config-dial-peer)# dtmf-relay sip-kpml
Device(config-dial-peer)# srtp fallback
Device(config-dial-peer)# codec g711ulaw
```

Creating outbound dial-peer with destination pattern ‘3001’ associated with VRF1.

```
Device(config)# dial-peer voice 300 voip
Device(config-dial-peer)# destination-pattern 3001
Device(config-dial-peer)# video codec h264
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target ipv4:10.0.0.1
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/1
Device(config-dial-peer)# voice-class sip bind media source-interface GigabitEthernet0/1
Device(config-dial-peer)# dtmf-relay sip-kpml
Device(config-dial-peer)# codec g711ulaw
```

Creating outbound dial-peer with destination pattern ‘3001’ associated with VRF2.

```
Device(config)# dial-peer voice 301 voip
Device(config-dial-peer)# destination-pattern 3001
Device(config-dial-peer)# video codec h264
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target ipv4:11.0.0.1
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/2
Device(config-dial-peer)# voice-class sip bind media source-interface GigabitEthernet0/2
Device(config-dial-peer)# dtmf-relay sip-kpml
Device(config-dial-peer)# codec g711ulaw
```

With above dial-peer group configuration, whenever dial-peer “3000” is matched as inbound dial-peer, CUBE will always route call using dial-peer “300” (VRF1). Without dial-peer group, CUBE would have picked dial-peers “300”(VRF1) and “301”(VRF2) in random to route the call.
Generally, on a router, two interfaces cannot be configured with the same IP address. With VRF feature, you can configure two or more interfaces with the same IP address. This is possible because, each interface having the same IP address belongs to a unique VRF and hence belongs to a different routing domain. However, for successful call processing, you must ensure that appropriate call routing protocols are configured on the VRFs.

The following is a sample configuration:

Configure GigabitEthernet 0/0 that belongs to VRF1 with IP address 10.0.0.0.

```plaintext
Device# enable
Device# configure terminal
Device(config)# ip vrf VRF1
Device(config)# rd 1:1
Device(config)# exit

Device> enable
Device# configure terminal
Device(config)# interface GigabitEthernet0/0
Device(config-if)# ip vrf forwarding VRF1
Device(config-if)# ip address 10.0.0.0 255.255.255.0
Device(config-if)# speed auto
Device(config-if)# exit
```

Configure GigabitEthernet 0/1 that belongs to VRF2 with IP address 10.0.0.0

```plaintext
Device# enable
Device# configure terminal
Device(config)# ip vrf VRF2
Device(config)# rd 1:1
Device(config)# exit

Device> enable
Device# configure terminal
Device(config)# interface GigabitEthernet0/1
Device(config-if)# ip vrf forwarding VRF2
Device(config-if)# ip address 10.0.0.0 255.255.255.0
Device(config-if)# speed auto
Device(config-if)# exit
```

For call routing on VRF1 and VRF2, ensure that appropriate routing entries are configured for both VRF1 and VRF2.

---

**Note**

The above configurations are specific to VRF support only. For call routing, appropriate routing protocols needs to be configured in the network.

Even though GigabitEthernet 0/0 and GigabitEthernet 0/1 have overlapping IP address, the call processing is not overlapped as they belong to different VRFs.
show ip interface brief command shows that GigabitEthernet 0/0 and GigabitEthernet 0/1 have overlapping IP address:

```
Device# show ip interface brief
Interface     IP-Address  OK? Method Status       Protocol
---           ---------  ---- ----- ---------       ------------
Embedded-Service-Engine0/0 unassigned YES NVRAM administratively down down
GigabitEthernet0/0  10.0.0.0 YES NVRAM up               up
GigabitEthernet0/1  10.0.0.0 YES NVRAM up               up
GigabitEthernet0/1.1 unassigned YES NVRAM up               up
GigabitEthernet0/2 unassigned YES NVRAM up               up
```

show voip rtp connections command shows a video call established on CUBE across different interfaces belonging to different VRF’s having Overlap IP address:

```
Device# show voip rtp connections
VoIP RTP Port Usage Information:
Max Ports Available: 11700, Ports Reserved: 303, Ports in Use: 4

<table>
<thead>
<tr>
<th>Min Media-Address Range</th>
<th>Max</th>
<th>Ports Available</th>
<th>Ports Reserved</th>
<th>Ports In-use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Media Pool</td>
<td>20000</td>
<td>22000</td>
<td>900</td>
<td>101</td>
</tr>
<tr>
<td>VRF ID Based Media Pool</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POD2</td>
<td>30002</td>
<td>32000</td>
<td>1000</td>
<td>0</td>
</tr>
<tr>
<td>POD1</td>
<td>20000</td>
<td>30000</td>
<td>4900</td>
<td>101</td>
</tr>
<tr>
<td>POD3</td>
<td>20000</td>
<td>30000</td>
<td>4900</td>
<td>101</td>
</tr>
</tbody>
</table>

VoIP RTP active connections:
<table>
<thead>
<tr>
<th>No.</th>
<th>CallId</th>
<th>dstCallId</th>
<th>LocalRTP</th>
<th>RmtRTP</th>
<th>LocalIP</th>
<th>RemoteIP</th>
<th>MFSS</th>
<th>VRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37</td>
<td>39</td>
<td>20000</td>
<td>18164</td>
<td>10.0.0.0</td>
<td>11.0.0.3</td>
<td>NO</td>
<td>VRF1</td>
</tr>
<tr>
<td>2</td>
<td>38</td>
<td>40</td>
<td>20002</td>
<td>18166</td>
<td>10.0.0.0</td>
<td>11.0.0.3</td>
<td>NO</td>
<td>VRF1</td>
</tr>
<tr>
<td>3</td>
<td>39</td>
<td>37</td>
<td>20002</td>
<td>16388</td>
<td>10.0.0.0</td>
<td>11.0.0.3</td>
<td>NO</td>
<td>VRF2</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>38</td>
<td>20000</td>
<td>16390</td>
<td>10.0.0.0</td>
<td>11.0.0.3</td>
<td>NO</td>
<td>VRF2</td>
</tr>
</tbody>
</table>

Found 4 active RTP connections
```

Using Server Groups with VRF

Whenever destination server group is used with VRF, ensure that the server group should have the session targets, belonging to the same network as that of sip bind on the dial-peer, where the server-group is configured. This is because the dial-peer bind is mandatory with VRF and only one sip bind can be configured on any given dial-peer.

The following scenario is considered in the below example:

Interfaces and associated IP address

- GigabitEthernet0/0/2 12.0.0.1
- GigabitEthernet0/0/1 11.0.0.1

```
Device# show ip interface brief
Interface     IP-Address  OK? Method Status       Protocol
---           ---------  ---- --------------       ------------
GigabitEthernet0/0/0  10.0.0.1 YES NVRAM up               up
GigabitEthernet0/0/1  11.0.0.1 YES NVRAM up               up
GigabitEthernet0/0/2  12.0.0.1 YES NVRAM up               up
```

- dial-peer 200 is bind to GigabitEthernet0/0/1
server-group 1 (belonging to VRF1) is applied to dial-peer 200

Device(config)# dial-peer voice 200 voip  
Device(config-dialpeer)# destination-pattern 4.....   
Device(config-dialpeer)# session protocol sipv2  
Device(config-dialpeer)# session transport udp  
Device(config-dialpeer)# session server-group 1  
Device(config-dialpeer)# voice-class sip bind control source-interface GigabitEthernet0/0/1  
Device(config-dialpeer)# voice-class sip bind media source-interface GigabitEthernet0/0/1  
Device(config-dialpeer)# codec g711ulaw

As dial-peer 200 is bind to GigabitEthernet0/0/1, the session targets configured in the “server-group 1” should belong to the network which is reachable by the bind source interface GigabitEthernet0/0/1 as shown below:

Device(config)# voice class server-group 1  
Device(config-class)# ipv4 11.0.0.22  
Device(config-class)# ipv4 11.0.0.8 preference 2

Inbound Dial-Peer Matching based on Multi-VRF

From Cisco IOS Release 15.6(3)M and Cisco IOS XE Denali 16.3.1 onwards, dial-peer matching is done based on the VRF ID associated with a particular interface.

Example: Inbound Dial-Peer Matching based on Multi-VRF

Prior to Cisco IOS 15.6(3)M and Cisco IOS XE Denali 16.3.1 releases, when an incoming out-of-dialog message such as INVITE, REGISTER, OPTIONS, NOTIFY, and so on are received on a particular VRF bound interface, inbound dial-peer matching was done using the complete set of inbound dial-peers regardless of the VRF association. The response would be sent based on this matched dial-peer. Since the inbound dial-peer selected could have a different VRF bound to it, the response was sent to the wrong VRF.

To overcome this issue, the inbound dial-peers are filtered based on the incoming VRF and then followed by the regular inbound dial-peer matching. Now, the response is sent to the same VRF on which the request was received.

Consider the following configuration example output to understand the inbound dial-peer matching criteria used in multi-VRF:

```
interface GigabitEthernet0/0
ip address 8.39.18.37 255.255.0.0
duplex auto
ip vrf forwarding VRF ID1
speed auto

interface GigabitEthernet0/1
ip address 9.39.18.55 255.255.0.0
duplex auto
ip vrf forwarding VRF ID2
speed auto

interface GigabitEthernet0/2
ip address 10.39.18.68 255.255.0.0
duplex auto
ip vrf forwarding VRF ID3
speed auto
```

Multi-Tenancy

Inbound Dial-Peer Matching based on Multi-VRF
Prior to Cisco IOS 15.6(3)M and Cisco IOS XE Denali 16.3.1 releases, when an incoming call is received for the dialed number 5678 on GigabitEthernet0/0 (VRF ID1), inbound dial-peer matching was done based on the called-number 5678. In this case, dial-peer 1000 which is bound to GigabitEthernet0/1 (VRF ID2) was considered to be the first matched dial-peer for this call. And, the response was sent incorrectly to VRF ID2 instead of VRF ID1.

With the introduction of VRF aware inbound dial-peer matching, the initial filtering is done based on the VRF ID and then based on the called-number. For the above example, a call with called-number of 5678 that is received on GigabitEthernet 0/0 with VRF ID 1 configured, the dial-peers will first be filtered to those that are bound to GigabitEthernet 0/0 before selection of the inbound dial-peer is performed. Now, the response is sent successfully on VRF ID1.
Whenever the VRF ID is added, modified, or removed under the interface, it is mandatory to execute the following command before making any calls: `clear interface <interface>`. If the `clear interface <interface>` command is not executed, the dial-peer is bound to the old VRF ID and not to the new VRF ID.

Inbound dial-peer matching based on VRF ID is selected in the following order of preference:
1. Dial-peer based configuration
2. Tenant based configuration
3. Global based configuration

### Example: Tenant based Inbound Dial-Peer Matching

```plaintext
voice class tenant 1
  bind control source-interface GigabitEthernet0/0
  bind media source-interface GigabitEthernet0/0
  dial-peer voice 2000 voip
    description "Inbound dial-peer bound to VRF-ID 1"
    session protocol sipv2
    session target sip-server
    session transport udp
    incoming called-number 5678
    voice-class sip tenant 1
    codec g711ulaw
```

### Example: Global based Inbound Dial-Peer Matching

```plaintext
voice service voip
  sip
    bind control source-interface GigabitEthernet0/0
    bind media source-interface GigabitEthernet0/0
```

## VRF Aware DNS for SIP Calls

The VRF Aware DNS for SIP Calls feature enables you to specify the Virtual Routing and Forwarding (VRF) table so that the domain name system (DNS) can forward queries to name servers using the VRF table.

Because the same IP address can be associated with different DNS servers in different VRF domains, a separate list of name caches for each VRF is maintained. The DNS looks up the specific VRF name cache before sending a query to the VRF name server. All IP addresses obtained from a VRF-specific name cache are routed using the VRF table.

While processing a SIP call, if a hostname has to be resolved, only the VRF associated with the SIP call is used during DNS resolutions.

Ensure that the name-server is configured using `ip name-server vrf` command. For configuration details, see Name Server Configuration.
High Availability with VRF

CUBE supports VRF in both HSRP and RG Infra high availability mode. VRF is supported on CUBE box-to-box and inbox high availability types.

For box-to-box high availability in Aggregation Services Routers 1000 Series and Integrated Services Routers 4000 Series, RG interface must not be associated with VRF where as the inbound and outbound interfaces (meant for handling VoIP traffic) can be associated with VRF’s depending upon the deployment.

For box-to-box high availability in Integrated Services Routers Generation 2, HSRP interface must not be associated with VRF where as the inbound and outbound interfaces (meant for handling VoIP traffic) can be associated with VRFs depending up upon the deployment.

All the configurations including the VRF based RTP port range has to be identical on active and standby routers. VRF IDs will be check pointed before and after the switchover.

Configuration Examples

**Note**

The steps in the following configuration example is for a new network and hence it is assumed that there is no existing configuration.

**Example: Configuring Multi-VRF in Standalone Mode**

The configuration in this scenario is as shown below where the Gigabitethernet 0/1 is assigned to VRF1 and GigabitEthernet 0/2 is assigned to VRF2.

*Figure 29: Multi-VRF in Standalone Mode*

**Configuring VRF**

```
Device# enable
Device# configure terminal
Device(config)# ip vrf VRF1
Device(config)# rd 1:1
Device(config)# ip vrf VRF2
Device(config)# rd 2:2
Device(config)# exit
```

**Associating interfaces with VRF**

```
```
Device(config)# interface GigabitEthernet0/1
Device(config-if)# ip vrf forwarding VRF1
Device(config)# interface GigabitEthernet0/2
Device(config-if)# ip vrf forwarding VRF2

If an IP address is already assigned to an interface, then associating a VRF with interface will disable the interface and remove the existing IP address. An error message (sample error message shown below) is displayed on the console. Assign the IP address to proceed further.

% Interface GigabitEthernet0/1 IPv4 disabled and address(es) removed due to enabling VRF VRF1

Configure Interface GigabitEthernet0/1

Device> enable
Device# configure terminal
Device(config)# interface GigabitEthernet0/1
Device(config-if)# ip address 10.0.0.2 255.255.255.0
Device(config-if)# speed auto
Device(config-if)# exit

Configure Interface GigabitEthernet0/2

Device(config)# interface GigabitEthernet0/2
Device(config-if)# ip address 11.0.0.2 255.255.255.0
Device(config-if)# speed auto
Device(config-if)# exit

Creating Dial-peer
Creating Inbound Dial-peer:

Device(config)# dial-peer voice 1111 voip
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# incoming called-number 1111
Device(config-dial-peer)# codec g711ulaw

Creating Outbound Dial-peer:

Device(config)# dial-peer voice 2222 voip
Device(config-dial-peer)# destination pattern 1111
Device(config-dial-peer)# session protocol sipv2

Execute the following command to verify the dial-peer association with interface:

Device# show dial-peer voice summary

<table>
<thead>
<tr>
<th>TAG</th>
<th>TYPE</th>
<th>MIN</th>
<th>OPER</th>
<th>PREFIX</th>
<th>DEST-PATTERN</th>
<th>FER</th>
<th>PASS</th>
<th>THRU</th>
<th>SESS-TARGET</th>
<th>PORT</th>
<th>KEEPALIVE</th>
<th>VRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111</td>
<td>voip</td>
<td>up</td>
<td>up</td>
<td>-</td>
<td></td>
<td>0</td>
<td>syst</td>
<td>ipv4:10.0.0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VRF1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2222</td>
<td>voip</td>
<td>up</td>
<td>up</td>
<td>-</td>
<td></td>
<td>0</td>
<td>syst</td>
<td>ipv4:11.0.0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VRF2

Configure Binding

- Control and Media on a dial-peer have to bind with same VRF. Else, while configuring, the CLI parser will display an error.

- Whenever global sip bind interface associated with a VRF is added, modified, or removed, you should restart the sip services under voice service voip sip mode so that the change in global sip bind comes into effect with associated VRF ID.

```plaintext
Device(config)# voice service voip
Device(conf-voi-serv)# sip
Device(conf-serv-sip)# call service stop
Device(conf-serv-sip)# no call service stop
Device(conf-serv-sip)# end
```

```plaintext
Device(config)# dial-peer voice 1111 voip
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/1
Device(config-dial-peer)# voice-class sip bind media source-interface GigabitEthernet0/1
```

```plaintext
Device(config)# dial-peer voice 2222 voip
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/2
Device(config-dial-peer)# voice-class sip bind media source-interface GigabitEthernet0/2
```

Execute the following command to verify the interface association with VRF:

```plaintext
Device# show ip vrf brief
```

```
Name            Default   RD      Interfaces
Mgmt-intf       <not set> 1:1      Gi0
VRF1            1:1        Gi0/1
VRF2            2:2        Gi0/2
```

Execute the following command to verify a successful and active calls:

For a single call, you should be able to see two RTP connections as shown in the below example.

```plaintext
Device# show voip rtp connections
```

```
VoIP RTP Port Usage Information:
Max Ports Available: 23001, Ports Reserved: 101, Ports in Use: 2
Media-Address Range  Min Port Max Port Available Reserved In-use
Global Media Pool     8000 48198 19999 101      0
```

```
VoIP RTP active connections:
No. CallId dstCallId LocalRTP RmtRTP LocalIP RemoteIP MFSS VRF
 1 1 1 2 25000 16390 10.0.0.1 10.0.0.2 NO VRF1
 2 2 1 25002 16398 11.0.0.1 11.0.0.2 NO VRF2
```
Device# show call active voice brief

Perf-AR1006#show call active voice brief
<ID>: <CallID> <start>ms.<index> (<start>) +<connect> pid:<peer_id> <dir> <addr> <state>
  dur hh:mm:ss tx:<packets>/bytes rx:<packets>/bytes dscp:<packets violation>
  media:<packets violation> audio tos:<audio tos value> video tos:<video tos value>
  IP <ip>:<udp> rtt:<time>ms pl:<play>/<gap>ms lost:<lost>/<early>/<late>
  delay:<last>/<min>/max ms <codec> <textrelay> <transcoded>
  media inactive detected:<y/n> media cntrl rcvd:<y/n> timestamp:<time>

  long duration call detected:<y/n> long duration call duration :<sec> timestamp:<time>
  LostPacketRate:<%> OutOfOrderRate:<%>
  VRF:<%>
  MDEMMPASS <method> buf:<fills>/<drains> loss <overall> <multipkt>/<corrected>
  last <buf event time> dur:<Min>/<Max>s
  FR <protocol> [int dlci cid] vad:<y/n> dtmf:<y/n> seq:<y/n>
  <codec> (payload size)
  ATM <protocol> [int vpi/vci cid] vad:<y/n> dtmf:<y/n> seq:<y/n>
  <codec> (payload size)
  Tele <int> (callID) [channel_id] tx:<tot>/v/<fax>ms <codec> noise:<l> acom:<l> i/o:<l>/<l> dBm
  MDEMRELAY info:<rcvd>/sent/<resend> xid:<rcvd>/sent total:<rcvd>/sent/<drops>
  speeds(bps): local <rx>/<tx> remote <rx>/<tx>
  Proxy <ip>:[audio udp],<video udp>,<tcp0>,<tcp1>,<tcp2>,<tcp3> endpt: <type>/<manf>
  bw: <req>/<act> codec: <audio> <video>
  tx: <audio pkts>/<audio bytes>,<video pkts>/<video bytes>,<t120 pkts>/<t120 bytes>
  rx: <audio pkts>/<audio bytes>,<video pkts>/<video bytes>,<t120 pkts>/<t120 bytes>

Telephony call-legs: 0
SIP call-legs: 2
H323 call-legs: 0
Call agent controlled call-legs: 0
SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 2
Answer 777412373 active
dur 00:00:22 tx:1110/66600 rx:1111/66660 dscp:0 media:0 audio tos:0xB8 video tos:0x0
10.0.0.2:30804 SRTP: off rtt:0ms pl:0/0/0ms lost:0/0/0 delay:0/0/0ms g729r8 TextRelay:
off Transcoded: No ICE: Off
media inactive detected:n media cntrl rcvd:n/a timestamp:n/a
long duration call detected:n long duration call duration:n/a timestamp:n/a
LostPacketRate:0.00 OutOfOrderRate:0.00
VRF: VRF1

11FF : 8565723 511605470ms.1 (*16:21:53.696 IST Tue Aug 4 2015) +0 pid:400000 Originate
777512373 active
dur 00:00:22 tx:1111/66660 rx:1110/66660 dscp:0 media:0 audio tos:0xB8 video tos:0x0
11.0.0.2:30804 SRTP: off rtt:0ms pl:0/0/0ms lost:0/0/0 delay:0/0/0ms g729r8 TextRelay:
off Transcoded: No ICE: Off
media inactive detected:n media cntrl rcvd:n/a timestamp:n/a
long duration call detected:n long duration call duration:n/a timestamp:n/a
LostPacketRate:0.00 OutOfOrderRate:0.00
VRF: VRF2

Telephony call-legs: 0
SIP call-legs: 2
H323 call-legs: 0
Call agent controlled call-legs: 0
SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 2
Device# show sip-ua connections udp brief

Total active connections : 2
No. of send failures : 0
No. of remote closures : 0
No. of conn. failures : 0
No. of inactive conn. ageouts : 2

------------- SIP Transport Layer Listen Sockets -------------
 Conn-Id Local-Address
 ============== ===============
 2 [10.0.0.1]:5060:VRF1
 3 [11.0.0.1]:5060:VRF2

Device# show call active voice compact

Total call-legs: 2
8565722 ANS T12 g711ulaw VOIP P777412373 10.0.0.2:30804 VRF1
8565723 ORG T12 g711ulaw VOIP P777512373 11.0.0.2:30804 VRF2

Device# show call active video compact

Total call-legs: 2
10193983 ANS T30 H264 VOIP-VIDEO P2005 10.0.0.2:18078 VRF1
10193985 ORG T30 H264 VOIP-VIDEO P3001 11.0.0.2:27042 VRF2

Example: Configuring RG Infra High Availability with VRF

Note
Below configuration example is applicable for Cisco ASR 1000 Series Aggregated Services Routers (ASR) and Cisco 4000 Series Integrated Services Routers (ISR G3).

Note
Do not configure VRF on the interface that is used for RG Infra. Traffic of VRF and RG Infra should be on different interfaces.
Figure 30: Multi-VRF in High Availability Mode (RG Infra)

Configuration on Active Router

Note

The configurations of Active Router and Stand By Router should be identical.

Configuring VRF

Device> enable
Device# configure terminal
Device(config)# ip vrf VRF1
Device(config)# rd 1:1
Device(config)# ip vrf VRF2
Device(config)# rd 2:2

Device(config)# voice service voip
Device(config)# no ip address trusted authenticate
Device(config)# media bulk-stats
Device(config)# allow-connections sip to sip
Device(config)# redundancy-group 1
Device(config)# sip

Device(config)# redundancy
Device(config)# mode none
Device(config)# application redundancy
Device(config)# group 1
Device(config)# name raf-b2b
Device(config)# priority 1
Device(config)# timers delay 30 reload 60
Device(config)# control GigabitEthernet0/0/0 protocol 1
Device(config)# data GigabitEthernet0/0/0

Associating interfaces with VRF

Device(config)# interface GigabitEthernet0/2
Device(config-if)# ip vrf forwarding vrf2
If an IP address is already assigned to an interface, then associating a VRF with interface will disable the interface and remove the existing IP address. An error message (sample error message shown below) is displayed on the console. Assign the IP address to proceed further.

% Interface GigabitEthernet0/1 IPv4 disabled and address(es) removed due to enabling VRF VRF1

GigabitEthernet0/0/0 is used for configuring RG Infra and therefore do not configure any VRF with this interface.

Device(config)# interface GigabitEthernet0/0/0
Device(config-if)# ip address 14.2.43.81 255.255.0.0
Device(config-if)# negotiation auto
Device(config-if)# cdp enable

Inbound interface - GigabitEthernet0/1 is used for voice traffic configured with VRF1.

Device(config)# interface GigabitEthernet0/1
Device(config-if)# ip address 10.0.0.3 255.0.0.0
Device(config-if)# negotiation auto
Device(config-if)# bfd interval 50 min_rx 50 multiplier 3
Device(config-if)# cdp enable
Device(config-if)# redundancy rii 1
Device(config-if)# redundancy group 1 ip 10.0.0.1 exclusive

Outbound interface - GigabitEthernet0/2 is used for voice traffic configured with VRF2.

Device(config)# interface GigabitEthernet0/2
Device(config-if)# ip address 11.0.0.3 255.0.0.0
Device(config-if)# negotiation auto
Device(config-if)# bfd interval 50 min_rx 50 multiplier 3
Device(config-if)# cdp enable
Device(config-if)# redundancy rii 2
Device(config-if)# redundancy group 1 ip 11.0.0.1 exclusive

Creating Dial-peer

Creating Inbound Dial-peer:

Device(config)# dial-peer voice 1111 voip
Device(config-dial-peer)# destination pattern 1111
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target ipv4:10.0.0.2
Device(config-dial-peer)# incoming called-number 1111

Creating Outbound Dial-peer:

Device(config)# dial-peer voice 3333 voip
Device(config)# destination-pattern 2222
Device(config-dial-peer)# session protocol sipv2
Configuring Binding

Control and Media on a dial-peer have to bind with same VRF. Else, while configuring, the CLI parser will display an error.

```
Device(config)# dial-peer voice 1111 voip
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/1
Device(config-dial-peer)# voice-class sip bind media source-interface GigabitEthernet0/1

Device(config)# dial-peer voice 3333 voip
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/2
Device(config-dial-peer)# voice-class sip bind media source-interface GigabitEthernet0/2
```

Configuration on Standby Router

The configurations of Active and Stand By should be identical.

```
Configuring VRF

Device(config)# enable
Device(config)# configure terminal
Device(config)# ip vrf VRF1
Device(config)# rd 1:1
Device(config)# ip vrf VRF2
Device(config)# rd 2:2

Device(config)# voice service voip
Device(config)# no ip address trusted authenticate
Device(config)# media bulk-stats
Device(config)# allow-connections sip to sip
Device(config)# redundancy-group 1
Device(config)# sip

Device(config)# redundancy
Device(config)# mode none
Device(config)# application redundancy
Device(config)# group 1
Device(config)# name raf-b2b
Device(config)# priority 1
Device(config)# timers delay 30 reload 60
Device(config)# control GigabitEthernet0/0/0 protocol 1
Device(config)# data GigabitEthernet0/0/0

Associating interfaces with VRF

Device(config)# interface GigabitEthernet0/2
Device(config-if)# ip vrf forwarding VRF2
If an IP address is already assigned to an interface, then associating a VRF with interface will disable the interface and remove the existing IP address. An error message (sample error message shown below) is displayed on the console. Assign the IP address to proceed further.

% Interface GigabitEthernet0/1 IPv4 disabled and address(es)removed due to enabling VRF VRF1

GigabitEthernet0/0/0 is used for configuring RG Infra and therefore do not configure any VRF with this interface.

```
Device(config)# interface GigabitEthernet0/0/0
Device(config-if)# ip address 14.2.43.81 255.255.0.0
Device(config-if)# negotiation auto
Device(config-if)# cdp enable
```

Inbound interface - GigabitEthernet0/1 is used for voice traffic configured with VRF1.

```
Device(config)# interface GigabitEthernet0/1
Device(config-if)# ip vrf forwarding VRF1
Device(config-if)# ip address 10.0.0.4 255.0.0.0
Device(config-if)# negotiation auto
Device(config-if)# bfd interval 50 min_rx 50 multiplier 3
Device(config-if)# cdp enable
Device(config-if)# redundancy rii 1
Device(config-if)# redundancy group 1 ip 10.0.0.1 exclusive
```

Outbound interface - GigabitEthernet0/2 is used for voice traffic configured with VRF2.

```
Device(config)# interface GigabitEthernet0/2
Device(config-if)# ip vrf forwarding VRF2
Device(config-if)# ip address 11.0.0.4 255.0.0.0
Device(config-if)# negotiation auto
Device(config-if)# bfd interval 50 min_rx 50 multiplier 3
Device(config-if)# cdp enable
Device(config-if)# redundancy rii 2
Device(config-if)# redundancy group 1 ip 11.0.0.1 exclusive
```

**Creating Dial-peer**

Creating Inbound Dial-peer:

```
Device(config)# dial-peer voice 1111 voip
Device(config-dial-peer)# destination pattern 1111
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target ipv4:10.0.0.2
Device(config-dial-peer)# incoming called-number 1111
```

Creating Outbound Dial-peer:

```
Device(config)# dial-peer voice 3333 voip
Device(config)# destination-pattern 2222
Device(config-dial-peer)# session protocol sipv2
```

Note

GigabitEthernet0/0/0 is used for configuring RG Infra and therefore do not configure any VRF with this interface.
Device(config-dial-peer)# session target ipv4:11.0.0.2

Configuring Binding

Control and Media on a dial-peer have to bind with same VRF. Else, while configuring, the CLI parser will display an error.

Device(config)# dial-peer voice 1111 voip
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/1
Device(config)# voice-class sip bind media source-interface GigabitEthernet0/1

Device(config)# dial-peer voice 3333 voip
Device(config)# voice-class sip bind control source-interface GigabitEthernet0/2
Device(config)# voice-class sip bind media source-interface GigabitEthernet0/2

Verification of Calls Before and After Switchover

RTP Connections on Active router:

Device# show voip rtp connections

VoIP RTP Port Usage Information:
Max Ports Available: 19999, Ports Reserved: 101, Ports in Use: 2

<table>
<thead>
<tr>
<th>Media-Address Range</th>
<th>Min</th>
<th>Max</th>
<th>Ports</th>
<th>Available</th>
<th>Reserved</th>
<th>In-use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Media Pool</td>
<td>8000</td>
<td>48198</td>
<td>19999</td>
<td>101</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

VoIP RTP active connections:

<table>
<thead>
<tr>
<th>No.</th>
<th>CallId</th>
<th>dstCallId</th>
<th>LocalRTP</th>
<th>RmtRTP</th>
<th>LocalIP</th>
<th>RemoteIP</th>
<th>MPSS</th>
<th>VRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>6</td>
<td>8008</td>
<td>16388</td>
<td>10.0.0.1</td>
<td>10.0.0.2</td>
<td>NO</td>
<td>VRF1</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>5</td>
<td>8010</td>
<td>16388</td>
<td>11.0.0.1</td>
<td>11.0.0.2</td>
<td>NO</td>
<td>VRF2</td>
</tr>
</tbody>
</table>

Found 2 active RTP connections

RTP Connections on Standby Router after switchover

Device# show voip rtp connections

VoIP RTP Port Usage Information:
Max Ports Available: 19999, Ports Reserved: 101, Ports in Use: 2

<table>
<thead>
<tr>
<th>Media-Address Range</th>
<th>Min</th>
<th>Max</th>
<th>Ports</th>
<th>Available</th>
<th>Reserved</th>
<th>In-use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Media Pool</td>
<td>8000</td>
<td>48198</td>
<td>19999</td>
<td>101</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

VoIP RTP active connections:

<table>
<thead>
<tr>
<th>No.</th>
<th>CallId</th>
<th>dstCallId</th>
<th>LocalRTP</th>
<th>RmtRTP</th>
<th>LocalIP</th>
<th>RemoteIP</th>
<th>MPSS</th>
<th>VRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>8</td>
<td>8012</td>
<td>16390</td>
<td>10.0.0.1</td>
<td>10.0.0.2</td>
<td>NO</td>
<td>VRF1</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>7</td>
<td>8014</td>
<td>16390</td>
<td>11.0.0.1</td>
<td>11.0.0.2</td>
<td>NO</td>
<td>VRF2</td>
</tr>
</tbody>
</table>

Found 2 active RTP connections
Active calls on Active Router

Device# show call active voice brief

11F3 : 5 243854170ms.1 (*11:48:43.972 UTC Mon May 25 2015) +6770 pid:0 Answer active
dur 00:00:14 tx:843/50551 rx:1028/61680 dscp:0 media:0 audio tos:0xB8 video tos:0x0
IP 10.0.0.2:16388 SRTP: off rtt:1ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g729r8 TextRelay:
off Transcoded: No ICE: Off
media inactive detected:n media contrl rcvd:n/a timestamp:n/a
long duration call detected:n long duration call duration:n/a timestamp:n/a
LostPacketRate:0.00 OutOfOrderRate:0.00

active
dur 00:00:14 tx:1028/61680 rx:843/50551 dscp:0 media:0 audio tos:0xB8 video tos:0x0
IP 11.0.0.2:16388 SRTP: off rtt:65522ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g729r8 TextRelay:
off Transcoded: No ICE: Off
media inactive detected:n media contrl rcvd:n/a timestamp:n/a
long duration call detected:n long duration call duration:n/a timestamp:n/a
LostPacketRate:0.00 OutOfOrderRate:0.00

Telephony call-legs: 0
SIP call-legs: 2
H.323 call-legs: 0
Call agent controlled call-legs: 0
SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 2

Device#show sip-ua connections udp brief

Total active connections : 2
No. of send failures : 0
No. of remote closures : 0
No. of conn. failures : 0
No. of inactive conn. ageouts : 2

-------------- SIP Transport Layer Listen Sockets ---------------
<table>
<thead>
<tr>
<th>Conn-Id</th>
<th>Local-Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>[10.0.0.1]:5060:VRF1</td>
</tr>
<tr>
<td>3</td>
<td>[11.0.0.1]:5060:VRF2</td>
</tr>
</tbody>
</table>

Active calls on Standby router after switchover:

Device# show call active voice brief

connected
dur 00:03:37 tx:6757/405420 rx:6757/405420 dscp:0 media:0 audio tos:0x0 video tos:0x0
IP 11.0.0.2:16390 SRTP: off rtt:65522ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g729r8 TextRelay:
off Transcoded: No ICE: Off
media inactive detected:n media contrl rcvd:n/a timestamp:n/a
long duration call detected:n long duration call duration:n/a timestamp:n/a
LostPacketRate:0.00 OutOfOrderRate:0.00

11F9 : 7 245073950ms.1 (*12:16:18.114 UTC Mon May 25 2015) +26840 pid:0 Answer connected
dur 00:03:37 tx:6757/405420 rx:6757/405420 dscp:0 media:0 audio tos:0x0 video tos:0x0
Example: Configuring HSRP High Availability with VRF

Note
Below configuration example is applicable for Cisco Integrated Services Routers Generation 2 (ISR G2) Platforms. [Cisco 2900 Series Integrated Services Routers and Cisco 3900 Series Integrated Services Routers]

Note
Do not configure VRF on the interface that is used for HSRP. Traffic of VRF and HSRP should be on different interfaces.

Figure 31: Multi-VRF in High Availability Mode (HSRP)

Configuration on Active Router

Note
The configurations of Active Router and Stand By Router should be identical.

Configuring VRF

Device> enable
Device# configure terminal
Device(config)# ip vrf VRF1
Device(config)# rd 1:1
Device(config)# ip vrf VRF2
Device(config)# rd 2:2

Associating interfaces with VRF

Device(config)# interface GigabitEthernet0/1
Device(config-if)# ip vrf forwarding VRF1

Device(config)# interface GigabitEthernet0/2
Device(config-if)# ip vrf forwarding VRF2

If an IP address is already assigned to an interface, then associating a VRF with interface will disable the interface and remove the existing IP address. An error message (sample error message shown below) is displayed on the console. Assign the IP address to proceed further.

% Interface GigabitEthernet0/1 IPv4 disabled and address(es) removed due to enabling VRF VRF1

The interface used for HSRP should not be configured with any VRF. In this example, GigabitEthernet0/0/0 is used for configuring HSRP and therefore no VRF is associated with this interface.

Device(config)# interface GigabitEthernet0/0/0
Device(config-if)# ip address 14.2.43.81 255.255.0.0
Device(config-if)# standby version 2
Device(config-if)# standby 93 ip 14.2.43.82
Device(config-if)# standby 93 priority 50
Device(config-if)# standby 93 preempt
Device(config-if)# standby 93 name cubeha
Device(config-if)# standby 93 track 1 decrement 5
Device(config-if)# standby 93 track 2 decrement 5
Device(config-if)# duplex auto
Device(config-if)# speed auto

Inbound interface - GigabitEthernet0/1 is used for voice traffic configured with VRF1.

Device(config)# interface GigabitEthernet0/1
Device(config-if)# ip vrf forwarding VRF1
Device(config-if)# ip address 10.0.0.3 255.0.0.0
Device(config-if)# standby version 2
Device(config-if)# standby 63 ip 10.0.0.4
Device(config-if)# standby 63 priority 50
Device(config-if)# standby 63 preempt
Device(config-if)# standby 63 track 1 decrement 5
Device(config-if)# duplex auto
Device(config-if)# speed auto
Device(config-if)# media-type rj45

Outbound interface - GigabitEthernet0/2 is used for voice traffic configured with VRF2.

Device(config)# interface GigabitEthernet0/2
Device(config-if)# ip vrf forwarding VRF2
Device(config-if)# ip address 11.0.0.3 255.0.0.0
Device(config-if)# standby version 2
Device(config-if)# standby 36 ip 11.0.0.4
Device(config-if)# standby 36 priority 50
Device(config-if)# standby 36 preempt
Device(config-if)# standby 36 track 1 decrement 5
Device(config-if)# duplex auto
Device(config-if)# speed auto
Device(config-if)# media-type rj45

Device(config)# ipc zone default
Device(config-ipczone)# association 1
Device(config-ipczone-assoc)# no shutdown
Device(config-ipczone-assoc)# protocol sctp
Device(config-ipc-protocol-sctp)# local port 5000
Device(config-ipc-local-sctp)# local-ip 14.2.43.81
Device(config-ipc-local-sctp)# exit
Device(config-ipc-protocol-sctp)# remote port 5000
Device(config-ipc-remote-sctp)# remote-ip 14.2.43.82

Creating Dial-peer
Creating Inbound Dial-peer:

Device(config)# dial-peer voice 1111 voip
Device(config-dial-peer)# destination pattern 1111
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target ipv4:10.0.0.2
Device(config-dial-peer)# incoming called-number 1111

Creating Outbound Dial-peer:

Device(config)# dial-peer voice 3333 voip
Device(config)# destination-pattern 2222
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target ipv4:11.0.0.2

Configuring Binding

Control and Media on a dial-peer have to bind with same VRF. Else, while configuring, the CLI parser will display an error.

Device(config)# dial-peer voice 1111 voip
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/1
Device(config-dial-peer)# voice-class sip bind media source-interface GigabitEthernet0/1

Device(config)# dial-peer voice 3333 voip
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/2
Device(config-dial-peer)# voice-class sip bind media source-interface GigabitEthernet0/2

Configuration on Standby Router
The configurations of Active and Stand By should be identical.

### Configuring VRF

```
Device> enable
Device# configure terminal
Device(config)# ip vrf VRF1
Device(config)# rd 1:1
Device(config)# ip vrf VRF2
Device(config)# rd 2:2
```

### Associating interfaces with VRF

```
Device(config)# interface GigabitEthernet0/1
Device(config-if)# ip vrf forwarding VRF1

Device(config)# interface GigabitEthernet0/2
Device(config-if)# ip vrf forwarding VRF2
```

### Note

If an IP address is already assigned to an interface, then associating a VRF with interface will disable the interface and remove the existing IP address. An error message (sample error message shown below) is displayed on the console. Assign the IP address to proceed further.

```
%Interface GigabitEthernet0/1 IPv4 disabled and address(es) removed due to enabling VRF VRF1
```

The interface used for HSRP should not be configured with any VRF. In this example, GigabitEthernet0/0/0 is used for configuring HSRP and therefore no VRF is associated with this interface.

```
Device(config)# interface GigabitEthernet0/0/0
Device(config-if)# ip address 14.2.43.82 255.255.0.0
Device(config-if)# standby version 2
Device(config-if)# standby 93 ip 14.2.43.81
Device(config-if)# standby 93 priority 50
Device(config-if)# standby 93 preempt
Device(config-if)# standby 93 name cubeha
Device(config-if)# standby 93 track 1 decrement 5
Device(config-if)# standby 93 track 2 decrement 5
Device(config-if)# duplex auto
Device(config-if)# speed auto
```

Inbound interface - GigabitEthernet0/1 is used for voice traffic configured with VRF1.

```
Device(config)# interface GigabitEthernet0/1
Device(config-if)# ip vrf forwarding VRF1
Device(config-if)# ip address 10.0.0.4 255.0.0.0
Device(config-if)# standby version 2
Device(config-if)# standby 63 ip 10.0.0.3
Device(config-if)# standby 63 priority 50
Device(config-if)# standby 63 preempt
```
Device(config-if)# standby 63 track 1 decrement 5
Device(config-if)# duplex auto
Device(config-if)# speed auto
Device(config-if)# media-type rj45

Outbound interface - GigabitEthernet0/2 is used for voice traffic configured with VRF2.

Device(config)# interface GigabitEthernet0/2
Device(config-if)# ip vrf forwarding VRF2
Device(config-if)# ip address 11.0.0.4 255.0.0.0
Device(config-if)# standby version 2
Device(config-if)# standby 36 ip 11.0.0.3
Device(config-if)# standby 36 priority 50
Device(config-if)# standby 36 preempt
Device(config-if)# standby 36 track 1 decrement 5
Device(config-if)# duplex auto
Device(config-if)# speed auto
Device(config-if)# media-type rj45

Device(config)# ipc zone default
Device(config-ipczone)# association 1
Device(config-ipczone-assoc)# no shutdown
Device(config-ipczone-assoc)# protocol sctp
Device(config-ipc-protocol-sctp)# local port 5000
Device(config-ipc-local-sctp)# local-ip 14.2.43.82
Device(config-ipc-local-sctp)# exit
Device(config-ipc-protocol-sctp)# remote port 5000
Device(config-ipc-remote-sctp)# remote-ip 14.2.43.81

Creating Dial-peer
Creating Inbound Dial-peer:

Device(config)# dial-peer voice 1111 voip
Device(config-dial-peer)# destination pattern 1111
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target ipv4:10.0.0.2
Device(config-dial-peer)# incoming called-number 1111

Creating Outbound Dial-peer:

Device(config)# dial-peer voice 3333 voip
Device(config)# destination-pattern 2222
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target ipv4:11.0.0.2

Configuring Binding

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
</table>

Control and Media on a dial-peer have to bind with same VRF. Else, while configuring, the CLI parser will display an error.

Device(config)# dial-peer voice 1111 voip
Device(config-dial-peer)# voice-class sip bind control source-interface GigabitEthernet0/1
Device(config)# voice-class sip bind media source-interface GigabitEthernet0/1

Device(config)# dial-peer voice 3333 voip
Device(config)# voice-class sip bind control source-interface GigabitEthernet0/2
Device(config)# voice-class sip bind media source-interface GigabitEthernet0/2

Verification of redundancy States

On Active Router

Device(config)# show redundancy status

my state = 13 -ACTIVE
peer state = 8 -STANDBY HOT
Mode = Duplex
Unit ID = 0
Maintenance Mode = Disabled
Manual Swact = enabled
Communications = Up

client count = 17
client_notification_TMR = 120000 milliseconds
RF debug mask = 0x0

On Standby Router

Device(config)# show redundancy status

my state = 8 -STANDBY HOT
peer state = 13 ACTIVE
Mode = Duplex
Unit ID = 0
Maintenance Mode = Disabled
Manual Swact = enabled
Communications = Up

client count = 17
client_notification_TMR = 120000 milliseconds
RF debug mask = 0x0

Verification of Calls Before and After Switchover

RTP Connections on Active router:

Device# show voip rtp connections

VoIP RTP Port Usage Information:
Max Ports Available: 19999, Ports Reserved: 101, Ports in Use: 2

<table>
<thead>
<tr>
<th>Media-Address Range</th>
<th>Min</th>
<th>Max</th>
<th>Ports Available</th>
<th>Ports Reserved</th>
<th>In-use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Media Pool</td>
<td>8000</td>
<td>48198</td>
<td>19999</td>
<td>101</td>
<td>2</td>
</tr>
</tbody>
</table>

VoIP RTP active connections:

<table>
<thead>
<tr>
<th>No.</th>
<th>CallId</th>
<th>dstCallId</th>
<th>LocalRTP</th>
<th>RmtRTP</th>
<th>LocalIP</th>
<th>RemoteIP</th>
<th>MPSS</th>
<th>VRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>6</td>
<td>8008</td>
<td>16388</td>
<td>10.0.0.1</td>
<td>10.0.0.2</td>
<td>NO</td>
<td>VRF1</td>
</tr>
</tbody>
</table>
Found 2 active RTP connections

RTP Connections on Standby Router after switchover

Device# show voip rtp connections

VoIP RTP Port Usage Information:
Max Ports Available: 19999, Ports Reserved: 101, Ports in Use: 2

<table>
<thead>
<tr>
<th>Min</th>
<th>Max</th>
<th>Port Available</th>
<th>Port Reserved</th>
<th>Port In-use</th>
</tr>
</thead>
<tbody>
<tr>
<td>8000</td>
<td>48198</td>
<td>19999</td>
<td>101</td>
<td>2</td>
</tr>
</tbody>
</table>

VoIP RTP active connections:

<table>
<thead>
<tr>
<th>No.</th>
<th>CallId</th>
<th>dstCallId</th>
<th>LocalRTP</th>
<th>RmtRTP</th>
<th>LocalIP</th>
<th>RemoteIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>8</td>
<td>8012</td>
<td>16390</td>
<td>10.0.0.1</td>
<td>10.0.0.2</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>7</td>
<td>8014</td>
<td>16390</td>
<td>11.0.0.1</td>
<td>11.0.0.2</td>
</tr>
</tbody>
</table>

Found 2 active RTP connections

Active calls on Active Router

Device# show call active voice brief

11F3 : 5 243854170ms.1 (*11:48:43.972 UTC Mon May 25 2015) +6770 pid:0 Answer active
dur 00:00:14 tx:843/50551 rx:1028/61680
dscp:0 media:0 audio tos:0xB8 video tos:0x0
IP 10.0.0.2:16388 SRTP: off rtt:1ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g729r8 TextRelay:
off Transcoded: No ICE: Off
media inactive detected:n media contrl rcvd:n/a timestamp:n/a
long duration call detected:n long duration call duration:n/a timestamp:n/a
LostPacketRate:0.00 OutOfOrderRate:0.00

dur 00:00:14 tx:1028/61680 rx:843/50551 dscp:0 media:0 audio tos:0xB8 video tos:0x0
IP 11.0.0.2:16388 SRTP: off rtt:65522ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g729r8 TextRelay:
off Transcoded: No ICE: Off
media inactive detected:n media contrl rcvd:n/a timestamp:n/a
long duration call detected:n long duration call duration:n/a timestamp:n/a
LostPacketRate:0.00 OutOfOrderRate:0.00

Telephony call-legs: 0
SIP call-legs: 2
H323 call-legs: 0
Call agent controlled call-legs: 0
SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 2

Device# show sip-ua connections udp brief

Total active connections : 2
No. of send failures : 0
No. of remote closures : 0
No. of conn. failures : 0
No. of inactive conn. ageouts : 2

-------------- SIP Transport Layer Listen Sockets ---------------

Conn-Id | Local-Address
---------|----------------
 2       | [10.0.0.1]:5060:VRF1
 3       | [11.0.0.1]:5060:VRF2

Active calls on Standby router after switchover:

Device# show call active voice brief

dur 00:03:37 tx:6757/405420 rx:6757/405420 dscp:0 media:0 audio tos:0x0 video tos:0x0
IP 11.0.0.2:16390 SRTP: off rtt:65531ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g729r8 TextRelay: off
media inactive detected:n media contrl rcvd:n/a timestamp:n/a
lostPacketRate:0.00 OutOfOrderRate:0.00

11F9 : 7 245073850ms.1 (*12:16:18.114 UTC Mon May 25 2015) +26840 pid:0 Answer connected
dur 00:03:37 tx:6757/405420 rx:6757/405420 dscp:0 media:0 audio tos:0x0 video tos:0x0
IP 10.0.0.2:16390 SRTP: off rtt:65523ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g729r8 TextRelay: off
media inactive detected:n media contrl rcvd:n/a timestamp:n/a
long duration call detected:n long duration call duration:n/a timestamp:n/a
lostPacketRate:0.00 OutOfOrderRate:0.00

Telephony call-legs: 0
SIP call-legs: 2
H323 call-legs: 0
Call agent controlled call-legs: 0
SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 2
CHAPTER 23

Configuring Multi-Tenants on SIP Trunks

The feature allows specific global configurations for multiple tenants on SIP trunks that allow differentiated services for tenants. Configuring Multi-Tenants on SIP Trunks allows each tenant to have their own individual configurations. The configurations include timers, credentials, bind requests, and other parameters which are available under sip-ua and voice service voip/sip configurations. Multi-tenant functionality helps to create multiple configurations with ease and provides support for scalable and flexible mix of typical enterprise services.

- Feature Information for Configuring Multi-Tenants on SIP Trunks, on page 315
- Information About Configuring Multi-Tenants on SIP Trunks, on page 315
- How to Configure Multi-Tenants on SIP Trunks, on page 319
- Example: SIP Trunk Registration in Multi-Tenant Configuration, on page 321

Feature Information for Configuring Multi-Tenants on SIP Trunks

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
</table>
| Support for Configuring Multi Tenants on SIP Trunks | Cisco IOS 15.6(2)T Cisco IOS XE Denali 16.3.1 | This feature allows the provision to configure specific global configurations for multiple tenants on SIP trunks. The following commands were introduced: `voice class tenant <tag>` and `voice-class sip tenant <tag>`.

Information About Configuring Multi-Tenants on SIP Trunks

In the previous releases of Cisco IOS software, CUBE supported only single tenancy, with sip-specific attributes configured either globally or under dial-peer. With the introduction of multi-tenancy support on CUBE, the
sip-specific attributes can now be configured at per tenant basis in addition to the existing global or dial-peer levels.

The **voice class tenant** `<tag>` command allows sip-specific attributes to be configured at per tenant basis. The command **voice class tenant** `<tag>` can be then applied to individual dial-peers, thereby associating them to a particular tenant. See the following table "Table 36: Multi-Tenant Configuration List" for information on the complete list of configurations present under the **voice class tenant** `<tag>`.

If tenants are configured under dial-peer, then configurations are applied in the following order of preference.

- Dial-peer configuration
- Tenant configuration
- Global configuration

That is, if the value of the attribute under dial-peer configuration is system, then the value is taken from the tenant configuration. And, if the value under the tenant configuration is also system, then the global configuration is used.

If there are no tenants configured under dial-peer, then the configurations are applied using the default behavior in the following order:

- Dial-peer configuration
- Global configuration

The following table lists the various configurations present under **voice class tenant** `<tag>`. For more information on specific configurations, see the Voice and Video command reference guide lists.

---

**Note**

Attributes that are not available under **voice class tenant** `<tag>` use the default behavior—With preference of dial-peer followed by the global configuration.

---

**Table 36: Multi-Tenant Configuration List**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>aaa</td>
<td>SIP-UA AAA related configuration</td>
</tr>
<tr>
<td>anat</td>
<td>Allow alternative network address types IPv4 and IPv6</td>
</tr>
<tr>
<td>asserted-id</td>
<td>Configure SIP UA privacy identity settings</td>
</tr>
<tr>
<td>associate</td>
<td>Associate a RCB for outgoing calls</td>
</tr>
<tr>
<td>asymmetric</td>
<td>Configure global SIP asymmetric payload support</td>
</tr>
<tr>
<td>authenticate</td>
<td>Call authentication policy</td>
</tr>
<tr>
<td>authentication</td>
<td>Digest Authentication Configuration</td>
</tr>
<tr>
<td>bandwidth</td>
<td>Allow SIP SDP bandwidth-related options</td>
</tr>
<tr>
<td>bind</td>
<td>SIP bind command</td>
</tr>
<tr>
<td><strong>Command</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------</td>
</tr>
<tr>
<td>block</td>
<td>Block 18X response to INVITE</td>
</tr>
<tr>
<td>call-route</td>
<td>Configure call routing options</td>
</tr>
<tr>
<td>conn-reuse</td>
<td>Reuse the sip registration tcp connection for the end-point behind a Firewall</td>
</tr>
<tr>
<td>connection-reuse</td>
<td>Use listener port for sending requests over UDP</td>
</tr>
<tr>
<td>contact-passing</td>
<td>302 contact to be passed through for CFWD</td>
</tr>
<tr>
<td>content</td>
<td>Content carried as part of SIP message</td>
</tr>
<tr>
<td>copy-list</td>
<td>Configure list of entities to be sent to peer leg</td>
</tr>
<tr>
<td>credentials</td>
<td>User credentials for registration</td>
</tr>
<tr>
<td>disable-early-media</td>
<td>Disable early-media cut through</td>
</tr>
<tr>
<td>dns-a-override</td>
<td>Skip DNS A/AAAA query when SRV query timesout</td>
</tr>
<tr>
<td>dscp-profile</td>
<td>DSCP Profile global config</td>
</tr>
<tr>
<td>early-media</td>
<td>Configure method to handle early-media Update Request</td>
</tr>
<tr>
<td>early-offer</td>
<td>Configure sending Early-Offer</td>
</tr>
<tr>
<td>encap</td>
<td>Configure SDP encapsulation</td>
</tr>
<tr>
<td>error-code-override</td>
<td>Configure sip error code</td>
</tr>
<tr>
<td>error-passthru</td>
<td>SIP error response pass-thru functionality</td>
</tr>
<tr>
<td>exit</td>
<td>Exits from the voice class configuration mode</td>
</tr>
<tr>
<td>g729</td>
<td>G729 codec interoperability settings</td>
</tr>
<tr>
<td>handle-replaces</td>
<td>Handle INVITE with REPLACES header at SIP spi</td>
</tr>
<tr>
<td>header-passing</td>
<td>SIP Headers need to be passed to Applications</td>
</tr>
<tr>
<td>help</td>
<td>Description of the interactive help system</td>
</tr>
<tr>
<td>history-info</td>
<td>History Info header support</td>
</tr>
<tr>
<td>host-registrar</td>
<td>Use sip-ua registrar value in Diversion and Contact header for 3xx messages</td>
</tr>
<tr>
<td>interop-handling</td>
<td>Enable interop-handling</td>
</tr>
<tr>
<td>localhost</td>
<td>Specify the DNS name for the localhost</td>
</tr>
<tr>
<td>map</td>
<td>Mapping options</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>max-forwards</td>
<td>Change number of max-forwards for SIP Methods</td>
</tr>
<tr>
<td>midcall-signaling</td>
<td>Configure method to handle mid-call signaling</td>
</tr>
<tr>
<td>nat</td>
<td>SIP nat global config</td>
</tr>
<tr>
<td>no</td>
<td>Negate a command or set its defaults</td>
</tr>
<tr>
<td>notify</td>
<td>SIP Signaling Notify Configuration</td>
</tr>
<tr>
<td>offer</td>
<td>Configure settings for Offers made from the Gateway</td>
</tr>
<tr>
<td>options-ping</td>
<td>Send OPTION pings to remote end</td>
</tr>
<tr>
<td>outbound-proxy</td>
<td>Configure an Outbound Proxy Server</td>
</tr>
<tr>
<td>pass-thru</td>
<td>SIP pass-through global config</td>
</tr>
<tr>
<td>permit</td>
<td>Permit hostname for this gateway</td>
</tr>
<tr>
<td>preloaded-route</td>
<td>Use pre-loaded route header for outgoing calls, if available</td>
</tr>
<tr>
<td>privacy</td>
<td>Configure SIP UA privacy settings</td>
</tr>
<tr>
<td>privacy-policy</td>
<td>Set privacy behavior for outgoing SIP messages</td>
</tr>
<tr>
<td>random-contact</td>
<td>Use Random Contact for outgoing calls, if available</td>
</tr>
<tr>
<td>random-request-uri</td>
<td>Configure options for Request-URI having random value</td>
</tr>
<tr>
<td>reason-header</td>
<td>Configure settings for supporting SIP Reason Header</td>
</tr>
<tr>
<td>redirection</td>
<td>Enable call redirection (3xx) handling</td>
</tr>
<tr>
<td>refer-ood</td>
<td>Configure maximum number of out-of-dialog refer made to the Gateway</td>
</tr>
<tr>
<td>refer-to-passing</td>
<td>Refer-To needs to be passed through for transfer</td>
</tr>
<tr>
<td>registrar</td>
<td>Configure SIP registrar VoIP Interface</td>
</tr>
<tr>
<td>registration</td>
<td>Enable registration options</td>
</tr>
<tr>
<td>rel1xx</td>
<td>Type of reliable provisional response support</td>
</tr>
<tr>
<td>remote-party-id</td>
<td>Enable Remote-Party-ID support in SIP User Agent</td>
</tr>
<tr>
<td>requiri-passing</td>
<td>Request URI needs to be passed through</td>
</tr>
<tr>
<td>reset</td>
<td>SIP Reset Options</td>
</tr>
<tr>
<td>retry</td>
<td>Change default retries for each SIP Method</td>
</tr>
<tr>
<td>send</td>
<td>Configure outgoing message options</td>
</tr>
</tbody>
</table>
How to Configure Multi-Tenants on SIP Trunks

Configuring Multi-Tenants on SIP Trunks

SUMMARY STEPS

1. enable
2. configure terminal
3. Use the following commands to configure multi-tenants:

   • voice class tenant <tag> in the global configuration mode

   Once you configure the voice class tenant <tag> command in the global mode, the configuration will move to the voice class tenant <tag> submode. You can configure all the sip-specific attributes in this submode.

   • voice-class sip tenant <tag> in the dial-peer configuration mode

4. authenticate
5. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
</tbody>
</table>
| Example:          | • Enter your password if prompted.
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> Use the following commands to configure multi-tenants:</td>
<td>Use the <strong>voice-class sip tenant&lt;tag&gt;</strong> command in the global configuration mode to configure a tenant with sip-specific attributes. This command tag can then be applied to one or more dial-peers using the <strong>voice-class sip tenant&lt;tag&gt;</strong> command under the dial-peers.</td>
</tr>
<tr>
<td>• <strong>voice class tenant&lt;tag&gt;</strong> in the global configuration mode</td>
<td></td>
</tr>
<tr>
<td>Once you configure the <strong>voice class tenant&lt;tag&gt;</strong> command in the global mode, the configuration will move to the <strong>voice class tenant&lt;tag&gt;</strong> submode. You can configure all the sip-specific attributes in this submode.</td>
<td></td>
</tr>
<tr>
<td>• <strong>voice-class sip tenant&lt;tag&gt;</strong> in the dial-peer configuration mode</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>In global configuration mode</td>
<td></td>
</tr>
<tr>
<td>! Configuring tenant 1</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice class tenant 1</td>
<td></td>
</tr>
<tr>
<td>Device (config-class)# ?</td>
<td></td>
</tr>
<tr>
<td>aaa – sip-ua AAA related configuration</td>
<td></td>
</tr>
<tr>
<td>anat – Allow alternative network address types IPV4 and IPV6</td>
<td></td>
</tr>
<tr>
<td>asserted-id – Configure SIP-UA privacy identity settings</td>
<td></td>
</tr>
<tr>
<td>……</td>
<td></td>
</tr>
<tr>
<td>……</td>
<td></td>
</tr>
<tr>
<td>Video – video related function</td>
<td></td>
</tr>
<tr>
<td>Warn-header – SIP related config for SIP. SIP warning-header global config.</td>
<td></td>
</tr>
<tr>
<td>Device (config-voi-tenant)# end</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>! Configuring tenant 2</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice class tenant 2</td>
<td></td>
</tr>
<tr>
<td>Device (config-class)# ?</td>
<td></td>
</tr>
<tr>
<td>aaa – sip-ua AAA related configuration</td>
<td></td>
</tr>
<tr>
<td>anat – Allow alternative network address types IPV4 and IPV6</td>
<td></td>
</tr>
<tr>
<td>asserted-id – Configure SIP-UA privacy identity settings</td>
<td></td>
</tr>
<tr>
<td>……</td>
<td></td>
</tr>
<tr>
<td>……</td>
<td></td>
</tr>
<tr>
<td>outbound-proxy – Configure an Outbound Proxy Server</td>
<td></td>
</tr>
<tr>
<td>pass-thru – SIP pass-through global config</td>
<td></td>
</tr>
<tr>
<td>……</td>
<td></td>
</tr>
<tr>
<td>……</td>
<td></td>
</tr>
<tr>
<td>srtp – Allow SIP related SRTP options</td>
<td></td>
</tr>
<tr>
<td>Warn-header – SIP related config for SIP</td>
<td></td>
</tr>
</tbody>
</table>
Example: SIP Trunk Registration in Multi-Tenant Configuration

For SIP trunk registration, the `voice class tenant <tag>` command is not associated with any dial-peer configuration. All outgoing registrations are triggered to the Registrars when credentials are configured under `voice class tenant <tag>`.

```
Router# show run | sec tenant
V oice class tenant 1
```
registrar 1 ipv4:10.64.86.35:9051 expires 3600
credentials username aaaa password 7 06070E204D realm aaaa.com
outbound-proxy ipv4:10.64.86.35:9057
bind control source-interface GigabitEthernet0/0

Voice class tenant 2
registrar 1 ipv4:9.65.75.45:9052 expires 3600
credentials username bbbb password 7 110B1B0715 realm bbbb.com
outbound-proxy ipv4:10.64.86.40:9040
bind control source-interface GigabitEthernet0/1
PART V

Codecs

• Codec Support and Restrictions, on page 325
• Codec Preference Lists, on page 329
Codec Support and Restrictions

This chapter provides advanced information about the support of and restrictions for certain codecs on CUBE. For basic information on how to configure codecs, refer to the Introduction to Codecs section.

- Feature Information for Codec Support on CUBE, on page 325
- ISAC Codec Support on CUBE, on page 326
- AAC-LD MP4A-LATM Codec Support on Cisco UBE, on page 326

Feature Information for Codec Support on CUBE

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 37: Feature Information for Codec Support on CUBE

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAC-LD MP4A-LATM Codec Support on Cisco UBE</td>
<td>15.4(1)T</td>
<td>The AAC-LD MP4A-LATM codec is a wideband audio codec used by video endpoints. MP4A-LATM is an MPEG4 audio coding standard, where LATM is Low-Overhead MPEG-4 Audio Transport Multiplex. The Cisco Unified Border Element (Cisco UBE) supports MP4A-LATM to enable call flows involving endpoints that use this codec, especially for media recording. The following commands were introduced or modified: <strong>codec mp4a-latm, codec preference tag mp4a-latm</strong></td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Release 3.12S</td>
<td></td>
</tr>
<tr>
<td>ISAC Codec Support on CUBE</td>
<td>15.1(1)T</td>
<td>The ISAC Codec Support on CUBE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The following commands were introduced by this feature: <strong>codec isac, codec preference tag isac.</strong></td>
</tr>
</tbody>
</table>
ISAC Codec Support on CUBE

The iSAC codec is an adaptive VoIP codec specially designed to deliver wideband sound quality in both low- and high-bit rate applications. The iSAC codec automatically adjusts the bit-rate for the best quality or a fixed bit rate can be used if the network characteristics are known. This codec is designed for wideband VoIP communications. The iSAC codec offers better quality with reduced bandwidth for sideband applications.

Restrictions for ISAC Codec Support on CUBE

- Low complexity is not supported for the iSAC codec.

AAC-LD MP4A-LATM Codec Support on Cisco UBE

As part of this feature, Cisco UBE supports the following:

- Accept and send MP4A-LATM codec and corresponding FMTP profiles
- Configure MP4A-LATM under dial-peer or under voice-class codec as preferred codec
- Pass across real-time transport protocol (RTP) media for MP4A-LATM codec without any interworking
- Offer pre-configured FMTP profile for MP4A-LATM for DO-EO (Delayed-Offer to Early-Offer) calls
- Offer more than one FMTP profile (each with different payload type number) as mentioned by the offering endpoint, so that the answering endpoint can choose the best option.
- Offer only one instance of MP4A-LATM if media forking is applicable. The offered instance is the first one received in the offer.
- Calculate bandwidth for MP4A-LATM on the basis of either “b=TIAS” attribute or “bitrate” parameter in the FMTP attribute. If none of them are present in the session description protocol (SDP), the default maximum bandwidth, that is, 128 Kbps will be used for calculation.
- The following Cisco UBE features are supported with the MP4A-LATM codec:
  - Basic call (audio and video) flow-around and flow-through (FA and FT).
  - Voice Class Codec support in Cisco UBE with codec filtering
  - SRTP and SRCTP passthrough for SIP-to-SIP calls
  - Supplementary services
  - RSVP
  - Dynamic payload type interworking for DTMF and codec packets for SIP-to-SIP calls
  - Media Anti-Trombone with SIP signaling control on CUBE
  - Support for SIP UPDATE message per RFC 3311
  - RTP Media Loopback
  - Media forking for IP based calls using Zephyr recording server
  - Cisco UBE Mid-call Re-INVITE consumption
  - Signaling forking (Fastweb multile SIP Early Dialog Support, FA and FT)
  - Maximum bandwidth-based CAC
  - Media Policing
  - Box-to-Box High Availability (B2B HA)
  - Inbox High Availability (Inbox HA)
Restrictions for AAC-LD MP4A-LATM Codec Support on Cisco UBE

Cisco UBE does not support the following:

- Codec transcoding between MP4A-LATM and other codecs
- Dual-tone Multifrequency (DTMF) interworking with MP4A-LATM codec
- Non-SIP-SIP, that is, SIP to other service provider interface (SPI) interworking with MP4A-LATM codec
Restrictions for AAC-LD MP4A-LATM Codec Support on Cisco UBE
Codec Preference Lists

This chapter describes how to negotiate an audio codec from a list of codec associated with a preference. This chapter also describes how to disable codec filtering by configuring CUBE to send an outgoing offer with all configured audio codecs in the list assuming that the dspfarm supports all these codecs.

- Feature Information for Negotiation of an Audio Codec from a List of Codecs, on page 329
- Codecs configured using Preference Lists, on page 330
- Prerequisites for Codec Preference Lists, on page 330
- Restrictions for Codecs Preference Lists, on page 331
- How to Configure Codec Preference Lists, on page 331
- Troubleshooting Negotiation of an Audio Codec from a List of Codecs, on page 334
- Verifying Negotiation of an Audio Codec from a List of Codecs, on page 334

Feature Information for Negotiation of an Audio Codec from a List of Codecs

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negotiation of an Audio Codec from a List of Codecs on Each Leg of a SIP-to-SIP Call on the Cisco Unified Border Element</td>
<td>15.1(2)T</td>
<td>The Negotiation of an Audio Codec from a List of Codecs on Each Leg of a SIP-to-SIP Call on the Cisco Unified Border Element feature supports negotiation of an audio codec using the Voice Class Codec and Codec Transparent infrastructure on the Cisco UBE. The following command was introduced or modified: <code>voice-class codec (dial peer).</code></td>
</tr>
</tbody>
</table>
**Feature Name**  |  **Releases**  |  **Feature Information**
--- | --- | ---
Negotiation of an Audio Codec from a List of Codecs on Each Leg of a SIP-to-SIP Call on the Cisco Unified Border Element | Cisco IOS XE Release 3.8S | The Negotiation of an Audio Codec from a List of Codecs on Each Leg of a SIP-to-SIP Call on the Cisco Unified Border Element feature supports negotiation of an audio codec using the Voice Class Codec and Codec Transparent infrastructure on the Cisco UBE.

The following command was introduced or modified: `voice-class codec (dial peer)`.  

Negotiation of an Audio Codec from a List of Codecs on Each Leg of a SIP-to-SIP Call on the Cisco Unified Border Element. | 15.3(2)T | This feature provides high availability support for negotiation of an audio codec from a list of codecs on each leg of a SIP-to-SIP call on the Cisco Unified Border Element under the Voice Class Codec.

---

**Codecs configured using Preference Lists**

SIP-to-SIP calls configured using codecs using preference lists have the following features:

- Incoming and outgoing dial-peers can be configured with different preference lists.
- Both normal transcoding and high-density transcoding are supported with preference lists.
- Mid-call codec changes for supplementary services are supported with preference lists. Transcoder resources are dynamically inserted or deleted when there is a codec or RTP-NTE to inband DTMF interworking required.
- Reinvite-based supplementary services invoked from the Cisco Unified Communications Manager (CUCM), like call hold, call resume, music on hold (MOH), call transfer, and call forward are supported with preference lists.
- T.38 fax and fax passthrough switchover with preference lists are supported.
- Reinvite-based call hold and call resume for Secure Real-Time Transfer protocol (SRTP) and Real-Time Transport Protocol (RTP) interworking on CUBE is supported with preference lists.
- High availability is supported for calls that use codecs with preference lists. But calls requiring the transcoder to be invoked are not checkpointed. During mid-call renegotiation, if the call releases the transcoder, then the call is checkpointed.

**Prerequisites for Codec Preference Lists**

- Transcoding configuration on the CUBE.
- The digital signal processor (DSP) requirements to support the transcoding feature on the CUBE.
Restrictions for Codecs Preference Lists

For All Calls (SIP-to-SIP, H323-to-H323, SIP-to-H323 calls)

- Video codecs are not supported with preference lists.
- Multiple audio streams are not supported.
- High-density transcoding is not supported when delayed offer to early offer is configured. Only low density transcoding is supported.
- Codec re-packetization feature is not supported when preference lists are configured.

For H323-to-H323 and SIP-to-H323 Calls

The below restrictions do not exist for SIP-to-SIP calls from 15.1(2)T and Cisco IOS XE Release 3.8S onwards.

- You can configure dissimilar preference lists on the incoming and outgoing dial peers.
- Incoming and outgoing dial-peers cannot be configured with the different preference lists.
- Transcoding is not supported when preference lists are used.
- Mid-call codec changes and supplementary services (call-hold / resume, call forward) do not work when a preference list is configured.
- Mid-call insertion or deletion of transcoder is not supported with preference lists.
- Rotary dial peers are not supported when preference lists are used.
- Both incoming and outgoing dial-peers need to be configured with the same codec voice classes.
- The preference of codecs configured in a codec voice classes is not be applied to the outgoing call-leg. Basically codec filtering is applied first and only the filtered codecs will be sent out in the outgoing offer from CUBE.
- T.38 fax, fax-passthru and modem-passthru is not be supported with preference lists.
- SRTP<->RTP is not supported with preference lists.
- When a codec voice class is configured, call establishment is un-predictable when a transcoder is involved in the call. The call succeeds only if the end points choose the first codec in the list of offered codecs.

How to Configure Codec Preference Lists

Configuring Audio Codecs Using a Codec Voice Class and Preference Lists

Preferences can be used to determine which codecs will be selected over others.

A codec voice class is a construct within which a codec preference order can be defined. A codec voice class can then be applied to a dial peer, which then follows the preference order defined in the codec voice class.

SUMMARY STEPS

1. enable
2. configure terminal
3. voice class codec tag
4. Do the following for each audio codec you want to configure in the voice class:
### Configuring Audio Codecs Using a Codec Voice Class and Preference Lists

- **codec preference** `value codec-type[bytes payload-size fixed-bytes ]`  
- **codec preference** `value isac [mode {adaptive | independent} [bit-rate value framesize { 30 | 60 }] [fixed] ]`  
- **codec preference** `value ilbc [mode frame-size [bytes payload-size]]`  
- **codec preference** `value mp4-latm [profile tag]`

5. `exit`
6. `dial-peer voice number voip`
7. `voice-class codec tag offer-all`
8. `end`

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><code>enable</code></td>
<td>- Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device&gt; enable</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><code>configure terminal</code></td>
<td>Device&gt; configure terminal</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Enters voice-class configuration mode for the specified codec voice class.</td>
</tr>
<tr>
<td><code>voice class codec tag</code></td>
<td>Device(config)# voice class codec 10</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Configure a codec within the voice class and specifies a preference for the codec. This becomes part of a preference list</td>
</tr>
<tr>
<td>Do the following for each audio codec you want to configure in the voice class:</td>
<td></td>
</tr>
<tr>
<td>- <strong>codec preference</strong> <code>value codec-type[bytes payload-size fixed-bytes ]</code></td>
<td></td>
</tr>
<tr>
<td>- <strong>codec preference</strong> `value isac [mode {adaptive</td>
<td>independent} [bit-rate value framesize { 30</td>
</tr>
<tr>
<td>- <strong>codec preference</strong> <code>value ilbc [mode frame-size [bytes payload-size]]</code></td>
<td></td>
</tr>
<tr>
<td>- <strong>codec preference</strong> <code>value mp4-latm [profile tag]</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td><code>exit</code></td>
<td>- Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-class)# exit</td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>Enters dial peer configuration mode for the specified VoIP dial peer.</td>
</tr>
<tr>
<td><code>dial-peer voice number voip</code></td>
<td>Device(config)# dial-peer voice 1 voip</td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td>Applies the previously configured voice class and associated codecs to a dial peer.</td>
</tr>
<tr>
<td><code>voice-class codec tag offer-all</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
</tbody>
</table>

---

Cisco Unified Border Element Configuration Guide

332
Disabling Codec Filtering

Cisco UBE is configured to filter common codecs for the subsets, by default. The filtered codecs are sent in the outgoing offer. You can configure the Cisco UBE to offer all the codecs configured on an outbound leg instead of offering only the filtered codecs.

Note
This configuration is applicable only for early offer calls from the Cisco UBE. For delayed offer calls, by default all codecs are offered irrespective of this configuration.

Perform this task to disable codec filtering and allow all the codecs configured on an outbound leg.

SUMMARY STEPS

1. enable
2. configure terminal
3. dial-peer voice tag voip
4. voice-class codec tag offer-all
5. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> dial-peer voice tag voip</td>
<td>Enters dial peer voice configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config)# dial-peer voice 10 voip</td>
<td></td>
</tr>
</tbody>
</table>
### Troubleshooting Negotiation of an Audio Codec from a List of Codecs

Use the following commands to debug any errors that you may encounter when you configure the Negotiation of an Audio Codec from a List of Codecs on Each Leg of a SIP-to-SIP Call on the Cisco Unified Border Element feature:

- `debug ccsip all`
- `debug voip ccap input`
- `debug sccp messages`
- `debug voip rtp session`

For DSP-related debugs, use the following commands:

- `debug voip dsmp all`
- `debug voip dsmp rtp both payload all`
- `debug voip ipipgw`

### Verifying Negotiation of an Audio Codec from a List of Codecs

Perform this task to display information to verify Negotiation of an Audio Codec from a List of Codecs on Each Leg of a SIP-to-SIP Call on the Cisco Unified Border Element configuration. These `show` commands need not be entered in any specific order.

**SUMMARY STEPS**

1. `enable`
2. `show call active voice brief`
3. `show voip rtp connections`
4. `show sccp connections`
5. `show dspfarm dsp active`
DETAILED STEPS

Step 1  enable

Enables privileged EXEC mode.

Step 2  show call active voice brief

Displays a truncated version of call information for voice calls in progress.

Example:

```
Device# show call active voice brief
<ID>: <CallID> <start>ms.::<index> +<connect> pid::<peer_id> <dir> <addr> <state>
    dur hh:mm:ss tx:<packets>/<bytes> rx:<packets>/<bytes>
IP <ip>:<udp> rtt::<time>ms. pl:<play>ms lost::<lost> <early>/:<late>
delay:<last>ms/<min>ms. <max>ms <codec>
media inactive detected:<n> media cntrl rcvd:<n> <state>:
timeout duration call detected:<n> long duration call duration:<sec> <time>
MODEMPASS <method> buf::<fills>/<drains> loss <overall%> <multipkt>:<corrected>
last <buf> event time: <dur>:<min> <Max> s
FR <protocol> [int dlci cid] vad:<n> dtmf:<y/n> <seq:<y/n>
    <codec> (payload size)
ATM <protocol> [int vpl/vci cid] vad:<n> dtmf:<y/n> <seq:<y/n>
    <codec> (payload size)
Tele <int> (callID) [channel_id] tx:<tot>/<v:<fax}>ms <codec> noise:<l> acom:<l> i/o:<l>/<l> dBm
long duration call detected:<n> media inactive detected:<n> media cntrl rcvd:<n/a> timestamp:<n/a>
    speeds:<bps> local <rx/>remote <tx/> <tx>
Proxy <ip>:<audio udp>,<video udp>,<udp>,<tcp>,<tcp2>,<tcp3> endpt: <type> <manf>
bw: <req>/act codec: <audio/</video>
tx: <audio pkts>/<audio bytes>,<video pkts>/<video bytes>,<t120 pkts>/<t120 bytes>
rx: <audio pkts>/<audio bytes>,<video pkts>/<video bytes>,<t120 pkts>/<t120 bytes>
Telephony call-legs: 0
SIP call-legs: 2
H323 call-legs: 0
Call agent controlled call-legs: 0
SCCP call-legs: 2
Multicast call-legs: 0
Total call-legs: 4
```

```
1243 : 11 917490ms.1 +-1 pid:1 Answer 1230000 connecting
    dur 00:00:00 tx:415/66400 rx:17/2561
IP 192.0.2.1:19304 SRTP: off rtt::<time>ms. pl:<play>ms lost::<lost> <early>/:<late>
media inactive detected:<n> media cntrl rcvd:<n/a> timestamp:<n/a>
long duration call detected:<n> long duration call duration:<sec> <time>
1243 : 12 917500ms.1 +-1 pid:2 Originate 3210000 connecting
    dur 00:00:00 tx:5/10 rx:4/8
IP 9.44.26.4:16512 SRTP: off rtt::<time>ms. pl:<play>ms lost::<lost> <early>/:<late>
media inactive detected:<n> media cntrl rcvd:<n/a> timestamp:<n/a>
long duration call detected:<n> long duration call duration:<sec> <time>
0 : 13 917560ms.1 +0 pid:0 Originate connecting
    dur 00:00:08 tx:415/66400 rx:17/2561
IP 192.0.2.1:19304 SRTP: off rtt::<time>ms. pl:<play>ms lost::<lost> <early>/:<late>
media inactive detected:<n> media cntrl rcvd:<n/a> timestamp:<n/a>
long duration call detected:<n> long duration call duration:<sec> <time>
0 : 15 917570ms.1 +0 pid:0 Originate connecting
    dur 00:00:08 tx:5/10 rx:3/6
IP 192.0.2.1:19304 SRTP: off rtt::<time>ms. pl:<play>ms lost::<lost> <early>/:<late>
media inactive detected:<n> media cntrl rcvd:<n/a> timestamp:<n/a>
long duration call detected:<n> long duration call duration:<sec> <time>
Telephony call-legs: 0
SIP call-legs: 2
H323 call-legs: 0
```
Call agent controlled call-legs: 0
SCCP call-legs: 2
Multicast call-legs: 0
Total call-legs: 4

Step 3  show voip rtp connections
Displays Real-Time Transport Protocol (RTP) connections.

Example:

```
Device# show voip rtp connections
VoIP RTP active connections :
No. CallId dstCallId LocalRTP RmtRTP LocalIP RemoteIP
1  11 12 16662 19304 192.0.2.1
192.0.2.2
2  12 11 17404 16512 192.0.2.2
192.0.2.3
3  13 14 18422 2000 192.0.2.4
9.44.26.3
4  15 14 16576 2000 192.0.2.6
192.0.2.5
Found 4 active RTP connections
```

Step 4  show sccp connections
Displays information about the connections controlled by the Skinny Client Control Protocol (SCCP) transcoding and conferencing applications.

Example:

```
Device# show sccp connections
sess_id conn_id stype mode codec sport rport ripaddr
5  5 xcode sendrecv g729b 16576 2000 192.0.2.3
5  6 xcode sendrecv g711u 18422 2000 192.0.2.4
Total number of active session(s) 1, and connection(s) 2
```

Step 5  show dspfarm dsp active
Displays active DSP information about the DSP farm service.

Example:

```
Device# show dspfarm dsp active
SLOT DSP VERSION STATUS CHNL USE TYPE RSC_ID BRIDGE_ID PKTS_TXED PKTS_RXED
0  1 27.0.201 UP 1 USED xcode 1 0x9 5 8
0  1 27.0.201 UP 1 USED xcode 1 0x8 2558 17
Total number of DSPPARM DSP channel(s) 1
```
PART VI

DSP Services

• Transcoding, on page 339
• Transrating, on page 357
• Call Progress Analysis Over IP-to-IP Media Session, on page 359
Transcoding

Transcoding is a process of converting one voice codec to another. For example, transcoding iLBC-G.711 or iLBC-G.729.

**LTI based Transcoding**

- Internal API is used to access Digital Signaling Processor (DSP) resources for transcoding.
- Transcoding resources (DSPFARM) and CUBE need to be on the same platform.
- Only DSPFARM profile configuration is required. Skinny Client Control Protocol (SCCP) configuration configuration is not required.
- No TCP socket is opened and no registration is used.
- DSPFARM profile is associated to a new application type CUBE.

```bash
Device(config)# dspfarm profile 1 transcode
Device(config-dspfarm-profile)# associate application CUBE
```

- With LTI transcoding, higher performance is achieved since there is no need for extra SCCP legs and associated RTP streams. The performance will be in line high density mode offered with SCCP based transcoding.
- **crypto pki trustpoint** configuration is not required for Secure Real-time Transport Protocol (SRTP) to Real-time Transport Protocol (RTP) calls.

**SCCP based Transcoding**

- Skinny Client Control Protocol (SCCP) protocol is used for controlling Digital Signaling Processor (DSP) resources used for transcoding.
- Transcoding resources (DSPFARM) and CUBE can be on different platforms.
- SCCP client (For example, `sccp ccm` configuration and SCCP server (telephony service) configuration is required apart from DSPFARM profile configuration.
- DSPFARM registers with Cisco Unified Border Element over TCP Socket, using SCCP.

- DSPFARM profile is associated to SCCP using the following commands:

```bash
Device(config)# dspfarm profile 1 transcode
Device(config-dspfarm-profile)# associate application SCCP
```
• High density transcoding needs to be enabled for higher performance. High density transcoding will flow-around through the transcoder
• Secure Real-time Transport Protocol (SRTP) to Real-time Transport Protocol (RTP) using transcoder requires **crypto pki trustpoint** configuration to establish the Transport Layer Security (TLS) connection with SCCP server.

---

**Note**

Integrated Services Routers Generation 1 series and Integrated Services Routers Generation 2 Series devices support SCCP-based Transcoding only.

• Configuring LTI-based Transcoding, on page 340
• Configuration Examples for LTI Based Transcoding, on page 341
• Configuring SCCP-based Transcoding (ISR-G2 devices only), on page 344
• TLS for SCCP Connection for DSP Services, on page 346
• Configuring Secure Transcoding, on page 347
• Configuration Examples for SCCP Based Transcoding, on page 355

---

### Configuring LTI-based Transcoding

**Note**

We recommend you to configure LTI-based Transcoding for Cisco Aggregated Services Routers (ASR), Cisco Integrated Services Generation 2 Routers (ISR G2), and Cisco 4000 Series Integrated Services Routers (ISR G3).

---

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice-card voice-interface-slot-number
4. dspfarm services dspfarm
5. exit
6. dsp service dspfarm
7. codec codec
8. maximum sessions sessions
9. associate application CUBE
10. exit

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device&gt; configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice-card voice-interface-slot-number</td>
<td>Configures a voice card and enters voice-card configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# voice-card 1</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> dspfarm services dspfarm</td>
<td>Enable voice-only DSPFARM services on the Voice Card.</td>
</tr>
<tr>
<td><strong>Step 5</strong> exit</td>
<td>Exits the voice-card configuration mode.</td>
</tr>
<tr>
<td><strong>Step 6</strong> dsp service dspfarm</td>
<td>Configures a Transcoding profile and enters DSP profile configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# dsp service dspfarm</td>
<td>• You can specify just the codec type, and the DSP uses the default codec parameter, such as independent mode, 32 kbps bit-rate, and 30 ms framesize.</td>
</tr>
<tr>
<td><strong>Step 7</strong> codec codec</td>
<td>The codec rate to be attempted for SCCP-controlled connections.</td>
</tr>
<tr>
<td>Example: Device(config-dspfarm-profile)# codec ilbc</td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong> maximum sessions sessions</td>
<td>Configures maximum number of sessions.</td>
</tr>
<tr>
<td><strong>Step 9</strong> associate application CUBE</td>
<td></td>
</tr>
<tr>
<td>Example: Device(config-dspfarm-profile)# codec g711ulaw</td>
<td>Configures an application to the profile for LTI based transcoding.</td>
</tr>
<tr>
<td><strong>Step 10</strong> exit</td>
<td>Exits interface configuration mode.</td>
</tr>
</tbody>
</table>

### Configuration Examples for LTI Based Transcoding

**Example: LTI-based Transcoding**

```bash
! Enabling dspfarm services under voice-card
Device(config)# voice-card 0/1
Device(config-voicecard)# dspfarm
Device(config-voicecard)# dsp services dspfarm
Device(config-voicecard)# exit

! Configuring dspfarm profile
Device(config)# dspfarm profile 1 transcode
Device(config-dspfarm-profile)# codec g711ulaw
Device(config-dspfarm-profile)# codec g711alaw
Device(config-dspfarm-profile)# codec g729r8
```
Device(config-dspfarm-profile)# maximum sessions 10
Device(config-dspfarm-profile)# associate application CUBE
Device(config-dspfarm-profile)# exit

! Starting Service Engine
Device(config)# interface ServiceEngine0/1/0
Device(config-if)# no shutdown
Device(config-if)# exit

**Example: Secure LTI-based Transcoding**

!Client trustpoints use HTTP to receive certificate from CA.
Device(config)#ip http server

!Generate an RSA Keypair.
!(This step generates Private and Public keys. In this example, CUBE is just a label. It can be anything.)
crypto key generate rsa general-keys label CUBE modulus 1024
The name for the keys will be: CUBE
% The key modulus size is 1024 bits
% Generating 1024 bit RSA keys, keys will be non-exportable...
[OK] (elapsed time was 0 seconds)

!Configure IOS CA Server. In this example, CA Server is named cube-ca.
crypto pki server cube-ca
database level complete
no database archive
grant auto
lifetime certificate 1800
Secure-CUBE(cs-server)#no shut
%Some server settings cannot be changed after CA certificate generation.
% Please enter a passphrase to protect the private key
% or type Return to exit
Password:
Re-enter password:
% Generating 1024 bit RSA keys, keys will be non-exportable...
[OK] (elapsed time was 0 seconds)
% Certificate Server enabled.

!Create PKI trustpoints for cube for TLS communication.
crypto pki trustpoint CUBE-TLS
enrollment url http://X.X.X.X:80
serial-number none
fqdn none
ip-address none
subject-name CN=Secure-CUBE
revocation-check none
rsakeypair CUBE

!Authenticate the trustpoint with CA server and accept certificate of CA

crypto pki authenticate CUBE-TLS
Certificate has the following attributes:
    Fingerprint MD5: BCEBB5A1 1AC882F7 24BE476D 06537711
    Fingerprint SHA1: CE2FEEA5 42515B33 3EF6A8F6 7E31D6DF 8E32BE6

% Do you accept this certificate? [yes/no]: yes
Trustpoint CA certificate accepted.

!Enroll the trustpoint with CA server.
!In this step the CUBE receives a signed certificate from CA.

Secure-CUBE(config)#crypto pki enroll CUBE-TLS
%
% Start certificate enrollment ..
% Create a challenge password. You will need to verbally provide this
    password to the CA Administrator in order to revoke your certificate.
    For security reasons your password will not be saved in the configuration.
    Please make a note of it.

Password:
Re-enter password:

% The subject name in the certificate will include: CN=Secure-CUBE
% The fully-qualified domain name will not be included in the certificate
Request certificate from CA? [yes/no]: yes
% Certificate request sent to Certificate Authority
% The 'show crypto pki certificate verbose CUBE-TLS' command will show the
    fingerprint.

!Configure TCP TLS as transport protocol

voice service voip
sip
session transport tcp tls

!Assign trustpoint for sip-ua, this trustpoint is used for all SIP signaling between CUBE
and CUCM.

sip-ua
crypto signaling remote-addr <cucm pub ip address> 255.255.255.255 trustpoint CUBE-TLS
crypto signaling remote-addr <cucm sub ip address> 255.255.255.255 trustpoint CUBE-TLS

!or or default trustpoint can be configured for all SIP signaling from CUBE.

sip-ua
crypto signaling default trustpoint CUBE-TLS

!Enable SRTTP.
Voice service voip
srtp fallback

!Configure secure transcoder is required.
dspfarm profile 1 transcode universal security
codec g711ulaw
codec g711alaw
codec g729ar8
codec g729abr8
maximum sessions 10
associate application CUBE

Configuring SCCP-based Transcoding (ISR-G2 devices only)

SUMMARY STEPS

1. enable
2. configure terminal
3. voice-card voice-interface-slot-number
4. dspfarm
5. dsp service dspfarm
6. exit
7. telephony-service
8. sdspfarm units units
9. sdspfarm transcode sessions units
10. sdspfarm tag value Device-Name
11. max-ephones max-phones-to-be-supported
12. max-dn max-directorynumbers-to-be-supported
13. ip source-address CUBE-internal-ipv4-address [port port-number]
14. exit
15. sccp local interface-type number
16. sccp ccm CUBE-internal-ipv4-address identifier identifier-number version version-number
17. sccp
18. sccp ccm group group-id
19. associate ccm CCM-identifier priority priority
20. associate profile profile-identifier register Device-Name
21. exit
22. dspfarm profile profile-id transcode
23. codec codec
24. maximum sessions sessions
25. associate application sccp
26. exit
## Detailed Steps

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| 1    | enable           | Enables privileged EXEC mode.  
  * Enter your password if prompted. |
| 2    | configure terminal | Enters global configuration mode. |
| 3    | voice-card `voice-interface-slot-number` | Configures a voice card and enters voice-card configuration mode. |
| 4    | dspfarm          | Enable voice card for DSP. |
| 5    | dsp service dspfarm | Enable voice-only dspfarm services on the Voice Card. |
| 6    | exit             | Exits the voice-card configuration mode. |
| 7    | telephony-service | Enters telephony-service configuration mode. |
| 8    | sdspfarm units `units` | Define maximum number of dspfarm units. |
| 9    | sdspfarm transcode sessions `units` | Define maximum number of dspfarm transcode session. |
| 10   | sdspfarm tag `value Device-Name` | Configures a name for the transcoder. |
| 11   | max-ephones `max-phones-to-be-supported` | Configures the maximum number of phones that are to be supported. |
| 12   | max-dn `max-directorynumbers-to-be-supported` | Configures the maximum number of directories to be supported. |
| 13   | ip source-address `CUBE-internal-ipv4-address [port port-number]` | Defines an IP address and port number for the telephony service. |
| 14   | exit             | Exits the telephony-service configuration mode. |
| 15   | sccp local `interface-type number` | Configures the local gateway related parameters values. |
| 16   | sccp ccm `CUBE-internal-ipv4-address identifier identifier-number version version-number` | Configures call manager related parameter values. |
| 17   | sccp             | Enable Skinny Client Control Protocol. |
### Purpose

**Command or Action**

<table>
<thead>
<tr>
<th>Step 18</th>
<th><code>sccp ccm group group-id</code></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td><code>Device(config)# sccp ccm group 1</code></td>
</tr>
</tbody>
</table>

**Purpose:** Configures Call Manager Group and enters SCCP CCM configuration mode.

<table>
<thead>
<tr>
<th>Step 19</th>
<th><code>associate ccm CCM-identifier priority priority</code></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td><code>Device(config-sccp-ccm)# associate ccm 1 priority 1</code></td>
</tr>
</tbody>
</table>

**Purpose:** Configures Call Manager Group and enters SCCP CCM configuration mode.

<table>
<thead>
<tr>
<th>Step 20</th>
<th><code>associate profile profile-identifier register Device-Name</code></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td><code>Device(config-sccp-ccm)# associate profile 1 register CUBE-XCODE</code></td>
</tr>
</tbody>
</table>

**Purpose:** Specifies the device name that needs to register.

<table>
<thead>
<tr>
<th>Step 21</th>
<th><code>exit</code></th>
</tr>
</thead>
</table>

**Purpose:** Exits SCCP CCM configuration mode.

<table>
<thead>
<tr>
<th>Step 22</th>
<th><code>dspfarm profile profile-id transcode</code></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td><code>Device(config)# dspfarm profile 1 transcode</code></td>
</tr>
</tbody>
</table>

**Purpose:** Configures a Transcoding profile and enters DSP profile configuration mode.

<table>
<thead>
<tr>
<th>Step 23</th>
<th><code>codec codec</code></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td><code>Device(config-dspfarm-profile)# codec ilbc</code></td>
</tr>
</tbody>
</table>

**Purpose:** The codec rate to be attempted for SCCP-controlled connections.

<table>
<thead>
<tr>
<th>Step 24</th>
<th><code>maximum sessions sessions</code></th>
</tr>
</thead>
</table>

**Purpose:** Configures maximum number of sessions.

<table>
<thead>
<tr>
<th>Step 25</th>
<th><code>associate application sccp</code></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td><code>Device(config-dspfarm-profile)# associate application sccp</code></td>
</tr>
</tbody>
</table>

**Purpose:** Configures an application to the profile for SCCP-based transcoding.

<table>
<thead>
<tr>
<th>Step 26</th>
<th><code>exit</code></th>
</tr>
</thead>
</table>

**Purpose:** Exits the telephony-service configuration mode.

---

## TLS for SCCP Connection for DSP Services

The Cisco Unified Border Element Supports Transport Layer Security (TLS) to be enabled or disabled between the Skinny Call Control Protocol (SCCP) server and the SCCP client. By default, TLS is enabled, which provides added protection at the transport level and ensures that SRTP keys are not easily accessible. Once TLS is disabled, the SRTP keys are not protected.

SRTP-RTP interworking is available with normal and universal transcoders. The transcoder on the Cisco Unified Border Element is invoked using SCCP messaging between the SCCP server and the SCCP client. SCCP messages carry the SRTP keys to the digital signal processor (DSP) farm at the SCCP client. The transcoder can be within the same router or can be located in a separate router. TLS should be disabled only when the transcoder is located in the same router. To disable TLS, configure the `no` form of the `tls` command in DSPFARM profile configuration mode. Disabling TLS improves CPU performance.
Configuring Secure Transcoding

Configuring the Certificate Authority

Perform the steps described in this section to configure the certificate authority.

SUMMARY STEPS

1. enable
2. configure terminal
3. ip http server
4. crypto pki server cs-label
5. database level complete
6. grant auto
7. no shutdown
8. exit

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>configure terminal</td>
<td></td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>Enables the HTTP server on your IPv4 or IPv6 system,</td>
</tr>
<tr>
<td>ip http server</td>
<td>including the Cisco web browser user interface.</td>
</tr>
<tr>
<td>Example: Device(config)# ip http server</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td>Enables a Cisco IOS certificate server and enters certificate</td>
</tr>
<tr>
<td>crypto pki server cs-label</td>
<td>server configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# crypto pki server 3854-cube</td>
<td>• In the example, 3854-cube is specified as the name of the certificate server.</td>
</tr>
<tr>
<td>Step 5</td>
<td>Controls what type of data is stored in the certificate</td>
</tr>
<tr>
<td>database level complete</td>
<td>enrollment database.</td>
</tr>
<tr>
<td>Example: Device(cs-server)# database level complete</td>
<td>• In the example, each issued certificate is written to the database.</td>
</tr>
</tbody>
</table>
### Configuring a Trustpoint for the Secure Universal Transcoder

Perform the task in this section to configure, authenticate, and enroll a trustpoint for the secure universal transcoder.

**Before you begin**

Before you configure a trustpoint for the secure universal transcoder, you should configure the certificate authority, as described in the Configuring the Certificate Authority, on page 347.

#### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `crypto pki trustpoint name`
4. `enrollment url url`
5. `serial-number`
6. `revocation-check method`
7. `rsakeypair key-label`
8. `end`
9. `crypto pki authenticate name`
10. `crypto pki enroll name`
11. `exit`

#### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Device&gt; enable</strong></td>
<td>Enters global configuration mode.</td>
</tr>
</tbody>
</table>
| **Step 2** configure terminal | Declares the trustpoint that the router uses and enters ca-trustpoint configuration mode.  
  - In the example, the trustpoint is named secdsp. |
| **Example:** Device# configure terminal | |
| **Step 3** crypto pki trustpoint *name* | Specifies the enrollment parameters of a certification authority (CA).  
  - In the example, the URL is defined as http://10.13.2.52:80. |
| **Example:** Device(config)# crypto pki trustpoint secdsp | |
| **Step 4** enrollment url *url* | Specifies whether the router serial number should be included in the certificate request. |
| **Example:** Device(ca-trustpoint)# enrollment url http://10.13.2.52:80 | |
| **Step 5** serial-number | Checks the revocation status of a certificate.  
  - In the example, the certificate revocation list checks the revocation status. |
| **Example:** Device(ca-trustpoint)# serial-number | |
| **Step 6** revocation-check *method* | Specifies which key pair to associate with the certificate.  
  - In the example, the key pair 3845-cube generated during enrollment is associated with the certificate. |
| **Example:** Device(ca-trustpoint)# revocation-check crl | |
| **Step 7** rsakeypair *key-label* | Exits ca-trustpoint configuration mode. |
| **Example:** Device(ca-trustpoint)# rsakeypair 3845-cube | |
| **Step 8** end | Authenticates the CA.  
  - Accept the trustpoint CA certificate if prompted. |
| **Example:** Device(ca-trustpoint)# end | |
| **Step 9** crypto pki authenticate *name* | Obtains the certificate for the router from the CA.  
  - Create and enter a new password if prompted.  
  - Request a certificate from the CA if prompted. |
| **Example:** Device(config)# crypto pki authenticate secdsp | |
| **Step 10** crypto pki enroll *name* | |
| **Example:** Device(config)# crypto pki enroll secdsp | |
### Purpose

**Purpose**

**Command or Action**

| Step 11 | exit |

**Example:**

```
Device(config)# exit
```

### Exiting global configuration mode.

**Purpose**

Exits global configuration mode.

### Configuring DSPFARM Services

For configuration steps, see Configuring LTI-based Transcoding.

### Associating SCCP to the Secure DSPFARM Profile

Perform the task in this section to associate SCCP to the secure DSPFARM profile.

**Before you begin**

Before you associate SCCP to the secure DSPFARM profile, you should configure DSPFARM services, as described in the “Configuring DSPFARM Services”.

### SUMMARY STEPS

1. enable
2. configure terminal
3. sccp local interface-type interface-number
4. sccp ccm ip-address identifier identifier-number version version-number
5. sccp
6. associate ccm identifier-number priority priority-number
7. associate profile profile-identifier register device-name
8. dspfarm profile profile-identifier transcode universal security
9. trustpoint trustpoint-label
10. codec codec-type
11. Repeat Step 10 to configure required codecs.
12. maximum sessions number
13. associate application sccp
14. no shutdown
15. exit

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td></td>
</tr>
</tbody>
</table>

- Enter your password if prompted.
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><code>configure terminal</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device# configure terminal</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Selects the local interface that SCCP applications (transcoding and conferencing) use to register with Cisco CallManager.</td>
</tr>
<tr>
<td><code>sccp local interface-type interface-number</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(config)# sccp local GigabitEthernet 0/0</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Adds a Cisco Unified Communications Manager server to the list of available servers.</td>
</tr>
<tr>
<td><code>sccp ccm ip-address identifier identifier-number version version-number</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(config)# sccp ccm 10.13.2.52 identifier 1 version 5.0.1</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Enables SCCP and related applications (transcoding and conferencing) and enters SCCP Cisco CallManager configuration mode.</td>
</tr>
<tr>
<td><code>sccp</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(config)# sccp</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>Associates a Cisco Unified CallManager with a Cisco CallManager group and establishes its priority within the group.</td>
</tr>
<tr>
<td><code>associate ccm identifier-number priority priority-number</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(config-sccp-ccm)# associate ccm 1 priority 1</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td>Associates a DSPFARM profile with a Cisco CallManager group.</td>
</tr>
<tr>
<td><code>associate profile profile-identifier register device-name</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cisco Unified Border Element Configuration Guide
### Command or Action

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device(config-sccp-ccm)# associate profile 1 register sxcoder</td>
<td>The number 1 identifies the DSPFARM profile. Sxcoder is configured as the user-specified device name in Cisco Unified CallManager.</td>
</tr>
</tbody>
</table>

**Step 8**

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>dspfarm profile profile-identifier transcode universal security</td>
<td>Defines a profile for DSPFARM services and enters DSPFARM profile configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-sccp-ccm)# dspfarm profile 1 transcode universal security</td>
<td>In the example, the following parameters are set:</td>
</tr>
<tr>
<td></td>
<td>• Profile 1 is enabled for transcoding.</td>
</tr>
<tr>
<td></td>
<td>• Profile 1 is enabled for secure DSPFARM services.</td>
</tr>
</tbody>
</table>

**Step 9**

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>trustpoint trustpoint-label</td>
<td>Associates a trustpoint with a DSPFARM profile.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dspfarm-profile)# trustpoint secdsp</td>
<td>In the example, the trustpoint to be associated with the DSPFARM profile is labeled secdsp.</td>
</tr>
</tbody>
</table>

**Step 10**

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>codec codec-type</td>
<td>Specifies the codecs that are supported by a DSPFARM profile.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dspfarm-profile)# codec g711ulaw</td>
<td>In the example, the g711ulaw codec is specified.</td>
</tr>
</tbody>
</table>

**Step 11**

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeat Step 10 to configure required codecs.</td>
<td>--</td>
</tr>
</tbody>
</table>

**Step 12**

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>maximum sessions number</td>
<td>Specifies the maximum number of sessions that are supported by the profile.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dspfarm-profile)# maximum sessions 84</td>
<td>In the example, a maximum of 84 sessions are supported by the profile. The maximum number of sessions depends on the number of DSPs available for transcoding.</td>
</tr>
</tbody>
</table>

**Step 13**

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>associate application sccp</td>
<td>Associates SCCP to the DSPFARM profile.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dspfarm-profile)# associate application sccp</td>
<td></td>
</tr>
</tbody>
</table>

**Step 14**

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>no shutdown</td>
<td>Allocates DSPFARM resources and associates them with the application.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dspfarm-profile)# no shutdown</td>
<td></td>
</tr>
</tbody>
</table>

**Step 15**

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>exit</td>
<td>Exits DSPFARM profile configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dspfarm-profile)# exit</td>
<td></td>
</tr>
</tbody>
</table>
Registering the Secure Universal Transcoder to the CUBE

Perform the task in this section to register the secure universal transcoder to the Cisco Unified Border Element. The Cisco Unified Border Element Support for SRTP-RTP Interworking feature supports both secure transcoders and secure universal transcoders.

Before you begin

Before you register the secure universal transcoder to the Cisco Unified Border Element, you should associate SCCP to the secure DSPFARM profile, as described in the Associating SCCP to the Secure DSPFARM Profile, on page 350.

SUMMARY STEPS

1. enable
2. configure terminal
3. telephony-service
4. sdspfarm transcode sessions number
5. sdspfarm tag number device-name
6. em logout time1 time2 time3
7. max-ephones max-ephones
8. max-dn max-directory-numbers
9. ip source-address ip-address
10. secure-signaling trustpoint label
11. tftp-server-credentials trustpoint label
12. create cnf-files
13. no sccp
14. sccp
15. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device&gt; configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> telephony-service</td>
<td>Enters telephony-service configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# telephony-service</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Specifies the maximum number of transcoding sessions allowed per Cisco CallManager Express router.</td>
</tr>
<tr>
<td><strong>sdspfarm transcode sessions number</strong></td>
<td>- In the example, a maximum of 84 DSPFARM sessions are specified.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-telephony)# sdspfarm transcode sessions 84</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Permits a DSPFARM to be to registered to Cisco Unified CallManager Express and associates it with an SCCP client interface's MAC address.</td>
</tr>
<tr>
<td><strong>sdspfarm tag number device-name</strong></td>
<td>- In the example, DSPFARM 1 is associated with the scoder device.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-telephony)# sdspfarm tag 1 scoder</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>Configures three time-of-day-based timers for automatically logging out all Extension Mobility feature users.</td>
</tr>
<tr>
<td><strong>em logout time1 time2 time3</strong></td>
<td>- In the example, all users are logged out from Extension Mobility after 00:00.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-telephony)# em logout 0:0 0:0 0:0</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td>Sets the maximum number of Cisco IP phones to be supported by a Cisco CallManager Express router.</td>
</tr>
<tr>
<td><strong>max-phones max-phones</strong></td>
<td>- In the example, a maximum of four phones are supported by the Cisco CallManager Express router.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-telephony)# max-phones 4</td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong></td>
<td>Sets the maximum number of extensions (ephone-dns) to be supported by a Cisco Unified CallManager Express router.</td>
</tr>
<tr>
<td><strong>max-dn max-directory-numbers</strong></td>
<td>- In the example, a maximum of four extensions is allowed.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-telephony)# max-dn 4</td>
<td></td>
</tr>
<tr>
<td><strong>Step 9</strong></td>
<td>Identifies the IP address and port through which IP phones communicate with a Cisco Unified CallManager Express router.</td>
</tr>
<tr>
<td><strong>ip source-address ip-address</strong></td>
<td>- In the example, 10.13.2.52 is configured as the router IP address.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-telephony)# ip source-address 10.13.2.52</td>
<td></td>
</tr>
<tr>
<td><strong>Step 10</strong></td>
<td>Specifies the name of the Public Key Infrastructure (PKI) trustpoint with the certificate to be used for TLS handshakes with IP phones on TCP port 2443.</td>
</tr>
<tr>
<td><strong>secure-signaling trustpoint label</strong></td>
<td>- In the example, PKI trustpoint secdsp is configured.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config-telephony)# secure-signaling trustpoint secdsp</td>
<td></td>
</tr>
<tr>
<td><strong>Step 11</strong></td>
<td>Specifies the PKI trustpoint that signs the phone configuration files.</td>
</tr>
<tr>
<td><strong>tftp-server-credentials trustpoint label</strong></td>
<td>- In the example, PKI trustpoint secdsp is configured.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device(config-telephony)# tftp-server-credentials trustpoint scme</td>
<td>Builds the XML configuration files that are required for IP phones in Cisco Unified CallManager Express.</td>
</tr>
<tr>
<td>Step 12 create cnf-files</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-telephony)# create cnf-files</td>
<td></td>
</tr>
<tr>
<td>Step 13 no sccp</td>
<td>Disables SCCP and its related applications (transcoding and conferencing) and exits telephony-service configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-telephony)# no sccp</td>
<td></td>
</tr>
<tr>
<td>Step 14 sccp</td>
<td>Enables SCCP and related applications (transcoding and conferencing).</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# sccp</td>
<td></td>
</tr>
<tr>
<td>Step 15 end</td>
<td>Exits global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# end</td>
<td></td>
</tr>
</tbody>
</table>

## Configuration Examples for SCCP Based Transcoding

**Example: SCCP-based Transcoding**

```bash
! Enabling dspfarm services under voice-card
Device(config)# voice-card 1
Device(config-voicecard)# dspfarm
Device(config-voicecard)# dsp services dspfarm
Device(config-voicecard)# exit

! Configuring Telephony Service
Device(config)# telephony-service
Device(config-telephony)# sdspfarm units 1
Device(config-telephony)# sdspfarm transcode sessions 128
Device(config-telephony)# sdspfarm tag 1 CUBE-XCODE
Device(config-telephony)# max-ephones 10
Device(config-telephony)# max-dn 10
Device(config-telephony)# ip source-address 10.1.1.1 port 2000
Device(config-telephony)# exit

! Configuring SCCP
Device(config)# no sccp
Device(config)# sccp local GigabitEthernet0/0
Device(config)# sccp ccm 10.1.1.1 identifier 1 version 4.0
```

Cisco Unified Border Element Configuration Guide
Device(config)# sccp
Device(config)# sccp ccm group 1
Device(config-sccp-ccm)# associate ccm 1 priority 1
Device(config-sccp-ccm)# associate profile 1 register CUBE-XCODE
Device(config-sccp-ccm)# exit

! Configuring dspfarm profile
Device(config)# dspfarm profile 1 transcode
Device(config-dspfarm-profile)# codec g711ulaw
Device(config-dspfarm-profile)# codec g711alaw
Device(config-dspfarm-profile)# codec g729r8
Device(config-dspfarm-profile)# maximum sessions 10

Device(config-dspfarm-profile)# associate application SCCP
Device(config-dspfarm-profile)# exit
Transrating

Transrating is a process of configuring a different packetization for a voice codec. For example, transrating G.729 20ms to G.729 30ms.

- Voice Packetization, on page 357
- Configuring Transrating for a Codec, on page 358

Voice Packetization

After the voice wavelength is digitized, the DSP collects the digitized data for an amount of time until there is enough data to fill the payload of a single packet.

With G.711, either 20 ms or 30 ms worth of voice is transmitted in a single packet. 20 ms worth of voice corresponds to 160 samples per packet. With 20 ms worth of voice per packet, 50 packets are created per second: 1 sec / 20 ms = 50.

The packetization rate has a direct effect on the total amount of bandwidth needed. More packets require more headers, and each header adds 40 bytes to the packet. The Table 13: Codec and Bandwidth Information, on page 52 table shows the effect of packetization rates on bandwidth utilization.

Codes such as G.729 also compress the digitized output. G.729 creates a codeword for every 10 ms of voice. This “codeword” is a predefined representation of a 10-ms sample of human voice. Two codewords are contained in each packet at 50 packets per second or three codewords at 33.3 packets per second. Because the codewords need fewer bits, the overall bandwidth required is reduced.

<table>
<thead>
<tr>
<th>Supported Codecs</th>
<th>Packetization (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.711 a-law 64 Kbps</td>
<td>10, 20, 30</td>
</tr>
<tr>
<td>G.711 law 64 Kbps</td>
<td>10, 20, 30</td>
</tr>
<tr>
<td>G.723 5.3/6/3 Kbps</td>
<td>30, 60</td>
</tr>
<tr>
<td>G.729, G.729A, G.729B, G.729AB 8 Kbps</td>
<td>10, 20, 30, 40, 50, 60</td>
</tr>
<tr>
<td>G.722—64 Kbps</td>
<td>10, 20, 30</td>
</tr>
</tbody>
</table>
Configuring Transrating for a Codec

SUMMARY STEPS

1. enable
2. configure terminal
3. dial-peer voice number voip
4. codec codec-name bytes voice-payload-size [fixed-bytes]
5. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| Step 1 | enable
   Example:
   Device> enable | Enables privileged EXEC mode.
   • Enter your password if prompted. |
| Step 2 | configure terminal
   Example:
   Device> configure terminal | Enters global configuration mode. |
| Step 3 | dial-peer voice number voip
   Example:
   Device(config)# dial-peer voice 1 voip | Enters dial peer configuration mode for the specified VoIP dial peer. |
| Step 4 | codec codec-name bytes voice-payload-size [fixed-bytes]
   Example:
   Device(config-dial-peer)# codec g729r8 bytes 30 fixed-byte | Configures a different packetizations for a voice codec. |
| Step 5 | end
   Example:
   Device(config-dial-peer)# end | Exits to privileged EXEC mode. |
CHAPTER 28

Call Progress Analysis Over IP-to-IP Media Session

The Call Progress Analysis Over IP-IP Media Session feature enables the detection of automated answering systems and live human voices on outbound calls and communicates the detected information to the external application. Typically, call progress analysis (CPA) is extensively used in contact center deployments in conjunction with the outbound Session Initiation Protocol (SIP) dialer, where CPA is enabled on the Cisco Unified Border Element (Cisco UBE), and digital signal processors (DSP) perform the CPA functionality.

- Feature Information for Call Progress Analysis Over IP-IP Media Session, on page 359
- Restrictions for Call Progress Analysis Over IP-to-IP Media Session, on page 360
- Information About Call Progress Analysis Over IP-IP Media Session, on page 361
- How to Configure Call Progress Analysis Over IP-to-IP Media Session, on page 362
- Configuration Examples for the Call Progress Analysis Over IP-to-IP Media Session, on page 365

Feature Information for Call Progress Analysis Over IP-IP Media Session

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
Table 40: Feature Information for Call Progress Analysis Over IP-IP Media Session

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call Progress Analysis Over IP-to-IP Media Session</td>
<td>15.3(2)T</td>
<td>The Call Progress Analysis Over IP-to-IP Media Session feature enables detection of automated answering systems and live human voices on outbound calls and communicates the detected information to an external application. The following command was introduced: <code>call-progress-analysis</code>.</td>
</tr>
<tr>
<td>Call Progress Analysis Over IP-to-IP Media Session</td>
<td>Cisco IOS XE Release 3.9S</td>
<td>The Call Progress Analysis Over IP-to-IP Media Session feature enables detection of automated answering systems and live human voices on outbound calls and communicates the detected information to an external application. The following command was introduced: <code>call-progress-analysis</code>.</td>
</tr>
</tbody>
</table>
| Support for additional call flows                | 15.5(2)T Cisco IOS XE Release 3.15S | Call Progress Analysis feature is enhanced to support the following call-flows:  
  • 180 SIP response received without SDP  
  • Direct call connect (without 18x from Service Provider)  
  • Multiple 18x response to INVITE  
  • Early dialog UPDATE  
  • Dialer-CUBE CPA call record |

Restrictions for Call Progress Analysis Over IP-to-IP Media Session

- Only SIP-to-SIP Early Offer (EO-to-EO) call flows are supported.
- Session Description Protocol (SDP) passthrough and flow-around media calls are not supported.
- Only the G711 flavor of codec is supported.
- High Availability (HA) is not supported.
- Skinny Client Control Protocol (SCCP)-based digital signal processor (DSP) farm is not supported.
- CPA cannot not be detected if Dialer uses Inband as DTMF relay mechanism, that is, Inband to RTP-NTE DTMF inter-working is not supported with CPA.
- CPA call record is not supported for "180 without SDP" and "Direct Call Connect (without 18x)" call flows from Service Provider.
Information About Call Progress Analysis Over IP-IP Media Session

Call Progress Analysis

Call progress analysis (CPA) is a DSP algorithm that analyzes the Real-Time Transport Protocol (RTP) voice stream to look for special information tones (SIT), fax or modem tones, human speech, and answering machine tones. CPA also passes the voice information to Cisco IOS or Cisco Unified Border Element (Cisco UBE).

CPA is initiated on receiving a new SIP INVITE with x-cisco-cpa content. While a call is in progress, the DSP or the Xcoder analyzes the incoming voice or media stream. The DSP identifies the type of voice stream based on statistical voice patterns or specific tone frequencies and provides the information to the Cisco UBE. The Cisco UBE notifies the dialer with a SIP UPDATE with x-cisco-cpa content along with the detected event. Based on the report, the caller (dialer) can decide to either transfer the call or terminate the call.

To use the CPA functionality, you must enable CPA and configure CPA timing and threshold parameters.

Table 41: X-cisco-cpa content meaning

<table>
<thead>
<tr>
<th>SIP Message</th>
<th>Direction of Message</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>18x or 200</td>
<td>Cisco IOS to dialer</td>
<td>Cisco UBE informs the dialer if CPA is enabled for a call or not.</td>
</tr>
<tr>
<td>New INVITE</td>
<td>Dialer to Cisco IOS</td>
<td>Dialer requests Cisco IOS or the Cisco UBE to activate the CPA algorithm for this session.</td>
</tr>
<tr>
<td>UPDATE</td>
<td>Cisco IOS to dialer</td>
<td>Cisco IOS or the Cisco UBE notifies the dialer about the detected event.</td>
</tr>
</tbody>
</table>

CPA Events

Table 42: CPA Event Detection List

<table>
<thead>
<tr>
<th>CPA Event</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asm</td>
<td>Answer machine</td>
</tr>
<tr>
<td>AsmT</td>
<td>Answer machine terminate tone</td>
</tr>
<tr>
<td>CpaS</td>
<td>Start of the Call Progress Analysis</td>
</tr>
<tr>
<td>FT</td>
<td>Fax/Modem tone</td>
</tr>
<tr>
<td>LS</td>
<td>Live human speech</td>
</tr>
<tr>
<td>LV</td>
<td>Low volume or dead air call</td>
</tr>
<tr>
<td>CPA Event</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>SitIC</td>
<td>Special information tone IC -- Intercept -- Vacant number or Automatic Identification System (AIS)</td>
</tr>
<tr>
<td>SitNC</td>
<td>SIT tone NC—No Circuit (NC), Emergency, or Trunk Blockage</td>
</tr>
<tr>
<td>SitVC</td>
<td>SIT tone VC—Vacant Code</td>
</tr>
<tr>
<td>SitRO</td>
<td>SIT tone RO—Reorder Announcement</td>
</tr>
<tr>
<td>SitMT</td>
<td>Miscellaneous SIT Tone</td>
</tr>
</tbody>
</table>

How to Configure Call Progress Analysis Over IP-to-IP Media Session

Enabling CPA and Setting the CPA Parameters

Perform the following task to enable CPA and set the CPA timing and threshold parameters:

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `dspsfarm profile profile-identifier transcode`
4. `call-progress-analysis`
5. `exit`
6. `voice service voip`
7. `cpa timing live-person max-duration`
8. `cpa timing term-tone max-duration`
9. `cpa threshold active-signal signal-threshold`
10. `end`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
</tr>
</tbody>
</table>
| enable             | Enables privileged EXEC mode.  
| Example:           | • Enter your password if prompted. |
| Device> enable     |         |
| **Step 2**        |         |
| configure terminal | Enters global configuration mode. |
| Example:           |         |
### DSP Services

#### Enabling CPA and Setting the CPA Parameters

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
</tbody>
</table>

**Step 3**  
**dspfarm profile** profile-identifier transcode  
**Example:**  
Device(config)# dspfarm profile 15 transcode  
Enters DSP farm profile configuration mode, defines a profile for DSP farm services, and enables the profile for transcoding.

**Step 4**  
**call-progress-analysis**  
**Example:**  
Device(config-dspfarm-profile)# call-progress-analysis  
Enables call progress analysis (CPA) on Cisco UBE.  
- You must configure this command to activate the CPA feature and set CPA parameters.

**Step 5**  
**exit**  
**Example:**  
Device(config-dspfarm-profile)# exit  
Exits DSP farm profile configuration mode and enters global configuration mode.

**Step 6**  
**voice service voip**  
**Example:**  
Device(config)# voice service voip  
Enters voice service configuration mode.

**Step 7**  
**cpa timing live-person** max-duration  
**Example:**  
Device(conf-voi-serv)# cpa timing live-person 2501  
(Optional) Sets the maximum waiting time (in milliseconds) that the CPA algorithm uses to determine if a call is answered by a live human.

**Step 8**  
**cpa timing term-tone** max-duration  
**Example:**  
Device(conf-voi-serv)# cpa timing term-tone 15500  
(Optional) Sets the maximum waiting time (in milliseconds) that the CPA algorithm uses to wait for the answering machine termination tone after the answering machine is detected.

**Step 9**  
**cpa threshold active-signal** signal-threshold  
**Example:**  
Device(conf-voi-serv)# cpa threshold active-signal 18db  
(Optional) Sets the threshold (in decibels) of an active signal that is related to the measured noise floor level.  
- If a signal threshold configured by this command is greater than the measured noise floor level, then the signal is considered as active. The active signal thresholds that you can configure are 9, 12, 15, 18, and 21 decibels.

**Step 10**  
**end**  
**Example:**  
Device(conf-voi-serv)# end  
Exits voice service configuration mode and returns to privileged EXEC mode.
Verifying the Call Progress Analysis Over IP-to-IP Media Session

Perform this task to verify that call progress analysis has been configured for a digital signal processor (DSP) farm profile.

**SUMMARY STEPS**

1. `enable`
2. `show dspfarm profile profile-identifier`

**DETAILED STEPS**

**Step 1** `enable`

Enables privileged EXEC mode.

**Example:**

```
Device> enable
```

**Step 2** `show dspfarm profile profile-identifier`

Displays the configured DSP farm profile information for a selected Cisco Call Manager group. In the following sample output, the Call Progress Analysis field shows that CPA is enabled.

**Example:**

```
Device# show dspfarm profile 3
Profile ID = 3, Service = Universal TRANSCODING, Resource ID = 3
Profile Description :
Profile Service Mode : Non Secure
Profile Admin State : UP
Profile Operation State : ACTIVE
Application : CUBE  Status : ASSOCIATED
Resource Provider : FLEX_DSPRM  Status : UP
Number of Resource Configured : 4
Number of Resources Out of Service : 0
Number of Resources Active : 0
Codec Configuration: num_of_codecs:4
Codec : g711ulaw, Maximum Packetization Period : 30
Codec : g711alaw, Maximum Packetization Period : 30
Codec : g729ar8, Maximum Packetization Period : 60
Codec : g729abr8, Maximum Packetization Period : 60
Noise Reduction : ENABLED
Call Progress Analysis : ENABLED
```

**Troubleshooting Tips**

Use the following commands to troubleshoot the call progress analysis for SIP-to-SIP calls:

- `debug ccsip all`
- `debug voip ccap inout`
• debug voip hpi all
• debug voip ipipgw
• debug voip media resource provisioning all

Configuration Examples for the Call Progress Analysis Over IP-to-IP Media Session

Example: Enabling CPA and Setting the CPA Parameters

The following example shows how to enable CPA and set a few timing and threshold parameters. Depending on your requirements, you can configure more timing and threshold parameters.

Device> enable  
Device# configure terminal  
Device(config)# dspfarm profile 15 transcode  
Device(config-dspfarm-profile)# call-progress-analysis  
Device(config-dspfarm-profile)# exit  
Device(config)# voice service voip  
Device(config-voi-serv)# cpa timing live-person 2501  
Device(config-voi-serv)# cpa timing term-tone 15500  
Device(config-voi-serv)# cpa threshold active-signal 18db  
Device(config-voi-serv)# end
PART VII

Video

• Video Suppression, on page 369
Video Suppression

Video suppression feature allows pass-through of only audio and image (for T.38 Fax) media types in SDP and drops all other media capabilities.

* Feature Information for Video Suppression, on page 369
* Restrictions, on page 369
* Information About Video Suppression, on page 370
* Configuring Video Suppression, on page 370
* Troubleshooting Tips, on page 371

### Feature Information for Video Suppression

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for Video Suppression</td>
<td>Cisco IOS 15.6(2)T</td>
<td>This feature allows pass-through of only audio and image (for T.38 Fax) media types and drops all other media types in SDP. The following commands are introduced: <strong>audio forced</strong>, <strong>voice-class sip audio forced</strong></td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE Denali 16.3.1</td>
<td></td>
</tr>
</tbody>
</table>

### Restrictions

* Supports only SIP-SIP calls.
• Video suppression is not supported in SDP pass-through mode.
• Video suppression feature removes both video and application m-lines in the incoming SDP. It is not possible to remove application m-line alone and pass across video m-line parameters.

Information About Video Suppression

Video suppression feature enables CUBE to interwork with the networks that support only audio and image media types in SDP and the networks that support video and application media types in addition to audio and image media types.

By default video suppression feature is disabled on CUBE and hence the video capabilities are passed through in SDP. Passing across the video capabilities could cause interoperability issues if one of the networks do not support video capabilities.

By enabling video suppression feature, you can configure CUBE to pass-through audio and image only, and drop all other capabilities such as video and application m-lines. This helps enterprises to interwork with audio capable networks and video capable networks smoothly.

You can enable video suppression at dial-peer level and at global configuration level.

Feature Behavior

• If video suppression is enabled on any of the dial-peers (inbound or outbound), video capabilities are not offered for that particular call.

• Configuring voice-class sip audio forced [system] command at a dial-peer level makes use of global configuration level settings for allowing only audio and image media.

• Video suppression feature will work as expected even when codec transparent feature is configured.

Configuring Video Suppression

SUMMARY STEPS

1. enable
2. configure terminal
3. Enter one of the following commands:
   • In the dial-peer configuration mode
     voice-class sip audio forced
   • In the global VoIP SIP configuration mode
     audio forced
4. end
## DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| Step 1 | enable | Enables privileged EXEC mode.  
  - Enter your password if prompted. |
| Step 2 | configure terminal | Enters global configuration mode. |
| Step 3 | Enter one of the following commands:  
  - In the dial-peer configuration mode  
    `voice-class sip audio forced`  
  - In the global VoIP SIP configuration mode  
    `audio forced` | Enables pass-through of only audio and image media types in SDP. |

**Example:**

In dial-peer configuration mode

```
!Applying audio-forced to one dial peer only
Device (config)# dial-peer voice 10 voip
Device (config-dial-peer)# voice-class sip audio forced
Device (config-dial-peer)# end
```

**Example:**

In global VoIP SIP configuration mode

```
! Applying audio forced globally
Device(config)# voice service voip
Device (config-voi-serv)# sip
Device (config-voi-sip)# audio forced
Device (config-voi-sip)# end
```

| Step 4 | end | Exits present configuration mode and enters privileged EXEC mode. |

## Troubleshooting Tips

The following commands are useful for debugging:

- `show voip rtp connections`
- `show call active voice brief`
- `show call active video brief`
- `debug voip dialpeer`
- `debug ccsip all`
- `debug voip ccapi inout`
PART VIII

Media Recording

• Network-Based Recording, on page 375
• SIPREC (SIP Recording), on page 401
• Video Recording - Additional Configurations, on page 425
• Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording, on page 431
• Cisco Unified Communications Gateway Services--Extended Media Forking, on page 439
Network-Based Recording

The Network-Based Recording feature supports software-based forking for Real-time Transport Protocol (RTP) streams. Media forking provides the ability to create midcall multiple streams (or branches) of audio and video associated with a single call and then send the streams of data to different destinations. To enable network-based recording using Cisco Unified Border Element (CUBE), you can configure specific commands or use a call agent. CUBE acts as a recording client and MediaSense Session Initiation Protocol (SIP) recorder acts a recording server.

- Feature Information for Network-Based Recording, on page 375
- Restrictions for Network-Based Recording, on page 376
- Information About Network-Based Recording Using CUBE, on page 377
- How to Configure Network-Based Recording, on page 380
- Additional References for Network-Based Recording, on page 399

Feature Information for Network-Based Recording

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 44: Feature Information for Network-Based Recording

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio-only Stream Forking of Video Call</td>
<td>Cisco IOS 15.4(3)M Cisco IOS XE 3.13S</td>
<td>The Audio-only Stream Forking of Video Call feature supports CUBE-based forking and recording of only audio calls in a call that includes both audio and video. The following commands were introduced: media-type audio.</td>
</tr>
<tr>
<td>Network-Based Recording of Video Calls Using CUBE</td>
<td>Cisco IOS 15.3(3)M Cisco IOS XE 3.10S</td>
<td>The Network-Based Recording of Video Calls using CUBE feature supports forking and recording of video calls.</td>
</tr>
</tbody>
</table>
Restrictions for Network-Based Recording

• Network-based recording is not supported for the following calls:
  • Calls that do not use Session Initiation Protocol (SIP). Must be a SIP-to-SIP call flow
  • Flow-around calls
  • Session Description Protocol (SDP) pass-through calls
  • Real-time Transport Protocol (RTP) loopback calls
  • High-density transcoder calls
  • IPv6-to-IPv6 calls
  • IPv6-to-IPv4 calls with IPv4 endpoint.
  • Secure Real-time Transport Protocol (SRTP) passthrough calls
  • SRTP-RTP calls with forking for SRTP leg (forking is supported for the RTP leg)
  • Resource Reservation Protocol (RSVP)
  • Multicast music on hold (MOH)

• Any media service parameter change via Re-INVITE or UPDATE from Recording server is not supported
  Midcall renegotiation and supplementary services can be done through the primary call only.

• Media service parameter change via Re-INVITE or UPDATE message from the recording server is not supported

• Recording is not supported if CUBE is running a TCL IVR application.

• Media mixing on forked streams is not supported

• Digital Signal Processing (DSP) resources are not supported on forked legs

Restrictions for Video Recording

• If the main call has multiple video streams (m-lines), the video streams other than the first video m-line are not forked.

• Application media streams of the primary call are not forked to the recording server.

• Forking is not supported if the anchor leg or recording server is on IPv6.
• High availability is not supported on forked video calls.

Information About Network-Based Recording Using CUBE

Deployment Scenarios for CUBE-based Recording

CUBE as a recording client has the following functions:

• Acts as a SIP user agent and sets up a recording session (SIP dialog) with the recording server.
• Acts as the source of the recorded media and forwards the recorded media to the recording server.
• Sends information to a server that helps the recording server associate the call with media streams and identifies the participants of the call. This information sent to the recording server is called metadata.

Given below is a typical deployment scenario of a CUBE-based recording solution. The information flow is described below:

Figure 32: Deployment Scenario for CUBE-based Recording Solution

1. Incoming call from SIP trunk.
2. Outbound call to a Contact Centre
3. Media between endpoints flow through CUBE
4. CUBE sets up a new SIP session with MediaSense based on policy.
5. CUBE forks RTP media to MediaSense. For an audio call, audio is forked. For a video call, both audio and video are forked. For an audio-only configuration in an audio-video call, only audio is forked. There will be two or four m-lines to the recording server, based on the type of recording

The metadata carried in the SIP session between the recording client and the recording server is to:

• Carry the communication session data that describes the call.
• Send the metadata to the recording server. The recording server uses the metadata to associate communication sessions involving two or more participants with media streams.

The call leg that is created between the recording client and the recording server is known as the recording session.
Open Recording Architecture

The Open Recording Architecture (ORA) comprises of elements, such as application management server and SIP bridge, to support IP-based recording. The ORA IP enables recording by solving topology issues, which accelerates the adoption of Cisco unified communication solutions.

Following are the three layers of the ORA architecture:

Network Layer

The ORA network layer is comprises call control systems, media sources, and IP foundation components, such as routers and switches.

Capture and Media Processing Layer

The ORA capture and media processing layer includes core functions of ORA—terminating media streams, storage of media and metadata, and speech analytics that can provide real-time events for applications.

Application Layer

The ORA application layer supports in-call and post-call applications through open programming interfaces. In-call applications include applications that make real-time business decisions (for example, whether to record a particular call or not), control pause and resume from Interactive Voice Response (IVR) or agent desktop systems, and perform metadata tagging and encryption key exchange at the call setup.
Post-call applications include the following:

- Traditional compliance search, replay, and quality monitoring.
- Advanced capabilities, such as speech analytics, transcription, and phonetic search.
- Custom enterprise integration.
- Enterprise-wide policy management.

### Media Forking Topologies

The following topologies support media forking:

#### Media Forking with Cisco UCM

The figure below illustrates media forking with Cisco Unified CallManager (Cisco UCM) topology. This topology supports replication of media packets to allow recording by the caller agent. It also enables CUBE to establish full-duplex communication with the recording server. In this topology, SIP recording trunk is enhanced to have additional call metadata.

#### Media Forking without Cisco UCM

The topology below shows media forking without the Cisco UCM topology. This topology supports static configuration on CUBE and the replication of media packets to allow recording caller-agent and full-duplex interactions at an IP call recording server.
**SIP Recorder Interface**

SIP is used as a protocol between CUBE and the MediaSense SIP server. Extensions are made to SIP to carry the recording session information needed for the recording server. This information carried in SIP sessions between the recording client and the recording server is called metadata.

**Metadata**

Metadata is the information that is passed by the recording client to the recording server in a SIP session. Metadata describes the communication session and its media streams.

Metadata is used by the recording server to:

- Identify participants of the call.
- Associate media streams with the participant information. Each participant can have one or more media streams, such as audio and video.
- Identify the participant change due to transfers during the call.

The recording server uses the metadata information along with other SIP message information, such as dialog ID and time and date header, to derive a unique key. The recording server uses this key to store media streams and associate the participant information with the media streams.

**How to Configure Network-Based Recording**

**Configuring Network-Based Recording (with Media Profile Recorder)**

**SUMMARY STEPS**

1. enable
2. configure terminal
3. media profile recorder profile-tag
4. (Optional) media-type audio
5. media-recording dial-peer-tag [dial-peer-tag2...dial-peer-tag5]
6. exit
7. media class tag
8. recorder profile tag
9. exit
10. dial-peer voice dummy-recorder-dial-peer-tag voip
11. media-class tag
12. destination-pattern [+ string T]
13. session protocol sipv2
14. session target ipv4:[recording-server-destination-address | recording-server-dns]
15. session transport tcp
16. end
### DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td></td>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>media profile recorder profile-tag</td>
<td>Configures the media profile recorder and enters media profile configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# media profile recorder 100</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>(Optional) media-type audio</td>
<td>Configures recording of audio only in a call with both audio and video. If this configuration is not done, both audio and video are recorded.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(cfg-mediaprofile)# media-type audio</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>media-recording dial-peer-tag [dial-peer-tag2...dial-peer-tag5]</td>
<td>Configures the dial-peers that need to be configured.</td>
</tr>
<tr>
<td></td>
<td>Note You can specify a maximum of five dial-peer tags.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(cfg-mediaprofile)# media-recording 8000 8001 8002</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>exit</td>
<td>Exits media profile configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(cfg-mediaprofile)# exit</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>media class tag</td>
<td>Configures a media class and enters media class configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# media class 100</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>recorder profile tag</td>
<td>Configures the media profile recorder.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(cfg-mediaclass)# recorder profile 100</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>exit</td>
<td>Exits media class configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(cfg-mediaclass)# exit</td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

<table>
<thead>
<tr>
<th>Step 10</th>
<th>dial-peer voice dummy-recorder-dial-peer-tag voip</th>
<th><strong>Purpose</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config)# dial-peer voice 8000 voip</td>
<td>Configures a recorder dial peer and enters dial peer voice configuration mode.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 11</th>
<th>media-class tag</th>
<th><strong>Purpose</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-dial-peer)# media-class 100</td>
<td>Configures media class on a dial peer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 12</th>
<th>destination-pattern [+] string [T]</th>
<th><strong>Purpose</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-dial-peer)# destination-pattern 595959</td>
<td>Specifies either the prefix or the full E.164 telephone number (depending on your dial plan) to be used for a dial peer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 13</th>
<th>session protocol sipv2</th>
<th><strong>Purpose</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-dial-peer)# session protocol sipv2</td>
<td>Configures the VoIP dial peer to use Session Initiation Protocol (SIP).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 14</th>
<th>session target ipv4:[recording-server-destination-address</th>
<th><strong>Purpose</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-dial-peer)# session target ipv4:10.42.29.7</td>
<td>Specifies a network-specific address for a dial peer. Keyword and argument are as follows:</td>
</tr>
<tr>
<td></td>
<td>recording-server-dns]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 15</th>
<th>session transport tcp</th>
<th><strong>Purpose</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-dial-peer)# session transport tcp</td>
<td>Configures a VoIP dial peer to use Transmission Control Protocol (TCP).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 16</th>
<th>end</th>
<th><strong>Purpose</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config-dial-peer)# end</td>
<td>Returns to privileged EXEC mode.</td>
</tr>
</tbody>
</table>

## Configuring Network-Based Recording (without Media Profile Recorder)

### SUMMARY STEPS

1. enable
2. configure terminal
3. media class tag
4. recorder parameter
Media Recording

5. (Optional) **media-type audio**
6. **media-recording** *dial-peer-tag*
7. **exit**
8. **exit**
9. **dial-peer** voice *dummy-recorder-dial-peer-tag voip*
10. **media-class** *tag*
11. **destination-pattern** *[++ string [T]>*
12. **session protocol** sipv2
13. **session target** ipv4:*[recording-server-destination-address | recording-server-dns]*
14. **session transport** tcp
15. **end**

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>enable</td>
<td></td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>configure terminal</td>
<td></td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Configures the media class and enters media class configuration mode.</td>
</tr>
<tr>
<td>media class <em>tag</em></td>
<td></td>
</tr>
<tr>
<td>Example: Device(config)# media class 100</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Enters media class recorder parameter configuration mode to enable you to configure recorder-specific parameters.</td>
</tr>
<tr>
<td>recorder parameter</td>
<td></td>
</tr>
<tr>
<td>Example: Device(cfg-mediaclass)# recorder parameter</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Configures recording of audio only in a call with both audio and video.</td>
</tr>
<tr>
<td>(Optional) <strong>media-type audio</strong></td>
<td></td>
</tr>
<tr>
<td>Example: Device(cfg-mediaprofile)# media-type audio</td>
<td><strong>Note</strong> If this configuration is not done, both audio and video are recorded.</td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>Configures voice-class recording parameters.</td>
</tr>
<tr>
<td><strong>media-recording</strong> <em>dial-peer-tag</em></td>
<td></td>
</tr>
<tr>
<td>Example: Device(cfg-mediaclass-recorder)# media-recording 8000, 8001, 8002</td>
<td><strong>Note</strong> You can specify a maximum of five dial-peer tags.</td>
</tr>
<tr>
<td>Step</td>
<td>Command or Action</td>
</tr>
<tr>
<td>------</td>
<td>------------------</td>
</tr>
<tr>
<td>7</td>
<td>exit</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(cfg-mediaclass-recorder)# exit</td>
</tr>
<tr>
<td>8</td>
<td>exit</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(cfg-mediaclass)# exit</td>
</tr>
<tr>
<td>9</td>
<td>dial-peer voice</td>
</tr>
<tr>
<td></td>
<td>dummy-recorder-dial-peer-tag voip</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(config)# dial-peer voice 8000 voip</td>
</tr>
<tr>
<td>10</td>
<td>media-class tag</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# media-class 100</td>
</tr>
<tr>
<td>11</td>
<td>destination-pattern</td>
</tr>
<tr>
<td></td>
<td>[+ string [T]]</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# destination-pattern 595959</td>
</tr>
<tr>
<td>12</td>
<td>session protocol</td>
</tr>
<tr>
<td></td>
<td>sipv2</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# session protocol sipv2</td>
</tr>
<tr>
<td>13</td>
<td>session target</td>
</tr>
<tr>
<td></td>
<td>ipv4:destination</td>
</tr>
<tr>
<td></td>
<td>[recording-server-destination-address</td>
</tr>
<tr>
<td></td>
<td>recording-server-dns]</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# session target ipv4:10.42.29.7</td>
</tr>
<tr>
<td>14</td>
<td>session transport</td>
</tr>
<tr>
<td></td>
<td>tcp</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# session transport tcp</td>
</tr>
<tr>
<td>15</td>
<td>end</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# end</td>
</tr>
</tbody>
</table>
Verifying the Network-Based Recording Using CUBE

Perform this task to verify the configuration of the Network-Based Recording Using CUBE. The show and debug commands can be entered in any order.

**SUMMARY STEPS**

1. enable
2. show voip rtp connections
3. show voip recmsp session
4. show voip recmsp session detail call-id call-id
5. show voip rtsp forking
6. show call active voice compact
7. show call active video compact
8. show sip-ua calls
9. show call active video brief
10. debug ccsip messages (for audio calls)
11. debug ccsip messages (for video calls)
12. debug ccsip messages (for audio-only recording in a call with both audio and video)
13. Enter one of the following:
   - debug ccsip all
   - debug voip recmsp all
   - debug voip ccapi all
   - debug voip fpi all (for ASR devices only)

**DETAILED STEPS**

**Step 1**  
**enable**  
Enables privileged EXEC mode.  
**Example:**  
Device> enable

**Step 2**  
**show voip rtp connections**  
Displays Real-Time Transport Protocol (RTP) connections. Two extra connections are displayed for forked legs.  
**Example:**  
Device# show voip rtp connections

VoIP RTP Port Usage Information:  
Max Ports Available: 8091, Ports Reserved: 101, Ports in Use: 8  
Port range not configured, Min: 16384, Max: 32767

<table>
<thead>
<tr>
<th>Media-Address Range</th>
<th>Ports Available</th>
<th>Ports Reserved</th>
<th>Ports In-use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Address-Range</td>
<td>8091</td>
<td>101</td>
<td>8</td>
</tr>
</tbody>
</table>
VoIP RTP active connections:

<table>
<thead>
<tr>
<th>No.</th>
<th>CallId</th>
<th>dstCallId</th>
<th>LocalRTP</th>
<th>RmtRTP</th>
<th>LocalIP</th>
<th>RemoteIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>16384</td>
<td>20918</td>
<td>10.104.45.191</td>
<td>10.104.8.94</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>16386</td>
<td>17412</td>
<td>10.104.45.191</td>
<td>10.104.8.98</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>4</td>
<td>16388</td>
<td>29652</td>
<td>10.104.45.191</td>
<td>10.104.8.98</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>3</td>
<td>16390</td>
<td>20036</td>
<td>10.104.45.191</td>
<td>10.104.8.94</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>5</td>
<td>16392</td>
<td>58368</td>
<td>10.104.45.191</td>
<td>10.104.105.232</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>5</td>
<td>16394</td>
<td>53828</td>
<td>10.104.45.191</td>
<td>10.104.105.232</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>5</td>
<td>16396</td>
<td>39318</td>
<td>10.104.45.191</td>
<td>10.104.105.232</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>5</td>
<td>16398</td>
<td>41114</td>
<td>10.104.45.191</td>
<td>10.104.105.232</td>
</tr>
</tbody>
</table>

Found 8 active RTP connections

**Step 3**

**show voip recmsp session**

Displays active recording Media Service Provider (MSP) session information internal to CUBE.

**Example:**

```
Device# show voip recmsp session

RECMSP active sessions:
MSP Call-ID AnchorLeg Call-ID ForkedLeg Call-ID
143  141  145

Found 1 active sessions
```

**Step 4**

**show voip recmsp session detail call-id call-id**

Displays detailed information about the recording MSP Call ID.

**Example:**

```
Device# show voip recmsp session detail call-id 145

RECMSP active sessions:
Detailed Information
-------------------------------
Recording MSP Leg Details:
Call ID: 143
GUID : 7C5946D38ECD

AnchorLeg Details:
Call ID: 141
Forking Stream type: voice-nearend
Participant: 708090

Non-anchor Leg Details:
Call ID: 140
Forking Stream type: voice-farend
Participant: 10000

Forked Leg Details:
Call ID: 145
Near End Stream CallID 145
Stream State ACTIVE
Far End stream CallID 146
```
Stream State ACTIVE
Found 1 active sessions

Device# show voip recmsp session detail call-id 5

RECMSP active sessions:
Detailed Information
------------------------
Recording MSP Leg Details:
Call ID: 5
GUID : 1E01B6000000

AnchorLeg Details:
Call ID: 1
Forking Stream type: voice-nearend
Forking Stream type: video-nearend
Participant: 1777

Non-anchor Leg Details:
Call ID: 2
Forking Stream type: voice-farend
Forking Stream type: video-farend
Participant: 1888

Forked Leg Details:
Call ID: 6
Voice Near End Stream CallID 6
Stream State ACTIVE
Voice Far End stream CallID 7
Stream State ACTIVE
Video Near End stream CallID 8
Stream State ACTIVE
Video Far End stream CallID 9
Stream State ACTIVE
Found 1 active sessions

<table>
<thead>
<tr>
<th>Output Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream State</td>
<td>Displays the state of the call. This can be ACTIVE or HOLD.</td>
</tr>
<tr>
<td>Msp Call-Id</td>
<td>Displays an internal Media service provider call ID and forking related statistics for an active forked call.</td>
</tr>
<tr>
<td>Anchor Leg Call-id</td>
<td>Displays an internal anchor leg ID, which is the dial peer where forking enabled. The output displays the participant number and stream type. Stream type voice-near-end indicates the called party side.</td>
</tr>
<tr>
<td>Non-Anchor Call-id</td>
<td>Displays an internal non-anchor leg ID, which is the dial peer where forking is not enabled. The output displays the participant number and stream type. Stream type voice-near-end indicates the called party side.</td>
</tr>
<tr>
<td>Forked Call-id</td>
<td>This forking leg call-id will show near-end and far-end stream call-id details with state of the Stream . Displays an internal foked leg ID. The output displays near-end and far-end details of a stream.</td>
</tr>
</tbody>
</table>

**Step 5**

**show voip rtp forking**
Displays RTP media-forking connections.

**Example:**
Device# show voip rtp forking
VoIP RTP active forks:
Fork 1:
  stream type voice-only (0): count 0
  stream type voice+dtmf (1): count 0
  stream type dtmf-only (2): count 0
  stream type voice-nearend (3): count 1
    remote ip 10.42.29.7, remote port 38526, local port 18648
    codec g711ulaw, logical ssrc 0x53
    packets sent 29687, packets received 0
  stream type voice+dtmf-nearend (4): count 0
  stream type voice-farend (5): count 1
    remote ip 10.42.29.7, remote port 50482, local port 17780
    codec g711ulaw, logical ssrc 0x55
    packets sent 29686, packets received 0
  stream type voice+dtmf-farend (6): count 0
  stream type video (7): count 1

<table>
<thead>
<tr>
<th>Output Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>remote ip 10.42.29.7, remote port 38526, local port 18648</td>
<td>Recording server IP, recording server port, and local CUBE device port where data for stream 1 was first sent from.</td>
</tr>
<tr>
<td>remote ip 10.42.29.7, remote port 50482, local port 17780</td>
<td>Recording server IP, recording server port, and local CUBE device port where data for stream 2 was first sent from.</td>
</tr>
<tr>
<td>packets sent 29686</td>
<td>Number of packets sent to the recorder</td>
</tr>
<tr>
<td>codec g711ulaw</td>
<td>Codec negotiated for the recording leg.</td>
</tr>
</tbody>
</table>

**Step 6**

**show call active voice compact**

Displays a compact version of voice calls in progress. An additional call leg is displayed for media forking.

**Example:**

Device# show call active voice compact

<table>
<thead>
<tr>
<th>&lt;callID&gt;</th>
<th>A/O</th>
<th>FAX</th>
<th>T&lt;sec&gt;</th>
<th>Codec type</th>
<th>Peer Address</th>
<th>IP R&lt;ip&gt;:&lt;udp&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>140 ANS</td>
<td>T644</td>
<td>g711ulaw</td>
<td>VOIP</td>
<td>P10000</td>
<td>10.42.30.32:18638</td>
<td></td>
</tr>
<tr>
<td>141 ORG</td>
<td>T644</td>
<td>g711ulaw</td>
<td>VOIP</td>
<td>P708090</td>
<td>10.42.30.189:26184</td>
<td></td>
</tr>
<tr>
<td>145 ORG</td>
<td>T643</td>
<td>g711ulaw</td>
<td>VOIP</td>
<td>P595959</td>
<td>10.42.29.7:38526</td>
<td></td>
</tr>
</tbody>
</table>

**Step 7**

**show call active video compact**

Displays a compact version of video calls in progress.

**Example:**

Device# show call active video compact

<table>
<thead>
<tr>
<th>&lt;callID&gt;</th>
<th>A/O</th>
<th>FAX</th>
<th>T&lt;sec&gt;</th>
<th>Codec type</th>
<th>Peer Address</th>
<th>IP R&lt;ip&gt;:&lt;udp&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ANS</td>
<td>T14</td>
<td>H264</td>
<td>VOIP-VIDEO</td>
<td>P1777</td>
<td>10.104.8.94:20036</td>
<td></td>
</tr>
<tr>
<td>2 ORG</td>
<td>T14</td>
<td>H264</td>
<td>VOIP-VIDEO</td>
<td>P1888</td>
<td>10.104.8.98:29652</td>
<td></td>
</tr>
<tr>
<td>6 ORG</td>
<td>T13</td>
<td>H264</td>
<td>VOIP-VIDEO</td>
<td>P1234</td>
<td>10.104.105.232:39318</td>
<td></td>
</tr>
</tbody>
</table>

**Step 8**

**show sip-ua calls**

Displays active user agent client (UAC) and user agent server (UAS) information on SIP calls.
Example:

Device# show sip-ua calls
Total SIP call legs:3, User Agent Client:2, User Agent Server:1
SIP UAC CALL INFO
Call 1
SIP Call ID : 99EA5118-506211E0-80C6E01B-4C27AA62@10.42.30.10
  State of the call : STATE_ACTIVE (7)
  Substate of the call : SUBSTATE_NONE (0)
  Calling Number : 10000
  Called Number : 708090
  Bit Flags : 0xC04018 0x10000100 0x80
  CC Call ID : 141
  Source IP Address (Sig ) : 10.42.30.10
  Destn SIP Req Addr:Port : [10.42.30.5]:5060
  Destn SIP Resp Addr:Port: [10.42.30.5]:5060
  Destination Name : 10.42.30.5
  Number of Media Streams : 1
  Number of Active Streams: 1
  RTP Fork Object : 0x0
  Media Mode : flow-through
  Media Stream 1
    State of the stream : STREAM_ACTIVE
    Stream Call ID : 141
    Stream Type : voice+dtmf (1)
    Stream Media Addr Type : 1
    Negotiated Codec : g711ulaw (160 bytes)
    Codec Payload Type : 0
    Negotiated Dtmf-relay : rtp-nte
    Dtmf-relay Payload Type : 101
    QoS ID : -1
    Local QoS Strength : BestEffort
    Negotiated QoS Strength : BestEffort
    Negotiated QoS Direction : None
    Local QoS Status : None
    Media Source IP Addr:Port: [10.42.30.10]:19256
    Media Dest IP Addr:Port : [10.42.30.189]:26184
    Options-Ping ENABLED:NO ACTIVE:NO
Call 2
SIP Call ID : 9A6D8922-506211E0-80CEE01B-4C27AA62@10.42.30.10
  State of the call : STATE_ACTIVE (7)
  Substate of the call : SUBSTATE_NONE (0)
  Calling Number :
  Called Number : 595959 Recoding server number
  Bit Flags : 0xC04018 0x10800100 0x80
  CC Call ID : 145
  Source IP Address (Sig ) : 10.42.30.10
  Destn SIP Req Addr:Port : [10.42.29.7]:5060
  Destn SIP Resp Addr:Port: [10.42.29.7]:5060
  Destination Name : 10.42.29.7
  Number of Media Streams : 2
  Number of Active Streams: 2
  RTP Fork Object : 0x0
  Media Mode : flow-through
  Media Stream 1
    State of the stream : STREAM_ACTIVE
    Stream Call ID : 145
    Stream Type : voice-nearend (3)
    Stream Media Addr Type : 1
    Negotiated Codec : g711ulaw (160 bytes)
    Codec Payload Type : 0
    Negotiated Dtmf-relay : inband-voice
    Dtmf-relay Payload Type : 0
    QoS ID : -1
Local QoS Strength : BestEffort
Negotiated QoS Strength : BestEffort
Negotiated QoS Direction : None
Local QoS Status : None
Media Source IP Addr:Port: [10.42.30.10]:18648
Media Dest IP Addr:Port : [10.42.29.7]:38526
Media Stream 2
State of the stream : STREAM_ACTIVE
Stream Call ID : 146
Stream Type : voice-farend (5)
Stream Media Addr Type : 1
Negotiated Codec : g711ulaw (160 bytes)
Codec Payload Type : 0
Negotiated Dtmf-relay : inband-voice
Dtmf-relay Payload Type : 0
QoS ID : -1
Local QoS Strength : BestEffort
Negotiated QoS Strength : BestEffort
Negotiated QoS Direction : None
Local QoS Status : None
Media Source IP Addr:Port: [10.42.30.10]:17780
Media Dest IP Addr:Port : [10.42.29.7]:50482
Options-Ping ENABLED:NO ACTIVE:NO
Number of SIP User Agent Client(UAC) calls: 2
SIP UAS CALL INFO
Call 1
SIP Call ID : 7CF44DF3-506611E0-8ED2B9D4-CA68C314810.42.30.32
State of the call : STATE_ACTIVE (7)
Substate of the call : SUBSTATE_NONE (0)
Calling Number : 10000
Called Number : 708090
Bit Flags : 0x8C4401C 0x10000100 0x4
CC Call ID : 140
Destn SIP Req Addr:Port : [10.42.30.32]:5060
Destn SIP Resp Addr:Port: [10.42.30.32]:52757
Destination Name : 10.42.30.32
Number of Media Streams : 1
Number of Active Streams: 1
RTP Fork Object : 0x0
Media Mode : flow-through
Media Stream 1
State of the stream : STREAM_ACTIVE
Stream Call ID : 140
Stream Type : voice+dtmf (0)
Stream Media Addr Type : 1
Negotiated Codec : g711ulaw (160 bytes)
Codec Payload Type : 0
Negotiated Dtmf-relay : rtp-nte
Dtmf-relay Payload Type : 101
QoS ID : -1
Local QoS Strength : BestEffort
Negotiated QoS Strength : BestEffort
Negotiated QoS Direction : None
Local QoS Status : None
Media Source IP Addr:Port: [10.42.30.10]:18792
Media Dest IP Addr:Port : [10.42.29.7]:18638
Options-Ping ENABLED:NO ACTIVE:NO
Number of SIP User Agent Server(UAS) calls: 1

Step 9 show call active video brief
Displays a truncated version of video calls in progress.
Example:

```
Device# show call active video brief

Telephony call-legs: 0
SIP call-legs: 3
H323 call-legs: 0
Call agent controlled call-legs: 0
SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 3
```

```
0 : 1 87424920ms.1 (*12:23:53.573 IST Wed Jul 17 2013) +1050 pid:1 Answer 1777 active
dur 00:00:46 tx:5250/1857831 rx:5293/1930598 dscp:0 media:0 audio tos:0xB8 video tos:0x88
IP 10.104.8.94:20036 SRTP: off rtt:0ms pl:0/0ms lost:0/0/0 delay:0/0/0ms H264 TextRelay: off
Transcoded: No
...
```

```
0 : 2 87424930ms.1 (*12:23:53.583 IST Wed Jul 17 2013) +1040 pid:2 Originate 1888 active
dur 00:00:46 tx:5293/1930598 rx:5250/1857831 dscp:0 media:0 audio tos:0xB8 video tos:0x88
IP 10.104.8.94:20036 SRTP: off rtt:0ms pl:0/0ms lost:0/0/0 delay:0/0/0ms H264 TextRelay: off
Transcoded: No
...
```

```
0 : 6 87425990ms.1 (*12:23:54.643 IST Wed Jul 17 2013) +680 pid:1234 Originate 1234 active
dur 00:00:46 tx:10398/3732871 rx:0/0 dscp:0 media:0 audio tos:0xB8 video tos:0x0
IP 10.104.105.232:39318 SRTP: off rtt:0ms pl:0/0ms lost:0/0/0 delay:0/0/0ms H264 TextRelay: off
Transcoded: No
...
```

Step 10  debug ccsip messages (for audio calls)

Sent:
INVITE sip:22222@10.42.29.7:5060 SIP/2.0
Via: SIP/2.0/TCP 10.42.30.10:5060;branch=z9hG4bKB622CF
X-Cisco-Recording-Participant: sip:708090@10.42.30.5;media-index="0"
X-Cisco-Recording-Participant: sip:10000@10.42.30.32;media-index="1"
From: <sip:10.42.30.10>;tag=5096700-1E1A
To: <sip:595959@10.42.29.7>
Date: Fri, 18 Mar 2011 07:01:50 GMT
Call-ID: 6E6CF813-506411E0-80EAE01B-4C27A62@10.42.30.10
Supported: 100rel,timer,resource-priority,replaces,sdp-anat
Min-SE: 1800
Cisco-Guid: 1334370502-1348997600-2396699092-3395863316
User-Agent: Cisco-SIPGateway/IOS-15.2(0.0.2)PIA16
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, UPDATE, REFER, SUBSCRIBE, NOTIFY, INFO, REGISTER
CSeq: 101 INVITE
Max-Forwards: 70
Timestamp: 1300431710
Contact: <sip:10.42.30.10:5060;transport=tcp>
Expires: 180
Allow-Events: telephone-event
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 449

v=0
o=CiscoSystemsSIP-GW-UserAgent 3021 3526 IN IP4 10.42.30.10
s=SIP Call
c=IN IP4 10.42.30.10
t=0 0
m=audio 24544 RTP/AVP 0 101 19
```
```
c=IN IP4 10.42.30.10
a-rtpmap:0 PCMU/8000
a-rtpmap:101 telephone-event/8000
a-fmtp:101 0-16
a-rtpmap:19 CN/8000
```
Verifying the Network-Based Recording Using CUBE

<table>
<thead>
<tr>
<th>Output Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>INVITE sip:22222@10.42.29.7:5060 SIP/2.0</td>
<td>22222 is the destination pattern or the number of recording server and is configured under the recorder dial peer.</td>
</tr>
<tr>
<td>X-Cisco-Recording-Participant: sip:708090@10.42.30.5;media-index=&quot;0&quot;</td>
<td>Cisco proprietary header with originating and terminating participant number and IP address used to communicate to the recording server.</td>
</tr>
<tr>
<td>Cisco-Guid: 1334370502-1348997630-2396387502-3385863316</td>
<td>GUID is the same for the primary call and forked call.</td>
</tr>
</tbody>
</table>
### Output Field | Description
--- | ---
m=audio 24544 RTP/AVP 0 101 19 | First m-line of participant with payload type and codec information.
m=audio 31166 RTP/AVP 0 101 19 | Second m-line of another participant with codec info and payload type.
a=sendonly | CUBE is always in send only mode towards Recording server.
a=recvonly | Recording server is in receive mode only.

---

**Step 11**

**debug ccsip messages** (for video calls)

Sent: INVITE sip:575757@9.45.38.39:7686 SIP/2.0

 Via: SIP/2.0/UDP 9.41.36.41:5060;branch=z9hG4bK2CC2408
 X-Cisco-Recording-Participant: sip:1777@10.104.45.207;media-index="0 2"
 X-Cisco-Recording-Participant: sip:1888@10.104.45.207;media-index="1 3"
 Cisco-Guid: 0884935168-0000065536-0000000401-3475859466
 v=0
 m=audio 17232 RTP/AVP 0 19
 a=sendonly
 m=audio 17234 RTP/AVP 0 19
 a=sendonly
 m=video 17236 RTP/AVP 126
 a=fmtp:126 profile-level-id=42801E;packetization-mode=1
 a=sendonly
 m=video 17238 RTP/AVP 126
 a=fmtp:126 profile-level-id=42801E;packetization-mode=1
 a=sendonly
<table>
<thead>
<tr>
<th>Output Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sent: INVITE sip:575757@9.45.38.39:7686 SIP/2.0</td>
<td>22222 is the destination pattern or the number of recording server and is configured under the recorder dial peer.</td>
</tr>
<tr>
<td>X-Cisco-Recording-Participant:</td>
<td>Cisco proprietary header with originating and terminating participant number and IP address used to communicate to the recording server</td>
</tr>
<tr>
<td>sip:1777@10.104.45.207;media-index=&quot;0 2&quot;</td>
<td></td>
</tr>
<tr>
<td>X-Cisco-Recording-Participant:</td>
<td></td>
</tr>
<tr>
<td>sip:1888@10.104.45.207;media-index=&quot;1 3&quot;</td>
<td></td>
</tr>
<tr>
<td>Cisco-Guid:</td>
<td>GUID is the same for the primary call and forked call.</td>
</tr>
<tr>
<td>0884935168-0000065536-000000401-3475859466</td>
<td></td>
</tr>
<tr>
<td>m=audio 17232 RTP/AVP 0 19</td>
<td>First m-line of participant with payload type and audio codec.</td>
</tr>
<tr>
<td>m=audio 17234 RTP/AVP 0 19</td>
<td>Second m-line of another participant with payload type and audio codec.</td>
</tr>
<tr>
<td>m=video 17236 RTP/AVP 126</td>
<td>Third m-line of participant with video payload type and codec info.</td>
</tr>
<tr>
<td>m=video 17238 RTP/AVP 126</td>
<td>Fourth m-line of another participant with video payload type and codec info.</td>
</tr>
<tr>
<td>a=sendonly</td>
<td>CUBE is always in send only mode towards Recording server.</td>
</tr>
<tr>
<td>Receive:</td>
<td></td>
</tr>
<tr>
<td>SIP/2.0 200 OK</td>
<td></td>
</tr>
<tr>
<td>v=0</td>
<td></td>
</tr>
<tr>
<td>m=audio 1592 RTP/AVP 0</td>
<td></td>
</tr>
<tr>
<td>a=recvonly</td>
<td></td>
</tr>
<tr>
<td>m=audio 1594 RTP/AVP 0</td>
<td></td>
</tr>
<tr>
<td>a=recvonly</td>
<td></td>
</tr>
<tr>
<td>m=video 1596 RTP/AVP 126</td>
<td></td>
</tr>
<tr>
<td>a=recvonly</td>
<td></td>
</tr>
<tr>
<td>m=video 1598 RTP/AVP 126</td>
<td></td>
</tr>
<tr>
<td>a=fmtpl:97 profile-level-id=420015</td>
<td></td>
</tr>
<tr>
<td>a=recvonly</td>
<td></td>
</tr>
<tr>
<td>Sent:</td>
<td></td>
</tr>
<tr>
<td>ACK sip:9.45.38.39:7686;transport=UDP SIP/2.0</td>
<td></td>
</tr>
<tr>
<td>Via: SIP/2.0/UDP 9.41.36.41:5060;branch=z9hG4bK2CD7</td>
<td></td>
</tr>
<tr>
<td>From: <a href="">sip:9.41.36.41</a>;tag=1ECFD128-24DF</td>
<td></td>
</tr>
</tbody>
</table>
To: <sip:575757@9.45.38.39>;tag=16104SIPpTag011
Date: Tue, 19 Mar 2013 11:40:01 GMT
Call-ID: FFFFFFFF91E00FE6-FFFFFFFF8FC011E2-FFFFFFFF824DF469-FFFFFFFFB6661C06@9.41.36.41
Max-Forwards: 70
CSeq: 101 ACK
Allow-Events: telephone-event
Content-Length: 0

<table>
<thead>
<tr>
<th>Output Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>m=audio 1592 RTP/AVP 0</td>
<td>First m-line of recording server after it started listening.</td>
</tr>
<tr>
<td>m=audio 1594 RTP/AVP 0</td>
<td>Second m-line of recording server after it started listening.</td>
</tr>
<tr>
<td>m=video 1596 RTP/AVP 126</td>
<td>Third m-line of recording server after it started listening.</td>
</tr>
<tr>
<td>m=video 1598 RTP/AVP 126</td>
<td>Fourth m-line of recording server after it started listening.</td>
</tr>
<tr>
<td>a=recvonly</td>
<td>Recording server in receive only mode.</td>
</tr>
</tbody>
</table>

Step 12  **debug cc sip messages** (for audio-only recording in a call with both audio and video)

Displays offer sent to MediaSense having only audio m-lines, when the **media-type audio** command is configured.

Sent:
INVITE sip:54321@9.45.38.39:36212 SIP/2.0
Via: SIP/2.0/UDP 9.41.36.15:5060;branch=z9hG4bK2216B
X-Cisco-Recording-Participant: sip:4321@9.45.38.39;media-index="0"
X-Cisco-Recording-Participant: sip:1111000010@9.45.38.39;media-index="1"
From: <sip:9.41.36.15>;tag=A2C74-5D9
To: <sip:54321@9.45.38.39>......
Content-Type: application/sdp
Content-Disposition: session;handling=required
Content-Length: 337

v=0
o=CiscoSystemsSIP-GW-UserAgent 9849 5909 IN IP4 9.41.36.15
s=SIP Call
c=IN IP4 9.41.36.15
t=0 0
m=audio 16392 RTP/AVP 0 19
c=IN IP4 9.41.36.15
a=rtpmap:0 PCMU/8000
a=rtpmap:19 CN/8000
a=ptime:20
a=sendonly
m=audio 16394 RTP/AVP 0 19
c=IN IP4 9.41.36.15
a=rtpmap:0 PCMU/8000
a=rtpmap:19 CN/8000
a=ptime:20
a=sendonly

Response from CUBE has inactive video m-lines.
Received:
SIP/2.0 200 OK
Via: SIP/2.0/UDP 9.41.36.15:5060;branch=z9hG4bK2216B
---
v=0
m=audio 36600 RTP/AVP 0
c=IN IP4 9.45.38.39
a=rtpmap:0 PCMU/8000
a=ptime:20
a=recvonly
m=audio 36602 RTP/AVP 0
c=IN IP4 9.45.38.39
a=rtpmap:0 PCMU/8000
a=ptime:20
a=recvonly
m=video 0 RTP/AVP 98
c=IN IP4 9.45.38.39
b=TIAS:1500000
a=rtpmap:98 H264/90000
a=fmtp:98 profile-level-id=420015
a=inactive
m=video 0 RTP/AVP 98
c=IN IP4 9.45.38.39
b=TIAS:1500000
a=rtpmap:98 H264/90000
a=fmtp:98 profile-level-id=420015
a=inactive

Step 13
Enter one of the following:

- debug csip all
- debug voip recmsp all
- debug voip ccap all
- debug voip fpi all (for ASR devices only)

Displays detailed debug messages.

For Audio:

Media forking initialized:


Media forking started:

Forking header populated:

Media forking setup record session is successful:
*Jun 15 10:37:55.404: //103/3E7E90AE8006/SIP/Info/ccsip_get_recording_participant_header: MF: Sipuser = 98459845
*Jun 15 10:37:55.404: //103/3E7E90AE8006/SIP/Info/ccsip_get_recording_participant_header: MF: Host = 9.42.30.34
*Jun 15 10:37:55.404: //103/3E7E90AE8006/SIP/Function/sipSPIGetFirstStream:
*Jun 15 10:37:55.404: //103/3E7E90AE8006/SIP/Function/voip_media_dir_to_cc_media_dir:
*Jun 15 10:37:55.404: //103/3E7E90AE8006/SIP/Info/ccsip_ipip_media_forking_BuildMediaRecStream: MF: dtmf is inband
*Jun 15 10:37:55.404: //103/3E7E90AE8006/SIP/Info/ccsip_ipip_media_forking_Write_to_TDContainer: MF: Data written to TD Container..

Media forking forked stream started:
*Jun 15 10:37:55.406: //106/3E7E90AE8006/SIP/Info/ccsip_ipip_media_forking_read_from_TDContainer: MF: Data read from TD container..
*Jun 15 10:37:55.406: //106/000000000000/SIP/Info/ccsip_ipip_media_forking_forked_leg_config: MF: Overwriting the GUID with the value got from MSP.
*Jun 15 10:37:55.406: //106/000000000000/SIP/Function/sipSPIGetFirstStream:
For Video:

Media Forking Initialized:


Media forking started:

*Mar 19 16:40:01.784 IST: //522/34BF0A000000/SIP/Info/info/36864/ccsip_ipip_media_forking: MF: Current State = 1, event =31

*Mar 19 16:40:01.784 IST: //522/34BF0A000000/SIP/Info/info/36864/ccsip_ipip_media_forking: MF: State & Event combination is cracked..

*Mar 19 16:40:01.784 IST: //522/34BF0A000000/SIP/Function/sipSPIGetMainStream:


Recording participant for anchor leg:

//522/34BF0A000000/SIP/Info/verbose/32768/ccsip_ipip_media_forking_BuildMediaRecParticipant: MF: Populating record participant header from this leg.

*Mar 19 16:40:01.788 IST: //522/34BF0A000000/SIP/Function/sipSPIGetFirstStream:


Adding an audio stream:

*Mar 19 16:40:01.788 IST: //522/34BF0A000000/SIP/Function/sipSPIGetFirstStream:


*Mar 19 16:40:01.789 IST: //522/34BF0A000000/SIP/Function/voip_media_dir_to_cc_media_dir:


*Mar 19 16:40:01.789 IST: //522/34BF0A000000/SIP/Info/info/32768/ccsip_ipip_media_forking_BuildAudioRecStream: MF: This rcstream has 522 callid


Video forking:

*Mar 19 16:40:01.789 IST: //522/34BF0A000000/SIP/Function/sipSPIGetVideoStream:

For Video

## Additional References for Network-Based Recording

### Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MediaSense Installation and Administration Guide</td>
<td>Cisco MediaSense Installation and Administration Guide</td>
</tr>
</tbody>
</table>

### Standards and RFCs

<table>
<thead>
<tr>
<th>RFCs</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFC 3984</td>
<td><em>RTP Payload Format for H.264 Video</em></td>
</tr>
<tr>
<td>RFC 5104</td>
<td><em>Codec Control Messages in the RTP Audio-Visual Profile with Feedback (AVPF)</em></td>
</tr>
<tr>
<td>RFC 5168</td>
<td><em>XML Schema for Media Control</em></td>
</tr>
</tbody>
</table>
CHAPTER 31

SIPREC (SIP Recording)

The SIPREC (SIP Recording) feature supports media recording for Real-time Transport Protocol (RTP) streams in compliance with section 3.1.1. of RFC 7245, with CUBE acting as the Session Recording Client. SIP is used as a protocol between CUBE and the recording server. Recording of a media session is done by sending a copy of a media stream to the recording server. Metadata is the information that is passed by the recording client to the recording server in a SIP session. The recording metadata describes the communication session and its media streams, and also identifies the participants of the call. CUBE acts as the recording client and any third party recorder acts as the recording server.

- Feature Information for SIPREC-based Recording, on page 401
- Prerequisites for SIPREC Recording, on page 402
- Restrictions for SIPREC Recording, on page 402
- Information About SIPREC Recording Using CUBE, on page 403
- How to Configure SIPREC-Based Recording, on page 404
- Configuration Examples for SIPREC-based Recording, on page 409
- Example of Metadata Variations with Different Mid-call Flows, on page 409
- Example of Metadata Variations with Different Transfer Flows, on page 422
- Example of Metadata Variations with Caller-ID UPDATE Flow, on page 422
- Example of Metadata Variations with Call Disconnect, on page 424

Feature Information for SIPREC-based Recording

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIPREC (SIP Recording)</td>
<td>Cisco IOS 15.6(1)T</td>
<td>The SIPREC Recording feature supports recording of audio and video calls. Only audio and video media lines are forked. The following commands were modified: recorder parameter and recorder profile.</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE 3.17S</td>
<td></td>
</tr>
</tbody>
</table>
Prerequisites for SIPREC Recording

• Recorders must be reachable from CUBE

• SIPREC should be configured; else, CUBE will fall back to the existing Network-Based Recording implementation. For more information on Network-Based Recording, see http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/voice/cube/configuration/cube-book/voi-ntwk-based.html.

• CUBE supports the SIP Recording Metadata model format requirements specified in draft-ietf-siprec-metadata-17. Recorders must support metadata format of ver17 at a minimum

• CUBE should be in compliance with the Session Recording Protocols defined in draft-ietf-siprec-protocol-16. CUBE supports only the “siprec Option” Tag and the “src feature” tag among the various other extensions defined in the protocols draft; CUBE does not support the SDP extensions

Restrictions for SIPREC Recording

SIPREC-based recording is not supported for the following calls:

• Any media service parameter change via Re-INVITE or UPDATE from recording server is not supported. For example, hold-resume or any codec changes

• IPv6-to-IPv6 call recording

• IPv6-to-IPv4 call recording if the recording server is configured on the IPv6 call leg

• Calls that do not use Session Initiation Protocol (SIP). Must be a SIP-to-SIP call flow

• Flow-around calls

• Session Description Protocol (SDP) pass-through calls

• Real-time Transport Protocol (RTP) loopback calls

• High-density transcoder calls

• Secure Real-time Transport Protocol (SRTP) passthrough calls

• SRTP-RTP calls with forking for SRTP leg (forking is supported for the RTP leg)

• Multicast music on hold (MOH)

• Mid-call renegotiation and supplementary services like Hold/Resume, control pause, and so on are not supported on the recorder call leg

• Recording is not supported if CUBE is running a TCL IVR application

• Media mixing on forked streams is not supported

• Digital Signal Processing (DSP) resources are not supported on forked legs

Restrictions for Video Recording
• If the main call has multiple video streams (m-lines), the video streams other than the first video m-line are not forked

• Application media streams of the primary call are not forked to the recording server

• Forking is not supported if the anchor leg or recording server is on IPv6

Information About SIPREC Recording Using CUBE

Deployment

• Participants—SIP UAs involved in the Communication Session. The UA can be any SIP element

• Communication Session (CS)—Session established between the endpoints

• Session Recording Client (SRC)—CUBE acts as the session recording client that triggers the recording session

• Session Recording Server (SRS)—A SIP User Agent (UA) which is a specialized media server and that acts as a sink for the recorded media and metadata

• Recording Session (RS) — SIP dialog established between CUBE (recording client) and the recording server

• Recording Metadata—Information on the CS and the associated media stream data sent from CUBE to RS

The following figure illustrates a third party recorder deployment with CUBE.

*Figure 33: Deployment Scenario for SIPREC Recording Solution*

Information flow is described below:

1. Incoming call from SIP trunk
2. Outbound call to Contact Center
3. Media between endpoints flowthrough CUBE
4. CUBE sets up a new SIP session with the recording device (SRS)

5. CUBE forks RTP media to SRS

In the preceding illustration, the Real Time Protocol (RTP) carries voice data and media streams between the user agents and CUBE. The RTP unidirectional stream represents the communication session forked from CUBE to the recording server to indicate forked media. The Session Initiation Protocol (SIP) carries call signaling information along with the metadata information. Media streams from CUBE to recording server are unidirectional because only CUBE sends recorded data to recording server; the recording server does not send any media to CUBE.

Metadata has the following functions:

- Carry the communication session data (audio and video calls) that describes the call to the recording server
- Identifies the participants list
- Identifies the session and media association time

If there are any changes in the call sessions, for example, hold-resume, transfer and so on, these sessions are notified to the recording server through metadata.

**SIPREC High Availability Support**

High availability is supported for SIPREC recording using CUBE. All metadata elements will be checkpointed in a forked call when high-availability is configured. In the event of SSO, all the forked calls and media contexts are preserved on failover.

**How to Configure SIPREC-Based Recording**

**Configuring SIPREC-Based Recording (with Media Profile Recorder)**

**SUMMARY STEPS**

1. enable
2. configure terminal
3. media profile recorder profile-tag
4. (Optional) media-type audio
5. media-recording dial-peer-tag [dial-peer-tag2...dial-peer-tag5]
6. exit
7. media class tag
8. recorder profile tag siprec
9. exit
10. dial-peer voice dummy-recorder-dial-peer-tag voip
11. media-class tag
12. destination-pattern [+ string T]
13. session protocol sipv2
### Media Recording

#### Configuring SIPREC-Based Recording (with Media Profile Recorder)

14. `session target ipv4:[recording-server-destination-address | recording-server-dns]
15. `session transport tcp
16. `end

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>· Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> <code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> <code>media profile recorder profile-tag</code></td>
<td>Configures the media profile recorder and enters media profile configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config)# media profile recorder 100</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> <code>media-type audio</code></td>
<td>Configures recording of audio only in a call with both audio and video.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(cfg-mediaprofile)# media-type audio</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> <code>media-recording dial-peer-tag</code></td>
<td>Configures the dial-peers that need to be configured</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(cfg-mediaprofile)# media-recording 8000 8001</td>
<td>Note: You can specify a maximum of five dial-peer tags.</td>
</tr>
<tr>
<td><strong>Step 6</strong> <code>exit</code></td>
<td>Exits media profile configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(cfg-mediaprofile)# exit</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> <code>media class tag</code></td>
<td>Configures a media class and enters media class configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config)# media class 100</td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong> <code>recorder profile tag siprec</code></td>
<td>Configures the media profile SIPREC recorder.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(cfg-mediaclass)# recorder profile 201 siprec</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Step 9</strong></td>
<td>Exits media class configuration mode.</td>
</tr>
<tr>
<td>exit</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(cfg-mediaclass)# exit</td>
<td></td>
</tr>
<tr>
<td><strong>Step 10</strong></td>
<td>Configures a recorder dial peer and enters dial peer voice configuration mode.</td>
</tr>
<tr>
<td>dial-peer voice dummy-recorder-dial-peer-tag voip</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# dial-peer voice 8000 voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 11</strong></td>
<td>Configures media class on a dial peer.</td>
</tr>
<tr>
<td>media-class tag</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# media-class 100</td>
<td></td>
</tr>
<tr>
<td><strong>Step 12</strong></td>
<td>Specifies either the prefix or the full E.164 telephone number (depending on your dial plan) to be used for a dial peer.</td>
</tr>
<tr>
<td>destination-pattern [+] string [T]</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# destination-pattern 595959</td>
<td></td>
</tr>
<tr>
<td><strong>Step 13</strong></td>
<td>Configures the VoIP dial peer to use Session Initiation Protocol (SIP).</td>
</tr>
<tr>
<td>session protocol sipv2</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# session protocol sipv2</td>
<td></td>
</tr>
<tr>
<td><strong>Step 14</strong></td>
<td>Specifies a network-specific address for a dial peer. Keyword and argument are as follows:</td>
</tr>
<tr>
<td>session target</td>
<td></td>
</tr>
<tr>
<td>ipv4:[recording-server-destination-address</td>
<td></td>
</tr>
<tr>
<td>recording-server-dns]</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# session target ipv4:10.42.29.7</td>
<td></td>
</tr>
<tr>
<td><strong>Step 15</strong></td>
<td>Configures a VoIP dial peer to use Transmission Control Protocol (TCP).</td>
</tr>
<tr>
<td>session transport tcp</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# session transport tcp</td>
<td></td>
</tr>
<tr>
<td><strong>Step 16</strong></td>
<td>Returns to privileged EXEC mode.</td>
</tr>
<tr>
<td>end</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# end</td>
<td></td>
</tr>
</tbody>
</table>
## Configuring SIPREC-Based Recording (without Media Profile Recorder)

### SUMMARY STEPS

1. enable
2. configure terminal
3. media class tag
4. recorder parameters siprec
5. (Optional) media-type audio
6. media-recording dial-peer-tag
7. exit
8. exit
9. dial-peer voice dummy-recorder-dial-peer-tag voip
10. media-class tag
11. destination-pattern [+ string [T]]
12. session protocol sipv2
13. session target ipv4:[recording-server-destination-address | recording-server-dns]
14. session transport tcp
15. end

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>- Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> media class tag</td>
<td>Configures the media class and enters media class configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# media class 100</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> recorder parameters siprec</td>
<td>Enables SIPREC recording.</td>
</tr>
<tr>
<td>Example: Device(cfg-mediaclass)# recorder parameter siprec</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> (Optional) media-type audio</td>
<td>Configures recording of audio only in a call with both audio and video.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
</tbody>
</table>
### Media Recording

#### Configuring SIPREC-Based Recording (without Media Profile Recorder)

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Device</strong>(cfg-mediaprofile)# media-type audio</td>
<td>If this configuration is not done, both audio and video are recorded.</td>
</tr>
</tbody>
</table>

**Step 6**

**media-recording dial-peer-tag**

- **Example:**
  
  Device**(cfg-mediaclass-recorder)# media-recording 8000, 8001, 8002

- **Purpose:** Configures voice-class recording parameters.

- **Note:** You can specify a maximum of five dial-peer tags.

**Step 7**

**exit**

- **Example:**
  
  Device**(cfg-mediaclass-recorder)# exit

- **Purpose:** Exits media class recorder parameter configuration mode.

**Step 8**

**exit**

- **Example:**
  
  Device**(cfg-mediaclass)# exit

- **Purpose:** Exits media class configuration mode.

**Step 9**

**dial-peer voice dummy-recorder-dial-peer-tag voip**

- **Example:**
  
  Device**(config)# dial-peer voice 8000 voip

- **Purpose:** Configures a recorder dial peer and enters dial peer voice configuration mode.

**Step 10**

**media-class tag**

- **Example:**
  
  Device**(config-dial-peer)# media-class 100

- **Purpose:** Configures media class on a dial peer.

**Step 11**

**destination-pattern [+| T]**

- **Example:**
  
  Device**(config-dial-peer)# destination-pattern 595959

- **Purpose:** Specifies either the prefix or the full E.164 telephone number (depending on your dial plan) to be used for a dial peer. Keywords and arguments are as follows:

**Step 12**

**session protocol sipv2**

- **Example:**
  
  Device**(config-dial-peer)# session protocol sipv2

- **Purpose:** Configures the VoIP dial peer to use Session Initiation Protocol (SIP).

**Step 13**

**session target ipv4:**

- **Example:**
  
  Device**(config-dial-peer)# session target ipv4:10.42.29.7

- **Purpose:** Specifies a network-specific address for a dial peer. Keyword and argument are as follows:

  - **ipv4:** destination address --IP address of the dial peer, in this format: xxx.xxx.xxx.xxx
### Purpose

**Command or Action**

<table>
<thead>
<tr>
<th>Step 14</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>session transport tcp</td>
<td>Configures a VoIP dial peer to use Transmission Control Protocol (TCP).</td>
</tr>
</tbody>
</table>

**Example:**

```
Device(config-dial-peer)# session transport tcp
```

<table>
<thead>
<tr>
<th>Step 15</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>end</td>
<td>Returns to privileged EXEC mode.</td>
</tr>
</tbody>
</table>

**Example:**

```
Device(config-dial-peer)# end
```

### Configuration Examples for SIPREC-based Recording

**Example: Configuring SIPREC-based Recording with Media Profile Recorder**

```
Router> enable
Router# configure terminal
Router(config)# media class 101
Router(config)# recorder profile 201 siprec
```

**Example: Configuring SIPREC-based Recording without Media Profile Recorder**

```
Router> enable
Router# configure terminal
Router(config)# media class 101
Router(config)# recorder parameter siprec
Router(config)# media-recording 403
```

### Example of Metadata Variations with Different Mid-call Flows

**Example: Complete SIP Recording Metadata information sent in INVITE or Re-INVITE**

The following example provides all the elements involved in Recording Metadata XML body.

```
--uniqueBoundary
Content-Type: application/sdp
Content-Disposition: session; handling=required
v=0
c=In IP4 9.42.25.149
s=SIP Call
c=IN IP4 9.42.25.149
t=0 0
m=audio 16552 RTP/AVP 8 101
c=IN IP4 9.42.25.149
a=rtpmap:8 PCMA/8000
```

---

**Cisco Unified Border Element Configuration Guide**

---
Example: Complete SIP Recording Metadata information sent in INVITE or Re-INVITE

Content-Type: application/rs-metadata+xml
Content-Disposition: recording-session

<?xml version="1.0" encoding="UTF-8"?>
<recording xmlns="urn:ietf:params:xml:ns:recording:1">
  <datamode>complete</datamode>
  <session session_id="JaPQeP1CEeSA66sYHx7YVg==">
    <start-time>2015-05-19T09:42:06.911Z</start-time>
  </session>
  <participant participant_id="JaPQeP1CEeSA76sYHx7YVg==">
    <nameID aor="sip:808808@9.0.0.174">
      <name xml:lang="en">808808</name>
    </nameID>
  </participant>
  <participantsessionassoc participant_id="JaPQeP1CEeSA76sYHx7YVg==" session_id="JaPQeP1CEeSA66sYHx7YVg==">
    <associate-time>2015-05-19T09:42:06.911Z</associate-time>
  </participantsessionassoc>
  <stream stream_id="JaPQeP1CEeSA8KsYHx7YVg==" session_id="JaPQeP1CEeSA66sYHx7YVg==">
    <label>1</label>
  </stream>
  <stream stream_id="JaPQeP1CEeSA8asYHx7YVg==" session_id="JaPQeP1CEeSA66sYHx7YVg==">
    <label>3</label>
  </stream>
  <participant participant_id="JaPQeP1CEeSA8qsYHx7YVg==">
    <nameID aor="sip:909909@9.0.0.174">
      <name xml:lang="en">909909</name>
    </nameID>
  </participant>
  <participantsessionassoc participant_id="JaPQeP1CEeSA8qsYHx7YVg==" session_id="JaPQeP1CEeSA66sYHx7YVg==">
    <associate-time>2015-05-19T09:42:06.911Z</associate-time>
  </participantsessionassoc>
  <stream stream_id="JaPQeP1CEeSA86sYHx7YVg==" session_id="JaPQeP1CEeSA66sYHx7YVg==">
    <label>2</label>
  </stream>
</recording>
Example: Complete SIP Recording Metadata information sent in INVITE or Re-INVITE

```
<stream stream_id="JaPqePlCEeSA9KsYHx7YVg==" session_id="JaPqePlCEeSA66sYHx7YVg==">
    <label>4</label>
</stream>

<participantstreamassoc participant_id="JaPqePlCEeSA76sYHx7YVg==">
    <send>JaPqePlCEeSA86sYHx7YVg==</send>
    <recv>JaPqePlCEeSA8asYHx7YVg==</recv>
    <send>JaPqePlCEeSA9KsYHx7YVg==</send>
    <recv>JaPqePlCEeSA8asYHx7YVg==</recv>
</participantstreamassoc>

<participantstreamassoc participant_id="JaPqePlCEeSA8qsYHx7YVg==">
    <send>JaPqePlCEeSA86sYHx7YVg==</send>
    <recv>JaPqePlCEeSA9KsYHx7YVg==</recv>
    <send>JaPqePlCEeSA9KsYHx7YVg==</send>
    <recv>JaPqePlCEeSA8asYHx7YVg==</recv>
</participantstreamassoc>
```

<table>
<thead>
<tr>
<th>Output Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>datamode&gt;complete&lt;/datamode</td>
<td>&lt;dataMode&gt; is a recording element that indicates whether the XML document is a complete document or a partial update. If no &lt;dataMode&gt; element is present then the default value is &quot;complete&quot;.</td>
</tr>
<tr>
<td>session session_id=&quot;JaPqePlCEeSA66sYHx7YVg==&quot;</td>
<td>Session ID which remains constant for the complete call leg.</td>
</tr>
<tr>
<td>&lt;participant participant_id=&quot;JaPqePlCEeSA76sYHx7YVg==&quot;&gt;</td>
<td>Name and participant ID of the first participant. The first participant will always be the anchor leg of the call. Each participant has a unique 'participant_id' attribute. For example, nameID is sip:808808.</td>
</tr>
<tr>
<td>a=label:1;</td>
<td>The &lt;stream&gt; element represents a Media Stream object. Stream element indicates the SDP media lines associated with the session and participants.</td>
</tr>
<tr>
<td>&lt;stream stream_id=&quot;JaPqePlCEeSA86sYHx7YVg==&quot; session_id=&quot;JaPqePlCEeSA66sYHx7YVg==&quot;&gt;</td>
<td>The &lt;label&gt; element within the &lt;stream&gt; element references an SDP &quot;a=label&quot; attribute that identifies an m-line within the RS SDP. This m-line carries the media stream from the SRC to the SRS.</td>
</tr>
</tbody>
</table>
### ParticipantCSAssociation

ParticipantCS Association class describes the association of the first participant to a CS for a period of time. A participant can associate and dissociate from a CS several times.

**ParticipantCS association class has the following attributes:**

- **Associate-time**—Time when the participant is associated to CS.
- **Disassociate-time**—Time when the participant is disassociated from a CS.

Each CS object is represented by one session element. Each session element has a unique 'session_id' attribute which helps to identify unique CS sessions.

### ParticipantStream

Participant stream association class describes the association of either participant 1 or 2 to a media stream for a period of time, as a sender or as a receiver, or both. These streams can be either audio or video or both.

**ParticipantStream association class has the following attributes:**

- **Associate-time**—Time when the participant starts contributing for a media stream.
- **Disassociate-time**—Time when the participant stops receiving a media stream.

### Example: Hold with Send-only / Recv-only Attribute in SDP

When a participant puts the audio call on hold with send-only attribute, the stream is sent only in one direction.

Here, in a normal recording session, both participants sent audio and video streams.

```
--uniqueBoundary
Content-Type: application/sdp
Content-Disposition: session;handling=required

v=0
o=CiscoSystemsSIP-GW-UserAgent 2973 4879 IN IP4 9.42.25.149
s=SIP Call
c=IN IP4 9.42.25.149
t=0 0
m=audio 16464 RTP/AVP 0 101
c=IN IP4 9.42.25.149
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event/8000
```
a=fmtp:101 0-16
a=ptime:20
a=sendonly
a=label:1
m=audio 16466 RTP/AVP 0 101
c=IN IP4 9.42.25.149
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20
a=sendonly
a=label:2
m=video 16468 RTP/AVP 97
c=IN IP4 9.42.25.149
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0
a=sendonly
a=label:3
m=video 16470 RTP/AVP 97
c=IN IP4 9.42.25.149
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0
a=sendonly
a=label:4

--uniqueBoundary
Content-Type: application/rs-metadata+xml
Content-Disposition: recording-session

<?xml version="1.0" encoding="UTF-8"?>
<recording xmlns="urn:ietf:params:xml:ns:recording:1">
  ...
  <stream stream_id="jIBTUf1BBeSaKsYHx7YVv==" session_id="jH+2kf1BeSa6sYHx7YVv==">
    <label>1</label>
  </stream>
  <stream stream_id="jIBTUf1BBeSaKsYHx7YVv==" session_id="jH+2kf1BeSa6sYHx7YVv==">
    <label>3</label>
  </stream>
  ...
  <stream stream_id="jIBTUf1BBeSaKsYHx7YVv==" session_id="jH+2kf1BeSa6sYHx7YVv==">
    <label>2</label>
  </stream>
  <stream stream_id="jIBTUf1BBeSaKsYHx7YVv==" session_id="jH+2kf1BeSa6sYHx7YVv==">
    <label>4</label>
  </stream>
  ...
  <participantstreamassoc participant_id="jIBTUf1BBeSa6sYHx7YVv==">
    <send>jIBTUf1BBeSa6sYHx7YVv==</send>
    <recv>jIBTUf1BBeSaKsYHx7YVv==</recv>
    <send>jIBTUf1BBeSaKsYHx7YVv==</send>
    <recv>jIBTUf1BBeSaKsYHx7YVv==</recv>
  </participantstreamassoc>
  ...
</recording>

--uniqueBoundary--
In this scenario, the second participant puts the call on hold using sendonly and the first participant will respond using recvonly. You can see from the `participantStream association` element that the second participant only sends audio and video streams and the first participant just receives the media streams.

The output after the second participant puts the call on hold with sendonly attribute:

```plaintext
--uniqueBoundary
Content-Type: application/sdp

v=0
o=CiscoSystemsSIP-GW-UserAgent 2973 4880 IN IP4 9.42.25.149
s=SIP Call
c=IN IP4 9.42.25.149
t=0 0
m=audio 16464 RTP/AVP 0 101
c=IN IP4 9.42.25.149
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20
a=inactive
a=label:1
m=audio 16466 RTP/AVP 0 101
c=IN IP4 9.42.25.149
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20
a=sendonly
a=label:2
m=video 16468 RTP/AVP 97
c=IN IP4 9.42.25.149
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0
a=inactive
a=label:3
m=video 16470 RTP/AVP 97
c=IN IP4 9.42.25.149
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0
a=sendonly
a=label:4

--uniqueBoundary
Content-Type: application/rs-metadata+xml
Content-Disposition: recording-session

<?xml version="1.0" encoding="UTF-8"?>
<recording xmlns="urn:ietf:params:xml:ns:recording:1">
  ...
  <stream stream_id="jIBTUf1BEeSAdRsYHx7YVg==" session_id="jH+2kf1BBeSAb6sYHx7YVg==">
    <label>1</label>
  </stream>
  <stream stream_id="jIBTUf1BEeSAdasYHx7YVg==" session_id="jH+2kf1BBeSAb6sYHx7YVg==">
    <label>3</label>
  </stream>
  ...
  <stream stream_id="jIBTUf1BEeSAd6sYHx7YVg==" session_id="jH+2kf1BBeSAb6sYHx7YVg==">
    <label>2</label>
  </stream>
  <stream stream_id="jIBTUf1BEeSAeRsYHx7YVg==" session_id="jH+2kf1BBeSAb6sYHx7YVg==">
    <label>4</label>
  </stream>
</recording>
```
Example: Hold with Inactive Attribute in SDP

Here, you can see that video call is sent in the initial INVITE to recorder where both the participants send and receive audio and video streams. There are 2 audio and 2 video streams from both the participants each in the **participantStream association** element.

```sdp
--uniqueBoundary--
Content-Type: application/sdp
Content-Disposition: session;handling=required
v=0
o=CiscoSystemsSIP-GW-UserAgent 7476 1347 IN IP4 9.42.25.149
s=SIP Call
c=IN IP4 9.42.25.149
t=0 0
m=audio 16496 RTP/AVP 0 101
c=IN IP4 9.42.25.149
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20
a=sendonly
a=label:1
m=audio 16498 RTP/AVP 0 101
c=IN IP4 9.42.25.149
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20
a=sendonly
a=label:2
m=video 16500 RTP/AVP 97
c=IN IP4 9.42.25.149
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0
a=sendonly
a=label:3
m=video 16502 RTP/AVP 97
c=IN IP4 9.42.25.149
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0
a=sendonly
a=label:4
--uniqueBoundary--
Content-Type: application/rs-metadata+xml
Content-Disposition: recording-session
```
When the first participant puts the call on hold with inactive SDP attribute, there will be not any active streams in the metadata.
Example: Escalation

During escalation, video streams will be added to the Re-INVITE meta-data sent to the recorder.

In the below example, you can see the metadata representation of an original audio call sent in the initial INVITE to the recorder where both the participants send and receive audio streams.

```
<stream stream_id="uV/B4f1BEeSAm6sYHx7YVg==" session_id="uV/B4f1BEeSAk6sYHx7YVg==">
  <label>2</label>
</stream>
<stream stream_id="uV/B4f1BEeSAm6sYHx7YVg==" session_id="uV/B4f1BEeSAk6sYHx7YVg==">
  <label>4</label>
</stream>
<participantstreamassoc participant_id="uV/B4f1BEeSA16sYHx7YVg==">
  <participantstreamassoc>
  </participantstreamassoc>
</participantstreamassoc>
```

```xml
<?xml version="1.0" encoding="UTF-8"?>
<recording xmlns="urn:ietf:params:xml:ns:recording:1">
  ...
  <stream stream_id="uV/B4f1BEeSAmKsYHx7YVg==" session_id="uV/B4f1BEeSAk6sYHx7YVg==">
    <label>1</label>
  </stream>
  ...
  <stream stream_id="uV/B4f1BEeSAm6sYHx7YVg==" session_id="uV/B4f1BEeSAk6sYHx7YVg==">
    <label>3</label>
  </stream>
  ...
  <stream stream_id="uV/B4f1BEeSAm6sYHx7YVg==" session_id="uV/B4f1BEeSAk6sYHx7YVg==">
    <label>2</label>
  </stream>
  ...
  <stream stream_id="uV/B4f1BEeSAm6sYHx7YVg==" session_id="uV/B4f1BEeSAk6sYHx7YVg==">
    <label>4</label>
  </stream>
  ...
  <participantstreamassoc participant_id="uV/B4f1BEeSA16sYHx7YVg==">
    <participantstreamassoc>
  </participantstreamassoc>
  ...
</recording>
```
After escalation, video streams get added into the `participantStream association` element in metadata for both the participants. There will be 4 streams in total.
Example: De-escalation

During de-escalation, video streams will be truncated in the Re-INVITE metadata sent to the recorder.

In the below example, you can see two streams each for the audio and video calls in the metadata.

---uniqueBoundary---

Content-Type: application/sdp
Content-Disposition: session;handling=required

v=0
c=IN IP4 9.42.25.149
m=audio 16648 RTP/AVP 116 101
s=SIP Call
t=0 0
a=rtpmap:116 iLBC/8000
a=fmtp:116 mode=20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20
a=maxptime:20
a=sendonly
a=label:1
m=audio 16650 RTP/AVP 116 101
c=IN IP4 9.42.25.149
a=rtpmap:116 iLBC/8000
a=fmtp:116 mode=20
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=ptime:20
a=maxptime:20
a=sendonly
a=label:2
m=video 16652 RTP/AVP 97
c=IN IP4 9.42.25.149
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0
a=sendonly
a=label:3
m=video 16654 RTP/AVP 97
c=IN IP4 9.42.25.149
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0
a=sendonly
a=label:4
--uniqueBoundary
---
Content-Type: application/rs-metadata+xml
Content-Disposition: recording-session

<?xml version="1.0" encoding="UTF-8"?><recording xmlns="urn:ietf:params:xml:ns:recording:1">
<stream stream_id="j5QqdP1CeeSBsYHx7YVg==" session_id="j5L0TP1CeeSBraYHx7YVg==">
  <label>1</label>
</stream>
<stream stream_id="j5QqdP1CeeSBsYHx7YVg==" session_id="j5L0TP1CeeSBraYHx7YVg==">
  <label>3</label>
</stream>
<stream stream_id="j5QqdP1CeeSBsYHx7YVg==" session_id="j5L0TP1CeeSBraYHx7YVg==">
  <label>2</label>
</stream>
<stream stream_id="j5QqdP1CeeSBsYHx7YVg==" session_id="j5L0TP1CeeSBraYHx7YVg==">
  <label>4</label>
</stream>
<participantstreamassoc participant_id="j5QqdP1CeeSBsYHx7YVg==">
  <send>j5QqdP1CeeSBsYHx7YVg==</send>
  <recv>j5QqdP1CeeSBsYHx7YVg==</recv>
</participantstreamassoc>
<participantstreamassoc participant_id="j5QqdP1CeeSBsYHx7YVg==">
  <send>j5QqdP1CeeSBsYHx7YVg==</send>
  <recv>j5QqdP1CeeSBsYHx7YVg==</recv>
</participantstreamassoc>
<participantstreamassoc participant_id="j5QqdP1CeeSBsYHx7YVg==">
  <send>j5QqdP1CeeSBsYHx7YVg==</send>
  <recv>j5QqdP1CeeSBsYHx7YVg==</recv>
</participantstreamassoc>
<participantstreamassoc participant_id="j5QqdP1CeeSBsYHx7YVg==">
  <send>j5QqdP1CeeSBsYHx7YVg==</send>
  <recv>j5QqdP1CeeSBsYHx7YVg==</recv>
</participantstreamassoc>
</recording>
After de-escalation, video streams are removed from the metadata and only audio calls will be present in the participantStream association element.

---uniqueBoundary---

Content-Type: application/sdp

v=0
o=CiscoSystemsSIP-GW-UserAgent 7616 8309 IN IP4 9.42.25.149
s=SIP Call
c=IN IP4 9.42.25.149
t=0 0
m=audio 16648 RTP/AVP 0 101
c=IN IP4 9.42.25.149
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event/8000
a=ptime:20
a=sendonly
a=label:1
m=audio 16650 RTP/AVP 0 101
c=IN IP4 9.42.25.149
a=rtpmap:0 PCMU/8000
a=rtpmap:101 telephone-event/8000
a=ptime:20
a=sendonly
a=label:2
m=video 0 RTP/AVP 97
c=IN IP4 9.42.25.149
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0
a=sendonly
a=label:3
m=video 0 RTP/AVP 97
c=IN IP4 9.42.25.149
b=TIAS:1000000
a=rtpmap:97 H264/90000
a=fmtp:97 profile-level-id=42801E;packetization-mode=0
a=sendonly
a=label:4

---uniqueBoundary---

Content-Type: application/rs-metadata+xml
Content-Disposition: recording-session

<?xml version="1.0" encoding="UTF-8"?><recording xmlns="urn:ietf:params:xml:ns:recording:1">
...<stream stream_id="j5QqdP1CHeSBSqsYHx7YVg==" session_id="j5L0TP1CEeSBRasYHx7YVg=="><label>1</label></stream>
...<stream stream_id="j5QqdP1CHeSBSqsYHx7YVg==" session_id="j5L0TP1CEeSBRasYHx7YVg=="><label>2</label></stream>
...<participantstreamassoc participant_id="j5QqdP1CHeSBSqsYHx7YVg=="><send>j5QqdP1CHeSBSqsYHx7YVg==</send><recv>j5QqdP1CHeSBSqsYHx7YVg==</recv></participantstreamassoc>
Example of Metadata Variations with Different Transfer Flows

Example: Transfer of Re-INVITE/REFER Consume Scenario

In the case of Re-INVITE or REFER Consume transfer scenarios, CUBE receives re-INVITE with caller-id change. This re-INVITE will have the remote-party-ID details.

After transfer, participant A is disassociated from the call and participant C joins the call. This information is provided in the metadata sent to the recording server. Here, 7774442214 associates and 7774442212 dissociates from the call.

Example of Metadata Variations with Caller-ID UPDATE Flow

Example: Caller-ID UPDATE Request and Response Scenario

In case of Re-INVITE based transfer, any UPDATE request will contain caller-id changes. These changes are forwarded to the remote party and once CUBE receives a 200OK message, the remote-party-ID details are transferred.
The response of UPDATE request contains the associated caller-id changes. The CUBE forwards the response UPDATE information to the remote party with caller-id changes after the UPDATE request. From the metadata, you can see that the participants A and C disassociate from the call and participants B and D joins (associates) the call. Here, 7774442212 and 7774442216 disassociates from the call and 7774442214 and 7774442218 joins the call after the caller-id update.

UPDATE sip:7774442216@10.64.86.102:5060;transport=tcp SIP/2.0
From: <sip:7774442212@10.104.54.52>;tag=498652-97a89a01
To: <sip:7774442216@10.64.86.102>;tag=7C798-1441
...
Remote-Party-ID: <sip:7774442214@10.104.54.52>;party=calling;screen=yes;privacy=off
Contact: <sip:7774442214@10.104.54.52:5060;transport=tcp>

Response of UPDATE contains caller-id changes
...
SIP/2.0 200 OK
From: <sip:7774442212@10.64.86.102>;tag=7C78C-1E7C
To: <sip:7774442216@10.104.54.52>;tag=498653-97a89a01
...
Remote-Party-ID: <sip:7774442218@10.104.54.52>;party=called;screen=yes;privacy=off
Contact: <sip:7774442218@10.104.54.52:5060>
Content-Length: 0
...

Example: Caller-ID UPDATE Request and Response Scenario
Example of Metadata Variations with Call Disconnect

Example: Disconnect while Sending Metadata with BYE

When the original call disconnects without any reason, CUBE initiates a BYE session with the recording server along with the metadata.

In this case, the metadata contains the end time of the session along with the disassociation time of all the active participants from the call.

BYE sip:5555555@8.41.17.71:13961;transport=UDP SIP/2.0
...  
Reason: Q.850;cause=16  
Content-Type: application/rs-metadata+xml  
Content-Disposition: recording-session  
Content-Length: 984

<?xml version="1.0" encoding="UTF-8"?>  
<recording xmlns="urn:ietf:params:xml:ns:recording:1">  
<datamode>complete</datamode>  
<session session_id="t5nW8RM6EeWACN4iOrLrag==">  
<end-time>2015-06-16T08:44:36.661Z</end-time>  
</session>  
<participant participant_id="t5nW8RM6EeWACt4iOrLrag==">  
<nameID aor="sip:7774442212@10.104.54.52">  
</nameID>  
</participant>  
<participantsessionassoc participant_id="t5nW8RM6EeWACt4iOrLrag==" session_id="t5nW8RM6EeWACt4iOrLrag==">  
<disassociate-time>2015-06-16T08:44:36.657Z</disassociate-time>  
</participantsessionassoc>  
<participant participant_id="t5nW8RM6EeWACd4iOrLrag==">  
<nameID aor="sip:7774442214@10.104.54.52">  
</nameID>  
</participant>  
<participantsessionassoc participant_id="t5nW8RM6EeWACd4iOrLrag==" session_id="t5nW8RM6EeWACd4iOrLrag==">  
<disassociate-time>2015-06-16T08:44:36.657Z</disassociate-time>  
</participantsessionassoc>  
</recording>
CHAPTER 32

Video Recording - Additional Configurations

This module describes the following additional configurations that can be done for Video Recording:

• Request a Full-Intra Frame using RTCP or SIP INFO methods.
• Configure an H.264 Packetization mode.
• Monitor Intra-Frames and Reference Frames

Feature Information for Video Recording - Additional Configurations

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 45: Feature Information for Network-Based Recording of Video Calls Using Cisco Unified Border Element

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network-Based Recording of Video Calls Using Cisco Unified Border Element</td>
<td>15.3(3)M Cisco IOS XE Release 3.10S</td>
<td>The Network-Based Recording of Video Calls Using Cisco Unified Border Element feature supports software-based forking and recording of video calls. The following commands were introduced or modified: media profile video, ref-frame-req rtcp, ref-frame-req sip-info, video profile, h264-packetization-mode, monitor-ref-frames.</td>
</tr>
</tbody>
</table>
Information About Additional Configurations for Video Recording

Full Intra-Frame Request

Full Intra-Frame Request is a request sent for an I-frame. An I-frame is an entire key or reference frame that is compressed without considering preceding or succeeding video frames. Succeeding video frames are differences to the original I-frame (what has moved) instead of entire video frame information.

The call between Cisco Unified Border Element and the Cisco MediaSense server is established after the call between the endpoints is established. As a result, the Real-Time Transport Protocol (RTP) channel between the endpoints gets established first and the RTP channel with the recording server gets established later. The impact of this delay is more on video recording because the initial I-frame from the endpoint may not get forked, and frames that follow cannot get decoded. To mitigate the impact of the lost RTP video packets, Cisco Unified Border Element generates Full Intra-Frame Request (FIR) using either Real-Time Transport Control Protocol (RTCP) or SIP INFO, or both, requesting the endpoint to send a fully encoded video frame in the subsequent RTP packet.

The following types of FIR are supported on network-based recording of video calls using Cisco Unified Border Element:

- RTCP FIR (based on RFC 5104).
- SIP INFO FIR (based on RFC 5168).
- Both RTCP FIR and SIP INFO FIR (Cisco Unified Border Element can be configured to send both RTCP FIR and SIP INFO requests at the same time).

How to Configure Additional Configurations for Video Recording

Enabling FIR for Video Calls (Using RTCP of SIP INFO)

Perform this task to enable Full Intra-Frame Request (FIR) during the network-based recording of a video call using Real-Time Transport Control Protocol (RTCP) or using the Session Initiation Protocol (SIP) INFO method.

SUMMARY STEPS

1. enable
2. configure terminal
3. media profile video media-profile-tag
4. Do one of the following:
   - ref-frame-req rtcp retransmit-count retransmit-number
   - ref-frame-req sip-info
5. end
### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> media profile video media-profile-tag</td>
<td>Configures a video media profile and enters media profile configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# media profile video 1</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> Do one of the following:</td>
<td></td>
</tr>
<tr>
<td>• ref-frame-req rtcp retransmit-count</td>
<td></td>
</tr>
<tr>
<td>• ref-frame-req sip-info</td>
<td>Enables FIR using the RTCP or SIP INFO method.</td>
</tr>
<tr>
<td>Example: Device(cfg-mediaprofile)# ref-frame-req rtcp retransmit-count 4</td>
<td></td>
</tr>
<tr>
<td>Example: Device(cfg-mediaprofile)# ref-frame-req sip-info</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> end</td>
<td>Exits media profile configuration mode.</td>
</tr>
<tr>
<td>Example: Device(cfg-mediaprofile)# end</td>
<td></td>
</tr>
</tbody>
</table>

### Configuring H.264 Packetization Mode

When a device configured as CUBE is offered more than one H.264 packetization mode on an inbound video call leg, the device offers all received modes to the outbound call leg, allowing dynamic change of mode during a call. However when a call is forked, the MediaSense recording server is not able to support this dynamic change of the packetization mode.

This feature restricts the device and allows it to offer only the configured packetization mode to the outbound call leg when media forking is configured.

### SUMMARY STEPS

1. enable
2. configure terminal
3. media profile video media-profile-tag
4. h264-packetization-mode packetization mode
5. end
### Monitoring Reference files or Intra Frames

Perform this task to configure device to perform deep packet inspection (DPI) of RTP packets received from an endpoint and keep track of how many instantaneous decoder refresh (IDR) frames have been received and the timestamp of the IDRs.

#### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `media profile video media-profile-tag`
4. `monitor-ref-frames`
5. `end`

#### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> <code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> <code>Device&gt;</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td><code>enable</code></td>
</tr>
<tr>
<td><strong>Step 2</strong> <code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> <code>Device</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td><code>configure terminal</code></td>
</tr>
<tr>
<td><strong>Step 3</strong> <code>media profile video media-profile-tag</code></td>
<td>Configures a video media profile and enters media profile configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> <code>Device(config)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td><code>media profile video 1</code></td>
</tr>
<tr>
<td><strong>Step 4</strong> <code>h264-packetization-mode packetization mode</code></td>
<td>Configures the H.264 packetization mode offered by a device on the outbound call leg of a forked call when multiple H.264 packetization modes are present in the offer received by the device on the inbound call leg.</td>
</tr>
<tr>
<td><strong>Example:</strong> <code>Device(cfg-mediaprofile)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td><code>h264-packetization-mode 2</code></td>
</tr>
<tr>
<td><strong>Step 5</strong> <code>end</code></td>
<td>Exits media profile configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> <code>Device(cfg-mediaprofile)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td><code>end</code></td>
</tr>
</tbody>
</table>
### Purpose

**Command or Action**

| Step 2 | configure terminal  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>Device# configure terminal</td>
</tr>
</tbody>
</table>

**Purpose**

Enters global configuration mode.

| Step 3 | media profile video media-profile-tag  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>Device(config)# media profile video 1</td>
</tr>
</tbody>
</table>

**Purpose**

Configures a video media profile and enters media profile configuration mode.

| Step 4 | monitor-ref-frames  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>Device(cfg-mediaprofile)# monitor-ref-frames</td>
</tr>
</tbody>
</table>

**Purpose**

Monitors reference frames or intra-frames.

| Step 5 | end  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td>Device(cfg-mediaprofile)# end</td>
</tr>
</tbody>
</table>

**Purpose**

Exits media profile configuration mode.

### Verifying Additional Configurations for Video Recording

Perform this task to verify the additional configurations of the video recording. The `show` commands can be entered in any order.

**SUMMARY STEPS**

1. `enable`
2. `show call active video called-number number | include VideoRtcpIntraFrameRequestCount`
3. `show call active video called-number number | include VideoSipInfoIntraFrameRequestCount`
4. `show call active video | include VideoTimeOfLastReferenceFrame`
5. `show call active video | include VideoReferenceFrameCount`

**DETAILED STEPS**

**Step 1**

`enable`

Enables privileged EXEC mode.

**Example:**

Device> enable

**Step 2**

`show call active video called-number number | include VideoRtcpIntraFrameRequestCount`

Displays the number of RTCP FIR requests sent on each leg.

**Example:**

Device# show call active video called-number 990057 | include VideoRtcpIntraFrameRequestCount

! Main call legs
VideoRtcpIntraFrameRequestCount=1
VideoRtcpIntraFrameRequestCount=1

!CUBE does not generate FIR request on forked leg
VideoRtcpIntraFrameRequestCount=0

Step 3  show call active video called-number number | include VideoSipInfoIntraFrameRequestCount

Displays the number of SIP INFO FIR requests sent on each leg.

Example:
Device# show call active video called-number 990062 | include VideoSipInfoIntraFrameRequestCount

! Main call legs
VideoSipInfoIntraFrameRequestCount=1
VideoSipInfoIntraFrameRequestCount=1

!CUBE does not generate FIR request on forked leg
VideoSipInfoIntraFrameRequestCount=0

Step 4  show call active video | include VideoTimeOfLastReferenceFrame

Displays the timestamp of latest IDR frame.

Step 5  show call active video | include VideoReferenceFrameCount

Displays the number of IDR frames received on that call leg.
CHAPTER 33

Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording

The Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording feature provides support for the transmission of globally unique identifiers (GUIDs) received from a third-party private branch exchange (PBX) to the recording server using an established Session Initiation Protocol (SIP) session, making CUBE recording more interoperable with third-party vendors.

- Feature Information for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording, on page 431
- Restrictions for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording, on page 432
- Information About Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording, on page 432
- How to Capture Third-Party GUID for Correlation Between Calls and SIP-based Recording, on page 432
- Verifying Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording, on page 435
- Configuration Examples for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording, on page 436

Feature Information for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
Table 46: Feature Information for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording</td>
<td>Cisco IOS 15.4(3)M, Cisco IOS XE 3.13S</td>
<td>The Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording feature provides support for the transmission of globally unique identifiers (GUIDs) received from a third-party private branch exchange (PBX) to the recording server via an established SIP session, making CUBE recording more interoperable with third-party vendors.</td>
</tr>
</tbody>
</table>

Restrictions for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording

- The third-party GUID must be received through an INVITE message or a 200 OK message (depending on whether the third-party PBX is initiating the call [caller] or receiving the call [callee]). No other request type, including re-invites, is supported.
- The third-party GUID can be received only through the primary inbound call leg or the primary outbound call leg.

Information About Third-Party GUID Capture for Correlation Between Calls and SIP-based recording

Enterprise call control systems such as the Cisco Unified Communications Manager (CUCM) use globally unique identifiers (GUIDs) to correlate the multiple call legs of a single call. The call can then be forwarded or transferred, creating additional call legs associated with the same GUID. When recording is configured, CUBE initiates a SIP session with a recorder server and forks the media packets it receives or transmits, along with participant information like called number, calling number, Remote Party ID (RPID), and P-Asserted-Identity (PAI).

While the Cisco-Guid header (used by CUCM) is transmitted to the recording server, third-party GUIDs are not. Third-party GUIDs can be received through an INVITE message or a 200 OK message, depending on whether the third-party PBX is initiating the call [caller] or receiving the call [callee].

Forwarding the GUID to the recording server enables correlation between call records of the PBX and the recording server.

How to Capture Third-Party GUID for Correlation Between Calls and SIP-based Recording

To capture the third-party GUID and forward it to the recording server, you need to copy a third-party GUID header that CUBE receives, configure a SIP copylist for that header, and apply it to the primary inbound and
outbound call leg dial peers. A SIP profile is configured to copy this incoming header to a user-defined variable and apply it to an outgoing header on the recording leg dial peer.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice class sip-copylist tag
4. sip-header ThirdParty-GUID-headername
5. exit
6. dial-peer voice inbound-dialpeer-tag voip
7. voice class sip-copylist tag
8. exit
9. dial-peer voice outbound-dialpeer-tag voip
10. voice class sip-copylist tag
11. exit
12. voice class sip-profiles profile-id
13. request INVITE peer-header sip GUID-header-to-copy copy header-value-to-match copy-variable
14. request INVITE sip-header header-to-add add header-value-to-add
15. request INVITE sip-header GUID-header-to-modify modify header-value-to-match header-value-to-replace
16. exit
17. dial-peer voice recorder-dial-peer-tag voip
18. voice-class sip profiles profile-tag
19. end

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Device&gt; enable</td>
<td>Enter your password if prompted.</td>
</tr>
<tr>
<td>2</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>voice class sip-copylist tag</td>
<td>Configures a list of entities to be sent to a peer call leg and enters voice class configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config)# voice class sip-copylist 100</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>sip-header ThirdParty-GUID-headername</td>
<td>Specifies that the third-party GUID header must be copied from the inbound dial-peer leg to the outbound dial-peer call leg.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config-class)# sip-header Third-Party-GUID</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>exit</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Exits voice class configuration mode.</td>
<td></td>
</tr>
<tr>
<td>Device(config-class)# exit</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>dial-peer voice inbound-dialpeer-tag voip</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Enters inbound dial-peer configuration mode.</td>
<td></td>
</tr>
<tr>
<td>Device(config)# dial-peer voice 2 voip</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td>voice class sip-copylist tag</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Applies the copy list to the dial peer.</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# voice class sip-copylist 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong></td>
<td>exit</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Exits to global configuration mode.</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# exit</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 9</strong></td>
<td>dial-peer voice outbound-dialpeer-tag voip</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Enters outbound dial-peer configuration mode.</td>
<td></td>
</tr>
<tr>
<td>Device(config)# dial-peer voice 3 voip</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 10</strong></td>
<td>voice class sip-copylist tag</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Applies the copy list to the dial peer.</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# voice class sip-copylist 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 11</strong></td>
<td>exit</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Exits to global configuration mode.</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# exit</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 12</strong></td>
<td>voice class sip-profiles profile-id</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Creates a SIP profile and enters voice class configuration mode.</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice class sip-profiles 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 13</strong></td>
<td>request INVITE peer-header sip GUID-header-to-copy</td>
<td>Copies headers from the INVITE message of the incoming dial peer into a copy variable.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device(config-class)# request INVITE peer-header sip Third-Party-GUID copy &quot;(.*)&quot; u01</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 14</strong></td>
<td>request INVITE sip-header header-to-add add</td>
<td>Adds a SIP header to a SIP request.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device(config-class)# request INVITE sip-header add header-value-to-add</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(config-class)# request INVITE sip-header Unsupported add &quot;Unsupported: Dummy Header&quot;</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 15</strong></td>
<td></td>
</tr>
<tr>
<td><code>request INVITE sip-header GUID-header-to-modify modify header-value-to-match header-value-to-replace</code></td>
<td>Modifies the outgoing header using the copy variable defined in the previous step.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(config-class)# request INVITE sip-header Unsupported modify &quot;.*&quot; &quot;Third-Party-GUID: \u01&quot;</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 16</strong></td>
<td></td>
</tr>
<tr>
<td><code>exit</code></td>
<td>Exits to global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(config-class)# exit</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 17</strong></td>
<td></td>
</tr>
<tr>
<td><code>dial-peer voice recorder-dial-peer-tag voip</code></td>
<td>Enters the dial peer configuration mode for the specified outbound recorder dial peer.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(config)# dial-peer voice 2 voip</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 18</strong></td>
<td></td>
</tr>
<tr>
<td><code>voice-class sip profiles profile-tag</code></td>
<td>Applies the SIP profile to the recording dial peer.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(config-dial-peer)# voice-class sip profiles 30</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 19</strong></td>
<td></td>
</tr>
<tr>
<td><code>end</code></td>
<td>Exits to privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(config-dial-peer)# end</code></td>
<td></td>
</tr>
</tbody>
</table>

### Verifying Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording

**SUMMARY STEPS**

1. `debug ccsip messages` for an INVITE message
2. `debug ccsip messages` for a 200 OK message

**DETAILED STEPS**

**Step 1**

`debug ccsip messages` for an INVITE message

Displays all Session Initiation Protocol (SIP) Service Provider Interface (SPI) messages for an INVITE message.

**Example:**
Configuration Examples for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording

Step 2  debug ccsp messages for a 200 OK message
Displays all Session Initiation Protocol (SIP) Service Provider Interface (SPI) messages for a 200 OK message.

Example:

Configuration Examples for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording
Device(config-class)# exit

! Apply SIP profile to outbound dial peer
Device(config)# dial-peer voice 2 voip
Device(config-dial-peer)# voice-class sip profiles 30
Configuration Examples for Third-Party GUID Capture for Correlation Between Calls and SIP-based Recording
CHAPTER 34

Cisco Unified Communications Gateway Services--Extended Media Forking

The Cisco Unified Communications (UC) Services API provides a unified web service interface for the different services in IOS gateway thereby facilitating rapid service development at application servers and managed application service providers.

This chapter explains the Extended Media Forking (XMF) provider that allows applications to monitor calls and trigger media forking on Real-time Transport Protocol (RTP) and Secure RTP calls.

- Feature Information for Cisco Unified Communications Gateway Services—Extended Media Forking, on page 439
- Restrictions for Unified Communications Gateway Services—Extended Media Forking, on page 440
- Information About Cisco Unified Communications Gateway Services, on page 440
- How to Configure UC Gateway Services, on page 447
- Configuration Examples for UC Gateway Services, on page 454

Feature Information for Cisco Unified Communications Gateway Services—Extended Media Forking

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Unified Communications Gateway Services</td>
<td>Cisco IOS 15.3(3)M Cisco IOS XE 3.10S</td>
<td>The Cisco Unified Communications (UC) Services API provides a unified web service interface for the different services in IOS gateway thereby facilitating rapid service development at application servers and managed application service providers.</td>
</tr>
</tbody>
</table>
## Restrictions for Unified Communications Gateway Services—Extended Media Forking

- Media renegotiation is not supported.
- Media mixing on forked media streams is not supported.
- recordTone insertion is not supported with SRTP calls.
- mediaForkingReason tag is only to notify midcall stream events; notification for events such as codec change is not supported.
- Only voice media stream is supported.
- Supplementary services are not supported.
- High Availability is not supported.

## Information About Cisco Unified Communications Gateway Services

### Extended Media Forking (XMF) Provider and XMF Connection

The XMF provider allows applications to monitor calls and trigger media forking on the calls and has the capability to service up to 32 applications. The XMF provider can invoke a call-based or a connection-based media forking using the Unified Communications (UC) API. After the media forking is invoked, it can preserve the media forking initiated by the web application if the WAN connection to the application is lost. The XMF provider also provides the recording tone to the parties involved in the call.

The XMF connection describes the relationship between an XMF call and the endpoint (or trunk) involved in the call. A connection abstraction maintained in the gateway has the following connection states:

- IDLE: This state is the initial state for all new connections. Such connections are not actively part of a telephone call, yet their references to the Call and Address objects are valid. Connections typically do not stay in the IDLE state for long and quickly transition to other states. The application may choose to be notified at this state using the event filters and if done, call/connection at the gateway provider will...
use the NotifyXmfConnectionData(CREATED) message to notify the application listener that a new connection is created.

• ADDRESS_COLLECT: In this state the initial information package is collected from the originating party and is examined according to the “dialing plan” to determine the end of collection of addressing information. In this state, the call in the gateway collects digits from the endpoint. No notification is provided.

• CALL_DELIVERY: On the originating side, this state involves selecting of the route as well as sending an indication of the desire to set up a call to the specified called party. On the terminating side, this state involves checking the busy/idle status of the terminating access and also informing the terminating message of an incoming call. The application may choose to be notified at this state using the event filters and if done, the call or connection at the gateway provider will use the NotifyXmfConnectionData (CALL_DELIVERY) message to notify the application listener.

• ALERTING: This state implies that the Address is being notified of an incoming call. The application may choose to be notified at this state using the event filters and if done, the call or connection at the gateway provider will use the NotifyXmfConnectionData (ALERTING) message to notify the application listener.

• CONNECTED: This state implies that a connection and its Address is actively part of a telephone call. In common terms, two parties talking to one another are represented by two connections in the CONNECTED state. The application may choose to be notified at this state using the event filters and if done, the call or connection at the gateway provider will use the NotifyXmfConnectionData (CONNECTED) message to notify the application listener.

• DISCONNECTED: This state implies it is no longer part of the telephone call. A Connection in this state is interpreted as once previously belonging to this telephone call. The application may choose to be notified at this state using the event filters and if done, the call or connection at the gateway provider will use the NotifyXmfConnectionData (DISCONNECTED) message to notify the application listener.

**XMF Call-Based Media Forking**

In call-based media forking of the gateway, the stream from the calling party is termed as near-end stream and the stream from the called party is termed as far-end stream. The XMF provider actively handles single media forking request per session. Any new media forking request from the external application will override or stop the current forking instance and would start a new forking instance (to the appropriate target IP address or ports). After the media forking request is accepted, the XMF provider returns a response message and starts to fork media streams of a connection to the target forked streams. A NotifyXmfCallData message will be notified to the application for the updated media forking status, that is, FORK-FAILED, FORK_STARTED, or FORK_DONE.

**XMF Connection-Based Media Forking**

In connection-based media forking of the gateway, the incoming stream to the connection is termed as near-end stream and the outgoing stream of the connection is termed as far-end stream. The XMF provider actively handles single media forking request per session. Any new media forking request from the external application will override or stop the current forking instance and would start a new forking instance (to the appropriate target IP address or ports). After the media forking request is accepted, the XMF provider returns a response message and starts to fork media streams of a connection to the target forked streams.
A NotifyXmfConnectionData message will be notified to the application for the updated media forking status:

- **FORK_FAILED**—Media forking is setup failure. No forked RTP connections can be established to target RTP addresses.
- **FORK_STARTED**—Media forking is set up successfully. Both Tx (transmit) and Rx (receive) forked RTP connections are established and connected to target (farEnd and nearEnd) RTP addresses.
- **FORK_DONE**—Media forking is completed. Both Tx and Rx forked RTP connections are released.

### Cisco UC Gateway Services Media Forking API with Survivability TCL

Cisco Unified Border Element (CUBE) supports Survivability TCL Script to co-exist with Cisco Unified Communication (UC) Services API.

Cisco UC Services API XMF interface supports media forking for all the calls controlled by survivability TCL script including the survivability re-attempted calls. Thus, all the calls controlled by survivability TCL script can be recorded when requested by Cisco UC Services XMF API.

Cisco Unified Communications Manager controlled Gateway recording utilizes XMF to trigger media forking on CUBE or SIP based PSTN gateways in the supported call flows.

---

**Note**

Media forking is allowed only for survivability TCL script supported by Cisco Unified Customer Voice Portal (CVP). CVP survivability TCL script is not supported in High Availability mode.

The following call scenarios are supported:

- Basic comprehensive call
• Calls with Refer Consume
• Calls with Mid-call failure
• Calls with alternative route with initial call failure

There are no configuration changes required for enabling CVP survivability TCL support with Cisco UC Gateway Services API.

**Media Forking for SRTP Calls**

• SRTP forking is supported in XCC and XMF application service providers and the supported APIs are RequestCallMediaForking, RequestCallMediaSetAttributes, and RequestConnectionMediaForking.

• SRTP forking is supported for SRTP-to-SRTP, SRTP-to-RTP, and RTP-to-SRTP calls.
  • For SRTP-to-SRTP calls, media forking on either leg would result in SRTP streams being forked.
  • For SRTP fallback calls, after the initial offer, CUBE will fall back to RTP. Media forking either call legs would result in RTP streams being forked.
  • For SRTP-to-RTP interworking calls, a digital signal processor (DSP) is required and involves transcoding. In this case, one leg would be SRTP and the other leg RTP.

• SRTP Crypto keys are notified over the API.
• Supports automatic stopping of media forking when stream changes from SRTP or to SRTP.
  • The optional mediaForkingReason tag in XMF or XCC Notify messages indicates that the forking has been stopped internally.
  • mediaForkingReason tag is only present when the connection changes state, such as mid-call re-INVITE. SRTP stream can change to RTP or SRTP stream can change keys mid-call.
  • mediaForkingReason tag is always accompanied by FORK_DONE.

**Crypto Tag**

For SRTP forking, the optional Crypto tag in NotifyXmfConnectionData or NotifyXmfCallData message indicates the context of an actively forked SRTP connection.

The Crypto tag is only present in the notification message where FORK_STARTED tag is present.

The optional Crypto tag specifies the following:
• The Crypto suite used for encryption and authentication algorithm.
• The base64 encoded mastery key and salt used for encryption.

Crypto suite can be one of the two suites supported in IOS:
• AES_CM_128_HMAC_SHA1_32
• AES_CM_128_HMAC_SHA1_80
Example of SDP Data sent in an SRTP Call

<table>
<thead>
<tr>
<th>Original SIP SDP Crypto Offer</th>
<th>SIP SDP Crypto Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>v=0</td>
<td>v=0</td>
</tr>
<tr>
<td>o=CiscoSystemsSIP-GW-UserAgent 7826 3751 IN IP4 172.18.193.98</td>
<td>o=CiscoSystemsSIP-GW-UserAgent 7826 3751 IN IP4 172.18.193.98</td>
</tr>
<tr>
<td>s=SIP Call</td>
<td>s=SIP Call</td>
</tr>
<tr>
<td>c=IN IP4 172.18.193.98</td>
<td>c=IN IP4 172.18.193.98</td>
</tr>
<tr>
<td>t=0 0</td>
<td>t=0 0</td>
</tr>
<tr>
<td>m=audio 51372 RTP/SAVP 0</td>
<td>m=audio 49170 RTP/SAVP 0</td>
</tr>
<tr>
<td>a=rtpmap:0 PCMU/8000</td>
<td>a=crypto:1 AES_CM_128_HMAC_SHA1_32</td>
</tr>
<tr>
<td>a=crypto:1 AES_CM_128_HMAC_SHA1_32</td>
<td>inline:d0RmdmcmVCspEcQGZINWpVLEJhQX1dhHwSoj</td>
</tr>
<tr>
<td>inline:0RmdmcmVCspEcQGZINWpVLEJhQX1dhHwSoj</td>
<td></td>
</tr>
</tbody>
</table>

**Note**

The application is notified of the content in Crypto and inline SDP lines.

**Multiple XMF Applications and Recording Tone**

Multiple XMF allows multiple (maximum 32) web applications to register with the XMF provider as separate XMF applications and provide redundancy for the voice calls recording. Recording tone provides recording tone capability to the recording sessions. Recording tone is supported for IP to IP, IP to TDM, and TDM to TDM trunks.

An example topology is as shown below where 4 CUCM applications are deployed. CUCM triggers media forking request to Cisco UBE. Recording tone is played to the parties involved in the call based on the recordTone parameter set in the media forking request.
Media forking can be invoked using any of the following APIs:

- RequestXmfConnectionMediaForking
- RequestXmfCallMediaForking
- RequestXmfCallMediaSetAttributes

The “recordTone” parameter can be enabled in any of the above requests and recording tone will be played for the parties involved in the call. The “recordTone” parameter in the API request can have the following values:

- COUNTRY_US
- COUNTRY_AUSTRALIA
- COUNTRY_GERMANY
- COUNTRY_RUSSIA
- COUNTRY_SPAIN
- COUNTRY_SWITZERLAND
There is no difference in the recording tone beep when any country value is chosen. Recording tone beep is played at an interval of every 15 seconds. Digital signal processors and other resources are not utilized for playing recording tone even for transcoded calls. No specific configuration is required to enable or disable recording tone. By default, no recording tone is enabled.

If “recordTone” parameter is enabled only on the farEndAddr, then this tone is played only on the outgoing leg. Likewise, if enabled only on the nearEndAddr, then the tone is played only on the incoming leg. When enabled in both the far and near end, then recording tone is played on both the legs.

The RequestXmfConnectionMediaForking API allows insertion of recording tone on a per connection basis. There could be scenarios where one leg receives two recordTone insertion requests. When a leg receives recordTone insertion request, the nearEnd request always takes precedence over the farEnd request.

**Forking Preservation**

After media forking is initiated by the web application, the forking can be preserved to continue the recording, even if the WAN connection to the application is lost or if the application is unregistered.

**Figure 36: Forking Preservation**

The “preserve” parameter value can be set to TRUE or FALSE in any of the 3 forking requests (RequestXmfConnectionMediaForking, RequestXmfCallMediaForking, or RequestXmfCallMediaSetAttributes) from the application to Cisco UBE.

- If the “preserve” parameter received is TRUE, then forking will continue the recording, even if the WAN connection to application is lost or application is unregistered.
- If the “preserve” parameter received is FALSE, then forking will not continue the recording.
- If the “preserve” parameter is not received in the media forking request, then forking will not continue the recording.
How to Configure UC Gateway Services

Configuring Cisco Unified Communication IOS Services on the Device

SUMMARY STEPS

1. enable
2. configure terminal
3. ip http server
4. ip http max-connections value
5. ip http timeout-policy idle seconds life seconds requests value
6. http client connection idle timeout seconds
7. uc wsapi
8. message-exchange max-failures number
9. probing max-failures number
10. probing interval keepalive seconds
11. probing interval negative seconds
12. source-address ip-address
13. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1** enable | Enables privileged EXEC mode.  
Example: Device> enable  
- Enter your password if prompted. |
| **Step 2** configure terminal | Enters global configuration mode.  
Example: Device# configure terminal |
| **Step 3** ip http server | Enables the HTTP server (web server) on the system.  
Example: Device(config)# ip http server |
| **Step 4** ip http max-connections value | Sets the maximum number of concurrent connections to the HTTP server that will be allowed. The default value is 5.  
Example: Device(config)# ip http max-connection 100 |
**Command or Action**: ip http timeout-policy idle seconds life seconds requests value

**Example**: Device(config)# ip http timeout-policy idle 600 life 86400 requests 86400

**Purpose**: Sets the characteristics that determine how long a connection to the HTTP server should remain open. The characteristics are:

- **idle**—The maximum number of seconds the connection will be kept open if no data is received or response data cannot be sent out on the connection. Note that a new value may not take effect on any already existing connections. If the server is too busy or the limit on the idle time or the number of requests is reached, the connection may be closed sooner. The default value is 180 seconds (3 minutes).

- **life**—The maximum number of seconds the connection will be kept open, from the time the connection is established. Note that the new value may not take effect on any already existing connections. If the server is too busy or the limit on the idle time or the number of requests is reached, it may close the connection sooner. Also, since the server will not close the connection while actively processing a request, the connection may remain open longer than the specified life time if processing is occurring when the life maximum is reached. In this case, the connection will be closed when processing finishes. The default value is 180 seconds (3 minutes). The maximum value is 86400 seconds (24 hours).

- **requests**—The maximum limit on the number of requests processed on a persistent connection before it is closed. Note that the new value may not take effect on any already existing connections. If the server is too busy or the limit on the idle time or the life time is reached, the connection may be closed before the maximum number of requests are processed. The default value is 1. The maximum value is 86400.

**Command or Action**: http client connection idle timeout seconds

**Example**: Device(config)# http client connection idle timeout 600

**Purpose**: Sets the number of seconds that the client waits in the idle state until it closes the connection.

**Command or Action**: uc wsapi

**Example**: Device(config)# uc wsapi

**Purpose**: Enters Cisco Unified Communication IOS Service configuration mode.
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 8</strong> message-exchange max-failures</td>
<td>Configures the maximum number of failed message exchanges between the application and the provider before the provider stops sending messages to the application. Range is 1 to 3. Default is 1.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-uc-wsapi)# message-exchange max-failures 2</td>
</tr>
<tr>
<td><strong>Step 9</strong> probing max-failures</td>
<td>Configures the maximum number of failed probing messages before the router unregisters the application. Range is 1 to 5. Default is 3.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-uc-wsapi)# probing max-failures 5</td>
</tr>
<tr>
<td><strong>Step 10</strong> probing interval keepalive</td>
<td>Configures the time interval between probing messages when the session is in a keepalive state. Range is from 1 to 255 seconds. Default is 5 seconds.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-uc-wsapi)# probing interval keepalive 255</td>
</tr>
<tr>
<td><strong>Step 11</strong> probing interval negative</td>
<td>Configures the interval between negative probing messages, in seconds.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-uc-wsapi)# probing interval negative 10</td>
</tr>
<tr>
<td><strong>Step 12</strong> source-address</td>
<td>Configures the IP address (hostname) as the source IP address for the UC IOS service.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-uc-wsapi)# source-address 192.1.12.14</td>
</tr>
<tr>
<td><strong>Step 13</strong> end</td>
<td>Returns to privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-uc-wsapi)# end</td>
</tr>
</tbody>
</table>
Configuring the XMF Provider

SUMMARY STEPS

1. enable
2. configure terminal
3. uc wsapi
4. source-address ip address
5. provider xmf
6. no shutdown
7. remote-url index url
8. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
</tbody>
</table>
| Example:
  Device> enable                     | • Enter your password if prompted.           |
| **Step 2** configure terminal        | Enters global configuration mode.            |
| Example:
  Device# configure terminal         |                                              |
| **Step 3** uc wsapi                  | Enters Cisco Unified Communication IOS Service mode. |
| Example:
  Device(config)# uc wsapi           |                                              |
| **Step 4** source-address ip address | Configures the source ip address.            |
| Example:
  Device(config)# source-address 172.156.19.38 |                                      |
| **Step 5** provider xmf              | Enters XMF provider configuration mode.       |
| Example:
  Device(config-uc-wsapi)# provider xmf |                                        |
| **Step 6** no shutdown                | Activates XMF provider.                      |
| Example:
  Device(config-uc-wsapi)# no shutdown |                                          |
Verifying the UC Gateway Services

The *show* commands can be entered in any order.

**SUMMARY STEPS**

1. enable
2. show wsapi registration all
3. show wsapi registration xmf *remote-url-index*
4. show call media-forking

**DETAILED STEPS**

**Step 1**

*enable*

Enables privileged EXEC mode.

**Example:**

Device> enable

**Step 2**

*show wsapi registration all*

Displays the details of applications registered. Each registered application is identified by a different ID.

**Example:**

Device# show wsapi registration all

Provider XMF

---------------------------------------------------------------
registration index: 11
id: 2E7C3034:XMF:myapp:26
appUrl:http://pascal-lnx.cisco.com:8094/xmf
appName: myapp
provUrl: http://9.45.46.16:8090/cisco_xmf
prober state: STEADY
connEventsFilter: CREATED|REDIRECTED|ALERTING|CONNECTED|TRANSFERRED|CALL_DELIVERY|DISCONNECTED|HANDOFF_JOIN|HANDOFF_LEAVE
mediaEventsFilter: DTMF|MEDIA_ACTIVITY|MODE_CHANGE|TONE_DIAL|TONE_OUT_OF_SERVICE|TONE_SECOND_DIAL
Step 3  show wsapi registration xmf  remote-url-index
Displays the details of only a particular XMF registered application with any ID ranging from 1 to 32.

Example:
Device# show wsapi registration xmf 1

Step 4  show call media-forking
Displays the forked stream information.

Example:
Device# show call media-forking

Warning: Output may be truncated if sessions are added/removed concurrently!
Troubleshooting Tips

You can use the following `debug` commands to troubleshoot the UC Gateway Services configurations.

- `debug wsapi infrastructure all`
- `debug wsapi xcc all`
- `debug wsapi xmf all`
- `debug wsapi xmf messages`
- `debug wsapi infrastructure detail`
- `debug voip application`
- `debug voip application media forking`
Configuration Examples for UC Gateway Services

Example: Configuring Cisco Unified Communication IOS Services

The following example shows how to configure the device for Cisco Unified Communication IOS Services and enable the HTTP server:

```
Device> enable
Device# configure terminal
Device(config)# ip http server
Device(config)# ip http max-connection 100
Device(config)# ip http timeout-policy idle 600 life 86400 requests 86400
Device(config)# http client connection idle timeout 600
Device(config)# uc wsapi
Device(config-uc-wsapi)# message-exchange max-failures 2
Device(config-uc-wsapi)# probing max-failures 5
Device(config-uc-wsapi)# probing interval keepalive 255
Device(config-uc-wsapi)# probing interval negative 10
Device(config-uc-wsapi)# source-address 192.1.12.14
Device(config-uc-wsapi)# end
```

Example: Configuring the XMF Provider

The following example shows how to enable the XMF providers. The configuration specifies the address and port that the application uses to communicate with the XMF provider:

```
Device> enable
Device# configure terminal
Device(config)# uc wsapi
Device(config-uc-wsapi)# provider xmf
Device(config-uc-wsapi)# no shutdown
Device(config-uc-wsapi)# remote-url 1 http://test.com:8090/ucm_xmf
Device(config-uc-wsapi)# end
```

Example: Configuring UC Gateway Services

```
uc wsapi
    message-exchange max-failures 5
    response-timeout 10
    source-address 192.1.12.14
    probing interval keepalive 250
    probing interval negative 20
! 
    provider xmf
    remote-url 1 http://pascal-lnx.cisco.com:8050/ucm_xmf
```
PART IX

SIP Header Manipulation

• Passing Headers Unsupported by CUBE, on page 457
• Copying SIP Headers, on page 459
• Manipulating SIP Status-Line Header of SIP Responses, on page 467
Passing Headers Unsupported by CUBE

This feature is used to pass parameters that are unsupported by CUBE, but mandatory to the service provider from one leg to another. When a SIP message is received, a check is done for the header, and if it is available, it is copied into a copy list and passed on to the outbound dial peer leg.

- Feature Information for Copying with SIP Profiles, on page 457
- Example: Passing a Header Not Supported by CUBE, on page 457

Feature Information for Copying with SIP Profiles

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 47: Feature Information for Copying with SIP Profiles

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for conditional header manipulation of SIP headers</td>
<td>15.1(3)T Cisco IOS XE Release 3.6S</td>
<td>This feature allows users to copy content from one header to the another. This is done by copying the content of messages into variables which can then be used to modify other SIP headers. This feature modifies the following commands: voice class sip-profiles, response, request, voice-class sip copy-list, sip-header</td>
</tr>
</tbody>
</table>

Example: Passing a Header Not Supported by CUBE

CUBE does not pass “x-cisco-tip”. However, certain TelePresence equipments require “TIP”.

The SIP profile below will look for "x-cisco-tip" in the inbound contact header then pass it in the outbound contact header.
Inbound Contact Header
Contact: <sip:89016442998@161.44.77.193;transport=udp>;x-cisco-tip

Outbound Contact Header
Contact: <sip:89016442998@10.86.176.19:5060>;x-cisco-tip

Create a copylist to pass the Contact Header from the incoming message to the outgoing message. The “x-cisco-tip” is not copied in this step as it is unsupported by CUBE.

!Create a copyList
Device(config)# voice class sip-copylist 1
Device(config-class)# sip-header Contact
Device(config-class)# exit

!Apply the copylist to incoming dial peer.
Device(config)# dial-peer voice 1 voip
Device(config-dial-peer)# description incoming SIP Trunk
Device(config-dial-peer)# incoming called-number
Device(config-dial-peer)# voice-class sip copy-list 1

Create a SIP profile that copies “x-cisco-tip” into a variable, and use that variable to modify the outgoing Contact header. Apply the SIP profile to an outbound dial peer.

Device# voice class sip-profiles 3001

!Copy the Contact header from the incoming dial peer into variable u01
Device(config-class)# request INVITE peer-header sip Contact copy "(;x-cisco-tip)" u01

!Modify the outgoing SIP Invite with this variable.
Device(config-class)# request INVITE sip-header Contact modify "$" "\u01"

!Apply the SIP Profile to the outgoing dial peer.
Device(config)# dial-peer voice 5000 voip
Device(config-dial-peer)# description outbound SIP
Device(config-dial-peer)# destination-pattern 5...$
Device(config-dial-peer)# voice-class sip profiles 3001
CHAPTER 36

Copying SIP Headers

This feature shows you how outgoing SIP headers can be manipulated using information from incoming and other outgoing SIP headers.

- Feature Information for Copying with SIP Profiles, on page 459
- How to Copy SIP Header Fields to Another, on page 460
- Example: Copying the To Header into the SIP-Req-URI, on page 463

Feature Information for Copying with SIP Profiles

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 48: Feature Information for Copying with SIP Profiles

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for conditional header manipulation of SIP headers</td>
<td>15.1(3)T Cisco IOS XE Release 3.6S</td>
<td>This feature allows users to copy content from one header to the another. This is done by copying the content of messages into variables which can then be used to modify other SIP headers. This feature modifies the following commands: voice class sip-profiles, response, request, voice-class sip copy-list, sip-header</td>
</tr>
</tbody>
</table>
How to Copy SIP Header Fields to Another

Copying From an Incoming Header and Modifying an Outgoing Header

To copy content from an incoming header that a device receives to an outgoing header, configure a SIP copylist for that header and apply it to an incoming dial peer. A SIP profile is configured to copy this incoming header to a user-defined variable and apply it to an outgoing header.

SUMMARY STEPS

1. enable
2. configure terminal
3. voice class sip-copylist tag
4. Do one of the following:
   • sip-header header-name
   • sip-header SIP-Req-URI
5. exit
6. dial-peer voice inbound-dial-peer-tag voip
7. voice class sip-copylist tag
8. exit
9. voice class sip-profiles profile-id
10. {request | response} message peer-header sip header-to-copy copy header-value-to-match copy-variable
11. {request | response} message {sip-header | sdp-header} header-to-modify modify header-value-to-match header-value-to-replace
12. exit
13. dial-peer voice inbound-dial-peer-tag voip
14. voice class sip-copylist tag
15. exit

DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Step 2</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Step 3</td>
<td>voice class sip-copylist tag</td>
<td>Configures a list of entities to be sent to a peer call leg and enters voice class configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config)# voice class sip-copylist 100</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td>Do one of the following:</td>
<td>Specifies the SIP header to be copied to the peer call leg.</td>
</tr>
<tr>
<td></td>
<td>• sip-header <em>header-name</em></td>
<td>• sip-req-uri—Configures Cisco Unified Border Element (UBE) to send a SIP request Uniform Resource Identifier (URI) to the peer call leg.</td>
</tr>
<tr>
<td></td>
<td>• sip-header SIP-Req-URI</td>
<td>• header-name—Configures Cisco Unified Border Element (UBE) to send the header name specified to the peer call leg.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-class)# sip-header To</td>
<td></td>
</tr>
</tbody>
</table>

| Step 5 | exit | Exits voice class configuration mode. |

| Step 6 | dial-peer voice *inbound-dial-peer-tag* voip | Enters the dial peer configuration mode for the specified inbound dial peer. |
|        | **Example:** | |
|        | Device(config)# dial-peer voice 2 voip | |

| Step 7 | voice class sip-copylist *tag* | Applies the copy list to the dial-peer. |
|        | **Example:** | |
|        | Device(config-dial-peer)# voice class sip-copylist 100 | |

| Step 8 | exit | Exits to global configuration mode. |

| Step 9 | voice class sip-profiles *profile-id* | Creates a SIP Profiles and enters voice class configuration mode. |
|        | **Example:** | |
|        | Device(config)# voice class sip-profiles 10 | |

| Step 10 | `{request | response}` message peer-header sip header-to-copy copy header-value-to-match copy-variable | Copies headers from the corresponding incoming dial peer into a copy variable. |
|         | **Example:** | |
|         | Device(config-class)# request INVITE peer-header sip TO copy "sip:(.*)" u01 | |

| Step 11 | `{request | response}` message `{sip-header | sdp-header}` header-to-modify modify header-value-to-match header-value-to-replace | Modifies an outgoing SIP or SDP header using the copy variable defined in the previous step. |
|         | **Example:** | |
|         | Device(config-class)# request INVITE sip-header SIP-Req-URI modify ".*@(.*)" "INVITE sip:\u01\1" | |

| Step 12 | exit | Exits to global configuration mode. |

| Step 13 | dial-peer voice *inbound-dial-peer-tag* voip | Enters the dial peer configuration mode for the specified inbound dial peer. |
|         | **Example:** | |
|         | Device(config)# dial-peer voice 2 voip | |
Purpose

Command or Action | Purpose
--- | ---
Step 14 voice class sip-copylist tag | Applies the copy list to the dial-peer.

Example:
Device(config-dial-peer)# voice class sip-copylist 100

Step 15 exit | Exits to global configuration mode.

What to do next

Apply the SIP profile to an outbound dial peer.

Copying From One Outgoing Header to Another

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice class sip-profiles profile-id
4. {request | response} message {sip-header | sdp-header} header-to-copy copy header-value-to-match copy-variable
5. {request | response} message {sip-header | sdp-header} header-to-modify modify header-value-to-match header-value-to-replace
6. end

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Step 3 voice class sip-profiles profile-id</td>
<td>Creates a SIP profile and enters voice class configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# voice class sip-profiles 10</td>
<td></td>
</tr>
<tr>
<td>Step 4 {request</td>
<td>response} message {sip-header</td>
</tr>
<tr>
<td>Example: Device(config-class)# request INVITE sip-header TO copy &quot;sip:(.*)@&quot; u01</td>
<td></td>
</tr>
</tbody>
</table>
Purpose: Command or Action

Step 5

| {request | response} message {sip-header | sdp-header} header-to-modify modify header-value-to-match header-value-to-replace |

Purpose: Modifies an outgoing SIP or SDP header using the copy variable defined in the previous step.

Example:

Device(config-class)# request INVITE sip-header SIP-Req-URI modify ".*@(.*)" "INVITE sip:\u010\1"

Step 6

| end |

Purpose: Exits voice class configuration mode and enters privileged EXEC mode.

Example:

Device(config-class)# end

What to do next

Apply the SIP Profile to an outbound dial peer.

Example: Copying the To Header into the SIP-Req-URI

Copying Contents from One Header to Another

Given below is a scenario in an organization, where the provider has sent only a global reference number in the SIP-Req-URI header of the INVITE message, and has placed the actual phone destination number only in the To: SIP header. The CUCM typically routes on the SIP-Req-URI.

Given below is the original SIP message, where the INVITE has a non-routable value of 4356432A5. The actual phone destination number is 25555552 and is present in the To: SIP header.

Figure 37: Incoming SIP Message

Given below is the SIP message that is required. Note that 4356432A5 has changed to 25555552 in the SIP INVITE.
Because CUBE is a back-to-back user agent, the incoming dial peer is matched to the outgoing dial peer. The SIP Profile configured below copies the value from the incoming dial peer

```
Device# voice class sip-profiles 1

!Copy the To header from the incoming dial peer into variable u01
Device(config-class)# request INVITE peer-header sip TO copy "sip:(.*)@" u01

!Modify the outgoing SIP Invite with this variable.
Device(config-class)# request INVITE sip-header SIP-Req-URI modify ".*@(.*)" "INVITE sip:u01@1"

Apply the SIP profile to the incoming dial peer.

Device(config)# dial-peer voice 99 voip
Device(config-dial-peer)# outgoing to CUCM
Device(config-dial-peer)# destination-pattern 02555555.
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target ipv4:10.1.2.3

!Applying SIP profile to the dial peer
Device(config-dial-peer)# voice-class sip profiles 1
Device(config-dial-peer)# voice-class code 1
Device(config-dial-peer)# dtmf-relay rtp-nte
Device(config-dial-peer)# no vad

Additionally, if you would like to copy the To: Header from the inbound dial peer to the outbound dial peer, use a copy list.

!Create a copy List
Device(config)# voice class sip-copylist 1
Device(config-class)# sip-header TO
Device(config-class)# exit

!Apply the copy list to incoming dial peer.
Device(config)# dial-peer voice 1 voip
Device(config-dial-peer)# description incoming SIP Trunk
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target sip-server
Device(config-dial-peer)# incoming uri to TRUNK
Device(config-dial-peer)# voice-class code 1
Device(config-dial-peer)# voice-class sip copy-list 1

Device(config)# voice class uri TRUNK sip
Device(config-class)# user-id 2555555.
Device(config-class)# end
```
Example: Copying the To Header into the SIP-Req-URI
Example: Copying the To Header into the SIP-Req-URI
CHAPTER 37

Manipulating SIP Status-Line Header of SIP Responses

The SIP status line is a SIP response header, and it can be modified like any other SIP headers of a message. It can either be modified with a user-defined value, or the status line from an incoming response can be copied to an outgoing SIP response. The SIP header keyword used for the response status line is **SIP-StatusLine**.

- Feature Information for Manipulating SIP Responses, on page 467
- Copying Incoming SIP Response Status Line to Outgoing SIP Response, on page 468
- Modifying Status-Line Header of Outgoing SIP Response with User Defined Values, on page 471

Feature Information for Manipulating SIP Responses

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

**Table 49: Feature Information for Manipulating SIP Responses**

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
</table>
| SIP Profile Enhancements for SIP responses and error codes | 15.4(1)T Cisco IOS XE Release 3.12S | This feature extends SIP profiles to allow the following:  
  - Modification of the outgoing SIP response status line. Previously, only modification of outgoing SIP requests and responses was possible.  
  - Copying of the incoming SIP response status-line. The information from the peer-leg status-line can then be copied to user-variables and applied to the outbound response status-line. This option can be used to pass-thru the error-code and error phrase from peer-leg. Previously, only copying of SIP headers were possible.  
  - Before applying a SIP profile to a response from CUBE, the response can be mapped to its corresponding request. |
### Feature Information

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for conditional header manipulation of SIP headers</td>
<td>15.1(3)T Cisco IOS XE Release 3.6S</td>
<td>This feature allows users to copy content from one header to the other. This is done by copying the content of messages into variables which can then be used to modify other SIP headers. This feature modifies the following commands: <code>voice class sip-profiles</code>, <code>response</code>, <code>request</code>, <code>voice-class sip copy-list</code>, <code>sip-header</code></td>
</tr>
</tbody>
</table>

## Copying Incoming SIP Response Status Line to Outgoing SIP Response

To copy content from the status line of an incoming SIP response that a device receives to an outgoing response, configure a SIP copylist for SIP status line and apply it to an incoming dial peer. A SIP profile must be configured to copy the status line of an incoming SIP response to a user-defined variable and apply it to an outgoing SIP response.

*Figure 39: Call Flow for Copying the Status Line from the Incoming SIP Response to the Outgoing SIP Response*

### SUMMARY STEPS

1. enable
2. configure terminal
3. voice class sip-copylist *tag*
4. sip-header SIP-StatusLine
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice class sip-copy-list tag</td>
<td>Configures a list of entities to be sent to the peer call leg and enters voice class configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# voice class sip-copy-list 1</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> sip-header SIP-StatusLine</td>
<td>Specifies that the Session Initiation Protocol (SIP) status line header must be sent to the peer call leg.</td>
</tr>
<tr>
<td>Example: Device(config-class)# sip-header SIP-StatusLine</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> exit</td>
<td>Exits voice class configuration mode and returns to global configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config-class)# exit</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> dial-peer voice inbound-dial-peer-id voip</td>
<td>Specifies an inbound dial peer and enters dial peer configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# dial-peer voice 99 voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> voice-class sip copy-list list-id</td>
<td>Associates the SIP copy list with the inbound dial peer.</td>
</tr>
<tr>
<td>Example: Device(config-dial-peer)# voice-class sip copy-list 1</td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong> exit</td>
<td>Exits dial peer configuration mode and returns to global configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config-dial-peer)# exit</td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>Command or Action</td>
</tr>
<tr>
<td>------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Step 9</td>
<td>voice class sip-profiles tag</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config)# voice class sip-profiles 10</td>
</tr>
<tr>
<td>Step 10</td>
<td>response response-code peer-header sip SIP-StatusLine copy match-pattern copy-variable</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-class)# response ANY peer-header sip SIP-StatusLine copy &quot;(.*)&quot; \u01</td>
</tr>
<tr>
<td>Step 11</td>
<td>response response-code sip-header SIP-StatusLine modify match-pattern copy-variable</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-class)# response ANY sip-header SIP-StatusLine modify &quot;.*&quot; &quot;\u01&quot;</td>
</tr>
<tr>
<td>Step 12</td>
<td>exit</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-class)# exit</td>
</tr>
</tbody>
</table>

What to do next

Apply the SIP profile to the outbound dial peer to copy the SIP response to the outbound leg.
Modifying Status-Line Header of Outgoing SIP Response with User Defined Values

SUMMARY STEPS

1. enable
2. configure terminal
3. voice class sip-profiles tag
5. exit

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
</tbody>
</table>
### SIP Header Manipulation

#### Modifying Status-Line Header of Outgoing SIP Response with User Defined Values

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 3</strong></td>
<td>Enables dial peer-based VoIP SIP profile configurations and enters voice class configuration mode.</td>
</tr>
<tr>
<td>voice class sip-profiles <em>tag</em></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice class sip-profiles 10</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Modifies SIP status line of a SIP response with user-defined values.</td>
</tr>
<tr>
<td>response response-code [method method-type] sip-header sip-status-line modify match-pattern replacement-pattern</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Modifying status line of a SIP header to a user-defined response type:</td>
<td></td>
</tr>
<tr>
<td>Device(config-class)# response 404 sip-header sip-status-line modify &quot;404 Not Found&quot; &quot;404 MyError&quot;</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Exits voice class configuration mode.</td>
</tr>
<tr>
<td>exit</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-class)# exit</td>
<td></td>
</tr>
</tbody>
</table>

**What to do next**

Associate the SIP profile with an outbound dial peer.
PART X

Payload Type Interoperability

• Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls, on page 475
CHAPTER 38

Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls

The Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls feature provides dynamic payload type interworking for dual tone multifrequency (DTMF) and codec packets for Session Initiation Protocol (SIP) to SIP calls.

Based on this feature, the Cisco Unified Border Element (Cisco UBE) interworks between different dynamic payload type values across the call legs for the same codec. Also, Cisco UBE supports any payload type value for audio, video, named signaling events (NSEs), and named telephone events (NTEs) in the dynamic payload type range 96 to 127.

- Feature Information for Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls, on page 475
- Restrictions for Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls, on page 476
- Symmetric and Asymmetric Calls, on page 476
- High Availability Checkpointing Support for Asymmetric Payload, on page 477
- How to Configure Dynamic Payload Type Passthrough for DTMF and Codec Packets for SIP-to-SIP Calls, on page 478
- Configuration Examples for Assymetric Payload Interworking, on page 481

Feature Information for Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
Table 50: Feature Information for Dynamic Payload Interworking for DTMF and Codec Packets Support

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP</td>
<td>15.0(1)XA</td>
<td>The Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls feature provides dynamic payload type interworking for DTMF and codec packets for SIP-to-SIP calls. The following commands were introduced or modified: asymmetric payload and voice-class sip asymmetric payload.</td>
</tr>
<tr>
<td>Calls</td>
<td>15.1(1)T</td>
<td></td>
</tr>
<tr>
<td>Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP</td>
<td>Cisco IOS</td>
<td>The Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls feature provides dynamic payload type interworking for DTMF and codec packets for SIP-to-SIP calls. The following commands were introduced or modified: asymmetric payload and voice-class sip asymmetric payload.</td>
</tr>
<tr>
<td>Calls</td>
<td>Release XE 3.1S</td>
<td></td>
</tr>
</tbody>
</table>

Restrictions for Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls

The Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls feature is not supported for the following:

- H323-to-H323 and H323-to-SIP calls.
- All transcoded calls.
- Secure Real-Time Protocol (SRTP) pass-through calls.
- Flow-around calls.
- Asymmetric payload types are not supported on early-offer (EO) call legs in a delayed-offer to early-offer (DO-EO) scenario.
- Cisco fax relay.
- Multiple $m$ lines with the same dynamic payload types, where $m$ is:

\[
m = \text{audio} <\text{media-port1}> \text{RTP/AVP XXX} \quad m = \text{video} <\text{media-port2}> \text{RTP/AVP XXX}
\]

Symmetric and Asymmetric Calls

Cisco UBE supports dynamic payload type negotiation and interworking for all symmetric and asymmetric payload type combinations. A call leg on Cisco UBE is considered as symmetric or asymmetric based on the payload type value exchanged during the offer and answer with the endpoint:
• A symmetric endpoint accepts and sends the same payload type.
• An asymmetric endpoint can accept and send different payload types.

The Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls feature is enabled by default for a symmetric call. An offer is sent with a payload type based on the dial-peer configuration. The answer is sent with the same payload type as was received in the incoming offer. When the payload type values negotiated during the signaling are different, the Cisco UBE changes the Real-Time Transport Protocol (RTP) payload value in the VoIP to RTP media path.

To support asymmetric call legs, you must enable The Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls feature. The dynamic payload type value is passed across the call legs, and the RTP payload type interworking is not required. The RTP payload type handling is dependent on the endpoint receiving them.

### High Availability Checkpointing Support for Asymmetric Payload

High availability for a call involving asymmetric payloads is supported. In case of fail-over from active to stand-by, the asymmetric payload interworking will be continued as new active CUBE passes across the payload type values according to the negotiation and call establishment.

*Figure 41: Sample High-Availability Topology*
How to Configure Dynamic Payload Type Passthrough for DTMF and Codec Packets for SIP-to-SIP Calls

Configuring Dynamic Payload Type Passthrough at the Global Level

Perform this task to configure the pass through of DTMF or codec payload to the other call leg (instead of performing dynamic payload type interworking) feature at the global level.

SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. sip
5. asymmetric payload {dtmf | dynamic-codecs | full | system}
6. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 3 voice service voip</td>
<td>Enters voice service configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 4 sip</td>
<td>Enters voice service SIP configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 5 asymmetric payload {dtmf</td>
<td>dynamic-codecs</td>
</tr>
</tbody>
</table>
Configuring Dynamic Payload Type Passthrough for a Dial Peer

Perform this task to configure the pass through of DTMF or codec payload to the other call leg (instead of performing dynamic payload type interworking) feature at the dial-peer level.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. dial-peer voice tag voip
4. voice-class sip asymmetric payload {dtmf | dynamic-codecs | full | system}
5. end

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td></td>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>dial-peer voice tag voip</td>
<td>Enters dial peer voice configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# dial-peer voice 77 voip</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>voice-class sip asymmetric payload {dtmf</td>
<td>dynamic-codecs</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
</tbody>
</table>

Note: The dtmf and dynamic-codecs keywords are internally mapped to the full keyword to provide asymmetric payload type support for audio and video codecs, DTMF, and NSEs.
### Purpose

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>Device(config-dial-peer)# voice-class sip asymmetric payload full</code></td>
<td></td>
</tr>
</tbody>
</table>

**Step 5**  

**Example:**

```
Device(config-dial-peer)# end
```

(Optional) Exits dial peer voice configuration mode and enters privileged EXEC mode.

---

### Verifying Dynamic Payload Interworking for DTMF and Codec Packets Support

This task shows how to display information to verify Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls configuration feature. These `show` commands need not be entered in any specific order.

**SUMMARY STEPS**

1. `enable`
2. `show call active voice compact`
3. `show call active voice`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1**  
  **enable**  
  **Example:**
  `
  Device> enable
  '` | Enables privileged EXEC mode.  
  • Enter your password if prompted. |
| **Step 2**  
  **show call active voice compact**  
  **Example:**
  `
  Device# show call active voice compact
  '` | (Optional) Displays a compact version of call information. |
| **Step 3**  
  **show call active voice**  
  **Example:**
  `
  Device# show call active voice
  '` | (Optional) Displays call information for voice calls in progress. |

### Troubleshooting Tips

Use the following commands to debug any errors that you may encounter when you configure the Dynamic Payload Type Interworking for DTMF and Codec Packets for SIP-to-SIP Calls feature:

- `debug cc sip all`
- `debug voip ccapi inout`
- **debug voip rtp**

Use the following debug commands to troubleshoot HA Checkpointing for Asymmetric Payload:

- **debug voip ccapi all**
- **debug voice high-availability all**
- **debug voip rtp error**
- **debug voip rtp inout**
- **debug voip rtp packet**
- **debug voip rtp high-availability**
- **debug voip rtp function**
- **debug ccsp all**

Use the following `show` commands to troubleshoot HA Checkpointing for Asymmetric Payload:

- **show redundancy state**
- **show redundancy inter-device**
- **show standby brief**
- **show voice high-availability summary**
- **show voip rtp stats**
- **show voip rtp high-availability stats**
- **show voip rtp connection detail**
- **show call active voice brief**
- **show call active voice [summary]**
- **show call active video brief**
- **show call active video [summary]**
- **show align**
- **show memory debug leak**

### Configuration Examples for Assymmetric Payload Interworking

**Example: Asymmetric Payload Interworking—Passthrough Configuration**

```plaintext
! voice service voip
   allow-connections sip to sip
   sip
       rel1xx disable
       asymmetric payload full
       midcall-signaling passthru
!
dial-peer voice 1 voip
   voice-class sip asymmetric payload full
   session protocol sipv2
   rtp payload-type cisco-codec-fax-ind 110
   rtp payload-type cisco-codec-video-h264 112
   session target ipv4:9.13.8.23
!
```
In the above example, it is assumed that 110 and 112 are not used for any other payload.

Example: Asymmetric Payload Interworking—Interworking Configuration

```
!  voice service voip
   allow-connections sip to sip
!
  dial-peer voice 1 voip
   session protocol sipv2
   rtp payload-type cisco-codec-fax-ind 110
   rtp payload-type cisco-codec-video-h264 112
   session target ipv4:9.13.8.23
!
```

In the above example, it is assumed that 110 and 112 are not used for any other payload.
PART XI

Protocol Interworking

• Delayed-Offer to Early-Offer, on page 485
• H323-to-SIP Interworking on CUBE, on page 495
• H.323-to-H.323 Interworking on CUBE, on page 501
Delayed-Offer to Early-Offer

The Delayed-Offer to Early-Offer (DO-EO) feature allows CUBE to convert a delayed offer that it receives into an early offer. This feature is supported in the Media Flow-Around mode.

This feature also supports high-density transcoding calls, where transcoding IP addresses and port numbers are exchanged between the sender and receiver. This feature also supports midcall renegotiation of codecs required if an exchange of parameters that is not end-to-end causes an inefficient media flow.

- Feature Information for Delayed-Offer to Early-Offer, on page 485
- Prerequisites for Delayed-Offer to Early-Offer, on page 486
- Restrictions for Delayed-Offer to Early-Offer Media Flow-Around, on page 486
- Delayed-Offer to Early-Offer in Media Flow-Around Calls, on page 486
- MidCall Renegotiation Support for Delayed-Offer to Early-Offer Calls, on page 490
- High-Density Transcoding Calls in Delayed-Offer to Early-Offer, on page 492

Feature Information for Delayed-Offer to Early-Offer

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 51: Feature Information for Delayed-Offer to Early-Offer

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delayed-Offer to Early-Offer</td>
<td>Cisco IOS 12.4(3)</td>
<td>The Delayed-Offer to Early-Offer feature allows CUBE to convert a delayed offer it receives into an early offer.</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS 12.4(24)T</td>
<td>The following commands were introduced by this feature: voice-class sip early-offer forced, early-offer forced and media transcoder high-density.</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS 15.0(1)M</td>
<td></td>
</tr>
<tr>
<td>Delayed-Offer to Early-Offer Support for Video Calls</td>
<td>Cisco IOS 12.4(22)T</td>
<td>The Delayed-Offer to Early-Offer support was extended for video calls. The following command was introduced: codec-profile</td>
</tr>
</tbody>
</table>
### Feature Information

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media Flow-Around with SIP Signaling control on CUBE</td>
<td>Cisco IOS 15.1(3)T</td>
<td>Support for Media Flow-Around for Delayed-Offer to Early-Offer audio calls on CUBE was introduced. No new commands were introduced or modified.</td>
</tr>
<tr>
<td>Midcall Renegotiation Support for DO-EO Calls</td>
<td>Cisco IOS 15.4(2)T, Cisco IOS XE 3.12S</td>
<td>The Midcall renegotiation of codecs feature configures the midcall renegotiation of codecs, if an exchange of parameters that is not end-to-end causes an inefficient media flow. The following commands were modified by this feature: <code>voice-class sip early-offer forced renegotiate [always]</code>, <code>early-offer forced renegotiate [always]</code>.</td>
</tr>
</tbody>
</table>

### Prerequisites for Delayed-Offer to Early-Offer

Configure delayed-offer to early-offer in media flow-around mode.

### Restrictions for Delayed-OffertoEarly-Offer Media Flow-Around

- CUBE does not support change in IP address or port number in the locally triggered RE-INVITE response.
- CUBE does not support DE-EO Media Flow-Around for video calls.

### Delayed-Offer to Early-Offer in Media Flow-Around Calls

Delayed-Offer to Early-Offer (DO-EO) allows CUBE to convert a delayed offer (DO) into an early offer (EO) in the media flow-around mode.

CUBE sends its local IP address in the initial EO INVITE Session Description Protocol (SDP) message. In the image, this is illustrated by INVITE (SDP1, CUIP1). Later, an additional RE-INVITE is locally generated by CUBE to communicate the SDP message details from the sender. This is illustrated by RE-INVITE (SDP5, IP2) in the below image. The RE-INVITE response is consumed by CUBE and not communicated to the sender.

**Figure 42: Delayed Offer to Early Offer in Media Flow-Around Calls**

CUBE supports delayed offer to early offer for SIP-to-SIP video calls. CUBE generates an outgoing Early Offer INVITE with the configured codec list, for a incoming Delayed Offer INVITE.
DO-EO video call is supported if both audio and video codecs are configured under a dial peer. **codec profile** command defines the codec attributes for Video (H263, H264) and Audio (AACLD) codecs. The codec attributes configured under codec-profile is used to generate the a=fmtp attribute line in the Early Offer SDP.

## Configuring Delayed Offer to Early Offer

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Configure conversion of a delayed offer to an early offer:
   - In dial-peer configuration mode
     ```
     voice-class sip early-offer forced
     ```
   - In global VoIP SIP configuration mode
     ```
     early-offer forced
     ```
4. **end**

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
</tr>
<tr>
<td>enable</td>
<td>Enables privileged EXEC mode. Enter your password if prompted.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
</tr>
<tr>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td></td>
</tr>
<tr>
<td>Configure conversion of a delayed offer to an early offer:</td>
<td></td>
</tr>
<tr>
<td>• In dial-peer configuration mode</td>
<td></td>
</tr>
<tr>
<td>voice-class sip early-offer forced</td>
<td></td>
</tr>
<tr>
<td>• In global VoIP SIP configuration mode</td>
<td></td>
</tr>
<tr>
<td>early-offer forced</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>In dial-peer configuration mode:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Device (config) dial-peer voice 10 voip</td>
<td></td>
</tr>
<tr>
<td>Device (config-dial-peer) voice-class sip early-offer forced</td>
<td></td>
</tr>
<tr>
<td>Device (config-dial-peer) end</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
</tbody>
</table>
Configuring Delayed Offer to Early Offer for Video Calls

SUMMARY STEPS

1. enable
2. configure terminal
3. codec profile tag profile
4. dial-peer voice number number voip
5. codec codec profile
6. video codec codec profile
7. voice-class sip early-offer forced
8. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>enable</td>
<td>Enables privileged EXEC mode. Enter your password if prompted.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>codec profile tag profile</td>
<td>Configures the audio and video codec profiles.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>codec profile 1 aacld</td>
<td></td>
</tr>
<tr>
<td></td>
<td>codec profile 2 H264</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>dial-peer voice number number voip</td>
<td>Enters dial peer configuration mode for the specified VoIP dial peer.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# dial-peer voice 1 voip</td>
<td></td>
</tr>
</tbody>
</table>
### Configuring Delayed Offer to Early Offer Medial Flow-Around

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `medial flow-around`
4. Configure conversion of a delayed offer to an early offer:
   - In dial-peer configuration mode
     `voice-class sip early-offer forced`
   - In global VoIP SIP configuration mode
     `early-offer forced`
5. `end`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> <code>enable</code></td>
<td>Enables privileged EXEC mode. Enter your password if prompted.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> <code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### MidCall Renegotiation Support for Delayed-Offer to Early-Offer Calls

When CUBE converts a delayed offer into an early offer, an incomplete exchange of Format-specific parameters (FMTP) occurs during call establishment, resulting in either the noninitiation of media transmission or media transmission in a quality that may not be the best. This is especially a problem in video calls.

To overcome this situation, midcall renegotiation of capabilities can be configured.

The `early-offer forced renegotiate [always]` command is used to configure this in global VoIP configuration mode (config-voi-serv) and the `voice-class sip early-offer forced renegotiate` command is dial-peer configuration mode (config-dial-peer) and voice-class configuration mode (config-class).
The **early-offer forced renegotiate** command triggers a delayed-offer RE-INVITE if the negotiated codecs are one of the following:

- `aaclld`—Audio codec AACLD 90000 bps
- `h263`—Video codec H263
- `h263+`—Video codec H263+
- `h264`—Video codec H264
- `mp4a`—Wideband audio codec

The **early-offer forced renegotiate always** command always triggers a delayed-offer RE-INVITE. This option can be used to support all other codecs.

### Restrictions for MidCall Renegotiation Support for DO-EO Calls

- If **midcall-signaling block** or **midcall-signaling passthru media-change** commands have been configured, the feature does not work because a midcall RE-INVITE is not triggered by CUBE.
- If initial call is transcoded, then midcall re-invite is not triggered by CUBE.

### Configuring Mid Call Renegotiation Support for Delayed-Offer to Early-Offer Calls

**SUMMARY STEPS**

1. enable
2. configure terminal
3. dial-peer voice id voip
4. media transcoder high-density
5. end
# Detailed Steps

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode. Enter your password if prompted.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> dial-peer voice id voip</td>
<td>Enters dial-peer configuration mode and configures the selected dial peer.</td>
</tr>
<tr>
<td><strong>Step 4</strong> media transcorder high-density</td>
<td></td>
</tr>
<tr>
<td>Example: Device (config) dial-peer voice 10 voip</td>
<td></td>
</tr>
<tr>
<td>Device (config-dial-peer) media transcoder high-density</td>
<td></td>
</tr>
<tr>
<td>Device (config-dial-peer) end</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> end</td>
<td>Exits to privileged EXEC mode.</td>
</tr>
</tbody>
</table>

## High-Density Transcoding Calls in Delayed-Offer to Early-Offer

High-Density Transcoding Calls in the media flow-around DO-to-EO mode is a feature where the transcoding IP address and port number are exchanged between the originating and terminating user agents. For high-density transcoding calls, CUBE is in the media flow-through mode even if media flow-around is configured.

In the figure below, XIP1 is passed to CUCM1 when a 200 OK is received from SBC1. ACK from CUCM1 triggers new RE-INVITE with transcoding IP address and port number (XIP2) and this RE-INVITE has to be locally handled in CUBE.

*Figure 44: High-Density Transcoding Calls in DO-to-EO*
The **media transcoder high-density** command is used to configure this feature in dial-peer configuration mode (`config-dial-peer`). Refer to “Modes for Configuring Dial Peers” section to enter these modes and configure this feature.

For high-density transcoding calls with a common codec, CUBE should be in Media Flow-Through mode even though media flow-around is configured.

**Figure 45: High-Density Transcoding Calls for Common Codecs in DO-to-EO**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>enable</td>
<td>Enables privileged EXEC mode. Enter your password if prompted.</td>
</tr>
<tr>
<td>2.</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>3.</td>
<td>voice service voip</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>media transcoder high-density</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>sip</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>early offer-forced</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>end</td>
<td></td>
</tr>
</tbody>
</table>

**Restrictions for High-Density Transcoding DO-EO Calls**

For high-density transcoding calls with a common codec, CUBE will be in Media Flow-through mode even though Media Flow-Around is configured.

**Configuring High-Density Transcoding**

To configure High-Density Transcoding delayed offer to early offer calls in media flow-around mode, perform the following steps:

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice service voip
4. media transcoder high-density
5. sip
6. early offer-forced
7. end

**DETAILED STEPS**

---

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice service voip
4. media transcoder high-density
5. sip
6. early offer-forced
7. end

**DETAILED STEPS**

---
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td></td>
</tr>
<tr>
<td>voice service voip</td>
<td>Enters voice service configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td></td>
</tr>
<tr>
<td>media transcoder high-density</td>
<td>Enables media transcoder high-density for transcoding high-density media calls.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# media transcoder high-density</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td></td>
</tr>
<tr>
<td>sip</td>
<td>Enters SIP configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td></td>
</tr>
<tr>
<td>early offer-forced</td>
<td>Forcefully sends SIP EO invites on the Out-Leg.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-sip)# early offer-forced</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td></td>
</tr>
<tr>
<td>end</td>
<td>Exits the present configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-sip)# end</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 40

H323-to-SIP Interworking on CUBE

This chapter describes how to configure H.323-to-SIP interworking in CUBE and lists the various features supported in this interworking model.

- Prerequisites, on page 495
- Restrictions, on page 495
- H.323-to-SIP Basic Call Interworking, on page 496
- H.323-to-SIP Supplementary Features Interworking, on page 498
- H.323-to-SIP Codec Progress Indicator Interworking for Media Cut-Through, on page 499
- Configuring H.323-to-SIP Interworking, on page 499

Prerequisites

- Enable CUBE on the device
- Perform basic H.323 gateway configuration. See Configuring H.323 Gateway (Optional)
- Perform basic H.323 gatekeeper configuration. See Configuring H.323 Gatekeeper (Optional)

Restrictions

- Changing codecs during rotary dial peer selection is not supported.
- Voice class codec is not supported.
- Configure extended capabilities on dial peers for fast start-to-early media scenarios.
- Delayed Offer to Slow-Start is not supported for SRTP-to-SRTP H.323-to-SIP calls.
- During a triggered INVITE scenario the Cisco UBE always generates a delayed offer INVITE.
- Fast-start to delayed-media signal interworking is not supported.
- Fast Start to Early Offer Supplementary Service will not work without extended capabilities configured under dial-peer.
- GSMFR and GSMEFR codecs are not supported.
- Media flow-around is not supported.
- Passing multiple diversion headers or multiple contact header in 302 to the H.323 leg is not supported.
- RSVP for supplementary scenarios is not supported.
- Session refresh is not supported.
- SIP-to-H.323 Supplementary Services based on H.450 is not supported.
- Slow-start to early media signal interworking is not supported.
Supplementary services are Empty Capability Set (ECS) based supplementary services from the H.323 perspective, not H.450 supplementary services.

- LTI based transcoding is not supported.
- Transcoding for supplementary calls is not supported.
- SCCP based codec transcoding is not support with an exception of Delayed-Offer to Slow-Start with static codec.
- DTMF interworking rtp-nte to inband is supported only with non-high-density transcoding in a delayed-offer to slow-start call.

### H323-to-SIP Basic Call Interworking

This feature enables the IP-to-IP gateway to bridge calls between networks that support different VoIP call-signaling protocols (SIP and H.323). The SIP-to-H.323 protocol interworking capabilities of the CUBE support the following:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Supported Release</th>
<th>Additional Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic voice calls (G.711 and G.729 codecs)</td>
<td>12.4(11)T</td>
<td></td>
</tr>
<tr>
<td>UDP and TCP transport</td>
<td>12.3(11)T</td>
<td>SIP (UDP)←→H.323 (TCP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SIP (TCP)←→H.323 (TCP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SIP (UDP)←→H.323 (UDP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SIP (TCP)←→H.323 (UDP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Default SIP protocol is UDP. Default H.323 protocol is TCP.</td>
</tr>
<tr>
<td>Interworking between</td>
<td>12.3(11)T</td>
<td>• H.323 Fast Start←→SIP Early Media</td>
</tr>
<tr>
<td>• H.323 Fast-Start and SIP early-media signaling</td>
<td></td>
<td>• H.323 Slow Start ←→ SIP Delay Media</td>
</tr>
<tr>
<td>• H.323 Slow-Start and SIP delayed-media signaling</td>
<td></td>
<td>Note: No other combinations are supported. For example, H.323 Slow Start ←→ SIP Early Media is not supported and results in call failure.</td>
</tr>
<tr>
<td>Feature</td>
<td>Supported Release</td>
<td>Additional Description</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>H.323-to-SIP RSVP Support</td>
<td>12.3(11)T</td>
<td>The following cases are supported (acc-qos and reg_qos):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• H.323 to H.323 with only one leg having RSVP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• H.323 to H.323 with both legs having RSVP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• H.323 to SIP with only one leg having RSVP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• H.323 to SIP with both legs having RSVP</td>
</tr>
<tr>
<td>DTMF relay interworking:</td>
<td>12.3(11)T</td>
<td>• H.245 alpha/signal&lt;~=&gt;SIP Notify</td>
</tr>
<tr>
<td></td>
<td>12.4(6)XE</td>
<td>• H.245 alpha/signal &lt;~=&gt; SIP RFC 2833</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• H.245 alpha/signal &lt;~=&gt; SIP KPML</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• G.711 Inband DTMF&lt;~=&gt;RFC 2833</td>
</tr>
<tr>
<td>Voice call transcoding support</td>
<td>12.3(11)T</td>
<td>• Only voice and DTMF are supported. (G.711-G.729)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Codec transparent and codec filtering is not supported</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cisco Fax Relay and T.38 Fax are not supported</td>
</tr>
<tr>
<td>Calling/called name and number</td>
<td>12.3(11)T</td>
<td>• H.323 IOS FXS/SCCP – IPIPrew – SIP IOS FXS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• H.323 IOS FXS/SCCP – IPIPrew – SIP CCME Skinny Phone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• H.323 IOS FXS/SCCP – IPIPrew – SIP IP Phone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• CCM Phone – IPIPrew – SIP CCME Skinny Phone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• CCM Phone – IPIPrew – SIP IP Phone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SIP IOS FXS – IPIPrew – H.323 IOS FXS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SIP IOS FXS – IPIPrew – H.323 CCME Skinny Phone</td>
</tr>
</tbody>
</table>
### H323-to-SIP Supplementary Features Interworking

This interworking provides enhanced termination and re-origination of signaling and media between VoIP and Video Networks in conformance with RFC3261.

**Feature** | **Release** | **Additional Description**
---|---|---
RADIUS call-accounting records | 12.3(11)T | H.323<—>SIP Radius call accounting
TCL IVR 2.0 for SIP, including media playout and digit collection (RFC 2833 DTMF relay) | 12.3(11)T | 12.4(11)T — TCL IVR 2.0 for SIP, including media playout and digit collection (RFC 2833 DTMF relay)
| 12.4(11)T | 12.4(11)T — TCL IVR support with SIP NOTIFY DTMF
SRTP Passthrough | 12.4(15)XY | 
Supplementary Services (ECS based). | 12.4(11)XJ2 | 
Codec Transparent | 12.4(11)T | 
Extended codec support and codec filtering | 12.4(11)T | 

---

**Feature** | **Release**
---|---
Support H.323-to-SIP Supplementary services for CUCM with MTP on the H.323 Trunk. | 12.3(11)T
ILBC Codec Support | 12.3(11)T
Interworking between G.711 inband DTMF to RFC2833 | 12.3(11)T
VXML 3.x support | 12.3(11)T
SIP CDRs and H.323 CDRs Mapping | 12.3(11)T
Conference ID can be used to correlate H.323 and SIP Radius records. Conference ID is unique on both H.323 and SIP legs | 12.3(11)T
VXML support with SIP Notify | 12.4(11)T
Mapping ECS to ReINVITE and ECS to REFER on the Cisco CUBE | 12.4(20)T
H.323-to-SIP Codec Progress Indicator Interworking for Media Cut-Through

OGW is the originating gateway and TGW is the terminating gateway.

Table 52: SIP(OGW)→IPIPGW→H323(TGW) calls

<table>
<thead>
<tr>
<th>SIP at In Leg</th>
<th>H.323 at Out Leg</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>183 Session Progress</td>
<td>Progress/Alert PI = 8</td>
<td>Analog phone at TGW</td>
</tr>
<tr>
<td>180 Ring</td>
<td>Alert with PI = 0</td>
<td>SCCP phone at TGW</td>
</tr>
</tbody>
</table>

Table 53: H323(OGW)→IPIPGW→SIP(TGW) calls

<table>
<thead>
<tr>
<th>H.323 at In Leg</th>
<th>SIP at Out Leg</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progress/Alert PI = 8</td>
<td>183 Session Progress</td>
<td>Analog phone at TGW</td>
</tr>
<tr>
<td>Alert with PI = 0</td>
<td>180 Ring</td>
<td>SIP/SCCP phone at TGW</td>
</tr>
</tbody>
</table>

Configuring H323-to-SIP Interworking

SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. allow-connections h323 to sip
5. allow-connections sip to h323
6. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td>Enters Global VoIP configuration mode.</td>
</tr>
<tr>
<td><strong>Step 3</strong> voice service voip</td>
<td>Allows connections from a h323 endpoint to a SIP endpoint.</td>
</tr>
<tr>
<td>Example: Router(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> allow-connections h323 to sip</td>
<td>Allows connections from a SIP endpoint to a H.323 endpoint.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> allow-connections sip to h323</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> end</td>
<td>Exits to previlged EXEC mode.</td>
</tr>
<tr>
<td>Example: Router(config-voi-serv)# end</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 41

H.323-to-H.323 Interworking on CUBE

This chapter describes how to configure and enable features for H.323-to-H.323 connections on CUBE. Configuring H.323-to-H.323 connections on a CUBE opens all ports by default. If CUBE has a public IP address and a PSTN connection, CUBE becomes vulnerable to malicious attackers who can execute toll fraud across the gateway. To eliminate this threat, you can bind an interface to a private IP address that is inaccessible to untrusted hosts. In addition, you can protect any public or untrusted interface by configuring a firewall or an access control list (ACL) to prevent unwanted traffic from traversing the router.

- Feature Information for H.323-to-H.323 Interworking, on page 501
- Prerequisites, on page 502
- Restrictions, on page 502
- Slow Start to Fast-Start Interworking, on page 502
- Call Failure Recovery (Rotary), on page 504
- Managing H.323 IP Group Call Capacities, on page 505
- Overlap Signaling, on page 510
- Verifying H.323-to-H.323 Interworking, on page 511
- Troubleshooting H.323-to-H.323 Interworking, on page 513

Feature Information for H.323-to-H.323 Interworking

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 54: Feature Information for H.323-to-H.323 Interworking

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing H.323 IP Group Call Capacities</td>
<td>12.2(13)T</td>
<td>Creates a maximum capacity for the IP group providing extra control for load and resource balancing.</td>
</tr>
<tr>
<td>Feature Name</td>
<td>Releases</td>
<td>Feature Information</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>----------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Overlap Signaling for H.323-to-H.323 Connections on a Cisco Unified Border Element</td>
<td>12.3(11)T</td>
<td>The terminating gateway is responsible for collecting all the called number digits. Overlap signaling is implemented by matching destination patterns on the dial peers.</td>
</tr>
<tr>
<td>Signal Interworking</td>
<td>12.3(11)T</td>
<td>H.323-to-H.323 Interworking Between Fast Start and Slow Start. This feature enables the Cisco UBE to bridge calls between VoIP endpoints that support only H.323 FastStart procedures and endpoints that support only normal H.245 signaling (SlowStart).</td>
</tr>
</tbody>
</table>

**Prerequisites**

- Enable CUBE application on a device
- Perform basic H.323 gateway configuration. See Configuring H.323 Gateway
- Perform basic H.323 gatekeeper configuration. See Configuring H.323 Gatekeeper

**Restrictions**

- Voice class codec is not supported.
- LTI-based transcoding is not supported.
- Supplementary services with transcoding is not supported.
- DTMF Interworking rtp-nte to out of band is not supported when high density transcoder is enabled. Use normal transcoding for rtp-nte to out of band DTMF interworking.
- SCCP based codec transcoding is not supported. An exception to this restriction is slow start to slow start with a static codec.

**Slow Start to Fast-Start Interworking**

The slow-start to fast-start interworking feature allows two endpoints configured for slow start and fast start respectively to connect with each other through CUBE without dropping the call.
Restrictions for Slow-Start and Fast-Start Interworking

- Slow-start to fast-start interworking is supported only for H.323-to-H.323 calls.
- Transcoding in slow-start to fast-start interworking is not supported.

Enabling Interworking between Slow Start and Fast Start

Configure interworking between slow start and fast start on both inbound and outbound call legs.

**Note**

This task should not be used in situations where fast-start to fast-start or slow-start to slow-start calls are possible.

**Before you begin**

Ensure that a codec is configured on incoming and outgoing call legs.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. Use one of the following commands to configure interworking between slow start and fast start.
   - **call start interwork in global VoIP configuration mode**
   - **call start interwork in voice class configuration and applied to inbound and outbound dial peers.**
4. end

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td></td>
<td>Router&gt; enable</td>
<td></td>
</tr>
</tbody>
</table>

| Step 2 | configure terminal | Enters global configuration mode. |
|        | Example:           |         |
|        | Router# configure terminal |         |

<table>
<thead>
<tr>
<th>Step 3</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 3</td>
<td>Use one of the following commands to configure interworking between slow start and fast start.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• call start interwork in global VoIP configuration mode</td>
<td>Enables interworking between slow start and fast start.</td>
</tr>
<tr>
<td></td>
<td>• call start interwork in voice class configuration and applied to inbound and outbound dial peers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
</tbody>
</table>

Cisco Unified Border Element Configuration Guide
### Call Failure Recovery (Rotary)

Call failure recovery (Rotary) is a feature that provides the flexibility to route a call to a destination with multiple paths based on the policy of a service provider. If one path disconnects the call for any reason (like unreachableDestination, destinationReject, noPermission etc), the call can be routed by choosing another dial peer to the same destination based on configured preference.

Rotary is implemented using the dial peer hunt feature (see Configuring Hunt Groups), and the search for a successful dial peer continues until a **huntstop** command is encountered.

The feature described in this chapter is an enhancement that removes a restriction on codec configuration, that requires for identical codec capabilities configured on all dial peers in a rotary group. This is done by supporting an Empty Capability set (TCS=0) when rotary is configured.

The feature allows the CUBE to restart the codec negotiation process with the originating endpoint based on the codec capabilities of the next dial peer in the rotary group.

### Enabling Call Failure Recovery (Rotary) without Identical Codec Configuration

#### Before you begin

Configure Call Failure Recovery (Rotary) using dial-peer hunt groups. See Configuring Dial-Peer Hunt Groups.

#### SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. h323
5. `emptycapability`
6. `exit`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><code>enable</code></td>
<td>- Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device&gt; enable</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><code>configure terminal</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device# configure terminal</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Enters VoIP voice-service configuration mode.</td>
</tr>
<tr>
<td><code>voice service voip</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(config)# voice service voip</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Enters H.323 voice-service configuration mode.</td>
</tr>
<tr>
<td><code>h323</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(conf-voi-serv)# h323</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Enables call failure recovery (TCS=0) without the need for identical codec configuration.</td>
</tr>
<tr>
<td><code>emptycapability</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device(conf-serv-h323)# emptycapability</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td><code>exit</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Router(conf-serv-h323)# exit</code></td>
<td></td>
</tr>
</tbody>
</table>

**Managing H.323 IP Group Call Capacities**

Managing maximum capacity for an IP group is done with carrier IDs created on an IP trunk group. If you do not configure specific carrier IDs, you can use the `ip circuit default only` command to create a single carrier. However, if you want to use carrier ID-based routing, or if you need extra control for load and resource balancing, you must configure carrier IDs in conjunction with the `voice source-group` command.

CUBE works with the `voice source-group` command to provide matching criteria for incoming calls. The `voice source-group` command assigns a name to a set of source IP group characteristics. The terminating gateway uses these characteristics to identify and translate the incoming VoIP call. If there is no voice source group match, the default carrier ID is used, any source carrier ID on the incoming message is transmitted
without change, and no destination carrier is available. Call-capacity information is reported to the gatekeeper, but carrier routing information is not.

If the voice source group matches, the matched source carrier ID is used and the target carrier ID defined in the voice source group is used for the destination carrier ID.

Note
You can use this task only when there are no active calls are active.

SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. h323
5. ip circuit max-calls maximum-calls
6. ip circuit carrier-id carrier-name [reserved-calls reserved ]
7. ip circuit default only
8. exit

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>enable</td>
<td>Enter your password if prompted.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>configure terminal</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>Enters VoIP voice-service configuration mode.</td>
</tr>
<tr>
<td>voice service voip</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td>Enters H.323 voice-service configuration mode.</td>
</tr>
<tr>
<td>h323</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(conf-voi-serv)# h323</td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>Command or Action</td>
</tr>
<tr>
<td>------</td>
<td>------------------</td>
</tr>
<tr>
<td>5</td>
<td>ip circuit max-calls <em>maximum-calls</em></td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
</tr>
<tr>
<td></td>
<td>Router(config-serv-h323)# ip circuit max-calls 1500</td>
</tr>
<tr>
<td>6</td>
<td>ip circuit carrier-id <em>carrier-name</em> [reserved-calls <em>reserved</em> ]</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
</tr>
<tr>
<td></td>
<td>Router(config-serv-h323)# ip circuit carrier-id AA reserved-calls 500</td>
</tr>
<tr>
<td>7</td>
<td>ip circuit default only</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
</tr>
<tr>
<td></td>
<td>Router(config-serv-h323)# ip circuit default only</td>
</tr>
<tr>
<td>8</td>
<td>exit</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
</tr>
<tr>
<td></td>
<td>Router(config-serv-h323)# exit</td>
</tr>
</tbody>
</table>

**Configuration Examples for Managing H.323 IP Group Call Capacities**

The following examples show a default carrier with no voice source group configured:

**Example: Default Carrier with No Voice Source Group**

```
voice service voip
```
allow-connections h323 to h323
  h323
  ip circuit max-calls 1000
  ip circuit default only

If there is no incoming source carrier ID:

  • Capacity only is reported to the gatekeeper using the default circuit (two call legs).
  • No source or destination carrier information is reported.

If there is an incoming source carrier ID:

  • Two call legs are counted against the default circuit and reported to the GK.
  • The source carrier ID is passed through the gateway to the terminating leg.

The following examples show a configuration with more reserved calls than the default value for the `max-calls` argument (1000):

**Example: Configuration with Default Calls in Excess of 1000**

This example assigns 1100 calls to other carriers, leaving 400 calls available to the default carrier:

```
voice service voip
  allow-connections h323 to h323
  h323
  ip circuit max-calls 1000
  ip circuit carrier-id AA reserved-calls 500
  ip circuit carrier-id bb reserved-calls 500
  ip circuit carrier-id cc reserved-calls 100
```

The following examples show the default carrier configured with an incoming source carrier but no voice source group configured.

**Note**

In this example, 800 call legs are implicitly reserved for the default circuit.

**Example: Default Carrier and Incoming Source Carrier with No Voice Source Group**

```
voice service voip
  allow-connections h323 to h323
  h323
  ip circuit max-calls 1000
  ip circuit carrier-id AA reserved-calls 200
```

If there is no incoming source carrier ID:

  • Capacity only is reported to the GK using the default circuit (two call legs).
  • No source or destination carrier information is reported.

If there is an incoming source carrier ID called “AA”:

  • One call leg is counted against circuit “AA”.
  • One call leg (outbound) is counted against the default circuit.
The source carrier ID is passed through the gateway to the terminating leg.

If there is an incoming source carrier ID called “BB” (for example) or anything other than “AA”:

- Two call legs are counted against the default circuit.
- The source carrier ID “BB” is passed through the gateway to the terminating leg.

The following examples show the first voice source-group match case:

**Example: Voice Source-Group Match Case 1**

```
voice service voip
  allow-connections h323 to h323
h323
  ip circuit max-calls 1000
  ip circuit carrier-id AA reserved-calls 200
!
voice source-group 1
  carrier-id source AA
  carrier-id target AA
```

If there is no incoming source carrier ID, the default circuit is used because there is no match in the voice source group.

If there is an incoming source carrier ID called “AA,” the following are in effect:

- The voice source group matches.
- Both call legs are counted against circuit “AA”.
- The source carrier ID is passed through the gateway to the terminating leg.
- The destination carrier ID is “AA”.

The following examples show the second voice source-group match case:

**Example: Voice Source-Group Match Case 2**

```
voice service voip
  allow-connections h323 to h323
h323
  ip circuit max-calls 1000
  ip circuit carrier-id AA reserved-calls 200
  ip circuit carrier-id BB reserved-calls 200
!
voice source-group 1
  carrier-id source AA
  carrier-id target BB
```

If there is no incoming source carrier ID, the default circuit is used because there is no match in the voice source group.

If there is an incoming source carrier ID called “AA”:

- The voice source-group matches.
- One leg is counted against circuit “AA”.
- One leg is counted against circuit “BB”.
- The source carrier ID is passed through the gateway to the terminating leg.
- The destination carrier ID is “BB”.

The following examples show the third voice source-group match case:
Example: Voice Source-Group Match Case 3

```plaintext
voice service voip
  allow-connections h323 to h323
  h323
    ip circuit max-calls 1000
    ip circuit carrier-id AA reserved-calls 200
    ip circuit carrier-id BB reserved-calls 200
  !
voice source-group 1
  access-list 1
  carrier-id source BB

If the access-list matches, the following apply:

• One leg is counted against circuit “BB”.
• One leg is counted against the default circuit (for the destination circuit).
• The source carrier ID is synthesized to “BB” and used to report to the gatekeeper. It is also used on the outgoing setup.

If a source carrier ID is received on the incoming setup, it is overridden with the synthesized carrier ID.
```

Overlap Signaling

Overlap signaling requires that called digits be sent one-by-one as they are received from the calling device. The first digit is sent in a call setup message and subsequent digits are sent in information messages. This technique is used when a receiving gateway is able to recognize variable-length phone numbers, and requires that the originating gateway signal the end of the call setup process.

Overlap signaling is implemented by matching destination patterns on the dial peers. When H.225 signal overlap is configured on the originating gateway, it sends the SETUP to the terminating gateway once a dial-peer match is found. The originating gateway sends all further digits received from the user to the terminating gateway using INFO messages until it receives a sending complete message from the user. The terminating gateway receives the digits in SETUP and subsequent INFO messages and does a dial-peer match. If a match is found, it sends a SETUP with the collected digits to the PSTN. All subsequent digits are sent to the PSTN using INFO messages to complete the call.

Configuring Overlap Signaling

SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. h323
5. h225 signal overlap
6. h225 timeout t302 seconds
7. exit
### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice service voip</td>
<td>Enters VoIP voice-service configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> h323</td>
<td>Enters H.323 voice-service configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(conf-voi-serv)# h323</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> h225 signal overlap</td>
<td>Activates overlap signaling to the destination gateway.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(conf-serv-h323)# h225 signal overlap</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> h225 timeout t302 seconds</td>
<td>Sets the t302 timer timeout value. The argument is as follows:</td>
</tr>
<tr>
<td>Example:</td>
<td>• seconds—Number of seconds for timeouts. Range: 1 to 30.</td>
</tr>
<tr>
<td>Router(conf-serv-h323)# h225 timeout t302 15</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> exit</td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(conf-serv-h323)# exit</td>
<td></td>
</tr>
</tbody>
</table>

### Verifying H.323-to-H.323 Interworking

To verify Cisco Unified Border Element feature configuration and operation, perform the following steps (listed alphabetically) as appropriate.

#### Note
The word “calls” refers to call legs in some commands and output.
SUMMARY STEPS

1. show call active video
2. show call active voice
3. show call active fax
4. show call history video
5. show call history voice
6. show call history fax
7. show crm
8. show dial-peer voice
9. show running-config
10. show voip rtp connections

DETAILED STEPS

Step 1  show call active video
Use this command to display the active video H.323 call legs.

Step 2  show call active voice
Use this command to display call information for voice calls that are in progress.

Step 3  show call active fax
Use this command to display the fax transmissions that are in progress.

Step 4  show call history video
Use this command to display the history of video H.323 call legs.

Step 5  show call history voice
Use this command to display the history of voice call legs.

Step 6  show call history fax
Use this command to display the call history table for fax transmissions that are in progress.

Step 7  show crm
Use this command to display the carrier ID list or IP circuit utilization.

Step 8  show dial-peer voice
Use this command to display information about voice dial peers.

Step 9  show running-config
Use this command to verify which H.323-to-H.323, H.323-to-SIP, or SIP-to-SIP connection types are supported.

Step 10 show voip rtp connections
Use this command to display active Real-Time Transport Protocol (RTP) connections.
Troubleshooting H.323-to-H.323 Interworking

⚠️ **Caution**

Under moderate traffic loads, these `debug` commands produce a high volume of output.

- debug cch323 all
- debug h225 asn1
- debug h225 events
- debug h225 q931
- debug h245 asn1
- debug h245 events
- debug voip ipipgw
- debug voip ccapi inout
PART XII

Support for SRTP

- SRTP-SRTP Interworking, on page 517
- SRTP-RTP Interworking, on page 533
- SRTP-SRTP Pass-Through, on page 547
SRTP-SRTP Interworking

Cisco Unified Border Element (CUBE) supports secure calls between two networks having different cipher suites. SRTP-SRTP interworking is supported for audio and video calls.

- Feature Information for SRTP-SRTP Interworking, on page 517
- Prerequisites for SRTP-SRTP Interworking, on page 518
- Restrictions for SRTP-SRTP Interworking, on page 518
- Information About SRTP-SRTP Interworking, on page 518
- How to Configure SRTP-SRTP Interworking, on page 520
- Configuration Examples, on page 527

Feature Information for SRTP-SRTP Interworking

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

**Table 55: Feature Information for SRTP-SRTP Interworking**

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for SRTP-SRTP interworking</td>
<td>Cisco IOS XE Everest 16.5.1b</td>
<td>This feature allows secure calls between two enterprises using different cipher suites. Supported cipher suites are as follows:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- AEAD_AES_256_GCM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- AEAD_AES_128_GCM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- AES_CM_128_HMAC_SHA1_80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- AES_CM_128_HMAC_SHA1_32</td>
</tr>
</tbody>
</table>
Prerequisites for SRTP-SRTP Interworking

- Cisco IOS XE Everest Release 16.5.1b or later

Note

SRTP-SRTP Interworking feature is not supported on Cisco ISR G2 Series Routers.

Restrictions for SRTP-SRTP Interworking

- Asymmetric SRTP fallback configuration is not supported
- Call admission control (CAC) is not supported
- Call Progress Analysis (CPA) is not supported
- Transcoding calls are not supported
- SRTCP-RTCP interworking is not supported
- More than one audio and video m-line is not supported
- Unified CME and Unified SRST flows and SIP-TDM flows are not supported

Information About SRTP-SRTP Interworking

From Cisco IOS XE Everest Release 16.5.1b onwards, when SRTP is enabled, by default Cisco Unified Border Element supports secure calls between networks using different cipher suites. The cipher suites supported for SRTP-SRTP interworking with default preference order is as follows:

- AEAD_AES_256_GCM
- AEAD_AES_128_GCM
- AES_CM_128_HMAC_SHA1_80
- AES_CM_128_HMAC_SHA1_32
CUBE allows you to change the list of preference order of the cipher-suites. Cipher-suite preference can be configured globally (under `voice service voip >> sip`), on a voice class tenant, or on a dial-peer.

The preference range is from 1 to 4, where 1 represents highest preference. CUBE offers SRTP cipher-suites in SDP offer based on the preference configured. For SDP answer, the highest configured preference cipher-suite that matches the offer from peer is selected.

### Supplementary Services Support

The following supplementary services are supported:

- Midcall codec change with voice class codec configuration
- Reinvite-based call hold and resume
- Music on hold (MoH) invoked from the Cisco Unified Communications Manager (Cisco UCM), where the call leg changes between SRTP and RTP for an MoH source
- Reinvite-based call forward and call transfer
- Call transfer based on a REFER message, with local consumption or pass-through of the REFER message on the CUBE
- Call forward based on a 302 message, with local consumption or pass-through of the 302 message on the CUBE
- T.38 fax switchover
- Fax pass-through switchover

For call transfers involving REFER and 302 messages (messages that are locally consumed on CUBE), end-to-end media renegotiation is initiated from CUBE only when you configure the `supplementary-service media-renegotiate` command in voice service voip configuration mode.
When supplementary services are invoked from the end points, the call can switch between SRTP and RTP during the call duration. Hence, Cisco recommends that you configure such SIP trunks for SRTP fallback. For information on configuring SRTP fallback, refer Enabling SRTP Fallback, on page 525.

How to Configure SRTP-SRTP Interworking

Configuring SRTP

SUMMARY STEPS

1. enable
2. configure terminal
3. dial-peer voice tag voip
4. destination-pattern string
5. session protocol sipv2
6. session target ipv4:destination-address
7. incoming called-number string
8. srtp
9. codec codec
10. end
11. dial-peer voice tag voip
12. Repeat Steps 4, 5, 6, and 7 to configure a second dial peer.
13. srtp
14. codec codec
15. exit

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Defines a particular dial peer, to specify the method of voice encapsulation, and enters dial peer voice configuration mode.</td>
</tr>
<tr>
<td>dial-peer voice tag voip</td>
<td>• In the example, the following parameters are set:</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>• Dial peer 201 is defined.</td>
</tr>
<tr>
<td>Device(config)# dial-peer voice 201 voip</td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action | Purpose |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>VoIP is shown as the method of encapsulation.</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td><strong>destination-pattern</strong> <em>string</em></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# <strong>destination-pattern</strong> 5550111</td>
<td>Specifies either the prefix or the full E.164 telephone number to be used for a dial peer string.</td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td><strong>session protocol</strong> <em>sipv2</em></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# <strong>session protocol</strong> sipv2</td>
<td>Specifies a session protocol for calls between local and remote routers using the packet network.</td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td><strong>session target</strong> <em>ipv4:destination-address</em></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# <strong>session target</strong> ipv4:10.13.25.102</td>
<td>Designates an IP address where calls will be sent.</td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td><strong>incoming called-number</strong> <em>string</em></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# <strong>incoming called-number</strong> 5550111</td>
<td>Specifies a digit string that can be matched by an incoming call to associate the call with a dial peer.</td>
</tr>
<tr>
<td><strong>Step 8</strong></td>
<td><strong>srtp</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# <strong>srtp</strong></td>
<td>Specifies that SRTP is used to enable secure calls for the dial peer.</td>
</tr>
<tr>
<td><strong>Step 9</strong></td>
<td><strong>codec</strong> <em>codec</em></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# <strong>codec</strong> g711ulaw</td>
<td>Specifies the voice coder rate of speech for the dial peer.</td>
</tr>
<tr>
<td><strong>Step 10</strong></td>
<td><strong>end</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# <strong>end</strong></td>
<td>Exits dial peer voice configuration mode.</td>
</tr>
<tr>
<td><strong>Step 11</strong></td>
<td><strong>dial-peer voice</strong> <em>tag voip</em></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config)# <strong>dial-peer voice</strong> 200 voip</td>
<td>Defines a particular dial peer, to specify the method of voice encapsulation, and enters dial peer voice configuration mode.</td>
</tr>
</tbody>
</table>

Specifies either the prefix or the full E.164 telephone number to be used for a dial peer string. |

In the example, 5550111 is specified as the pattern for the telephone number. |

In the example, the sipv2 keyword is configured so that the dial peer uses the SIP protocol. |

In the example, calls matching this outbound dial-peer will be sent to 10.13.25.102. |

In the example, 5550111 is specified as the pattern for the E.164 or private dialing plan telephone number. |

In the example, G.711 mu-law at 64,000 bps, is specified as the voice coder rate for speech. |

In the example, the following parameters are set: |

- Dial peer 200 is defined.
### Configuring Cipher Suite Preference (optional)

**Note**
No additional configurations are required if you want to configure the default preference order. Use the following procedure for changing the default preference.

#### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `voice class srtp-crypto tag`
4. `crypto preference cipher-suite`
5. `exit`

#### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> <code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> <code>enable</code></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> <code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> <code>configure terminal</code></td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 3</td>
<td>voice class srtp-crypto tag</td>
<td>Enters voice class configuration mode and assigns an identification tag for a srtp-crypto voice class.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config)# voice class srtp-crypto 100</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td>crypto preference cipher-suite</td>
<td>Specifies the preference for an SRTP cipher-suite that will be offered by Cisco Unified Border Element (CUBE) in the SDP in offer and answer.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-class)# crypto 1 AEAD_AES_256_GCM</td>
<td>You can configure a maximum of four preferences.</td>
</tr>
<tr>
<td>Step 5</td>
<td>exit</td>
<td>Exists the present configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-class)# exit</td>
<td></td>
</tr>
</tbody>
</table>

**Example**

**What to do next**

Assign SRTP Crypto voice class globally, or on a voice-class tenant, or on a dial-peer. For more information, see Applying Crypto Suite Selection Preference (optional), on page 523.

### Applying Crypto Suite Selection Preference (optional)

**Before you begin**

- Ensure that an srtp voice-class is created using the **voice class srtp-crypto crypto-tag** command

**SUMMARY STEPS**

1. enable
2. configure terminal
3. Apply crypto suite selection preference
   - In global configuration mode:
     - voice service voice
     - sip
     - srtp-crypto crypto-tag
   - In voice class tenant configuration mode:
     - voice class tenant tag
     - srtp-crypto crypto-tag
   - In dial-peer configuration mode:
• dial-peer voice tag voip
• voice-class sip srtp-crypto crypto-tag

4. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Assigns previously configured crypto-suite selection preference.</td>
</tr>
<tr>
<td>Apply crypto suite selection preference</td>
<td>The crypto-tag maps to the tag created using the voice class srtp-crypto command available in global configuration mode.</td>
</tr>
<tr>
<td>• In global configuration mode:</td>
<td></td>
</tr>
<tr>
<td>• voice service voice</td>
<td></td>
</tr>
<tr>
<td>• sip</td>
<td></td>
</tr>
<tr>
<td>• srtp-crypto crypto-tag</td>
<td></td>
</tr>
<tr>
<td>• In voice class tenant configuration mode:</td>
<td></td>
</tr>
<tr>
<td>• voice class tenant tag</td>
<td></td>
</tr>
<tr>
<td>• srtp-crypto crypto-tag</td>
<td></td>
</tr>
<tr>
<td>• In dial-peer configuration mode:</td>
<td></td>
</tr>
<tr>
<td>• dial-peer voice tag voip</td>
<td></td>
</tr>
<tr>
<td>• voice-class sip srtp-crypto crypto-tag</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>In global configuration mode:</td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice service voice</td>
<td></td>
</tr>
<tr>
<td>Device(conf-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td>Device(conf-serv-sip)# srtp-crypto 102</td>
<td></td>
</tr>
<tr>
<td>In voice class tenant configuration mode:</td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| Device(config)# voice class tenant 100  
Device(conf-serv-sip)# srtp-crypto 102 | In dial-peer configuration mode: |
| Device> enable  
Device# configure terminal  
Device(config)# dial-peer voice 300 voip  
Device(config-dial-peer)# voice-class sip srtp-crypto 102 | |

**Step 4**  
**Example:**  
Device(config-dial-peer)# exit  

**Enabling SRTP Fallback**

You can configure SRTP with the fallback option so that a call can fall back to RTP if SRTP is not supported by the other call end. Enabling SRTP fallback is required for supporting nonsecure supplementary services such as MoH, call forward, and call transfer.

**SUMMARY STEPS**

1. enable  
2. configure terminal  
3. Enter one of the following commands:
   - In dial-peer configuration mode
     
     dial-peer  
     voice  
     tag  
     voip  
     srtp  
     fallback (for interworking with devices other than Cisco Unified Communications Manager)  
     or  
     voice-class sip srtp negotiate cisco (Enable this CLI along with srtp fallback command to support SRTP fallback with Cisco Unified Communications Manager )
   - In global VoIP SIP configuration mode  
     voice service voip  
     sip
Enabling SRTP Fallback

```
srtp
fallback (for interworking with devices other than Cisco Unified Communications Manager)
or

srtp
negotiate cisco (Enable this CLI along with srtp fallback command to support SRTP fallback with Cisco Unified Communications Manager)
```

4. exit

## Detailed Steps

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
</tbody>
</table>

| **Step 2**        | Enters global configuration mode. |
| configure terminal| |
| **Example:**      | |
| Device# configure terminal | |

| **Step 3**        | Enables call fallback to nonsecure mode. |
| Enter one of the following commands: | |
| • In dial-peer configuration mode | |
| dial-peer | |
| voice | |
| tag | |
| voip | |
| srtp | |
| fallback (for interworking with devices other than Cisco Unified Communications Manager) | |
| or | |
| voice-class sip srtp | |
| negotiate cisco (Enable this CLI along with srtp fallback command to support SRTP fallback with Cisco Unified Communications Manager) | |
| • In global VoIP SIP configuration mode | |
| voice service voip | |
| sip | |
| srtp | |
| fallback (for interworking with devices other than Cisco Unified Communications Manager) | |
### Command or Action

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td><code>srtp negotiate cisco</code> (Enable this CLI along with <code>srtp fallback</code> command to support SRTP fallback with Cisco Unified Communications Manager)</td>
<td></td>
</tr>
</tbody>
</table>

**Example:**

```
Device(config)# dial-peer voice 10 voip
Device(config-dial-peer)# srtp fallback
```

**Example:**

```
Device(config)# dial-peer voice 10 voip
Device(config-dial-peer)# voice-class sip srtp negotiate Cisco
```

**Example:**

```
Device(config)# voice service voip
Device(config)# sip
Device(conf-voi-serv)# srtp fallback
```

**Example:**

```
Device(config)# voice service voip
Device(config)# sip
Device(conf-voi-serv)# srtp negotiate cisco
```

### Configuration Examples

**Example: Configuring SRTP-SRTP Interworking**

The following example shows how to configure support for SRTP-SRTP interworking. In this example, the incoming call leg preference is set to AES/AES_256_GCM crypto-suite and the outgoing call leg preference is set to AES_CM_128_HMAC_SHA1_80 crypto-suite.

Configure SRTP:

```
Device> enable
Device# configure terminal
Device(config)# dial-peer voice 300 voip
```

Exits present configuration mode and enters privileged EXEC mode.
Example: Configuring SRTP-SRTP Interworking

Create a voice class srtp-crypto 100 and assign AEAD_AES_256_GCM crypto-suite with highest preference:

```
Device(config)# voice class srtp-crypto 100
Device(config-class)# crypto 1 AEAD_AES_256_GCM
```

Assign srtp-crypto 100 on incoming dial-peer:

```
Device(config)# dial-peer voice 400 voip
Device(config-dial-peer)# voice-class sip srtp-crypto 100
Device(config-dial-peer)# codec g711ulaw
Device(config-dial-peer)# srtp
```

Create a voice class srtp-crypto 103 and assign AES_CM_128_HMAC_SHA1_80 crypto-suite with highest preference:

```
Device> enable
Device# configure terminal
Device(config)# voice class srtp-crypto 103
Device(config-class)# crypto 1 AES_CM_128_HMAC_SHA1_80
```

Assign srtp-crypto 103 on outgoing dial-peer:

```
Device(config)# dial-peer voice 400 voip
Device(config-dial-peer)# voice-class sip srtp-crypto 103
Device(config-dial-peer)# codec g711ulaw
Device(config-dial-peer)# srtp
```

```
Device# show sip-ua calls
Total SIP call legs: 2, User Agent Client: 1, User Agent Server: 1
SIP UAC CALL INFO
Call 1
SIP Call ID : 706E9625-C4FB11E6-8008AFC8-C0129831@10.25.15.63
State of the call : STATE_ACTIVE (7)
Substate of the call : SUBSTATE_NONE (0)
Calling Number : 61230
Called Number : 81560
Called URI : 
Bit Flags : 0xC04018 0x80000100 0x80
CC Call ID : 2
Local UUID : d5173c8551b25b06820edc687e50ab90
```
Remote UUID : 2e9094e33b815992a519f82abfae09d2
Source IP Address (Sig ): 10.25.16.63
Destn SIP Req Addr:Port : [10.13.25.102]:14560
Destn SIP Resp Addr:Port: [10.13.25.102]:14560
Destination Name :
Number of Media Streams : 1
Number of Active Streams: 1
RTP Fork Object : 0x0
Media Mode : flow-through
Media Stream 1
State of the stream : STREAM_ACTIVE
Stream Call ID : 2
Stream Type : voice+dtmf (1)
Stream Media Addr Type : 1
Negotiated Codec : g711ulaw (80 bytes)
Codec Payload Type : 0
Negotiated Dtmf-relay : rtp-nte
Dtmf-relay Payload Type : 101
QoS ID : -1
Local QoS Strength : BestEffort
Negotiated QoS Strength : BestEffort
Negotiated QoS Direction : None
Local QoS Status : None
Media Source IP Addr:Port: [10.25.15.63]:8002
Media Dest IP Addr:Port : [10.13.25.102]:14240
Local Crypto Suite : AES_CM_128_HMAC_SHA1_80
Remote Crypto Suite : AES_CM_128_HMAC_SHA1_80
Mid-Call Re-Assocation Count: 0
SRTP-RTP Re-Assocation DSP Query Count: 0

Options-Ping enabled: NO   active: NO
Number of SIP User Agent Client (UAC) calls: 1

SIP UAS CALL INFO
Call 1
SIP Call ID : 1-8614010.41.50.13
State of the call : STATE_ACTIVE (7)
Substate of the call : SUBSTATE_NONE (0)
Calling Number : 61230
Called Number : 81560
Called URI : sip:81560@10.13.25.102:5060
Bit Flags : 0xC0401C 0x10000100 0x4
CC Call ID : 1
Local UUID : 2e9094e33b815992a519f82abfae09d2
Remote UUID : d5173c8551b25b06820edc687e50ab90
Source IP Address (Sig ): 10.25.16.63
Destn SIP Req Addr:Port : [10.41.50.13]:14450
Destn SIP Resp Addr:Port: [10.41.50.13]:14450
Destination Name : 10.41.50.13
Number of Media Streams : 1
Number of Active Streams: 1
RTP Fork Object : 0x0
Media Mode : flow-through
Media Stream 1
State of the stream : STREAM_ACTIVE
Stream Call ID : 1
Stream Type : voice+dtmf (0)
Stream Media Addr Type : 1
Negotiated Codec : g711ulaw (80 bytes)
Codec Payload Type : 0
Negotiated Dtmf-relay : rtp-nte
Dtmf-relay Payload Type : 101
QoS ID : -1
Example: Changing the Cipher-Suite Preference

Specify SRTP cipher-suite preference:

Device> enable
Device# configure terminal
Device(config)# voice class srtp-crypto 100
Device(config-class)# crypto 1 AEAD_AES_256_GCM
Device(config-class)# crypto 2 AEAD_AES_128_GCM
Device(config-class)# crypto 4 AES_CM_128_HMAC_SHA1_32

The following is the snippet of `show running-config` command output showing the cipher-suite preference:

Device# show running-config
voice class srtp-crypto 100
crypto 1 AEAD_AES_256_GCM
crypto 2 AEAD_AES_128_GCM
crypto 4 AES_CM_128_HMAC_SHA1_32

If you want to change the preference 4 to AES_CM_128_HMAC_SHA1_80, execute the following command:

Device(config-class)# crypto 4 AES_CM_128_HMAC_SHA1_80

The following is the snippet of `show running-config` command output showing the change in cipher-suite:

Device# show running-config
voice class srtp-crypto 100
crypto 1 AEAD_AES_256_GCM
crypto 2 AEAD_AES_128_GCM
crypto 4 AES_CM_128_HMAC_SHA1_80

If you want to change the preference of AES_CM_128_HMAC_SHA1_80 to 3, execute the following commands:

Device(config-class)# no crypto 4
Device(config-class)# crypto 3 AES_CM_128_HMAC_SHA1_80
The following is the snippet of `show running-config` command output showing the cipher-suite preference overwritten:

```
Device# show running-config
voice class srtp-crypto 100
crypto 1 AEAD_AES_256_GCM
crypto 2 AEAD_AES_128_GCM
crypto 3 AES_CM_128_HMAC_SHA1_80
```
CHAPTER 43

SRTP-RTP Interworking

The Cisco Unified Border Element (CUBE) Support for SRTP-RTP Interworking feature allows secure network to non-secure network calls and provides operational enhancements for Session Initiation Protocol (SIP) trunks from Cisco Unified Call Manager and Cisco Unified Call Manager Express. Support for Secure Real-Time Transport Protocol (SRTP) to Real-Time Transport Protocol (RTP) interworking in a network is enabled for SIP-SIP audio calls.

- Feature Information for SRTP-RTP Interworking, on page 533
- Prerequisites for SRTP-RTP Interworking, on page 534
- Restrictions for SRTP-RTP Interworking, on page 534
- Information About SRTP-RTP Interworking, on page 534
- How to Configure Support for SRTP-RTP Interworking, on page 537
- Configuration Examples for SRTP-RTP Interworking, on page 545

Feature Information for SRTP-RTP Interworking

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Unified Border Element Support for SRTP-RTP Interworking</td>
<td>12.4(22)YB , 15.0(1)M Cisco IOS XE 3.1S</td>
<td>This feature allows secure to non-secure enterprise calls. Support for SRTP-RTP interworking between one or multiple Cisco Unified Border Elements is enabled for SIP-SIP audio calls.</td>
</tr>
<tr>
<td>Supplementary Services Support on CUBE for SRTP-RTP Calls</td>
<td>Cisco IOS 15.2(1)T Cisco IOS XE 3.7S</td>
<td>The SRTP-RTP Interworking feature was enhanced to support supplementary services for SRTP-RTP calls.</td>
</tr>
</tbody>
</table>
**Feature Information**

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for AEAD_AES_GCM_256 and AEAD_AES_GCM_128 crypto-suites</td>
<td>Cisco IOS XE Everest 16.5.1b</td>
<td>AEAD_AES_GCM_256 and AEAD_AES_GCM_128 crypto suites were added to support SRTP-RTP interworking.</td>
</tr>
</tbody>
</table>

---

**Prerequisites for SRTP-RTP Interworking**

- SRTP-RTP interworking is supported with Cisco Unified CallManager 7.0 and later releases.
- DSP resources are required for platforms running on Cisco IOS Releases. For more information on configuring DSP resources, see Transcoding.
- Platforms running on Cisco IOS XE Releases do not require DSP resources.

---

**Restrictions for SRTP-RTP Interworking**

- Asymmetric SRTP fallback configuration is not supported.
- Dial peer hunting is not supported.
- SRTCP-RTCP interworking is not supported on platforms running on Cisco IOS Releases.
- Video calls are not supported on platforms running on Cisco IOS Releases.
- More than one video m-line is not supported.
- DTMF interworking is not supported on ISR G2 (2900, 3900) series routers. It is supported only on platforms running on Cisco IOS XE Releases.

---

**Information About SRTP-RTP Interworking**

To configure support for SRTP-RTP interworking, you should understand the following concepts:

---

**Support for SRTP-RTP Interworking**

The Cisco Unified Border Element Support for SRTP-RTP Interworking feature connects SRTP Cisco Unified CallManager domains with the following:

- RTP Cisco Unified CallManager domains. Domains that do not support SRTP or have not been configured for SRTP, as shown in the figure below.

- RTP Cisco applications or servers. For example, Cisco Unified MeetingPlace, Cisco WebEx, or Cisco Unity, which do not support SRTP, or have not been configured for SRTP, or are resident in a secure data center, as shown in the figure below.

- RTP to third-party equipment. For example, IP trunks to PBXs or virtual machines, which do not support SRTP.
The Cisco Unified Border Element Support for SRTP-RTP Interworking feature connects SRTP enterprise domains to RTP SIP provider SIP trunks. SRTP-RTP interworking connects RTP enterprise networks with SRTP over an external network between businesses. This provides flexible secure business-to-business communications without the need for static IPsec tunnels or the need to deploy SRTP within the enterprise, as shown in the figure below.

SRTP-RTP interworking also connects SRTP enterprise networks with static IPsec over external networks, as shown in the figure below.

SRTP-RTP interworking on the CUBE in a network topology uses single-pair key generation. Existing audio and dual-tone multifrequency (DTMF) transcoding is used to support voice calls. SRTP-RTP interworking support is provided in both flow-through and high-density mode. There is no impact on SRTP-SRTP pass-through calls.

SRTP is configured on one dial peer using the \texttt{srtp} and \texttt{srtp fallback} commands. RTP is configured on the other dial peer. The dial peer configuration takes precedence over the global configuration on the CUBE.

Fallback handling occurs if one of the call endpoints does not support SRTP. The call can fall back to RTP-RTP, or the call can fail, depending on the configuration. Fallback takes place only if the \texttt{srtp fallback} command is configured on the respective dial peer. RTP-RTP fallback occurs when no transcoding resources are available for SRTP-RTP interworking.
Using SRTP-RTP Chain for Interworking Between AES_CM_128_HMAC_SHA1_32 and AES_CM_128_HMAC_SHA1_80 Crypto Suites

A single Cisco Unified Call Manager (CUCM) device cannot terminate a Secure Real-time Transport Protocol (SRTP) connection with an IP Phone using the AES_CM_128_HMAC_SHA1_32 crypto suite and initiate an SRTP connection with an external CUBE device with the AES_CM_128_HMAC_SHA1_80 crypto suite at the same time.

For Cisco Unified Call Manager (Unified Communications Manager) and IP Phone devices that support only AES_CM_128_HMAC_SHA1_32 crypto suite, the interim SRTP-RTP interworking solution that is described below can be implemented.

- CUCM or IP Phone side:
  - An SRTP connection using the AES_CM_128_HMAC_SHA1_32 crypto suite exists between the IP Phone and CUBE1.
  - An RTP connection exists between CUBE1 and CUBE2.

- SIP trunk side—An SRTP connection using the AES_CM_128_HMAC_SHA1_80 crypto suite is initiated by CUBE2 here. In the image below, CUBE2 is the border element on the Customer Network and SBC is the border element on the Service Provider Network.

Figure 50: SRTP-RTP Interworking Supporting AES_CM_128_HMAC_SHA1_32 crypto suite

Note

- AES_CM_128_HMAC_SHA1_32 to AES_CM_128_HMAC_SHA1_80 interworking is not supported up to Cisco IOS 15.5(3)M Release and Cisco IOS XE Everest 16.4.1 Release.

- From Cisco IOS XE Everest 16.5.1b Release onwards, SRTP-SRTP interworking is supported and therefore SRTP-RTP chain is not required.
Supplementary Services Support

The following supplementary services are supported:

- Midcall codec change with voice class codec configuration
- Reinvite-based call hold and resume
- Music on hold (MoH) invoked from the Cisco Unified Communications Manager (Cisco UCM), where the call leg changes between SRTP and RTP for an MoH source
- Reinvite-based call forward and call transfer
- Call transfer based on a REFER message, with local consumption or pass-through of the REFER message on the CUBE
- Call forward based on a 302 message, with local consumption or pass-through of the 302 message on the CUBE
- T.38 fax switchover
- Fax pass-through switchover

For call transfers involving REFER and 302 messages (messages that are locally consumed on CUBE), end-to-end media renegotiation is initiated from CUBE only when you configure the supplementary-service media-renegotiate command in voice service voip configuration mode.

When supplementary services are invoked from the end points, the call can switch between SRTP and RTP during the call duration. Hence, Cisco recommends that you configure such SIP trunks for SRTP fallback. For information on configuring SRTP fallback, refer Enabling SRTP Fallback, on page 525.

How to Configure Support for SRTP-RTP Interworking

Configuring SRTP-RTP Interworking Support

Note

From Cisco IOS XE Everest Release 16.5.1b onwards, the following crypto suites are enabled by default on the SRTP leg:

- AEAD_AES_256_GCM
- AEAD_AES_128_GCM
- AES_CM_128_HMAC_SHA1_80
- AES_CM_128_HMAC_SHA1_32

Use the following procedure for changing the default preference list.

Perform the task in this section to enable SRTP-RTP interworking support between one or multiple Cisco Unified Border Elements for SIP-SIP audio calls. In this task, RTP is configured on the incoming call leg and SRTP is configured on the outgoing call leg.
This feature is available only on Cisco IOS images with security package.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `dial-peer voice tag voip`
4. `destination-pattern string`
5. `session protocol sipv2`
6. `session target ipv4: destination-address`
7. `incoming called-number string`
8. `codec codec`
9. `end`
10. `dial-peer voice tag voip`
11. Repeat Steps 4, 5, 6, and 7 to configure a second dial peer.
12. `srtp`
13. `codec codec`
14. `exit`

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><strong>enable</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Enter your password if prompted.</td>
</tr>
<tr>
<td></td>
<td>Device&gt; enable</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td><strong>configure terminal</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Device# configure terminal</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td><strong>dial-peer voice tag voip</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Defines a particular dial peer, to specify the method of voice</td>
</tr>
<tr>
<td></td>
<td>encapsulation, and enters dial peer voice configuration mode.</td>
</tr>
<tr>
<td></td>
<td>- In the example, the following parameters are set:</td>
</tr>
<tr>
<td></td>
<td>- Dial peer 201 is defined.</td>
</tr>
<tr>
<td></td>
<td>- VoIP is shown as the method of encapsulation.</td>
</tr>
<tr>
<td></td>
<td>Device(config)# dial-peer voice 201 voip</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td><strong>destination-pattern string</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Specifies either the prefix or the full E.164 telephone number to be</td>
</tr>
<tr>
<td></td>
<td>used for a dial peer string.</td>
</tr>
<tr>
<td></td>
<td>- In the example, 5550111 is specified as the pattern for the</td>
</tr>
<tr>
<td></td>
<td>telephone number.</td>
</tr>
<tr>
<td></td>
<td>Device(config)# destination-pattern string 201</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Device(config-dial-peer)# destination-pattern 5550111</td>
<td>Specifies a session protocol for calls between local and remote routers using the packet network.</td>
</tr>
<tr>
<td><strong>Step 5</strong> session protocol sipv2</td>
<td>Specifies that SIP is used for session setup.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>In the example, the <strong>sipv2</strong> keyword is configured so that the dial peer uses the SIP protocol.</td>
</tr>
<tr>
<td>Device(config-dial-peer)# session protocol sipv2</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> session target ipv4: destination-address</td>
<td>Designates an IPv4 destination address where calls will be sent.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>In the example, calls matching this outbound dial-peer will be sent to 10.13.25.102.</td>
</tr>
<tr>
<td>Device(config-dial-peer)# session target ipv4:10.13.25.102</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> incoming called-number string</td>
<td>Specifies a digit string that can be matched by an incoming call to associate the call with a dial peer.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>In the example, 5550111 is specified as the pattern for the E.164 or private dialing plan telephone number.</td>
</tr>
<tr>
<td>Device(config-dial-peer)# incoming called-number 5550111</td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong> codec codec</td>
<td>Specifies the voice coder rate of speech for the dial peer.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>In the example, G.711 mu-law at 64,000 bps, is specified as the voice coder rate for speech.</td>
</tr>
<tr>
<td>Device(config-dial-peer)# codec g711ulaw</td>
<td></td>
</tr>
<tr>
<td><strong>Step 9</strong> end</td>
<td>Exits dial peer voice configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)#end</td>
<td></td>
</tr>
<tr>
<td><strong>Step 10</strong> dial-peer voice tag voip</td>
<td>Defines a particular dial peer, to specify the method of voice encapsulation, and enters dial peer voice configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>In the example, the following parameters are set:</td>
</tr>
<tr>
<td>Device(config)# dial-peer voice 200 voip</td>
<td>• Dial peer 200 is defined.</td>
</tr>
<tr>
<td></td>
<td>• VoIP is shown as the method of encapsulation.</td>
</tr>
<tr>
<td><strong>Step 11</strong> Repeat Steps 4, 5, 6, and 7 to configure a second dial peer.</td>
<td></td>
</tr>
<tr>
<td><strong>Step 12</strong> srtpt</td>
<td>Specifies that SRTP is used to enable secure calls for the dial peer.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# srtpt</td>
<td></td>
</tr>
<tr>
<td><strong>Step 13</strong> codec codec</td>
<td>Specifies the voice coder rate of speech for the dial peer.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# codec g711ulaw</td>
<td>In the example, G.711 mu-law at 64,000 bps, is specified as the voice coder rate for speech.</td>
</tr>
</tbody>
</table>

**Step 14**

exit

<table>
<thead>
<tr>
<th>Example:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Device(config-dial-peer)# exit</td>
<td>Exits dial peer voice configuration mode.</td>
</tr>
</tbody>
</table>

### Configuring Crypto Authentication

**Note**

Effective Cisco IOS XE Everest Releases 16.5.1b, `srtp-auth` command is deprecated. Although this command is still available in Cisco IOS XE Everest software, executing this command does not cause any configuration changes. Use `voice class srtp-crypto` command to configure the preferred cipher-suites for the SRTP call leg (connection). For more information, see SRTP-SRTP Interworking.

### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. Execute the commands based on your configuration mode
   - In dial-peer configuration mode:
     ```
     dial-peer voice tag voip
     voice-class sip srtp-auth {sha1-32 | sha1-80 | system}
     ```
   - In global VoIP SIP configuration mode:
     ```
     voice service voip
     sip
     srtp-auth {sha1-32 | sha1-80}
     ```
4. `end`

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
</tr>
<tr>
<td><code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
</tr>
<tr>
<td><code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
</tbody>
</table>
Purpose

Command or Action

Device# configure terminal

<table>
<thead>
<tr>
<th>Step 3</th>
<th>Execute the commands based on your configuration mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• In dial-peer configuration mode:</td>
</tr>
<tr>
<td></td>
<td>dial-peer voice  tag  voip</td>
</tr>
<tr>
<td></td>
<td>voice-class sip  srtp-auth  {sha1-32</td>
</tr>
<tr>
<td></td>
<td>• In global VoIP SIP configuration mode:</td>
</tr>
<tr>
<td></td>
<td>voice service voip</td>
</tr>
<tr>
<td></td>
<td>sip</td>
</tr>
<tr>
<td></td>
<td>srtp-auth  {sha1-32</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config)# dial-peer voice 15 voip</td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# voice-class sip srtp-auth</td>
</tr>
<tr>
<td></td>
<td>sha1-80</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config)# voice service voip</td>
</tr>
<tr>
<td></td>
<td>Device(conf-voi-serv)# sip</td>
</tr>
<tr>
<td></td>
<td>Device(conf-serv-sip)# srtp-auth sha1-80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 4</th>
<th>end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example:</td>
<td>Device(conf-serv-sip)# end</td>
</tr>
</tbody>
</table>

Ends the current configuration session and returns to privileged EXEC mode.

Enabling SRTP Fallback

You can configure SRTP with the fallback option so that a call can fall back to RTP if SRTP is not supported by the other call end. Enabling SRTP fallback is required for supporting nonsecure supplementary services such as MoH, call forward, and call transfer.

SUMMARY STEPS

1. enable
2. configure terminal
3. Enter one of the following commands:
   • In dial-peer configuration mode
     - dial-peer
     - voice
     - tag
     - voip
srtp
fallback (for interworking with devices other than Cisco Unified Communications Manager)

or

voice-class sip srtp
negotiate cisco (Enable this CLI along with srtp fallback command to support SRTP fallback with Cisco Unified Communications Manager)

• In global VoIP SIP configuration mode

voice service voip

sip

srtp
fallback (for interworking with devices other than Cisco Unified Communications Manager)

or

srtp
negotiate cisco (Enable this CLI along with srtp fallback command to support SRTP fallback with Cisco Unified Communications Manager)

4. exit

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> Enter one of the following commands:</td>
<td>Enables call fallback to nonsecure mode.</td>
</tr>
<tr>
<td>• In dial-peer configuration mode</td>
<td></td>
</tr>
<tr>
<td>dial-peer voice tag voip</td>
<td></td>
</tr>
<tr>
<td>srtp fallback (for interworking with devices other than Cisco Unified Communications Manager)</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td><code>voice-class sip srtp negotiate cisco</code> (Enable this CLI along with <code>srtp fallback</code> command to support SRTP fallback with Cisco Unified Communications Manager)</td>
<td>• In global VoIP SIP configuration mode</td>
</tr>
<tr>
<td><code>voice service voip</code></td>
<td></td>
</tr>
<tr>
<td><code>sip</code></td>
<td></td>
</tr>
<tr>
<td><code>srtp fallback</code> (for interworking with devices other than Cisco Unified Communications Manager)</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td><code>srtp negotiate cisco</code> (Enable this CLI along with <code>srtp fallback</code> command to support SRTP fallback with Cisco Unified Communications Manager)</td>
<td></td>
</tr>
</tbody>
</table>

**Example:**

```
Device(config)# dial-peer voice 10 voip
Device(config-dial-peer)# srtp fallback
```

**Example:**

```
Device(config)# dial-peer voice 10 voip
Device(config-dial-peer)# voice-class sip srtp negotiate cisco
```

**Example:**

```
Device(config)# voice service voip
Device(config)# sip
Device(conf-voi-serv)# srtp fallback
```

**Example:**

```
Device(config)# voice service voip
Device(config)# sip
Device(conf-voi-serv)# srtp negotiate cisco
```

**Step 4**

**Example:**

```
Device(conf-voi-serv)# exit
```

Exits present configuration mode and enters privileged EXEC mode.
Troubleshooting Tips

The following commands help in troubleshooting SRTP-RTP supplementary services support:

- `debug cesip all`
- `debug voip ccapi inout`

Verifying SRTP-RTP Supplementary Services Support

Perform this task to verify the configuration for SRTP-RTP supplementary services support.

**SUMMARY STEPS**

1. `enable`
2. `show call active voice brief`

**DETAILED STEPS**

**Step 1**  
`enable`  
Enables privileged EXEC mode.  
**Example:**

```
Device> enable
```

**Step 2**  
`show call active voice brief`  
Displays call information for voice calls in progress.  
**Example:**

```
Device# show call active voice brief
Telephony call-legs: 0
SIP call-legs: 2
H323 call-legs: 0
Call agent controlled call-legs: 0
SCCP call-legs: 2
ulticast call-legs: 0
Total call-legs: 4
0 : 1 12:49:45.256 IST Fri Jun 3 2011.1 +29060 pid:1 Answer 10008001 connected
dur 00:01:19 tx:1653/271092 rx:2831/464284 dscp:0 media:a
IP 10.45.40.40:7892 SRTP: on rtt:0ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g711ulaw TextRelay: off
media inactive detected:n media contrl rcvd:n/a timestamp:n/a
long duration call detected:n long duration call duration:n/a timestamp:n/a

0 : 2 12:49:45.256 IST Fri Jun 3 2011.2 +29060 pid:22 Originate 20009001 connected
dur 00:01:19 tx:2831/452960 rx:1653/264480 dscp:0 media:0
IP 10.45.40.40:7893 SRTP: off rtt:0ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g711ulaw TextRelay: off
media inactive detected:n media contrl rcvd:n/a timestamp:n/a
long duration call detected:n long duration call duration:n/a timestamp:n/a

0 : 3 12:50:14.326 IST Fri Jun 3 2011.1 +0 pid:0 Originate connecting
dur 00:01:19 tx:2831/452960 rx:1653/264480 dscp:0 media:0
IP 10.45.34.252:2000 SRTP: off rtt:0ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g711ulaw TextRelay: off
media inactive detected:n media contrl rcvd:n/a timestamp:n/a
```
Configuration Examples for SRTP-RTP Interworking

Example: SRTP-RTP Interworking

The following example shows how to configure support for SRTP-RTP interworking. In this example, the incoming call leg is RTP and the outgoing call leg is SRTP.

```
%SYS-5-CONFIG_I: Configured from console by console
dial-peer voice 201 voip
   destination-pattern 5550111
   session protocol sipv2
   session target ipv4:10.13.25.102
   incoming called-number 5550112
   codec g711ulaw
!
dial-peer voice 200 voip
   destination-pattern 5550112
   session protocol sipv2
   session target ipv4:10.13.2.51
   incoming called-number 5550111
   srtp
   codec g711ulaw
```

Example: Configuring Crypto Authentication

Note

Effective Cisco IOS XE Everest Releases 16.5.1b, `srtp-auth` command is deprecated. Although this command is still available in Cisco IOS XE Everest software, executing this command does not cause any configuration changes. Use `voice class srtp-crypto` command to configure the preferred cipher-suites for the SRTP call leg (connection). For more information, see SRTP-SRTP Interworking.

Example: Configuring Crypto Authentication (Dial Peer Level)

The following example shows how to configure Cisco UBE to support an SRTP connection using the AES_CM_128_HMAC_SHA1_80 crypto suite at the dial peer level:

```
Device> enable
Device# configure terminal
Device(config)# dial-peer voice 15 voip
```
Example: Configuring Crypto Authentication (Global Level)

The following example shows how to configure Cisco UBE to support an SRTP connection using the AES_CM_128_HMAC_SHA1_80 crypto suite at the global level:

```
Device> enable
Device# configure terminal
Device(config)# voice service voip
Device(config-voi-serv)# sip
Device(config-serv-sip)# srtp-auth sha1-80
Device(config-serv-sip)# end
```
SRTP-SRTP Pass-Through

SRTP-SRTP pass-through feature allows pass-through of encrypted media from one call-leg to the other.

- Feature Information for Support of SRTP-SRTP Pass-Through Calls, on page 547
- Information About SRTP-SRTP Pass-Through, on page 548
- Configure Pass-Through of Unsupported Crypto Suites for a Specific Dial Peer, on page 549
- Configure Pass-Through of Unsupported Crypto Suites Globally, on page 551
- Configuration Examples for SRTP-SRTP Pass-Through, on page 552

Feature Information for Support of SRTP-SRTP Pass-Through Calls

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for SRTP-SRTP Basic calls</td>
<td>12.4.15XZ</td>
<td>This feature introduced support for basic SRTP-SRTP pass-through calls.</td>
</tr>
<tr>
<td>Support for AES_CM_128_HMAC_SHA1_80 crypto suite</td>
<td>Cisco IOS 15.4(1)T Cisco IOS XE 3.11S</td>
<td>Support AES_CM_128_HMAC_SHA1_80 crypto suite on the Session Initiation Protocol (SIP) Trunk interface was introduced. The following commands were introduced or modified: <code>show sip-ua srtp, srtp-auth</code> and <code>voice-class sip srtp-auth</code>.</td>
</tr>
<tr>
<td>Feature Name</td>
<td>Releases</td>
<td>Feature Information</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
| Enhanced Support for SRTP-SRTP Pass-Through | Cisco IOS 15.6(1)T Cisco IOS XE 3.17S | Introduced support for pass-through of the following unsupported crypto suites:  
  - AEAD_AES_128_GCM  
  - AEAD_AES_256_GCM  
  - AEAD_AES_128_CCM  
  - AEAD_AES_256_CCM  
  
  The `srt` command was modified to add `pass-thru` keyword. |

## Information About SRTP-SRTP Pass-Through

Cisco Unified Border Element supports SIP calls between endpoints using Transport Layer Security (TLS) for SIP signaling encryption and Secure Real-Time Protocol (SRTP) to provide RTP media encryption. However, these two encryption mechanisms may not be deployed simultaneously, depending on the required call flow invoked on the associated configuration.

The following are conditions of the SRTP Pass-through feature:

- SRTP Pass-through must be configured on both legs of the call. If the target adjacency does not support SRTP Pass-through, then the call is rejected by error message 415 (Unsupported Media Type).
- "m=..RTP/SAVP.." and a="crypto:..." fields coming in on an Invite from one adjacency are passed on in an Invite to the target adjacency.
- "m=...RTP/SAVP..." is a required field in the Invite to trigger SRTP Pass-through behavior in the SBC.

## Pass-Through of Unsupported Crypto Suites

**Note**  
Effective from Cisco IOS XE Everest Release 16.5.1b, CUBE supports AEAD_AES_128_GCM and AEAD_AES_256_GCM crypto-suites. For more information, see [SRTP-SRTP Interworking](#).

CUBE supports transparent pass-through of all (supported and unsupported) crypto suites.

Until Cisco IOS Release 15.6(1)T and Cisco IOS XE Release 3.17S, CUBE and DSP supported SRTP pass-through only for AES_CM_128_HMAC_SHA1_80 crypto suite.

From Cisco IOS Release 15.6(1)T and Cisco IOS XE Release 3.17S onwards, CUBE supports pass-through of the following unsupported crypto suites:

- AEAD_AES_128_GCM  
- AEAD_AES_256_GCM  
- AEAD_AES_128_CCM
CUBE has the ability to pass across crypto attributes (containing any unsupported crypto suites) as well as media packets (encrypted with unsupported crypto suites).

If SRTP pass-thru feature is enabled, media interworking will not be supported. Ensure that you have symmetric configuration on both the incoming and outgoing dial-peers to avoid media-related issues.

**Configure Pass-Through of Unsupported Crypto Suites for a Specific Dial Peer**

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `dial-peer voice tag voip`
4. `destination-pattern string`
5. `session protocol sipv2`
6. `sessiontarget ipv4: destination-address`
7. `incoming called-number string`
8. `srtppass-thru`
9. `codec codec`
10. `end`
11. `dial-peer voice tag voip`
12. Repeat Steps 4, 5, 6, and 7 to configure a second dial peer.
13. `srtppass-thru`
14. `codec codec`
15. `exit`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
</tr>
<tr>
<td><code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device&gt; enable</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
</tr>
<tr>
<td><code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Device# configure terminal</code></td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| **Step 3**

dial-peer voice *tag* voip

*Example:*

Device(config)# dial-peer voice 201 voip

*Purpose:*

Defines a particular dial peer, to specify the method of voice encapsulation, and enters dial peer voice configuration mode.

- In the example, the following parameters are set:
  - Dial peer 201 is defined.
  - VoIP is shown as the method of encapsulation.

| **Step 4**

destination-pattern *string*

*Example:*

Device(config-dial-peer)# destination-pattern 5550111

*Purpose:*

Specifies either the prefix or the full E.164 telephone number to be used for a dial peer string.

- In the example, 5550111 is specified as the pattern for the telephone number.

| **Step 5**

session protocol sipv2

*Example:*

Device(config-dial-peer)# session protocol sipv2

*Purpose:*

Specifies a session protocol for calls between local and remote routers using the packet network.

- In the example, the sipv2 keyword is configured so that the dial peer uses the IETF SIP.

| **Step 6**

session target ipv4: *destination-address*

*Example:*

Device(config-dial-peer)# session target ipv4:10.13.25.102

*Purpose:*

Designates a network-specific address to receive calls from a VoIP or VoIPv6 dial peer.

- In the example, the IP address of the dial peer to receive calls is configured as 10.13.25.102.

| **Step 7**

incoming called-number *string*

*Example:*

Device(config-dial-peer)# incoming called-number 5550111

*Purpose:*

Specifies a digit string that can be matched by an incoming call to associate the call with a dial peer.

- In the example, 5550111 is specified as the pattern for the E.164 or private dialing plan telephone number.

| **Step 8**

srtp pass-thru

*Example:*

Device(config-dial-peer)# srtp pass-thru

*Purpose:*

Enables transparent passthrough of all crypto suites for a specific dial peer.

| **Step 9**

codec *codec*

*Example:*

Device(config-dial-peer)# codec g711ulaw

*Purpose:*

Specifies the voice coder rate of speech for the dial peer.

- In the example, G.711 mu-law at 64,000 bps, is specified as the voice coder rate for speech.

| **Step 10**

end

*Example:*

Device(config-dial-peer)# end

*Purpose:*

Exits dial peer voice configuration mode.
### Purpose

**Command or Action**

<table>
<thead>
<tr>
<th>Step 11</th>
<th><code>dial-peer voice tag voip</code></th>
</tr>
</thead>
</table>

**Example:**

```
Device(config)# dial-peer voice 200 voip
```

**Purpose:**

Defines a particular dial peer, to specify the method of voice encapsulation, and enters dial peer voice configuration mode.

- In the example, the following parameters are set:
  - Dial peer 200 is defined.
  - VoIP is shown as the method of encapsulation.

<table>
<thead>
<tr>
<th>Step 12</th>
<th>Repeat Steps 4, 5, 6, and 7 to configure a second dial peer.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Step 13</th>
<th><code>srtp pass-thru</code></th>
</tr>
</thead>
</table>

**Example:**

```
Device(config-dial-peer)# srtp pass-thru
```

**Purpose:**

Enables transparent passthrough of all crypto suites for a specific dial peer.

<table>
<thead>
<tr>
<th>Step 14</th>
<th><code>codec codec</code></th>
</tr>
</thead>
</table>

**Example:**

```
Device(config-dial-peer)# codec g711ulaw
```

**Purpose:**

Specifies the voice coder rate of speech for the dial peer.

- In the example, G.711 mu-law at 64,000 bps, is specified as the voice coder rate for speech.

<table>
<thead>
<tr>
<th>Step 15</th>
<th><code>exit</code></th>
</tr>
</thead>
</table>

**Example:**

```
Device(config-dial-peer)# exit
```

**Purpose:**

Exits dial peer voice configuration mode.

### Configure Pass-Through of Unsupported Crypto Suites Globally

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `voice service voip`
4. `srtp pass-thru`
5. `end`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Step 1</th>
<th><code>enable</code></th>
</tr>
</thead>
</table>

**Example:**

```
Device> enable
```

**Purpose:**

Enables privileged EXEC mode.

- Enter your password if prompted.
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 2**
configure terminal
Example:
Device# configure terminal | Enters global configuration mode. |
| **Step 3**
voice service voip
Example:
Device(config)# voice service voip | Enters VoIP voice-service configuration mode. |
| **Step 4**
srtp pass-thru
Example:
Device(config-dial-peer)# srtp pass-thru | Enables transparent passthrough of all crypto suites globally. |
| **Step 5**
end
Example:
Device(config-dial-peer)# end | Exits dial peer voice configuration mode. |

**Configuration Examples for SRTP-SRTP Pass-Through**

**Example for SRTP=SRTP Pass-Through**

```
enable
configure terminal
dial-peer voice 201 voip
destination-pattern 5550111
session protocol sipv2
session target ipv4:10.13.25.102
incoming called-number 5550111
srtp
codec g711ulaw
end
dial-peer voice 200 voip
destination-pattern 5550111
session protocol sipv2
session target ipv4:10.13.25.101
incoming called-number 5550111
srtp
codec g711ulaw
end
```

**Example for Pass-Through of Unsupported Crypto Suites for a specific dial peer**

```
enable
configure terminal
```
dial-peer voice 201 voip
destination-pattern 5550111
session protocol sipv2
session target ipv4:10.13.25.102
incoming called-number 5550111
srtp pass-thru
codec g711ulaw
end

dial-peer voice 200 voip
destination-pattern 5550111
session protocol sipv2
session target ipv4:10.13.25.101
incoming called-number 5550111
srtp pass-thru
codec g711ulaw
end

Example for Pass-Through of Unsupported Crypto Suites Globally

enable
configure terminal
voice service voip
srtp pass-thru
end
Configuration Examples for SRTP-SRTP Pass-Through
PART XIII

High Availability

• CUBE High Availability Overview, on page 557
• DSP High Availability Support, on page 563
• Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices, on page 567
• CVP Survivability TCL support with High Availability, on page 581
CUBE High Availability Overview

High Availability (HA) is a feature that ensures the availability of resources in a computer system, in case of component failures in the system. The unique hardware and software architecture of the Cisco ASR1000 Series, Cisco ISR G2 and Cisco ISR 4000 Series routers is designed to maximize router uptime during any network event, and thereby provide maximum uptime and resilience within any network scenario.

Figure 51: CUBE High Availability

The diagram above illustrates the CUBE's HA feature that allows active calls to be preserved when a CUBE router experiences an outage.

This chapter provides a brief overview of the different types of high availability (HA) options on the Cisco routers for the CUBE Enterprise edition.

- Information About High Availability, on page 557
- Restrictions for CUBE High Availability, on page 561

Information About High Availability

Inbox versus Box-to-Box Redundancy

Refer to the next section in this document. For detailed information about inbox and box-to-box redundancies, refer to the chapter titled “Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices” in the Cisco Unified Border Element Configuration Guide.

Route Processor Redundancy

Route Processor Redundancy (RPR) allows you to configure a standby RP. When you configure RPR, the standby RP loads the Cisco IOS software on bootup and initializes itself in standby mode. In the event of a fatal error on the active RP, the system switches to the standby RP, which reinitializes itself as the active RP.
In this event, the entire system is rebooted, so the switchover with RPR is slower than with other High Availability switchover features such as Nonstop Forwarding/Stateful Switchover (NSF/SSO).

### Stateful Switchover

Stateful switchover (SSO) provides media preservation of calls and post-switchover teardown of calls, in case of active RP failure. This means that the CUBE calls would continue to be active even after the active RP card goes down (provided a redundant RP is present). The standby RP would become active and service new CUBE(ENT) calls. The context of the CUBE (ENT) calls that were switched over from the Active card would be present on the new active card. Hold/Resume or any other supplementary services will work after switchover. In SSO, both media and signaling session context are preserved on failover.

#### Note
The terms failover and switchover are used interchangeably.

### Nonstop Forwarding

Nonstop forwarding (NSF) helps to suppress routing flaps in devices that are enabled with stateful switchover (SSO), thereby reducing network instability. NSF allows for the forwarding of data packets to continue along known routes while the routing protocol information is being restored after a switchover. Non Stop Forwarding (NSF) works together with SSO and allows the routing protocols to reestablish their routing information by requesting their network neighbors to resend all of the routing information when a switchover occurs.

### HA Checkpointing

Checkpointing refers to the facility or architecture to implement stateful switchover (SSO). It provides the mechanisms to help synchronize state data between the active and standby route processors or chassis in a consistent, repeatable, and well-ordered manner.

From Cisco IOS Release 15.6(1)T and Cisco IOS-XE Release 3.17S onwards, checkpointing mechanism is enhanced to provide support for multimedia endpoints with larger SDP up to 6000 bytes. With the new enhancement, CUBE supports preservation of media up to a maximum of 6 m-lines/streams (audio, video, and application).

CUBE HA is enhanced to support the preservation of Record-Route and Contact header information. After SSO, all subsequent midcall SIP messages will be routed based on the correct Record-Route and Contact headers.

### CUBE High Availability Options

The CUBE HA implementation supports full stateful failover for active SIP-to-SIP calls. This means both media and signaling session information is preserved after switchover. The Cisco Unified Border Element (CUBE) provides three types of high availability (HA) options:

- **Inbox redundancy**—Supported only on ASR devices. Inbox redundancy with Stateful Switchover (SSO) mechanism provides redundancy within the same device. Some models of the ASR offer hardware redundancy within the box and some offer software redundancy.
• Hardware redundancy—Supports stateful failover from an active Enhanced Services Processor to a standby and from an active route processor to a standby on the same box. Cisco ASR1006 supports this type of failover.

• Software redundancy—Supports stateful failover from an active IOS process to a standby process, both running on the same route processor. This is different than the platforms running Cisco IOS such as the ISR G2 devices, where only one process can run on the operating system. Cisco ASR1001/1002/1004 supports this type of failover.

Figure 52: Inbox Redundancy

• L2 box-to-box redundancy (stateful failover of active calls)—ASR, ISR G2, and ISR G3 platforms support box-to-box HA. The redundancy protocols used are:
  • ASR—Redundancy Group (RG) infrastructure
  • ISR G2—Hot Standby Routing Protocol (HSRP)
  • ISR G3—Redundancy Group (RG) infrastructure

Figure 53: L2 Box-to-Box Redundancy

• Clustering with load balancing—Clustering is supported on ISR G2 and ASR devices. Clustering with load balancing provides local and geographical redundancies. Load balancing can be achieved using Cisco Unified SIP Proxy (CUSP) or using a Service Provider (SP) call agent.

Figure 54: Clustering with Load Balancing

Hot Standby Routing Protocol (ISR-G2 Devices)

The Cisco Unified Border Element (CUBE) provides high availability (HA) using box-to-box redundancy configurations when implemented on a Cisco ISR-G2 platform. CUBE box-to-box redundancy on ISR-G2 is based on the Hot Standby Routing Protocol (HSRP) router technology, and HSRP is specific to ISR-G2.
HSRP technology provides high network availability by routing IP traffic from hosts on networks without relying on the availability of any single router. HSRP is used in a group of routers for selecting an Active router and a Standby router. HSRP monitors both the inside and outside interfaces—if any interface goes down, the whole device is considered down, the standby device becomes active and takes over the responsibilities of the active router. Box-to-box high availability is supported using virtual IP addresses for the signaling and media. For more information about HA support using virtual IP addresses, refer to the section titled “Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices” in the CUBE Configuration Guide.

RG Infrastructure (ASR Devices)

On the ASR, box-to-box redundancy option (introduced in the previous section) uses the Redundancy Group (RG) Infrastructure to form an Active/Standby pair of routers. The Active/Standby pair share the same virtual IP address (VIP) and continually exchange status messages. CUBE session information is check-pointed across the Active/Standby pair of routers enabling the Standby router to take over immediately all CUBE call processing responsibilities if the Active router should go out of service. This redundancy option is supported on the ASR 1001/1002-X/1004 platforms, and with Cisco IOS XE 3.11S, it is also supported on ASR 1006 with a single route processor and an Embedded Services Processor (ESP). ASR 1006 supports both box-to-box and inbox redundancy, and you cannot switch between these two modes dynamically.

Box-to-box redundancy requires two identical ASR platforms on the same physical LAN. Redundancy Group (RG) Infra component provides the box-to-box communication infrastructure support between the two ASRs and will negotiate the final stable redundancy state. The RG Infra component provides:

- An HSRP-like protocol that negotiates the final redundancy state for each router by exchanging keepalive and hello messages between the two ASRs in pair (using the control interface).
- A transport mechanism for checkpointing the signaling and media state for each call from the ACTIVE to the STANDBY router (using the data interface).
- Configuration/management of the virtual IP (VIP) interface for the traffic interfaces (multiple traffic interfaces can be configured using the same RG).

Licensing implications and configuration details are not covered in this chapter. For information about HA, refer to the High Availability section in the CUBE Advanced guide.

Considerations for Choosing an HA Configuration

When considering HA design, the following VoIP aspects apply:

- Media preservation of active calls
- Calls that are currently being signaled
- Signaling protocol state preservation for active calls (supplementary services will work after switchover)
- Transcoded calls
- Calls using software MTP on the CUBE
- H323-to-SIP and H323-to-H323 calls
- Licensing implications
Restrictions for CUBE High Availability

- IPv6 is not supported on CUBE HA.
CHAPTER 46

DSP High Availability Support

Cisco Unified Border Element (CUBE) DSP High Availability support for SIP-to-SIP calls is added for Box-to-Box and Inbox configurations. Earlier, calls that required DSP resources were not checkpointed. As a result, both the media and signaling sessions were not preserved after switchover resulting in call failure.

**Note**

DSP HA is supported only for SIP-to-SIP calls.

- Feature Information for DSP High Availability Support on CUBE, on page 563
- Prerequisites for DSP High Availability, on page 564
- Features Supported with DSP High Availability, on page 564
- Restrictions for DSP High Availability, on page 564
- Troubleshooting DSP HA Support on CUBE, on page 565
- How to Configure High Availability, on page 565
- Configuration Examples for DSP HA, on page 565

## Feature Information for DSP High Availability Support on CUBE

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSP HA Support on CUBE</td>
<td>Cisco IOS 15.5(2)T</td>
<td>Provides DSP High availability support for SIP-to-SIP</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE 3.15S</td>
<td>calls on Box-to-Box and Inbox redundancies.</td>
</tr>
</tbody>
</table>

Table 58: Feature Information for DSP HA Support on CUBE
Prerequisites for DSP High Availability

- LTI Transcoding

- DSP HA is supported only on the following routers and its corresponding modules:
  - Cisco ISR G2 series (PVDM3)
  - Cisco ASR 1000 series (SPA-DSP)
  - Cisco ISR 4000 series (PVDM4)

- The same type and capacity DSP modules must be used in the Active and Standby CUBE devices (box-to-box)
- The DSP modules must be installed in the same slot and subslot in the Active and Standby CUBE devices (box-to-box)
- The Active and Standby CUBE devices must have the same DSPFARM configurations (box-to-box)

Features Supported with DSP High Availability

- Transcoding with Supplementary Services
- Voice Class Codec
- G.711 in-band -> RFC2833 (RTP-NTE) DTMF interworking variant
- SRTP-RTP Interworking (ISR-G2 only)
- Fax calls with transcoder invoked for codec mis-match

Restrictions for DSP High Availability

- Media flow-around calls are not supported.
- SDP passthrough calls are not supported.
- Audio Transrating is not supported.
- Call Progress Analysis is not supported.
- Dolby Noise Reduction (NR) and Acoustic Shock Protection (ASP) are not supported.
- All SCCP-based media resources (Conference bridge, Transcoding, HW MTP, and SW MTP) are not supported with Cisco Unified Border Element High Availability.
Troubleshooting DSP HA Support on CUBE

You can use the following debug commands to troubleshoot DSP HA:

- debug voip dsmp all
- debug voip dsm all
- debug ccsip message
- debug voip ipipgw
- debug voip ipipgw high-availability
- debug voip high-availability all
- debug media resource provisioning all
- debug dsp-resource-manager flex dspfarm
- debug dsp-resource-manager flex function
- debug dsp-resource-manager flex error

How to Configure High Availability

The Cisco Unified Border Element (CUBE) provides high availability (HA) through box-to-box redundancy configurations when implemented on a Cisco Integrated Services Router Generation 2 router (ISR G2) platform. CUBE box-to-box redundancy is achieved using the router-based Hot Standby Routing Protocol (HSRP) router technology.

To configure DSP HA, follow the general configuration procedure for HA at Cisco Unified Border Element High Availability (HA) Using HSRP Configuration Example.

Configuration Examples for DSP HA

Active Configuration

-------------
voice-card 0
dsp services dspfarm
dspfarm profile 2 transcode universal
codec g711ulaw
codec g711alaw
codec g729ar8
codec g729abr8
maximum sessions 100
associate application CUBE
Standby Configuration

----------------------
voice-card 0
dsp services dspfarm
dspfarm profile 2 transcode universal
codec g711ulaw
codec g711alaw
codec g729ar8
codec g729abr8
maximum sessions 100
associate application CUBE

The following examples show the DSP HA output for the active and standby configurations:

On Active:

Mang-Active#show dspfarm dsp active

<table>
<thead>
<tr>
<th>SLOT</th>
<th>DSP VERSION</th>
<th>STATUS</th>
<th>CHNL</th>
<th>USE</th>
<th>TYPE</th>
<th>RSC_ID</th>
<th>BRIDGE_ID</th>
<th>PKTS_TXED</th>
<th>PKTS_RXED</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>13</td>
<td>39.0.0</td>
<td>UP</td>
<td></td>
<td>xcode</td>
<td>1</td>
<td>0</td>
<td>3005</td>
<td>3007</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>39.0.0</td>
<td>UP</td>
<td></td>
<td>xcode</td>
<td>1</td>
<td>0</td>
<td>3004</td>
<td>3005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Total number of DSPFARM DSP channel(s) 1

On Standby:

Mang-Standby#show dspfarm dsp active

<table>
<thead>
<tr>
<th>SLOT</th>
<th>DSP VERSION</th>
<th>STATUS</th>
<th>CHNL</th>
<th>USE</th>
<th>TYPE</th>
<th>RSC_ID</th>
<th>BRIDGE_ID</th>
<th>PKTS_TXED</th>
<th>PKTS_RXED</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>13</td>
<td>39.0.0</td>
<td>UP</td>
<td></td>
<td>xcode</td>
<td>1</td>
<td>0</td>
<td>3005</td>
<td>3007</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>39.0.0</td>
<td>UP</td>
<td></td>
<td>xcode</td>
<td>1</td>
<td>0</td>
<td>3004</td>
<td>3005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Total number of DSPFARM DSP channel(s) 1
CHAPTER 47

Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices

Stateful switchover provides protection for network edge devices with dual Route Processors (RPs) that represent a single point of failure in the network design, and where an outage might result in loss of service for customers.

• Feature Information for Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices, on page 567
• Prerequisites for Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices, on page 568
• Restrictions for Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices, on page 569
• Information About Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices, on page 569

Feature Information for Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stateful Switchover Between Redundancy Paired Intra or Inter-box Devices</td>
<td>Cisco IOS XE Release 3.2S</td>
<td>Provides protection for network edge devices with dual Route Processors (RPs) that represent a single point of failure in the network design, and where an outage might result in loss of service for customers.</td>
</tr>
<tr>
<td>Stateful Switchover Between Redundancy Paired Intra or Inter-box Devices</td>
<td>Cisco IOS Release 15.2(3)T</td>
<td>Provides protection for network edge devices with dual Route Processors (RPs) that represent a single point of failure in the network design, and where an outage might result in loss of service for customers.</td>
</tr>
<tr>
<td>Stateful Switchover Between Redundancy Paired Intra or Inter-box Devices (Call Escalation and De-escalation with Stateful Switchover)</td>
<td>Cisco IOS XE Release 3.8S 15.3(1)T</td>
<td>Provides support for call escalation and de-escalation with stateful switchover.</td>
</tr>
</tbody>
</table>

Cisco IOS Release
15.2(3)T

Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices (Call Escalation and De-escalation with Stateful Switchover)
Prerequisites for Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices

Cisco Unified Border Element (Enterprise)

- Cisco IOS XE Release 3.2 or a later release must be installed and running on your Cisco ASR 1000 Series Router.

Cisco Unified Border Element

- Cisco IOS Release 15.2(3)T or a later release must be installed and running on your Cisco Unified Border Element.
Restrictions for Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices

- Call escalation and de-escalation are not supported in REFER consumption mode.
- Session Description Protocol (SDP) passthru calls are not supported.
- Secure Real-Time Transport Protocol (SRTP)-Real-Time Transport Protocol (RTP) internetworking between one or multiple CUBEis is not supported.
- SRTP passthrough is not supported.
- Resource Reservation Protocol (RSVP) is not supported.
- Alternative Network Address Types (ANAT) for IPv4 or IPv6 interworking is not supported.
- SDP passthrough calls are not supported for media forking.
- Media flow-around fork calls are not checkpointed.
- For high availability PROTECTED mode, redundancy group (RG) is not supported on cross-over cable. However, if cross-over cable is used and the connection flaps or if the RG link is connected using a switch and the switch resets, or if there is a switchover, then both the devices will go into PROTECTED mode resulting in no VoIP functionality.

Information About Stateful Switchover Between Redundancy Paired Intra- or Inter-box Devices

In specific Cisco networking devices that support dual RPs, stateful switchover takes advantage of Route Processor redundancy to increase network availability. When two route processors (RPs) are installed, one RP acts as the active RP, and the other acts as a backup, or standby RP. Following an initial synchronization between the two processors if the active RP fails, or is manually taken down for maintenance or removed, the standby RP detects the failure and initiates a switchover. During a switchover, the standby RP assumes control of the router, connects with the network interfaces, and activates the local network management interface and system console. Stateful switchover dynamically maintains Route Processor state information between them.

The following conditions and restrictions apply to the current implementation of SSO:

- Calls that are handled by nondefault session application (TCL/VXML) will not be checkpointed prebridge.
- Flow-through calls whose state has not been accurately checkpointed will be cleared with media inactivity-based clean up. This condition could occur if active failure happens when:
  - Some check point data has not yet been sent to the standby.
  - The call leg was in the middle of a transaction.
  - Flow around calls whose state has not been accurately checkpointed (due to either of the reasons mentioned above) can be cleared with the clear call voice causecode command.
For more information about the Stateful Switchover feature and for detailed procedures for enabling this feature, see the "Configuring Stateful Switchover" chapter of the Cisco IOS High Availability Configuration Guide, Release 12.2SR.

**Call Escalation with Stateful Switchover**

The call escalation workflow is as follows:

1. The call starts as an audio call between Phone A (video-capable) and Phone B (only audio-capable) registered to two different Cisco Unified Communications Manager (CUCM) clusters connected using Cisco Unified Border Element (Cisco UBE).
2. The call is then transferred to Phone C, which is a video-capable phone.
3. The media parameters within the reinvite are renegotiated end-to-end.
4. The call is escalated to a video call.

*Note*

If the Cisco UBE switchover happens at any instance, then audio calls will be preserved before escalation and video calls will be preserved after escalation.

**Call De-escalation with Stateful Switchover**

The call de-escalation workflow is as follows:

1. The call starts as a video call between Phone A and Phone B registered to two different Cisco Unified Communications Manager (CUCM) clusters connected using Cisco Unified Border Element (Cisco UBE).
2. The call is then transferred to Phone C, which is an audio-only phone.
3. The media parameters within the reinvite are renegotiated end-to-end.
4. The call is de-escalated to an audio-only call.

**Note**

If the Cisco UBE switchover happens at any instance, then video calls will be preserved before de-escalation and audio calls will be preserved after de-escalation.

**Figure 56: Call De-escalation**

---

**Media Forking with High Availability**

Media forking with high availability is supported on ISR G2 and ASR platforms. When a primary call is connected and a forked call-leg is established on an active Cisco UBE device, both the primary and the forked call-leg will be checkpointed in the standby Cisco UBE device. If the active device goes down, the standby device ensures that the forking call is active and is able to exchange further transactions with the recording server with preserved calls such as hold/resume, transfer, conference, and so on. A recording server is a Session Initiation Protocol (SIP) user agent that archives media for extended durations, providing search and retrieval of the archived media. The recording server is a storage place of the recorded session metadata.

The active and standby devices must have the same configurations for checkpointing to happen correctly. The recorder can be configured both ways with a media profile and directly on a media class. The media profile can be associated under media class, and the media class can be applied to the incoming or outgoing dial-peer to start recording.

For more information, see the “Network-based Recording Using Cisco UBE” module in the *Cisco Unified Border Element Protocol-Independent Features and Setup Configuration Guide*. 
High Availability Protected Mode and Box-to-Box Redundancy for ASR

To configure box-to-box high availability (HA) support for ASRs, use the `mode rpr` command (rpr is route processor redundancy) in `redundancy` configuration mode.

---

**Note**

- Use the same hardware for both the ASR boxes in the active or standby pair to ensure compatibility before and after failover.
- A separate physical interface must be used for checkpointing calls between the active and standby devices.

Self-reload in a voice HA-enabled device helps to recover the box-to-box HA pair from out-of-sync conditions. Instead of self-reload, you can configure the device to transition into protected mode. In protected mode:

- Bulk sync request, call checkpointing, and incoming call processing are disabled.
- The device in protected mode needs to be manually reloaded to come out of this state.

To enabled the protected mode, use the `no redundancy-reload` command under “voice service voip” configuration mode. The default is `redundancy-reload`, which reloads control when the redundancy group (RG) fails.

Support for Box-to-Box High Availability with Virtual IP Addresses

The OPTIONS ping with CUBE high availability feature adds the ability to match the incoming dial-peer in the context of the OPTIONS message, allowing response with the virtual IP address shared between the active and standby CUBEs. Box-to-box high availability is supported using virtual IP addresses for the signaling and media, by enhancing the CUBE response to an inbound OPTIONS ping message. This is possible because dial-peer matching of a request URI that does not have a user part is supported.

**Note**

For configuration examples, see the Examples section about configuring interfaces (ISR and ASR) and configuring SIP binding.

Monitoring Call Escalation and De-escalation with Stateful Switchover

Perform this task to monitor calls before and after escalation or de-escalation and before and after stateful switchover on active and standby Cisco UBE devices. The `show` commands can be entered in any order.

**SUMMARY STEPS**

1. enable
2. show call active voice compact
3. show call active video compact
4. show call active voice stats
5. show call active video stats
DETAILED STEPS

Step 1  enable
Enables privileged EXEC mode.

Example:
Device> enable

Step 2  show call active voice compact
Displays a compact version of call information for the voice calls in progress.

Example:
Device# show call active voice compact
<callID> A/O FAX T<sec> Codec type Peer Address IP R<ip>:<udp>
Total call-legs: 2
512 ANS T1 g711ulaw VOIP Psipp 9.45.38.39:6016
513 ORG T1 g711ulaw VOIP P123 10.104.46.222:6000

Step 3  show call active video compact
Displays a compact version of call information for the video calls in progress.

Example:
Device# show call active video compact
<callID> A/O FAX T<sec> Codec type Peer Address IP R<ip>:<udp>
Total call-legs: 2
512 ANS T19 H263 VOIP-VIDEO Psipp 9.45.38.39:1699
513 ORG T19 H263 VOIP-VIDEO P123 10.104.46.222:1697

Step 4  show call active voice stats
Displays information about digital signal processing (DSP) voice quality metrics.

Example:
Device# show call active voice stats
dur 00:00:16 tx:2238/85044 rx:1618/61484 dscp:0 media:0 audio tos:0XB8 video tos:0x0
IP 9.45.25.33:58300 SRTP: off rtt:0ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g711ulaw TextRelay: off
Transcoded: No
dur 00:00:16 tx:1618/61484 rx:2238/85044 dscp:0 media:0 audio tos:0xB8 video tos:0x0
IP 9.45.25.33:58400 SRTP: off rtt:0ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g711ulaw TextRelay: off
Transcoded: No

Step 5  show call active video stats
Displays information about digital signal processing (DSP) video quality metrics.

Example:
Device# show call active video stats
dur 00:00:00 tx:27352/1039376 rx:36487/1386506 dscp:0 media:0 audio tos:0xB8 video tos:0x88
IP 9.45.25.33:1697 SRTP: off rtt:0ms pl:0/0ms lost:0/0/0 delay:0/0/0ms H264 TextRelay: off Transcoded: No
dur 00:00:00 tx:36487/1386506 rx:27352/1039376 dscp:0 media:0 audio tos:0xB8 video tos:0x88
Monitoring Media Forking with High Availability

Perform this task to monitor media forking calls with high availability on active and standby Cisco UBE devices. The show commands can be entered in any order.

SUMMARY STEPS

1. enable
2. show call active voice compact
3. show voip rtp connections
4. show voip recmsp session
5. show voip rtp forking
6. show voip rtp forking

DETAILED STEPS

Step 1 enable
Enables privileged EXEC mode.

Example:
Device> enable

Step 2 show call active voice compact
Displays a compact version of call information for the voice calls in progress. In the output shown, the first and second connections are for the basic call and the third connection is for the forked leg.

Example:
Device# show call active voice compact
<callID> A/O FAX T<sec> Codec type Peer Address IP R<ip>:<udp>
Total call-legs: 3
4423 ANS T28 g711ulaw VOIP P9538390040 173.39.67.102:22792
4424 ORG T28 g711ulaw VOIP P708090 9.42.30.189:26300
4426 ORG T28 g711ulaw VOIP P9876 10.104.46.201:56356

Step 3 show voip rtp connections
Displays real-time transport protocol (RTP) named event packets. In the output shown, two additional call legs are shown on the Cisco UBE device. Both the active and standby devices will have the same number of connections.

Example:
Device# show voip rtp connections
VoIP RTP active connections :
No. CallId dstCallId LocalRTP RmtRTP LocalIP RemoteIP
1 4439 4440 16646 19022 10.104.46.251 173.39.67.102
2 4440 4439 16648 22950 9.42.30.213 9.42.30.189
Step 4  **show voip recmsp session**

Displays active recording Media Service Provider (MSP) session information. In the output shown, the fork leg details and the number of forking calls are displayed. Both the active and standby devices will have the same call information.

**Example:**

```
Device# show voip recmsp session
RECMSP active sessions:
MSP Call-ID AnchorLeg Call-ID ForkedLeg Call-ID
4441 4440 4442
Found 1 active sessions
```

Step 5  **show voip rtp forking**

Displays the RTP media-forking connections. In the output shown, on the active device, packets will be sent.

**Example:**

```
Device# show voip rtp forking
VoIP RTP active forks:
Fork 1
  stream type voice-only (0): count 0
  stream type voice+dtmf (1): count 0
  stream type dtmf-only (2): count 0
  stream type voice-nearend (3): count 1
  remote ip 10.104.46.201, remote port 36840, local port 16650
  codec g711ulaw, logical ssrc 0x53
  packets sent 30788, packets received 0
  stream type voice+dtmf-nearend (4): count 0
  stream type voice-farend (5): count 1
  remote ip 10.104.46.201, remote port 54754, local port 16652
  codec g711ulaw, logical ssrc 0x55
  packets sent 30663, packets received 0
  stream type voice+dtmf-farend (6): count 0
  stream type video (7): count 0
  stream type application (8): count 0
```

Step 6  **show voip rtp forking**

Displays the RTP media-forking connections. In the output shown, on the standby device, packets will not be sent. After the switchover happens, packets will be sent from the new active device.

**Example:**

```
Device# show voip rtp forking
VoIP RTP active forks:
Fork 1
  stream type voice-only (0): count 0
  stream type voice+dtmf (1): count 0
  stream type dtmf-only (2): count 0
  stream type voice-nearend (3): count 1
  remote ip 10.104.46.201, remote port 36840, local port 16650
  codec g711ulaw, logical ssrc 0x53
  packets sent 0, packets received 0
  stream type voice+dtmf-nearend (4): count 0
  stream type voice-farend (5): count 1
  remote ip 10.104.46.201, remote port 54754, local port 16652
  codec g711ulaw, logical ssrc 0x55
  packets sent 0, packets received 0
```
Verifying the High Availability Protected Mode

Perform this task to verify the configuration for high availability protected mode, assuming the local device is ACTIVE and the peer device went into PROTECTED mode.

SUMMARY STEPS

1. enable
2. show voice high-availability rf-client (active device)
3. show voice high-availability rf-client (standby device)

DETAILED STEPS

Step 1 enable
Example:
Router> enable
Enables privileged EXEC mode.

Step 2 show voice high-availability rf-client (active device)
Example:
Device# show voice high-availability rf-client
FUNCTIONING RF DOMAIN: 0x2
-----
RF Domain: 0x0
Voice HA Client Name: VOIP RF CLIENT
Voice HA RF Client ID: 1345
Voice HA RF Client SEQ: 128
My current RF state ACTIVE (13)
Peer current RF state DISABLED (1)
Current VOIP HA state [LOCAL / PEER] :
   [(ACTIVE (13) / UNKNOWN (0)]

-----
RF Domain: 0x2 [RG: 1]
Voice HA Client Name: VOIP RG CLIENT
Voice HA RF Client ID: 4054
Voice HA RF Client SEQ: 448
My current RF state ACTIVE (13)
Peer current RF state STANDBY HOT (8)
Current VOIP HA state [LOCAL / PEER] :
Step 3  
**show voice high-availability rf-client** (standby device)

**Example:**

```
Device# show voice high-availability rf-client

RF Domain: 0x0
Voice HA Client Name: VOIP RF CLIENT
Voice HA RF Client ID: 1345
Voice HA RF Client SEQ: 128
My current RF state ACTIVE (13)
Peer current RF state DISABLED (1)

Current VOIP HA state [LOCAL / PEER] :
  [(ACTIVE (13) / PROTECTED (0)]
```

```-----
RF Domain: 0x2 [RG: 1]
Voice HA Client Name: VOIP RG CLIENT
Voice HA RF Client ID: 4054
Voice HA RF Client SEQ: 448
My current RF state STANDBY HOT (8)
Peer current RF state ACTIVE (13)

Current VOIP HA state [LOCAL / PEER] :
  [PROTECTED (7) / ACTIVE (13)]
```

---

**Support for REFER and BYE/Also after Stateful Switch-Over**

REFER based supplementary services with high availability is supported post-stateful switchover on CUBE. Support is also provided for SIP-to-SIP BYE/Also calls.

Use the **show sip-ua handoff stats** command to display the call handoff statistics for calls handed off successfully after switchover. Following are the statistics displayed:

- Total number of calls handed off
- Total number of successful calls handoffs
- Total numbers of unsuccessful call handoffs

The following sample output displays the call handoff statistics:

```
2951-CUBE#show sip-ua handoff stats
Total Calls Handed Off    = 1
Successful Call Hand offs = 1
Un-Successful Call Hand offs = 0
2951-CUBE#
```

**Troubleshooting Tips**

Use the following commands to troubleshoot call escalation and de-escalation with stateful switchover:
• debug voip ccapi all
• debug voip ccapi service
• debug voice high-availability all
• debug voip rtp error
• debug voip rtp inout
• debug voip rtp high-availability
• debug voip rtp function
• debug ccsip all

Use the following commands to troubleshoot media forking support on high availability:
• debug ccsip all
• debug voip high-availability all
• debug voip ccapi inout
• debug voip recmsp all

Use the following commands to troubleshoot PROTECTED mode on high availability:
• debug voice high-availability rf
• debug voice high-availability inout
• debug redundancy progression
• debug redundancy application group faults all
• debug redundancy application group protocol all
• debug voip ccapi inout
• debug cch323 session
• debug cch323 function
• debug cch323 error
• debug ccsip all

Use the following debug commands to troubleshoot issues related to handling of REFER based supplementary services:
• debug ccsip verbose
• debug voip application all
• debug voip ccapi all
• debug voice high-availability all
Example: Configuring the Interfaces for ISR-G2 Devices

ISR-G2 (HSRP-based)

```
interface GigabitEthernet0/0/0
  ip address 10.10.25.14 255.255.255.0
duplex auto
keepalive
speed auto
standby delay minimum 30 reload 60
standby version 2
standby 0 ip 10.10.25.1
  standby 0 preempt
standby 0 priority 50
standby 0 track 2 decrement 10
standby 0 name SB
```

Example: Configuring the Interfaces for ASR Devices

ASR (RG Infra-based)

```
interface GigabitEthernet0/0/0
  ip address 10.13.25.190 255.255.0.0
negotiation auto
redundancy rii 1
redundancy group 1 ip 10.13.25.123 exclusive
```

Example: Configuring SIP Binding

```
dial-peer voice inbound-dial-peer-tag voip
  session protocol sipv2
  incoming uri from mydesturi
  voice-class sip call-route url
    voice-class sip bind control source-interface GigabitEthernet 0/0/0
! voice class uri mydesturi
  host abc.com
```
Example: Configuring SIP Binding
CHAPTER 48

CVP Survivability TCL support with High Availability

Call survivability features are supported in Cisco Unified Border Element (CUBE) high availability mode for all active calls handled by Cisco Voice Portal (CVP).

- Feature Information for CVP Survivability TCL support with High Availability, on page 581
- Prerequisites, on page 582
- Restrictions, on page 582
- Recommendations, on page 582
- CVP Survivability TCL support with High Availability, on page 582
- Configuring CVP Survivability TCL support with High Availability, on page 582

Feature Information for CVP Survivability TCL support with High Availability

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVP Survivability TCL support with High Availability</td>
<td>Cisco IOS 15.6(2)T, Cisco IOS XE Denali 16.3.1</td>
<td>This feature enables CUBE support call survivability features in CUBE high availability mode for all active calls handled by CVP.</td>
</tr>
</tbody>
</table>
Prerequisites

• CVP survivability TCL application is configured on incoming dial-peer

Restrictions

• If there is a courtesy callback (CCB) registered with CVP, then post switchover, CCB is not supported.
• Only call survivability TCL script is supported with CUBE high availability. Other TCL based services are not supported.
• Only the active calls will be checkpointed. (Calls which are connected - 200OK / ACK transaction completed). Calls in transition state will not be check pointed.

Recommendations

• Configure TCP session transport for the SIP trunk between CUBE and CVP.

CVP Survivability TCL support with High Availability

Contact Center Deployments use call survivability TCL script on CUBE to provide basic Call survivability services when downstream CVP nodes are not reachable. From Cisco IOS Release 15.6(2)T onwards, call survivability features are supported in CUBE High Availability mode. Post switchover, all events received on the calls handled by CVP are posted to Call Survivability TCL application for further processing. Thus, call survivability features are supported in CUBE high availability mode for all active calls handled by CVP.


Configuring CVP Survivability TCL support with High Availability

Existing configuration of applying the survivability TCL application on incoming dial-peer is sufficient. No additional configuration required.
PART XIV

ICE-Lite Support on CUBE

• ICE-Lite Support on CUBE, on page 585
ICE-Lite Support on CUBE

Interactive Connectivity Establishment (ICE) is a protocol for Network Address Translator (NAT) traversal for UDP-based multimedia sessions established with the offer-answer model. ICE makes use of the Session Traversal Utilities for NAT (STUN) protocol and its extension, Traversal Using Relay NAT (TURN), and can be used by any protocol utilizing the offer-answer model, such as the Session Initiation Protocol (SIP).

The ICE-Lite Support on CUBE feature enables the remote peers of CUBE (that may be behind a NAT and doing ICE) to use the ICE semantics in the session description protocol (SDP) and perform an offer-answer exchange of SDP messages. The CUBE can also interwork with endpoints that support or do not support ICE. ICE agents (devices) that are always attached to the public Internet have a special type of implementation called Lite. CUBE will be in ICE-lite mode only. CUBE supports the ICE-lite feature from Cisco IOS Release 15.5(2)S.

- Feature Information for ICE-Lite Support on CUBE, on page 585
- Restrictions for ICE-lite Support on CUBE, on page 586
- Information About ICE-Lite Support on CUBE, on page 586
- How to Configure ICE-Lite Support on CUBE, on page 588
- Additional References, on page 597

Feature Information for ICE-Lite Support on CUBE

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
Table 60: Feature Information for ICE-Lite Support on CUBE

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICE-Lite Support on CUBE</td>
<td>Cisco IOS 15.5(3)M</td>
<td>The ICE-Lite Support on CUBE feature enables the remote peers of CUBE (that may be behind a NAT and doing ICE) to use the ICE semantics in the session description protocol (SDP) and perform an offer-answer exchange of SDP messages. The CUBE can also interwork with endpoints that support or do not support ICE. ICE agents (devices) that are always attached to the public Internet have a special type of implementation called Lite. CUBE will be in ICE-lite mode only. The following commands were introduced or modified: <code>debug voip icelib</code>, <code>show voip ice global-stats</code>, <code>show voip ice instance call-id call-id</code>, <code>show voip ice summary</code>, and <code>stun usage ice</code></td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE 3.16S</td>
<td></td>
</tr>
</tbody>
</table>

Restrictions for ICE-lite Support on CUBE

The following features are not supported with ICE:

- IPv6
- Alternative Network Address Types (ANAT)
- ANAT-ICE interworking
- Media anti-trombone
- High availability support for video calls
- Codec Transparent
- SDP passthrough
- Media flow-around
- Resource Reservation Protocol (RSVP)
- SIP-to-TDM gateway support
- Media Termination Point (MTP)
- VXML and TCL Scripts

Information About ICE-Lite Support on CUBE

Characteristics

The following are some of the key characteristics of ICE-lite.

- A CLI configured for ICE-lite.
• Support for ICE-lite in the contact header with a media-tag option of REGISTER message (as per RFC 5768).

• ICE-lite feature is in compliance with section 4.2 of RFC 7584, with CUBE acting as ICE termination Back-to-Back UA.

• CUBE accepts Full ICE Offer and responds in ICE-lite mode.

• CUBE responds to mid call updates or early dialog updates with changes to SDP parameters, and which requires ICE to restart.

• For outbound offer from CUBE, a Session Description Protocol (SDP) with ICE-lite semantics is sent.

• ICE protocol verifies all types of media streams (audio, video, application media lines) and components (RTP, RTCP), wherever applicable.

### ICE Candidate

To execute ICE, an agent has to identify all of its address candidates. A candidate is a transport address—a combination of IP address and port for a transport protocol, such as UDP. A candidate can be derived from physical or logical network interfaces, or discoverable using STUN and TURN. A viable candidate is a transport address obtained directly from a local interface; such a candidate is called a host candidate. The local interface could be ethernet or WiFi, or it could be one that is obtained through a tunnel mechanism, such as a Virtual Private Network (VPN) or Mobile IP (MIP). In all cases, such a network interface appears to the agent as a local interface from which ports (and thus candidates) can be allocated.

**Note**

Refer to RFC 5245 for more information about ICE candidates.

### ICE Lite

ICE agents (devices) that are always attached to the public Internet have a special type of implementation called Lite. For ICE to be used in a call, both the endpoints (agents) must support it. An ICE agent that supports Lite neither gathers ICE candidates nor triggers ICE connectivity checks; however, the agent responds to connectivity checks and includes only host candidates for any media stream. An ICE agent that supports the lite mode is called an ICE-lite endpoint.

**Note**

Refer to RFC 5245 for more information about ICE-lite implementation and connectivity checks.

### High Availability Support with ICE

High availability (HA) is supported only for audio calls that use ICE. For video calls, as the size of SDP is larger, HA will not work. Some of the design considerations are the following:

• No new checkpoint module for ICE instance.

• ICE instance will be re-created on the standby device from SIP HA re-creation path by using source SDP, destination SDP, and configuration profile.
• As no information related to ICE is checkpointed, in the standby device, the ICE valid list (created after connectivity checks are done) is populated from currently used media address.

How to Configure ICE-Lite Support on CUBE

Configuring ICE on the CUBE

ICE lite can be configured under STUN, and the decision to use ICE for a session is based on the offer/answer. This configuration is used for outbound dial-peers of CUBE to decide whether to offer ICE in SDP or not. For an incoming offer, the decision to do ICE is based on what the remote end offers in SDP.

SUMMARY STEPS

1. enable
2. configure terminal
3. voice class stun-usage tag
4. stun usage ice lite
5. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice class stun-usage tag</td>
<td>Sets STUN usage global parameters, and enters voice class configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# voice class stun-usage 5</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> stun usage ice lite</td>
<td>Configures ICE in ICE-Lite mode.</td>
</tr>
<tr>
<td>Example: Device(config-class)# stun usage ice lite</td>
<td>• You can use the stun usage ice full command to configure ICE in ICE-Full mode.</td>
</tr>
<tr>
<td><strong>Step 5</strong> end</td>
<td>Returns to privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device(config-class)# end</td>
<td></td>
</tr>
</tbody>
</table>
Verifying ICE-Lite on the CUBE (Success Flow Calls)

The following `show` commands can be used to verify ICE for success flow calls. The `show` commands can be entered in any order.

**SUMMARY STEPS**

1. `show call active video compact`
2. `show voip rtp connections`
3. `show voip ice instance call-id call-id-1`
4. `show voip ice instance call-id call-id-2`
5. `show voip ice summary`
6. `show voip ice global-stats`

**DETAILED STEPS**

**Step 1**  
**show call active video compact**

*Example:*

```
Device# show call active video compact
<callID> A/O FAX T<sec> Codec type Peer Address IP R<ip>:<udp>
Total call-legs: 4
   25 ANS T189 H264 VOIP-VIDEO P8181 72.163.212.137:2328
   30 ORG T189 H264 VOIP-VIDEO P9191 9.45.46.16:8028
   35 ANS T189 H264 VOIP-VIDEO P8181 9.45.46.16:8008
   36 ORG T189 H264 VOIP-VIDEO P9191 72.163.212.163:2328
```

**Step 2**  
**show voip rtp connections**

The following sample output displays the VoIP RTP usage information and RTP active connections.

*Example:*

```
Device# show voip rtp connections
VoIP RTP Port Usage Information:
Media-Address Range Min Max Ports Available Reserved In-use
---------------------------------------------------------------
Global Media Pool 8000 48198 19999 101 20
------------------------------------------------------------------------
VoIP RTP active connections:
  No. CallId dstCallLocalRTP RmtRTP LocalIP        RemoteIP        MPSS
  1  25  30  8000  2326   10.104.45.107  72.163.212.137  NO
  2  26  31  8002  2328   10.104.45.107  72.163.212.137  NO
  3  27  32  8036  2454   10.104.45.107  72.163.212.137  NO
  4  28  33  8004  2330   10.104.45.107  72.163.212.137  NO
  5  29  34  8038  2352   10.104.45.107  72.163.212.137  NO
  6  30  25  8006  8016   9.45.46.16    9.45.46.16    NO
  7  31  26  8008  8028   9.45.46.16    9.45.46.16    NO
  8  32  27  8010  8030   9.45.46.16    9.45.46.16    NO
  9  33  28  8012  8032   9.45.46.16    9.45.46.16    NO
 10  34  29  8014  8034   9.45.46.16    9.45.46.16    NO
 11  35  36  8016  8006   9.45.46.16    9.45.46.16    NO
```
Verifying ICE-Lite on the CUBE (Success Flow Calls)

Found 20 active RTP connections

**Step 3**

**show voip ice instance call-id call-id-1**

The following sample output displays the active ICE sessions on the ICE-full and the ICE-lite legs where there are ICE negotiations.

**Example:**

```
Device# show voip ice instance call-id 25

Interactive Connectivity Check (ICE) Instance details:
Call-ID is 25
Instance is 0x7FC617FC0508
Overall ICE-State is COMPLETED
LocalAgent's mode is ICE-CONTROLLED
RemoteAgent's mode is ICE-CONTROLLING

m-line:1
-------
ICE-State: ACTIVE
NominatedPairs:
LocalIP 10.104.45.107 port 8000 type host RemoteIP 72.163.212.137 port 2326 type host

m-line:2
-------
ICE-State: ACTIVE
NominatedPairs:
LocalIP 10.104.45.107 port 8002 type host RemoteIP 72.163.212.137 port 2328 type host
LocalIP 10.104.45.107 port 8003 type host RemoteIP 72.163.212.137 port 2329 type host

m-line:3
-------
ICE-State: ACTIVE
NominatedPairs:
LocalIP 10.104.45.107 port 8036 type host RemoteIP 72.163.212.137 port 2454 type host

m-line:4
-------
ICE-State: ACTIVE
NominatedPairs:
LocalIP 10.104.45.107 port 8004 type host RemoteIP 72.163.212.137 port 2330 type host
LocalIP 10.104.45.107 port 8005 type host RemoteIP 72.163.212.137 port 2331 type host

m-line:5
-------
ICE-State: ACTIVE
NominatedPairs:
LocalIP 10.104.45.107 port 8038 type host RemoteIP 72.163.212.137 port 2332 type host

Total Rx STUN Bind Req 22
Total Tx STUN Bind Succ Resp 22
Total Tx STUN Bind failure resp 0
```

**Step 4**

**show voip ice instance call-id call-id-2**
The following sample output displays the idle ICE sessions on the ICE-lite and the ICE-lite legs where there are no ICE negotiations.

Example:

```
Device# show voip ice instance call-id 30
Interactive Connectivity Check (ICE) Instance details:
Call-ID is 30
Instance is 0x7FC617FC03F8
Overall ICE-State is RUNNING
Local Agent's mode is ICE-CONTROLLED
Remote Agent's mode is ICE-CONTROLLING
m-line:1
---------
ICE-State: IDLE
No candidate has been nominated
m-line:2
---------
ICE-State: IDLE
No candidate has been nominated
m-line:3
---------
ICE-State: IDLE
No candidate has been nominated
m-line:4
---------
ICE-State: IDLE
No candidate has been nominated
m-line:5
---------
ICE-State: IDLE
No candidate has been nominated
Total Rx STUN Bind Req 0
Total Tx STUN Bind Succ Resp 0
Total Tx STUN Bind failure resp 0
```

**Step 5**

**show voip ice summary**

The following sample output displays a summary of active ICE sessions.

Example:

```
Device# show voip ice summary
CALL-ID  ICE-STATE
--------  ------------
25        COMPLETED
30        RUNNING
35        RUNNING
36        COMPLETED
```

**Step 6**

**show voip ice global-stats**

The following sample output displays the global ICE statistics.

Example:
Device# show voip ice global-stats

Interactive Connectivity Establishment (ICE) global stats:
Total Rx Stun BindingRequests: 43
Total Tx Stun BindingSuccessResponses: 43
Total Tx Stun BindingErrorResponses: 0

ICE-Lite on CUBE (Error Flow Calls)

The following are the show command sample outputs followed by the system logs for error flow calls. The show commands can be entered in any order.

SUMMARY STEPS

1. show call active voice compact
2. show voip rtp connections
3. show voip ice instance call-id call-id
4. show voip ice instance call-id call-id
5. show voip ice summary
6. show voip ice global-stats

DETAILED STEPS

Step 1 show call active voice compact

Example:

Device# show call active video compact
<callID> A/O FAX T<sec> Codec type Peer Address IP R<ip>:<udp>
Total call-legs: 2
57 ANS T4 g711ulaw VOIP Padithyam 173.39.64.79:7078
58 ORG T4 g711ulaw VOIP P9191 72.163.212.163:2336

Step 2 show voip rtp connections

The following sample output displays the VoIP RTP usage information and RTP active connections.

Example:

Device# show voip rtp connections

VoIP RTP Port Usage Information:
Max Ports Available: 19999, Ports Reserved: 101, Ports in Use: 2

<table>
<thead>
<tr>
<th>Media-Address Range</th>
<th>Min</th>
<th>Max</th>
<th>Ports</th>
<th>Ports Available</th>
<th>Ports Reserved</th>
<th>In-use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Media Pool</td>
<td>8000</td>
<td>48198</td>
<td>19999</td>
<td>101</td>
<td>2</td>
<td>-------</td>
</tr>
</tbody>
</table>

VoIP RTP active connections:

<table>
<thead>
<tr>
<th>No.</th>
<th>CallID</th>
<th>dstCallLocalRTP</th>
<th>RmtRTP</th>
<th>LocalIP</th>
<th>RemoteIP</th>
<th>MPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>57</td>
<td>58</td>
<td>8040</td>
<td>7078</td>
<td>10.104.45.107</td>
<td>173.39.64.79</td>
</tr>
</tbody>
</table>
Step 3  \texttt{show voip ice instance call-id \textit{call-id}}

The following sample output displays the ICE sessions.

**Example:**

Device\#  \texttt{show voip ice instance call-id 57}

Interactive Connectivity Check(ICE) Instance details:
Call-ID is 57
Instance is 0x7FC617FC03F8
Overall ICE-State is RUNNING
LocalAgent's mode is ICE-CONTROLLED
RemoteAgent's mode is ICE-CONTROLLING
\texttt{m-line:1}
\texttt{---------}
ICE-State: IDLE
No candidate has been nominated

Total Rx STUN Bind Req 2
Total Tx STUN Bind Succ Resp 0
Total Tx STUN Bind failure resp 2

Step 4  \texttt{show voip ice instance call-id \textit{call-id}}

The following sample output displays the ICE sessions.

**Example:**

Device\#  \texttt{show voip ice instance call-id 58}

Interactive Connectivity Check(ICE) Instance details:
Call-ID is 58
Instance is 0x7FC617FC0508
Overall ICE-State is RUNNING
LocalAgent's mode is ICE-CONTROLLED
RemoteAgent's mode is ICE-CONTROLLING
\texttt{m-line:1}
\texttt{---------}
ICE-State: IDLE
No candidate has been nominated

Total Rx STUN Bind Req 2
Total Tx STUN Bind Succ Resp 0
Total Tx STUN Bind failure resp 2

Step 5  \texttt{show voip ice summary}

The following sample output displays a summary of active ICE sessions.

**Example:**

Device\#  \texttt{show voip ice summary}

\begin{tabular}{ll}
\hline
CALL-ID & ICE-STATE \\
\hline
57 & RUNNING \\
58 & RUNNING \\
\hline
\end{tabular}

Total number of sessions: 2
Step 6  

**show voip ice global-stats**

The following sample output displays the global ICE statistics.

**Example:**

```
Device# show voip ice global-stats

Interactive Connectivity Establishment(ICE) global stats:
Total Rx Stun BindingRequests : 47
Total Tx Stun BindingSuccessResponses: 43
Total Tx Stun BindingErrorResponses : 4

The following are the syslogs for invalid message integrity and for sending ICE-controlled parameter.

**Sys Log for invalid message integrity:**

```
004012: *Aug 8 14:25:30.876 IST: %CISCO_STUN-4-INVALID_MESSAGE_INTEGRITY: Invalid Message-Integrity attribute in the received STUN message on UDP IP address 10.104.45.107 port 8040 #STUN Message structure start###
Message Type : STUN_MSG_TYPE_BINDING_REQ
Magic Cookie : 2111A442
Transaction ID : 01C61B24C077331EDC27A5B
Mapped Address : Not Set/Present
User Name : Not Set/Present
Error code not present
Alternate Server : Not Set/Present
Realm : Not Set/Present
nonce : Not Set/Present
Xormapped Address : Not Set/Present
Server : Not Set/Present
ICE Priority : Not Set/Present
ICE Controlled : Not Set/Present
ICE Controlling : Not Set/Present
Cisco-flowdata :
cisco-flowdata is not present
Message Integrity : Not Set/Present
Finger Print : Not Set/Present
###STUN Message structure End###
```
STUN Message Length = 44
004030: *Aug 8 14:25:30.876 IST: /*-1/xxxxxxxxxxxx/STUN/Detail/stunEncodeMsgIntegrity: Successfully
Encoded MI attribute. Exit.
with success
004036: *Aug 8 14:25:30.876 IST: //57/91300134802E/STUN/Detail/stunSendMsgToNetwork: Message sending
from, 10.104.45.107:8040, to 173.39.64.79:7078
004037: *Aug 8 14:25:30.876 IST: //57/91300134802E/STUN/Detail/stunSendMsg: ** Sent Stun Packet to Network **

###STUN Message structure start###
**Message Type** : STUN_MSG_TYPE_BINDING_ERR_RESP
Magic Cookie : 2112A442
Transaction ID : 01CD61B24C077331EDC27A5B
Mapped Address : Not Set/Present
User Name : Not Set/Present

**Error Code** : Number = 400 ,Reason = Bad Request
Alternate Server : Not Set/Present
Realm : Not Set/Present
nonce : Not Set/Present
Xormapped Address : Not Set/Present
Server : Not Set/Present
ICE Priority : Not Set/Present
ICE Controlled : Not Set/Present
ICE Controlling : Not Set/Present
Cisco-flowdata : cisco-flowdata is not present
Message Integrity : D0E2E828944BF3D07CC5C06D026D8909B85EF3E9

004040: *Aug 8 14:25:30.876 IST: Finger Print : Not Set/Present
###STUN Message structure End###
the transaction
004042: *Aug 8 14:25:30.876 IST: //57/91300134802E/STUN/Detail/cisco_stun_process_send_msg_event:
STUN message Sent

Sys Log for sending ICE-controlled parameter instead of ICE-controlling parameter:

004132: *Aug 8 14:25:30.912 IST: //CISCO_STUN-4-ICE_ROLE_CONFLICT: Ice Role Conflict detected in the
received STUN message on UDP IP address 10.104.45.107 port 8042
reason:Role Conflict, code:487
with success
Post Message to Application
004138: *Aug 8 14:25:30.912 IST: /*-1/xxxxxxxxxxxx/STUN/Detail/cisco_stun_process_stun_pak_rcvd_event:
Received New STUN message###STUN Message structure start###
**Message Type** : STUN_MSG_TYPE_BINDING_REQ
Message Length : 80
Magic Cookie : 2112A442
Transaction ID : F1CF84958CE76D15C83059D9
ICE-Lite Support on CUBE

ICE-Lite on CUBE (Error Flow Calls)

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapped Address</td>
<td>Not Set/Present</td>
</tr>
<tr>
<td>User Name</td>
<td>GAah:4wWY</td>
</tr>
<tr>
<td>Error code</td>
<td>not present</td>
</tr>
<tr>
<td>Alternate Server</td>
<td>Not Set/Present</td>
</tr>
<tr>
<td>Realm</td>
<td>Not Set/Present</td>
</tr>
<tr>
<td>nonce</td>
<td>Not Set/Present</td>
</tr>
<tr>
<td>Xormapped Address</td>
<td>Not Set/Present</td>
</tr>
<tr>
<td>Server</td>
<td>Cisco</td>
</tr>
<tr>
<td>ICE Priority</td>
<td>11920035603547232620</td>
</tr>
<tr>
<td>ICE Controlled</td>
<td>Not Set/Present</td>
</tr>
<tr>
<td>Cisco-flowdata</td>
<td>Not Set/Present</td>
</tr>
</tbody>
</table>

Message Integrity: 0AF4B8C2378CB90AB0B0A386507D766BF5CD1DD

###STUN Message structure End###

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco-flowdata</td>
<td>Not present</td>
</tr>
<tr>
<td>Message Integrity</td>
<td>0AF4B8C2378CB90AB0B0A386507D766BF5CD1DD</td>
</tr>
</tbody>
</table>

###STUN Message structure start###

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>STUN_MSG_TYPE_BINDING_ERR_RESP</td>
</tr>
<tr>
<td>Magic Cookie</td>
<td>2112A442</td>
</tr>
<tr>
<td>Transaction ID</td>
<td>01CF84958CE76D15C83059D9</td>
</tr>
<tr>
<td>Mapped Address</td>
<td>Not Set/Present</td>
</tr>
<tr>
<td>User Name</td>
<td>Not Set/Present</td>
</tr>
</tbody>
</table>
Troubleshooting ICE-Lite Support on CUBE

You can use the following `debug` commands to troubleshoot the ICE-lite support on CUBE feature. Use these commands to enable ICE debugs for each call.

- `debug voip icelib all`
- `debug voip icelib default`
- `debug voip icelib detail`
- `debug voip icelib error`
- `debug voip icelib event`
- `debug voip icelib inout`
- `debug voip stun all`
- `debug voip stun default`
- `debug voip stun detail`
- `debug voip stun error`
- `debug voip stun event`
- `debug voip stun inout`
- `debug voip stun message`
- `debug voip stun packet`

Additional References

### Standards and RFCs

<table>
<thead>
<tr>
<th>Standard/RFC</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFC 5389</td>
<td><em>Session Traversal Utilities for NAT (STUN)</em></td>
</tr>
<tr>
<td>RFC 5245</td>
<td><em>Interactive Connectivity Establishment (ICE): A Protocol for Network Address Translator (NAT) Traversal for Offer/Answer Protocols</em></td>
</tr>
</tbody>
</table>
### Additional References

<table>
<thead>
<tr>
<th>Standard/RFC</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFC 5766</td>
<td><em>Traversal Using Relays around NAT (TURN): Relay Extensions to Session Traversal Utilities for NAT (STUN)</em></td>
</tr>
<tr>
<td>RFC 5768</td>
<td><em>Indicating Support for Interactive Connectivity Establishment (ICE) in the Session Initiation Protocol (SIP)</em></td>
</tr>
<tr>
<td>RFC 3840</td>
<td><em>Indicating User Agent Capabilities in the Session Initiation Protocol (SIP)</em></td>
</tr>
<tr>
<td>RFC 7584</td>
<td><em>Session Traversal Utilities for NAT (STUN) Message Handling for SIP Back-to-Back User Agents (B2BUAs)</em></td>
</tr>
</tbody>
</table>

### Technical Assistance

<table>
<thead>
<tr>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</td>
<td><a href="http://www.cisco.com/support">http://www.cisco.com/support</a></td>
</tr>
<tr>
<td>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</td>
<td></td>
</tr>
<tr>
<td>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</td>
<td></td>
</tr>
</tbody>
</table>
PART XV

SIP Protocol Handling

• Mid-call Signaling Consumption, on page 601
• Early Dialog UPDATE Block, on page 611
• Consumption of Forked 18x Responses with SDP During Early Dialog, on page 617
• Support for Pass-Through of Unsupported Content Types in SIP INFO Messages, on page 623
• Support for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element, on page 625
Mid-call Signaling Consumption

The Cisco Unified Border Element BE Mid-call Signaling support aims to reduce the interoperability issues that arise due to consuming mid-call RE-INVITES/UPDATES.

Mid-call Re-INVITEs/UPDATEs can be consumed in the following ways:

• Mid-call Signaling Passthrough - Media Change
• Mid-call Signaling Block
• Mid-call Signaling Codec Preservation

Feature Information for Mid-call Signaling

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
Table 61: Feature Information for Mid-call Signaling

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-call Re-INVITE Consumption</td>
<td>Cisco IOS 15.2(1)T Cisco IOS XE 3.6S</td>
<td>The Mid-call Re-INVITE consumption feature consumes mid-call Re-INVITEs from CUBE and helps to avoid interoperability issues because of these re-invites. The following commands were introduced or modified: midcall-signaling.</td>
</tr>
<tr>
<td>Mid-call Codec Preservation</td>
<td>Cisco IOS 15.3(2)T Cisco IOS XE 3.9S</td>
<td>The Mid-call Codec Preservation feature helps to disables codec negotiation in the middle of a call and preserves the codec negotiated before the call. The following commands were introduced or modified: midcall-signaling preserve-codec, voice-class sip midcall-signaling preserve-codec.</td>
</tr>
<tr>
<td>Mid-call Re-INVITE Consumption Enhancements</td>
<td>Cisco IOS 15.5(3)M Cisco IOS XE 3.16S</td>
<td>Mid-call signaling Re-INVITE consumption is enhanced to support: • Re-INVITE based call transfer • Call transfer with REFER Consume • Normalization of call hold in a call set-up</td>
</tr>
</tbody>
</table>

Prerequisites

- Enable CUBE application on a device
- Cisco IOS Release 15.2(1)T or later, or Cisco IOS-XE Release 15.2(2)S or later must be installed.
- supplementary-service media- renegotiate must be configured in global voice service voip mode.
Mid-call Signaling Passthrough - Media Change

Passthrough media change method optimizes or consumes mid-call, media-related signaling within the call. Mid-call signaling changes will be passed through only when bidirectional media like T.38 or video is added. The command `midcall-signaling passthru media-change` needs to be configured to enable passthrough media change.

Restrictions for Mid-call Signaling Passthrough - Media Change

- SIP-H.323 calls are not supported.
- TDM Gateways are not supported.
- Session Description Protocol (SDP) -passthrough is not supported
- When `codec T` is configured, the offer from CUBE has only audio codecs, and so the video codecs are not consumed.
- Re-invites are not consumed if media flow-around is configured.
- Re-invites are not consumed if media anti-tromboning is configured.
- De-escalation re-invites are consumed. So, one call leg might be de-escalated to audio only while the other call leg continues to support audio and video.
- Re-invites with media direction changes are consumed.
- Video transcoding is not supported.
- Secure Real-time Protocol - Real-time Protocol (SRTP-RTP) supplementary services are not supported.
- Multicast Music On Hold (MMOH) is not supported.
- When the `midcall-signaling passthru media-change` command is configured and high-density transcoder is enabled, there might be some impact on Digital Signal Processing (DSP) resources as the transcoder might be used for all the calls.
- Session timer is handled leg by leg whenever this feature is configured.
- More than two m-lines in the SDP is not supported.
- Alternative Network Address Types (ANAT) is not supported.
- Video calls and Application streams are not supported when mid-call signaling block is configured.

Behavior of Mid-call Re-INVITE Consumption

- If mid-call signaling block is enabled on either of call-legs, video parameters and application streams are not negotiated, and are rejected in the answer.
- When flow around and offer-all is configured, CUBE performs codec renegotiation even if mid-call signaling block is configured globally.
- Below behavior is for refer consume scenario:
  - REFER consume is supported for blind, alert and consult call transfers.
• Existing codecs or DTMF is used for local bridging of new call legs. No Re-INVITE or UPDATE is sent for media re-negotiation after REFER.
• Call gets dropped when DSP is required but not available.
• A call can be escalated to video only if transferee and transfer-to dial-peers do not have mid-call signaling block configured.
• Video calls are de-escalated if mid-call signaling block configuration on transfer-to dial-peer.
• For Re-INVITE based call-transfer involving Cisco Unified Communications Manager, all Re-INVITE are locally answered and transcoder is invoked if negotiated codecs are different than the codecs before call-transfer.

• The following table provides the details of the behavior when the initial call is establish without 'sendrecv' parameter, that means, the initial call is established with 'sendonly', 'recvonly' or 'inactive'.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>If an Offer is received with 'sendonly' and mid-call block is configured on any or both call legs</td>
<td>Offer is sent with 'sendrecv'.</td>
</tr>
<tr>
<td>If an Answer is received with 'sendonly' and the peer leg supports mid-call signaling</td>
<td>Answer is sent with 'sendonly'. Resume transaction is end-to-end.</td>
</tr>
<tr>
<td>If an Answer is received with 'sendonly' and the peer leg does not supports mid-call signaling</td>
<td>Answer is sent with 'sendrecv'. Resume transaction is consumed.</td>
</tr>
<tr>
<td>If Offer as well as Answer is received with 'sendonly' and Offering leg does not support mid-call signaling</td>
<td>Answer is sent with 'recvonly'. Resume from Offering leg is end-to-end. Resume from answering leg is consumed.</td>
</tr>
<tr>
<td>If Offer as well as Answer is received with 'sendonly' and Answering leg does not support mid-call signaling</td>
<td>Answer is sent with 'inactive'. Resume from Offering leg is consumed. Resume from answering leg is end-to-end.</td>
</tr>
<tr>
<td>If Offer as well as Answer is received with 'sendonly' and both legs do not support mid-call signaling</td>
<td>Answer is sent with 'recvonly'. Resume transaction is consumed.</td>
</tr>
</tbody>
</table>

**Configuring Passthrough of Mid-call Signalling**

Perform this task to configure passthrough of mid-call signaling (as Re-invites) only when bidirectional media is added.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. Configure passthrough of mid-call signaling changes only when bidirectional media is added.
   - In Global VoIP SIP configuration mode
     
     **midcall-signaling passthru media-change**
   - In dial-peer configuration mode
voice-class sip mid-call signaling passthru media-change

4. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>Configure passthrough of mid-call signaling changes only when bidirectional media is added.</td>
<td>Re-Invites are passed through only when bidirectional media is added.</td>
</tr>
<tr>
<td>• In Global VoIP SIP configuration mode</td>
<td>midcall-signaling passthru media-change</td>
<td></td>
</tr>
<tr>
<td>• In dial-peer configuration mode</td>
<td>voice-class sip mid-call signaling passthru media-change</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>In Global VoIP SIP configuration mode:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(conf-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(conf-serv-sip)# midcall-signaling passthru media-change</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>In Dial-peer configuration mode:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config)# dial-peer voice 2 voip</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# voice-class sip mid-call signaling passthru media-change</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td>end</td>
<td>Exits to privileged EXEC mode.</td>
</tr>
</tbody>
</table>

Example Configuring Passthrough SIP Messages at Dial Peer Level

The following example shows how to passthrough SIP messages at the dial peer Level:

dial-peer voice 600 voip
destination-pattern 2222222222
session protocol sipv2
session target ipv4:9.45.38.39:9001
voice-class sip mid-call signaling passthru media-change
incoming called-number 1111111111
voice-class codec 2 offer-all
dial-peer voice 400 voip
destination-pattern 1111111111
Example Configuring Passthrough SIP Messages at the Global Level

The following example shows how to passthrough SIP messages at the global level:

```
Device(config)# voice service voip
Device(conf-voi-serv)# no ip address trusted authenticate
Device(conf-voi-serv)# allow-connections sip to sip
Device(conf-voi-serv)# sip
Device(conf-serv-sip)# midcall-signaling passthru media-change
```

Mid-call Signaling Block

The Block method blocks all mid-call media-related signaling to the specific SIP trunk. The command `midcall-signaling block` needs to be configured to enable this behavior. Video escalation and T.38 call flow are rejected when the `midcall-signaling block` command is configured. This command should be configured only when basic call is the focus and mid-call can be consumed.

Restrictions for Mid-Call Signaling Block

- SIP-H.323 calls are not supported.
- TDM Gateways are not supported.
- Session Description Protocol (SDP) -passthrough is not supported.
- Video calls and Application streams are not supported.
- When media flow-around is configured, Mid-call INVITE is rejected with 488 error message.
- Re-invites are not consumed if media anti-tromboning is configured.
- SRTP-RTP supplementary services are not supported.
- Multicast Music On Hold (MMOH) is not supported.
- When the `midcall-signaling passthru media-change` command is configured and high-density transcoder is enabled, there might be some impact on Digital Signal Processing (DSP) resources as the transcoder might be used for all the calls.
- Session timer is handled leg by leg whenever this feature is configured.
- More than two m-lines in the SDP is not supported.
- Alternative Network Address Types (ANAT) is not supported.
- When mid-call signaling block is configured, you can either configure REFER consume or enable TCL script. Mid-call signaling block is not supported if both REFER consume and TCL script are enabled. We also recommend not to configure `supplementary-service media-renegotiate` command.
## Blocking Mid-Call Signaling

Perform this task to block mid-call signaling:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Configure blocking of mid-call signaling changes:
   - In Global VoIP SIP configuration mode
     ```
     midcall-signaling block
     ```
   - In dial-peer configuration mode
     ```
     voice-class sip mid-call signaling block
     ```
4. **end**

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><strong>enable</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device&gt; enable</td>
</tr>
<tr>
<td></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td><strong>configure terminal</strong></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Device# configure terminal</td>
</tr>
<tr>
<td></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Configure blocking of mid-call signaling changes:</td>
</tr>
<tr>
<td></td>
<td>• In Global VoIP SIP configuration mode</td>
</tr>
</tbody>
</table>
|                   | ```
|                   | midcall-signaling block |
|                   | • In dial-peer configuration mode |
|                   | ```
|                   | **voice-class sip mid-call signaling block** |
| **Example:**      | In Global VoIP SIP configuration mode: |
|                   | Device(config)# voice service voip |
|                   | Device(config-voi-serv)# sip |
|                   | Device(config-serv-sip)# midcall-signaling block |
| **Example:**      | In Dial-peer configuration mode: |
|                   | Device(config)# dial-peer voice 2 voip |
|                   | Device(config-dial-peer)# voice-class sip mid-call signaling block |
| **Step 4**        | **end** |
|                   | Exits to privileged EXEC mode. |
Example Blocking SIP Messages at Dial Peer Level

dial-peer voice 107 voip
destination-pattern 74000
session protocol sipv2
session target ipv4:9.45.36.9
incoming called-number 84000
voice-class codec 1 offer-all
!
dial-peer voice 110 voip
destination-pattern 84000
session protocol sipv2
session target ipv4:9.45.35.2
incoming called-number 74000
voice-class codec 1 offer-all
voice-class sip mid-call signaling block
!

Example: Blocking SIP Messages at the Global Level

The following example shows how to block SIP messages at the global Level

Device(config)#voice service voip
Device(config-voi-serv)#no ip address trusted authenticate
Device(config-voi-serv)#allow-connections sip to sip
Device(config-voi-serv)#sip
Device(config-serv-sip)#midcall-signaling block

Mid Call Codec Preservation

Mid call codec preservation defines whether a codec can be negotiated after a call has been initiated. You can enable or disable codec negotiation in the middle of a call.

Configuring Mid Call Codec Preservation

This task disables codec negotiation in the middle of a call and preserves the codec negotiated before the call.

SUMMARY STEPS

1. enable
2. configure terminal
3. Enter one of the following to disable midcall codec renegotiation:
   • In Global VoIP SIP configuration mode
     midcall-signaling preserve-codec
   • In dial-peer configuration mode
     voice-class sip midcall-signaling preserve-codec
4. end
## Detailed Steps

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> Enter one of the following to disable midcall codec renegotiation:</td>
<td>Disables codec negotiation in the middle of a call and preserves the codec negotiated before the call.</td>
</tr>
<tr>
<td>• In Global VoIP SIP configuration mode <strong>midcall-signaling preserve-codec</strong></td>
<td></td>
</tr>
<tr>
<td>• In dial-peer configuration mode <strong>voice-class sip midcall-signaling preserve-codec</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config)# voice service voip Device(conf-voi-serv)# sip Device(conf-serv-sip)# midcall-signaling preserve-codec</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong> Device(config)# dial-peer voice 10 voip Device(conf-dial-peer)# voice-class sip midcall-signaling preserve-codec</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> end</td>
<td>Exits to privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Device(conf-serv-sip)# end</td>
<td></td>
</tr>
</tbody>
</table>

## Example: Configuring Mid Call Codec Preservation at the Dial Peer Level

dial-peer voice 107 voip
destination-pattern 74000
session protocol sipv2
session target ipv4:9.45.36.9
incoming called-number 84000
voice-class codec 1 offer-all

!
dial-peer voice 110 voip
destination-pattern 84000
session protocol sipv2
session target ipv4:9.45.35.2
incoming called-number 74000
voice-class codec 1 offer-all
Example: Configuring Mid Call Codec Preservation at the Global Level

Device(config)# voice service voip
Device(conf-voi-serv)# no ip address trusted authenticate
Device(conf-voi-serv)# allow-connections sip to sip
Device(conf-voi-serv)# sip
Device(conf-serv-sip)# midcall-signaling preserve-codec
Early Dialog UPDATE Block

This feature enables CUBE to consume UPDATE requests with SDP, received during an early dialog. UPDATE requests are blocked at CUBE and are not passed through from one leg to the other leg.

If the UPDATE request contains changes in caller-ID, transcoder insertion or deletion, or video escalation or de-escalation, then, CUBE can renegotiate the capabilities by sending a DO invite after the call is established.

- Feature Information for Early Dialog UPDATE Block, on page 611
- Prerequisites, on page 612
- Restrictions, on page 612
- Information about Early Dialog UPDATE Block, on page 612
- Configuring Early Dialog UPDATE Block, on page 613
- Configuring Early Dialog UPDATE Block Renegotiate, on page 614
- Troubleshooting Tips, on page 615

Feature Information for Early Dialog UPDATE Block

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

**Table 62: Feature Information for Mid-call Signaling**

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Dialog UPDATE Block</td>
<td>Cisco IOS 15.5(3)M</td>
<td>This feature allows CUBE to consume the UPDATE requests with SDP received during an early dialog. The following command is introduced: <strong>early-media update block.</strong></td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE 3.16S</td>
<td></td>
</tr>
</tbody>
</table>

Cisco Unified Border Element Configuration Guide
Prerequisites

- rel1xx require "100rel" command needs to be configured in global voice service voip sip configuration mode.

Restrictions

- Switch over to fax calls are not supported.
- Session Description Protocol (SDP) passthrough is not supported.
- Alternative Network Address Types (ANAT) is not supported.

Information about Early Dialog UPDATE Block

UPDATE request with SDP received during an early dialog is consumed by CUBE and hence is not passed from one leg to the other leg. This feature can be configured only for the UPDATE requests with SDP.

To pass through the information in UPDATE requests containing changes in caller-ID, transcoder insertion or deletion, or video escalation or de-escalation, CUBE can renegotiate the capabilities by sending a DO invite after the call is established. Thus both the user agents are synchronized and this helps in effective utilization of resources.

Renegotiation can be configured only for the UPDATE requests containing the following changes:

- Caller ID
- Transcoder insertion or deletion
- Video escalation or de-escalation

'Early Dialog UPDATE Block' and 'Early Dialog UPDATE Block Renegotiate' can be configured at dial peer level and also at global voice service voip sip configuration level.

Important Characteristics of Early Dialog UPDATE Block

The following are a few important characteristics of Early Dialog UPDATE block:

- If vcc codec is offered by the user agent through an UPDATE, first codec common between received and configured in in-leg at dial-peer is sent in 200OK.
- UPDATE request is consumed, if an UPDATE request with SDP is received after CUBE sends out 200 OK for an INVITE and before ACK is received.
- A 200 Ok is sent for an UPDATE even if there is no transcoder available ONLY for DTMF (rtp-nte to inband). CUBE falls back to inband.
- If Transcoder is unavailable, only the first codec received in the UPDATE request is sent in 200OK.
- CUBE sends 488 message if transcoder is required but unavailable for codec changes, SRTP-RTP inter-working, and transrating.
• When a video escalation is received via UPDATE, CUBE sends 200 OK with video port as ZERO. No Video RTP or DP sessions are created.

• When a video de-escalation is received via UPDATE, CUBE sends 200 ok with video port as ZERO. RTP or DP sessions for video are made as INACTIVE instead of deleting. So, effectively there will be four RTP connections or 2 DP connections present with remote video port as ZERO.

• Early-media UPDATE renegotiation takes precedence over DO-EO renegotiation.

• If an early dialog UPDATE is received from one leg to change the caller-ID and the other leg supports UPDATE method, CUBE sends across the caller-id UPDATE to other side and there wont be any renegotiation.

• If Re-Invite is received before triggering DO invite, then DO is not triggered.

• If no update-callerid command is enabled and UPDATE request contains only caller-ID changes, then re-negotiation does not happen for any early dialog caller-ID changes. If UPDATE request contains transcoder changes or video escalation or de-escalation, re-negotiation happens even if no update-callerid command is enabled.

• If mid-call signaling block is configured, DO invite is not triggered.

**Configuring Early Dialog UPDATE Block**

Configuring early dialog UPDATE Block enables CUBE to block all early dialog UPDATE requests from passing through to the user agents.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. Enter one of the following commands to block early dialog UPDATE requests:
   - In the dial-peer configuration mode
     ```
     voice-class sip early-media update block
     ```
   - In the global VoIP SIP configuration mode
     ```
     early media update block
     ```
4. **end**

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Step 3</strong> Enter one of the following commands to block early dialog UPDATE requests:</td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

- In the dial-peer configuration mode
  ```
  voice-class sip early-media update block
  ```
- In the global VoIP SIP configuration mode
  ```
  early media update block
  ```

#### Example:

In dial-peer configuration mode

```
! Applying Early Dialog UPDATE block to one dial peer only
Device (config)# dial-peer voice 10 voip
Device (config-dial-peer)# Voice-class sip
Device (config-dial-peer)# early-media update block
Device (config-dial-peer)# end
```

#### Example:

In global VoIP SIP configuration mode

```
! Applying Early Dialog UPDATE block globally
Device(config)# voice service voip
Device (config-voi-serv)# sip
Device (config-voi-sip)# early media update block
Device (config-voi-sip)# end
```

### Configuring Early Dialog UPDATE Block Renegotiate

Configuring Early Dialog UPDATE Block Renegotiate enables CUBE to renegotiate the call if UPDATE request with SDP contains changes caller-ID, transcoder insertion or deletion, or video escalation or deletion. CUBE renegotiates by sending a DO invite after the call is established.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Enter one of the following commands:
   - In the dial-peer configuration mode
     ```
     voice-class sip early-media update block re-negotiate
     ```
   - In the global VoIP configuration mode
     ```
     early media update block re-negotiate
     ```
4. **end**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td><code>end</code></td>
<td>Exits VoIP SIP configuration mode and enters privileged EXEC mode.</td>
</tr>
</tbody>
</table>
### DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| Step 1 | enable | Enables privileged EXEC mode.  
• Enter your password if prompted. |
| Step 2 | configure terminal | Enters global configuration mode. |
| Step 3 | Enter one of the following commands:  
• In the dial-peer configuration mode  
  voice-class sip early-media update block re-negotiate  
• In the global VoIP configuration mode  
  early media update block re-negotiate | Renegotiates the call if the UPDATE request contains changes in caller ID, transcoder addition or deletion, or video escalation or de-escalation. |
| **Example:** | **In dial-peer configuration mode** | |
| | !Applying Early Dialog UPDATE block re-negotiate to one dial peer only  
Device (config)# dial-peer voice 10 voip  
Device (config-dial-peer)# voice-class sip  
early-media update block re-negotiate  
Device (config-dial-peer)# end | |
| **Example:** | **In global VoIP configuration mode** | |
| | !Applying Early Dialog UPDATE block re-negotiate globally  
Device(config)# voice service voip  
Device (config-voi-serv)# sip  
Device (config-voi-sip)# early media update block re-negotiate  
Device (config-voi-sip)# end | |
| Step 4 | end | Exits VoIP SIP configuration mode and enters privileged EXEC mode. |

### Troubleshooting Tips

Use the following command for debugging information:

• debug cc sip all  
• debug voip ccapi inout  
• show voip rtp connections
Consumption of Forked 18x Responses with SDP During Early Dialog

The Cisco Unified Border Element supports consumption of forked 18x responses with SDP, under certain conditions during an early dialog, to reduce the interoperability issues that arise due to signaling forking.

When CUBE receives forked 18x responses with SDP, the media negotiation by default is end-to-end. This means that CUBE has to send an UPDATE with SDP on the inbound leg to renegotiate the new media offer. Under certain conditions, the inbound leg may not be able to support sending UPDATE messages with SDP for media renegotiation. This results in CUBE consuming the forked 18x responses with SDP and may result in DSP resources being used for media interworking. Media parameters such as direction change, and call escalation or de-escalation is not propagated end-to-end. If required, these media changes can be renegotiated end-to-end, after the calls are connected, using a DO re-INVITE.

- Feature Information for Consumption of Multiple Forked 18x Responses with SDP During Early Dialog, on page 617
- Prerequisites, on page 618
- Restrictions, on page 618
- Information About Consumption of Forked 18x Responses with SDP During Early Dialog, on page 618
- Configuring Consumption of Forked 18x Responses with SDP During Early Dialog, on page 619
- Configuring Consumption of Forked 18x Responses with SDP During Early Dialog Renegotiate, on page 620
- Troubleshooting Tips, on page 622

Feature Information for Consumption of Multiple Forked 18x Responses with SDP During Early Dialog

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
Table 63: Feature Information for Consumption of Multiple Forked 18x Responses with SDP During Early Dialog

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for Forked 18x Responses with SDP during Early Dialog</td>
<td>Cisco IOS 15.6(3)M Cisco IOS XE Denali 16.3.1</td>
<td>This feature allows CUBE to consume multiple forked 18x responses with SDP received during an early dialog.</td>
</tr>
</tbody>
</table>

Prerequisites

- Re-negotiation is triggered only if the renegotiate early media update block re-negotiate CLI is enabled

Restrictions

The following features or call-flows are not supported:

- SIP Delayed-Offer to Delayed-Offer call flows
- Session Description Protocol (SDP) passthrough mode
- Secure Real-Time Transport Protocol (SRTP) passthrough calls
- Alternative Network Address Types (ANAT)
- Media flow-around
- Media anti-trombone
- Early-dialog UPDATE block

Information About Consumption of Forked 18x Responses with SDP During Early Dialog

Forked 18x responses for INVITE requests with SDP during early dialog will be consumed by CUBE to reduce interoperability issues between user agents.

Characteristics of Forked 18x Responses with SDP during Early Dialog

- If PRACK or UPDATE is not supported on the inbound leg, by default, CUBE consumes the forked 18x responses
- If PRACK or UPDATE is not supported and CUBE has to initiate renegotiation after call connect, then the early media update block re-negotiate CLI must be enabled
- When PRACK and UPDATE are supported on the inbound leg and CUBE has to consume the forked 18x responses, the early media update block CLI must be enabled
• If PRACK and UPDATE are supported and CUBE has to consume the forked 18x responses and initiate renegotiation after call connect, then the early media update block renegotiate CLI must be enabled

• If mid-call signaling block or mid-call signaling passthrough media changes are configured, DO invite is not triggered

Note
CUBE utilizes the EARLY UPDATE BLOCK functionality to configure the forked 18x responses with SDP during early dialog. The early media update block command is used to consume the forked 18x responses and the early media update block renegotiate command is used to renegotiate the forked 18x responses after the call connect.

Renegotiation (when enabled via configuration) is triggered for the forked 18x responses containing the following changes:

• DSP Transcoder insertion
• Video escalation or de-escalation
• Media directional changes

Note
It is recommended to configure the early media update block re-negotiate command whenever there are transcoding, DTMF interworking, or video changes.

Configuring Consumption of Forked 18x Responses with SDP During Early Dialog

Perform the following procedure to enable CUBE to block all early dialog forked 18x requests from passing through to the user agents.

SUMMARY STEPS

1. enable
2. configure terminal
3. Enter one of the following commands to block the forked 18x responses with SDP during early dialog:
   • In the dial-peer configuration mode
     voice-class sip early-media update block
   • In the global VoIP SIP configuration mode
     early media update block
4. end
## DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1** enable | Enables privileged EXEC mode.  
  • Enter your password if prompted. |
| **Step 2** configure terminal | Enters global configuration mode. |
| **Step 3** Enter one of the following commands to block the forked 18x responses with SDP during early dialog:  
  • In the dial-peer configuration mode  
    voice-class sip early-media update block  
  • In the global VoIP SIP configuration mode  
    early media update block  
**Example:**  
In dial-peer configuration mode  

```plaintext  
!Applying Early Dialog UPDATE block to one dial peer only  
Device (config)# dial-peer voice 10 voip  
Device (config-dial-peer)# voice-class sip  
early-media update block  
Device (config-dial-peer)# end  
```

**Example:**  
In global VoIP SIP configuration mode  

```plaintext  
! Applying Early Dialog UPDATE block globally  
Device (config)# voice service voip  
Device (config-voi-serv)# sip  
Device (config-voi-sip)# early media update block  
Device (config-voi-sip)# end  
```
| **Step 4** end | Exits VoIP SIP configuration mode and enters privileged EXEC mode. |

## Configuring Consumption of Forked 18x Responses with SDP During Early Dialog Renegotiate

Perform the following procedure to enable CUBE to renegotiate forked 18x calls with SDP during early dialog after consumption of these forked 18x responses. CUBE renegotiates by sending a DO invite after the call is established.

### SUMMARY STEPS

1. enable
2. configure terminal
3. Enter one of the following commands:
   - In the dial-peer configuration mode
     `voice-class sip early-media update block re-negotiate`
   - In the global VoIP configuration mode
     `early media update block re-negotiate`
4. end

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| Step 1 | enable | Enables privileged EXEC mode.  
   - Enter your password if prompted. |
| Step 2 | configure terminal | Enters global configuration mode. |
| Step 3 | Enter one of the following commands:  
   - In the dial-peer configuration mode
     `voice-class sip early-media update block re-negotiate`
   - In the global VoIP configuration mode
     `early media update block re-negotiate`
 | Renegotiates the call if the forked 18x responses with SDP during early dialog contains changes in transcoder addition, or video escalation or de-escalation. |

**Example:**

In dial-peer configuration mode

![Applying Early Dialog UPDATE block re-negotiate to one dial peer only](image)

In global VoIP SIP configuration mode

![Applying Early Dialog UPDATE block re-negotiate globally](image)

| Step 4 | end | Exits VoIP SIP configuration mode and enters privileged EXEC mode. |
Troubleshooting Tips

Use the following command for debugging information:

• debug ccsip verbose
• show voip rtp connections detail
• show call active voice brief
• show dspfarm dsp active
• show voice dsmp stream brief
• show platform hardware qfp active feature sbc global
Support for Pass-Through of Unsupported Content Types in SIP INFO Messages

This feature allows the CUBE to pass-through all unsupported content types in a SIP INFO message.

- Feature Information for Support for Pass-Through of Unsupported Content Types in SIP INFO Messages, on page 623
- Prerequisites, on page 623
- Information About Pass-Through of Unsupported Content Types in SIP INFO Messages, on page 624

Feature Information for Support for Pass-Through of Unsupported Content Types in SIP INFO Messages

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for pass-through of unsupported content types in SIP INFO messages</td>
<td>Cisco IOS 15.5(3)M, Cisco IOS XE 3.16S</td>
<td>This feature allows CUBE to pass-through SIP INFO methods or request message types with unsupported content types. Media negotiation and media exchange is completely end-to-end.</td>
</tr>
</tbody>
</table>

Prerequisites

You must enable the **pass-thru content unsupp** command to pass-through all unsupported content types in a SIP INFO message. There is no additional configuration task required for this feature.
Information About Pass-Through of Unsupported Content Types in SIP INFO Messages

The Support for Pass-Through of Unsupported Content Types in SIP INFO Messages feature allows the CUBE to pass-through all unsupported content types in a SIP INFO message.

Upon receipt of a SIP INFO message with unsupported content type, CUBE triggers a SIP INFO message on the outgoing peer call leg. The response received for this SIP INFO message is triggered on the incoming peer call leg and information flows end-to-end. Prior to releases 15.5(3)M and 3.16S, on reception of SIP INFO message with unsupported content type, CUBE will respond with the “415 Unsupported Media Type” error response.

Supported content types include the following:

- application/sdp
- application/qsig
- application/media-control+xml
- application/x-q931
- application/gtd
- application/simple-message-summary
- application/kpml-response+xml
- application/dtmf-relay
- application/broadsoft
- message/sipfrag
- audio/telephone-event
- multipart/mixed
CHAPTER 54

Support for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element

The figure below shows a typical network topology where the Cisco Unified Border Element is configured to route messages between a call manager system (such as the Cisco Unified Call Manager) and a Next Generation Network (NGN).

Figure 57: Cisco Unified Border Element and Next Generation Topology

Devices that connect to an NGN must comply with the User-Network Interface (UNI) specification. The Cisco Unified Border Element supports the NGN UNI specification and can be configured to interconnect NGN with other call manager systems, such as the Cisco Unified Call Manager.

The Cisco Unified Border Element supports the following:

- the use of P-Preferred Identity (PPID), P-Asserted Identity (PAID), Privacy, P-Called Party Identity (PCPID), in INVITE messages
- the translation of PAID headers to PPID headers and vice versa
- the translation of RPID headers to PAID or PPID headers and vice versa
- the configuration and/or pass through of privacy header values
- the use of the PCPID header to route INVITE messages
- the use of multiple PAURI headers in the response messages (200 OK) it receives to REGISTER messages

P-Preferred Identity and P-Asserted Identity Headers

NGN servers use the PPID header to identify the preferred number that the caller wants to use. The PPID is part of INVITE messages sent to the NGN. When the NGN receives the PPID, it authorizes the value, generates a PAID based on the preferred number, and inserts it into the outgoing INVITE message towards the called party.
However, some call manager systems, such as Cisco Unified Call Manager 5.0, use the Remote-Party Identity (RPID) value to send calling party information. Therefore, the Cisco Unified Border Element must support building the PPID value for an outgoing INVITE message to the NGN, using the RPID value or the From: value received in the incoming INVITE message. Similarly, CUBE supports building the RPID and/or From: header values for an outgoing INVITE message to the call manager, using the PAID value received in the incoming INVITE message from the NGN.

In non-NGN systems, the Cisco Unified Border Element can be configured to translate between PPID and PAID values, and between From: or RPID values and PAID/PPID values, at global and dial-peer levels.

In configurations where all relevant servers support the PPID or PAID headers, the Cisco Unified Border Element can be configured to transparently pass the header.

If the NGN sets the From: value to anonymous, the PAID is the only value that identifies the caller.

The table below describes the types of INVITE message header translations supported by the Cisco Unified Border Element. It also includes information on the configuration commands to use to configure P-header translations.

The table below shows the P-header translation configuration settings only. In addition to configuring these settings, you must configure other system settings (such as the session protocol).

Table 64: P-header Configuration Settings

<table>
<thead>
<tr>
<th>Incoming Header</th>
<th>Outgoing Header</th>
<th>Configuration Notes</th>
</tr>
</thead>
</table>
| From:           | RPID            | To enable the translation to RPID headers in the outgoing header, use the `remote-party-id` command in SIP user-agent configuration mode. For example: Router(config-sip-ua)# `remote-party-id`  
This is the default system behavior.  
<Note> If both, `remote-party-id` and `asserted-id` commands are configured, then the `asserted-id` command takes precedence over the `remote-part-id` command.  

| PPID            | PAID            | To enable the translation to PAID privacy headers in the outgoing header at a global level, use the `asserted-id pai` command in voice service VoIP SIP configuration mode. For example: Router(conf-serv-sip)# `asserted-id pai`  
To enable the translation to PAID privacy headers in the outgoing header on a specific dial peer, use the `voice-class sip asserted-id pai` command in dial peer voice configuration mode. For example: Router(config-dial-peer)# `voice-class sip asserted-id pai`  

| PPID            | RPID            | To enable the translation to RPID headers in the outgoing header, use the `remote-party-id` command in SIP user-agent configuration mode. For example: Router(config-sip-ua)# `remote-party-id`  
This is the default system behavior.  
|-----------------|-----------------|---------------------|
### Configuration Notes

**Outgoing Header**

**To enable the translation to PPIID privacy headers in the outgoing header at a global level, use the `asserted-id ppi` command in voice service VoIP SIP configuration mode. For example:**

```
Router(conf-serv-sip)# asserted-id ppi
```

**To enable the translation to PPIID privacy headers in the outgoing header on a specific dial peer, use the `voice-class sip asserted-id ppi` command in dial peer voice configuration mode. For example:**

```
Router(config-dial-peer)# voice-class sip asserted-id ppi
```

**PPID PAID**

**To enable the translation to RPID headers in the outgoing header, use the `remote-party-id` command in SIP user-agent configuration mode. For example:**

```
Router(config-sip-ua)# remote-party-id
```

This is the default system behavior.

**RPID PAID**

**To enable the translation to PPIID privacy headers in the outgoing header at a global level, use the `asserted-id ppi` command in voice service VoIP SIP configuration mode. For example:**

```
Router(conf-serv-sip)# asserted-id ppi
```

**To enable the translation to PPIID privacy headers in the outgoing header on a specific dial peer, use the `voice-class sip asserted-id ppi` command in dial peer voice configuration mode. For example:**

```
Router(config-dial-peer)# voice-class sip asserted-id ppi
```

**PAID RPID**

**To enable the translation to PAID privacy headers in the outgoing header at a global level, use the `asserted-id pai` command in voice service VoIP SIP configuration mode. For example:**

```
Router(conf-serv-sip)# asserted-id pai
```

**To enable the translation to PAID privacy headers in the outgoing header on a specific dial peer, use the `voice-class sip asserted-id pai` command in dial peer voice configuration mode. For example:**

```
Router(config-dial-peer)# voice-class sip asserted-id pai
```

**RPID From:**

**By default, the translation to RPID headers is enabled and the system translates PPIID headers in incoming messages to RPID headers in the outgoing messages. To disable the default behavior and enable the translation from PPIID to From headers, use the `no remote-party-id` command in SIP user-agent configuration mode. For example:**

```
Router(config-sip-ua)# no remote-party-id
```

---

### Note

The priority of P-headers are in the following order: PAID, PPIID, and RPID.
### Table 65: PAID and PPID header configuration settings for mid-call requests and responses

<table>
<thead>
<tr>
<th>Incoming Header</th>
<th>Outgoing Header</th>
<th>Configuration Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAID</td>
<td>PPID</td>
<td>To enable the translation to PPID headers in the outgoing header at a global level, use the <code>asserted-id ppi</code> command in voice service VoIP SIP configuration mode. For example: Router(conf-serv-sip)# asserted-id ppi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To enable the translation to PPID headers in the outgoing header on a specific dial peer, use the <code>voice-class sip asserted-id ppi</code> command in dial peer voice configuration mode. For example: Router(config-dial-peer)# voice-class sip asserted-id ppi</td>
</tr>
<tr>
<td>RPID</td>
<td>PPID</td>
<td>To enable the translation to PPID headers in the outgoing header at a global level, use the <code>asserted-id ppi</code> command in voice service VoIP SIP configuration mode. For example: Router(conf-serv-sip)# asserted-id ppi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To enable the translation to PPID headers in the outgoing header on a specific dial peer, use the <code>voice-class sip asserted-id ppi</code> command in dial peer voice configuration mode. For example: Router(config-dial-peer)# voice-class sip asserted-id ppi</td>
</tr>
<tr>
<td>PPID</td>
<td>PPID</td>
<td>To enable the translation to PPID headers in the outgoing header at a global level, use the <code>asserted-id ppi</code> command in voice service VoIP SIP configuration mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To enable the translation to PPID headers in the outgoing header on a specific dial peer, use the <code>voice-class sip asserted-id ppi</code> command in dial peer voice configuration mode. For example: Router(config-dial-peer)# voice-class sip asserted-id ppi</td>
</tr>
<tr>
<td>Incoming Header</td>
<td>Outgoing Header</td>
<td>Configuration Notes</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
| PAID           | PAID           | To enable the translation to PAID headers in the outgoing header at a global level, use the **asserted-id pai** command in voice service VoIP SIP configuration mode.  
To enable the translation to PAID headers in the outgoing header on a specific dial peer, use the **voice-class sip asserted-id pai** command in dial peer voice configuration mode. For example:  
Router(config-dial-peer)#  
**voice-class sip asserted-id pai** |
| RPID           | PAID           | To enable the translation to PAID headers in the outgoing header at a global level, use the **asserted-id pai** command in voice service VoIP SIP configuration mode.  
To enable the translation to PAID headers in the outgoing header on a specific dial peer, use the **voice-class sip asserted-id pai** command in dial peer voice configuration mode. |
| PPID           | PAID           | To enable the translation to PAID headers in the outgoing header at a global level, use the **asserted-id pai** command in voice service VoIP SIP configuration mode.  
To enable the translation to PAID headers in the outgoing header on a specific dial peer, use the **voice-class sip asserted-id pai** command in dial peer voice configuration mode. |
| PAID           | RPID           | To enable the translation to RPID headers in the outgoing header, use the **remote-party-id** command in SIP user-agent configuration mode.  
For example:  
Router(config-sip-ua)#  
**remote-party-id**.  
*Note* PAID and PPID headers are not configured in this case. |
<table>
<thead>
<tr>
<th>Incoming Header</th>
<th>Outgoing Header</th>
<th>Configuration Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPID</td>
<td>RPID</td>
<td>To enable the translation to RPID headers in the outgoing header, use the <code>remote-party-id</code> command in SIP user-agent configuration mode. For example: <code>Router(config-sip-ua)# remote-party-id</code>.</td>
</tr>
<tr>
<td>PPID</td>
<td>RPID</td>
<td>To enable the translation to RPID headers in the outgoing header, use the <code>remote-party-id</code> command in SIP user-agent configuration mode. For example: <code>Router(config-sip-ua)# remote-party-id</code>.</td>
</tr>
<tr>
<td>FROM</td>
<td>FROM</td>
<td>No configuration required except for the <code>remote-party-id</code> header.</td>
</tr>
<tr>
<td>PPID</td>
<td>RPID</td>
<td>To enable the translation to RPID headers in the outgoing header, use the <code>remote-party-id</code> command in SIP user-agent configuration mode. For example: <code>Router(config-sip-ua)# remote-party-id</code>.</td>
</tr>
<tr>
<td>PAID</td>
<td>PAID</td>
<td>Enables PPID headers on the incoming dial-peer and PAID headers on the outgoing dial-peer.</td>
</tr>
<tr>
<td>RPID</td>
<td>PAID</td>
<td>Enables PPID headers on incoming dial-peer and PAID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td>PPID</td>
<td>PAID</td>
<td>Enables PPID headers on incoming dial-peer and PAID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td>PAID</td>
<td>PAID</td>
<td>Enables RPID headers on incoming dial-peer and PAID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td>RPID</td>
<td>PAID</td>
<td>Enables RPID headers on incoming dial-peer and PAID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td>Incoming Header</td>
<td>Outgoing Header</td>
<td>Configuration Notes</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>PPID</td>
<td>PAID</td>
<td>Enables RPID headers on incoming dial-peer and PAID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td>PAID</td>
<td>PPID</td>
<td>Enables PAID headers on incoming dial-peer and PPID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td>RPID</td>
<td>PPID</td>
<td>Enables PAID headers on incoming dial-peer and PPID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td>PPID</td>
<td>PPID</td>
<td>Enables PAID headers on incoming dial-peer and PPID on outgoing dial-peer.</td>
</tr>
<tr>
<td>PAID</td>
<td>PPID</td>
<td>Enables RPID headers on incoming dial-peer and PPID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td>RPID</td>
<td>PPID</td>
<td>Enables RPID headers on incoming dial-peer and PPID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td>PPID</td>
<td>PPID</td>
<td>Enables RPID headers on incoming dial-peer and PPID headers on outgoing dial-peer.</td>
</tr>
</tbody>
</table>
| PAID            | RPID            | Enables PPID headers on incoming dial-peer and RPID headers on outgoing dial-peer.  
  **Note**  PAID headers will be given priority and RPID headers will be created using the PAID header information. |
| RPID            | RPID            | Enables PPID headers on incoming dial-peer and RPID headers on outgoing dial-peer. |
| PPID            | RPID            | Enables PPID headers on incoming dial-peer and RPID headers on outgoing dial-peer.  
  **Note**  PPID headers will be given priority and RPID headers will be created using the PPID header information. |
### Privacy

If the user is subscribed to a privacy service, the Cisco Unified Border Element can support privacy using one of the following methods:

- **Using prefixes**

  The NGN dial plan can specify prefixes to enable privacy settings. For example, the dial plan may specify that if the caller dials a prefix of 184, the calling number is not sent to the called party.

  The dial plan may also specify that the caller can choose to send the calling number to the called party by dialing a prefix of 186. Here, the Cisco Unified Border Element transparently passes the prefix as part of the called number in the INVITE message.

  The actual prefixes for the network are specified in the dial plan for the NGN, and can vary from one NGN to another.

- **Using the Privacy header**

  If the Privacy header is set to None, the calling number is delivered to the called party. If the Privacy header is set to a Privacy:id value, the calling number is not delivered to the called party.

- **Using Privacy values from the peer call leg**

  If the incoming INVITE has a Privacy header or a RPID with privacy on, the outgoing INVITE can be set to Privacy: id. This behavior is enabled by configuring `privacy pstn` command globally or `voice-class sip privacy pstn` command on the selected dial-per.

---

<table>
<thead>
<tr>
<th>Incoming Header</th>
<th>Outgoing Header</th>
<th>Configuration Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAID</td>
<td>RPID</td>
<td>Enables PAID headers on incoming dial-peer and RPID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note</strong> PAID headers will be given priority and RPID headers will be created using the PAID header information.</td>
</tr>
<tr>
<td>RPID</td>
<td>RPID</td>
<td>Enables PAID headers on incoming dial-peer and RPID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td>PPID</td>
<td>RPID</td>
<td>Enables PAID headers on incoming dial-peer and RPID headers on outgoing dial-peer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note</strong> PPID headers will be given priority and RPID headers will be created using the PPID header information.</td>
</tr>
</tbody>
</table>
Incoming INVITE can have multiple privacy header values, id, user, session, and so on. Configure the `privacy-policy passthru` command globally or `voice-class sip privacy-policy passthru` command to transparently pass across these multiple privacy header values.

Some NGN servers require a Privacy header to be sent even though privacy is not required. In this case the Privacy header must be set to none. The Cisco Unified Border Element can add a privacy header with the value None while forwarding the outgoing INVITE to NGN. Configure the `privacy-policy send-always` globally or `voice-class sip privacy-policy send-always` command in dial-peer to enable this behavior.

If the user is not subscribed to a privacy service, the Cisco Unified Border Element can be configured with no Privacy settings.

**P-Called Party Identity**

The Cisco Unified Border Element can be configured to use the PCPID header in an incoming INVITE message to route the call, and to use the PCPID value to set the To: value of outgoing INVITE messages.

The PCPID header is part of the INVITE messages sent by the NGN, and is used by Third Generation Partnership Project (3GPP) networks. The Cisco Unified Border Element uses the PCPID from incoming INVITE messages (from the NGN) to route calls to the Cisco Unified Call Manager.

---

**Note**

The PCPID header supports the use of E.164 numbers only.

**P-Associated URI**

The Cisco Unified Border Element supports the use of PAURI headers sent as part of the registration process. After the Cisco Unified Border Element sends REGISTER messages using the configured E.164 number, it receives a 200 OK message with one or more PAURIs. The number in the first PAURI (if present) must match the contract number. The Cisco Unified Border Element supports a maximum of six PAURIs for each registration.

---

**Note**

The Cisco Unified Border Element performs the validation process only when a PAURI is present in the 200 OK response.

The registration validation process works as follows:

- The Cisco Unified Border Element receives a REGISTER response message that includes PAURI headers that include the contract number and up to five secondary numbers.

- The Cisco Unified Border Element validates the contract number against the E.164 number that it is registering:
  - If the values match, the Cisco Unified Border Element completes the registration process and stores the PAURI value. This allows administration tools to view or retrieve the PAURI if needed.
  - If the values do not match, the Cisco Unified Border Element unregisters and then reregisters the contract number. The Cisco Unified Border Element performs this step until the values match.
Random Contact Support

The Cisco Unified Border Element can use random-contact information in REGISTER and INVITE messages so that user information is not revealed in the contact header.

To provide random contact support, the Cisco Unified Border Element performs SIP registration based on the random-contact value. The Cisco Unified Border Element then populates outgoing INVITE requests with the random-contact value and validates the association between the called number and the random value in the Request-URI of the incoming INVITE. The Cisco Unified Border Element routes calls based on the PCPID, instead of the Request-URI which contains the random value used in contact header of the REGISTER message.

The default contact header in REGISTER messages is the calling number. The Cisco Unified Border Element can generate a string of 32 random alphanumeric characters to replace the calling number in the REGISTER contact header. A different random character string is generated for each pilot or contract number being registered. All subsequent registration requests will use the same random character string.

The Cisco Unified Border Element uses the random character string in the contact header for INVITE messages that it forwards to the NGN. The NGN sends INVITE messages to the Cisco Unified Border Element with random-contact information in the Request URI. For example: INVITE sip:FefhH3zIHe9i8ImcGjDD1PeC5xiFy51G@10.12.1.46:5060.

The Cisco Unified Border Element will not use the To: value of the incoming INVITE message to route the call because it might not identify the correct user agent if supplementary services are invoked. Therefore, the Cisco Unified Border Element must use the PCPID to route the call to the Cisco Unified Call Manager. You can configure routing based on the PCPID at global and dial-peer levels.

- Feature Information for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element, on page 634
- Prerequisites for Support for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element, on page 636
- Restrictions for Support for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element, on page 636
- Configuring P-Header and Random-Contact Support on the Cisco Unified Border Element, on page 636

Feature Information for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
Table 66: Feature Information for PAID and PPID Headers on Cisco Unified Border Element (CUBE)

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
</table>
| PAID and PPID Headers in mid-call re-INVITE and UPDATE request and responses on Cisco Unified Border Element | Cisco IOS 15.5(3)M Cisco IOS XE 3.16S | This feature enables CUBE platforms to support:  
- P-Preferred Identity (PPID) and P-Asserted Identity (PAID) in mid-call re-INVITE messages and responses from end-to-end.  
- P-Preferred Identity (PPID) and P-Asserted Identity (PAID) in mid-call UPDATE messages and responses from end-to-end.  
- Configuration and/or pass through of PAID and PPID header values. |

Feature History Table entry for the Cisco Unified Border Element and Cisco Unified Border Element (Enterprise).

Table 67: Feature Information for PAID, PPID, Privacy, PCPID, and PAURI Headers on CUBE

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
</table>
| PAID, PPID, Privacy, PCPID, and PAURI Headers on the Cisco Unified Border Element | 12.4(22)YB 15.0(1)M Cisco IOS XE Release 3.1S | This feature enables CUBE platforms to support:  
- P-Preferred Identity (PPID), P-Asserted Identity (PAID), Privacy, P-Called Party Identity (PCPID), in INVITE messages  
- Translation of PAID headers to PPID headers and vice versa  
- Translation of From: or RPID headers to PAID or PPID headers and vice versa  
- Configuration and/or pass through of privacy header values  
- PCPID header to route INVITE messages  
- Multiple PAURI headers in the response messages (200 OK) it receives to REGISTER messages  
- P-Preferred Identity and P-Asserted Identity Headers  

The following commands were introduced: **call-route p-called-party-id, privacy-policy, random-contact, random-request-uri validate**, **voice-class sip call-route p-called-party-id, voice-class sip privacy-policy, voice-class sip random-contact**, and **voice-class sip random-request-uri validate**.
Prerequisites for Support for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element

Cisco Unified Border Element

- Cisco IOS Release 12.4(22)YB or a later release must be installed and running on your Cisco Unified Border Element.

Cisco Unified Border Element (Enterprise)

- Cisco IOS XE Release 3.1S or a later release must be installed and running on your Cisco ASR 1000 Series Router.

Restrictions for Support for PAID PPID Privacy PCPID and PAURI Headers on the Cisco Unified Border Element

- To enable random-contact support, you must configure the Cisco Unified Border Element to support SIP registration with random-contact information. In addition, you must configure random-contact support in VoIP voice-service configuration mode or on the dial peer.
- If random-contact support is configured for SIP registration only, the system generates the random-contact information, includes it in the SIP REGISTER message, but does not include it in the SIP INVITE message.
- If random-contact support is configured in VoIP voice-service configuration mode or on the dial peer only, no random contact is sent in either the SIP REGISTER or INVITE message.
- Passing of “+” is not supported with PAID PPID Privacy PCPID and PAURI Headers.

Configuring P-Header and Random-Contact Support on the Cisco Unified Border Element

To enable random contact support you must configure the Cisco Unified Border Element to support Session Initiation Protocol (SIP) registration with random-contact information, as described in this section.

To enable the Cisco Unified Border Element to use the PCPID header in an incoming INVITE message to route the call, and to use the PCPID value to set the To: value of outgoing INVITE messages, you must configure P-Header support as described in this section.

Configuring P-Header Translation on a Cisco Unified Border Element

To configure P-Header translations on a Cisco Unified Border Element, perform the steps in this section.
SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. sip
5. asserted-id header-type
6. exit

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice service voip</td>
<td>Enters VoIP voice-service configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> sip</td>
<td>Enters voip service VoIP SIP configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router(conf-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> asserted-id header-type</td>
<td>Specifies the type of privacy header in the outgoing SIP requests and response messages.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router(conf-serv-sip)# asserted-id ppi</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> exit</td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router(conf-serv-sip)# exit</td>
<td></td>
</tr>
</tbody>
</table>

Configuring P-Header Translation on an Individual Dial Peer

To configure P-Header translation on an individual dial peer, perform the steps in this section.
**SUMMARY STEPS**

1. enable
2. configure terminal
3. dial-peer voice tag voip
4. voice-class sip asserted-id header-type
5. exit

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Router&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> dial-peer voice tag voip</td>
<td>Defines the dial peer, specifies the method of voice encapsulation, and enters dial peer voice configuration mode.</td>
</tr>
<tr>
<td>Example: Router(config)# dial-peer voice 2611 voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> voice-class sip asserted-id header-type</td>
<td>Specifies the type of privacy header in the outgoing SIP requests and response messages, on this dial peer.</td>
</tr>
<tr>
<td>Example: Router(config-dial-peer)# voice-class sip asserted-id ppi</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> exit</td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td>Example: Router(config-dial-peer)# exit</td>
<td></td>
</tr>
</tbody>
</table>

**Configuring P-Called-Party-Id Support on a Cisco Unified Border Element**

To configure P-Called-Party-Id support on a Cisco Unified Border Element, perform the steps in this section.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice service voip
4. sip
5. call-route p-called-party-id
6. random-request-uri validate
7. exit

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice service voip</td>
<td>Enters VoIP voice-service configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> sip</td>
<td>Enters voice service VoIP SIP configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(conf-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> call-route p-called-party-id</td>
<td>Enables the routing of calls based on the PCPID header.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(conf-serv-sip)# call-route p-called-party-id</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> random-request-uri validate</td>
<td>Enables the validation of the random string in the Request URI of the incoming INVITE message.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(conf-serv-sip)# random-request-uri validate</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> exit</td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(conf-serv-sip)# exit</td>
<td></td>
</tr>
</tbody>
</table>

**Configuring P-Called-Party-Id Support on an Individual Dial Peer**

To configure P-Called-Party-Id support on an individual dial peer, perform the steps in this section.

**SUMMARY STEPS**

1. enable
### Configuring Privacy Support on a Cisco Unified Border Element

To configure privacy support on a Cisco Unified Border Element, perform the steps in this section.

### SUMMARY STEPS

1. **enable**

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><code>enable</code></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Example:</td>
<td>Router&gt; enable</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><code>configure terminal</code></td>
<td>Router# configure terminal</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Defines the dial peer, specifies the method of voice encapsulation, and enters dial peer voice configuration mode.</td>
</tr>
<tr>
<td><code>dial-peer voice tag voip</code></td>
<td>Router(config)# dial-peer voice 2611 voip</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Enables the routing of calls based on the PCPID header on this dial peer.</td>
</tr>
<tr>
<td><code>voice-class sip call-route p-called-party-id</code></td>
<td>Router(config-dial-peer)# voice-class sip call-route p-called-party-id</td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Enables the validation of the random string in the Request URI of the incoming INVITE message on this dial peer.</td>
</tr>
<tr>
<td><code>voice-class sip random-request-uri validate</code></td>
<td>Router(config-dial-peer)# voice-class sip random-request-uri validate</td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td><code>exit</code></td>
<td>Router(config-dial-peer)# exit</td>
</tr>
</tbody>
</table>
2. `configure terminal`
3. `voice service voip`
4. `sip`
5. `privacy privacy-option`
6. `privacy-policy privacy-policy-option`
7. `exit`

## DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router&gt;` enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td><code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td><code>voice service voip</code></td>
<td>Enters VoIP voice-service configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td><code>sip</code></td>
<td>Enters voice service VoIP SIP configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(conf-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td><code>privacy privacy-option</code></td>
<td>Enables the privacy settings for the header.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(conf-serv-sip)# privacy id</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td><code>privacy-policy privacy-policy-option</code></td>
<td>Specifies the privacy policy to use when passing the privacy header from one SIP leg to the next.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(conf-serv-sip)# privacy-policy passthru</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td><code>exit</code></td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(conf-serv-sip)# exit</td>
<td></td>
</tr>
</tbody>
</table>
Configuring Privacy Support on an Individual Dial Peer

To configure privacy support on an individual dial peer, perform the steps in this section.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. dial-peer voice tag voip
4. voice-class sip privacy privacy-option
5. voice-class sip privacy-policy privacy-policy-option
6. exit

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router&gt; enable</td>
<td>Enter your password if prompted.</td>
</tr>
<tr>
<td>Step 2</td>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>dial-peer voice tag voip</td>
<td>Defines the dial peer, specifies the method of voice encapsulation, and</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td>enters dial peer voice configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Router(config)# dial-peer voice 2611 voip</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td>voice-class sip privacy privacy-option</td>
<td>Enables the privacy settings for the header on this dial peer.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(config-dial-peer)# voice-class sip privacy id</td>
<td></td>
</tr>
<tr>
<td>Step 5</td>
<td>voice-class sip privacy-policy privacy-policy-option</td>
<td>Specifies the privacy policy to use when passing the privacy header from</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td>one SIP leg to the next, on this dial peer.</td>
</tr>
<tr>
<td></td>
<td>Router(config-dial-peer)# voice-class sip privacy-policy passthru</td>
<td></td>
</tr>
<tr>
<td>Step 6</td>
<td>exit</td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td></td>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(config-dial-peer)# exit</td>
<td></td>
</tr>
</tbody>
</table>
Configuring Random-Contact Support on a Cisco Unified Border Element

To configure random-contact support on a Cisco Unified Border Element, perform the steps in this section.

SUMMARY STEPS

1. enable
2. configure terminal
3. sip-ua
4. credentials username username password password realm domain-name
5. registrar ipv4: destination-address random-contact expires expiry
6. exit
7. voice service voip
8. sip
9. random-contact
10. exit

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td>Enter your password if prompted.</td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3 sip-ua</td>
<td>Enters SIP user-agent configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config)# sip-ua</td>
<td></td>
</tr>
<tr>
<td>Step 4 credentials username username password password realm domain-name</td>
<td>Sends a SIP registration message from the Cisco Unified Border Element.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-sip-ua)# credentials username 123456 password cisco realm cisco</td>
<td></td>
</tr>
<tr>
<td>Step 5 registrar ipv4: destination-address random-contact expiry</td>
<td>Enables the SIP gateways to register E.164 numbers on behalf of analog telephone voice ports (FXS), IP phone virtual voice ports (EFXS), and Skinny Client Control Protocol (SCCP) phones with an external SIP proxy or SIP registrar.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-sip-ua)# registrar ipv4:10.1.2.2 random-contact expires 200</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td>exit</td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-sip-ua)# exit</td>
<td></td>
</tr>
<tr>
<td>voice service voip</td>
<td>Enters VoIP voice-service configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td>sip</td>
<td>Enters voice service VoIP SIP configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(conf-voi-serv)# sip</td>
<td></td>
</tr>
<tr>
<td>random-contact</td>
<td>Enables random-contact support on a Cisco Unified Border Element.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(conf-serv-sip)# random-contact</td>
<td></td>
</tr>
<tr>
<td>exit</td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(conf-serv-sip)# exit</td>
<td></td>
</tr>
</tbody>
</table>

**Configuring Random-Contact Support for an Individual Dial Peer**

To configure random-contact support for an individual dial peer, perform the steps in this section.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. sip-ua
4. credentials username **username** password **password** realm **domain-name**
5. registrar ipv4: destination-address random-contact expires expiry
6. exit
7. dial-peer voice **tag** voip
8. voice-class sip random-contact
9. exit
### DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| 1    | `enable`          | Enables privileged EXEC mode.  
**Example:**  
Router> `enable`  
- Enter your password if prompted. |
| 2    | `configure terminal` | Enters global configuration mode.  
**Example:**  
Router# `configure terminal` |
| 3    | `sip-ua`          | Enters SIP user-agent configuration mode.  
**Example:**  
Router(config)# `sip-ua` |
| 4    | `credentials username username password password realm domain-name` | Sends a SIP registration message from the Cisco Unified Border Element.  
**Example:**  
Router(config-sip-ua)# `credentials username 123456 password cisco realm cisco` |
| 5    | `registrar ipv4: destination-address random-contact expires expiry` | Enables the SIP gateways to register E.164 numbers on behalf of FXS, EFXS, and SCCP phones with an external SIP proxy or SIP registrar.  
- The `random-contact` keyword configures the Cisco Unified Border Element to send the random string from the REGISTER message to the registrar.  
**Example:**  
Router(config-sip-ua)# `registrar ipv4:10.1.2.2 random-contact expires 200` |
| 6    | `exit`            | Exits the current mode.  
**Example:**  
Router(config-sip-ua)# `exit` |
| 7    | `dial-peer voice tag voip` | Defines the dial peer, specifies the method of voice encapsulation, and enters dial peer voice configuration mode.  
**Example:**  
Router(config)# `dial-peer voice 2611 voip` |
| 8    | `voice-class sip random-contact` | Enables random-contact support on this dial peer.  
**Example:**  
Router(config-dial-peer)# `voice-class sip random-contact` |
### Command or Action

| Step 9 | exit  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Example:</td>
<td>Router(config-dial-peer)# exit</td>
</tr>
</tbody>
</table>

### Purpose

- Exits the current mode.
PART XVI

SIP Supplementary Services

• Dynamic Refer Handling, on page 649
• Cause Code Mapping, on page 655
Dynamic Refer Handling

When a dial-peer match occurs, CUBE passes the REFER message from an in leg to an out leg. Also, the host part of the Refer-to header is modified with the IP address.

The Dynamic REFER handling feature provides configurations to pass across or consume the REFER message. When an endpoint invokes a supplementary service such as a call transfer, the endpoint generates and sends an in-dialog REFER request towards the Cisco UBE. If the REFER message is consumed, an INVITE is sent towards refer-to dial-peer.

- Feature Information for Dynamic REFER Handling, on page 649
- Prerequisites, on page 650
- Restrictions, on page 650
- Configuring REFER Passthrough with Unmodified Refer-to, on page 650
- Configuring REFER Consumption, on page 652
- Troubleshooting Tips, on page 654

Feature Information for Dynamic REFER Handling

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
</table>
| REFER Consume (Enhancements)  | IOS 15.5(1)T  
IOS XE 3.14.0 S      | REFER Consume (Enhancements) provides additional configurations to conditionally forward the REFER message. The following commands were introduced: refer consume. |
### Feature Information

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic REFER Handling</td>
<td>IOS 15.2(1)T</td>
<td>The Dynamic REFER handling feature provides configurations to pass across or consume the REFER message.</td>
</tr>
<tr>
<td></td>
<td>IOS XE Release 3.7S</td>
<td>The following commands were introduced: refer-to-passing, voice-class sip refer-to-passing.</td>
</tr>
</tbody>
</table>

### Prerequisites

- Transcoding configuration is required on the CUBE for midcall transcoder insertion, deletion, or modification during call transfers.

### Restrictions

- Only Session Initiation Protocol (SIP)-to-SIP call transfers are supported.
- Call escalation and de-escalation are not supported.
- Video transcoding is not supported.
- Session Description Protocol (SDP) pass-through is not supported.
- In REFER consume scenario, if TCL script is enabled, then supplementary-service media-renegotiate command should not be configured.
- REFER pass-through configuration is not supported on a CUBE configured with an inbound dial-peer using survivability TCL script.

### Configuring REFER Passthrough with Unmodified Refer-to

This task configures the passthrough of REFER message from the in leg to the out leg on a dial-peer match. A REFER is sent towards inbound dial peer. This task also ensures that the host part of the Refer-to header is unmodified and not changed to the IP address during passthrough.

<table>
<thead>
<tr>
<th>supplementary service refer</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>REFER is passed through from the in leg to the out leg</td>
</tr>
<tr>
<td>no</td>
<td>INVITE is sent towards refer-to dial-peer</td>
</tr>
</tbody>
</table>

**Note:**

This configurations in this task can be overridden by the refer consume command. Refer to the Configuring REFER Consumption task for more information.
SUMMARY STEPS

1. enable
2. configure terminal
3. Configure REFER passthrough:
   • supplementary-service sip refer in global VoIP configuration mode.
   • supplementary-service sip refer in dial-peer configuration mode.
4. (Optional) Configure unmodified Refer-to:
   • refer-to-passing in Global VoIP SIP configuration mode.
   • voice-class sip refer-to-passing [system] in dial-peer configuration mode.
5. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
</tr>
<tr>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
</tbody>
</table>

| **Step 2**        |         |
| configure terminal| Enters global configuration mode. |
| Example:          |         |
| Device# configure terminal | |

| **Step 3**        |         |
| Configure REFER passthrough: | Configures REFER passthrough. A REFER is sent towards the inbound dial peer |
| • supplementary-service sip refer in global VoIP configuration mode. | |
| • supplementary-service sip refer in dial-peer configuration mode. | |
| **Example:**      |         |
| In Global VoIP configuration mode: | |
| Device(config)# voice service voip | |
| Device(config)# supplementary-service sip refer | |

| **Step 4**        |         |
| (Optional) Configure unmodified Refer-to: | Ensures that the refer-to header is unmodified and not changed to the IP address during passthrough |
| • refer-to-passing in Global VoIP SIP configuration mode. | |
Purpose

Command or Action

• voice-class sip reftaro-passing [system] in dial-peer configuration mode.

Example:
In Global VoIP configuration mode:
Device(config)# voice service voip
Device(conf-voi-serv)# sip
Device(conf-serv-sip)# referto-passing

Example:
In dial-peer configuration mode:
Device(config)# dial-peer voice 22 voip
Device(config-dial-peer)# voice-class sip
referto-passing

Exit to privileged EXEC mode.

Step 5

end

Exits to privileged EXEC mode.

Configuring REFER Consumption

This task configures the consumption of REFER message on a dial-peer match. An INVITE is sent towards the Refer-to dial peer.

Table 69: Configurations for REFER Consumption

<table>
<thead>
<tr>
<th>supplementary service refer</th>
<th>refer consume</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>no</td>
<td>REFER is sent towards inbound dial-peer</td>
</tr>
<tr>
<td>yes</td>
<td>yes</td>
<td>INVITE is sent towards refer-to dial-peer</td>
</tr>
<tr>
<td>no</td>
<td>no</td>
<td>INVITE is sent towards refer-to dial-peer</td>
</tr>
<tr>
<td>no</td>
<td>yes</td>
<td>INVITE is sent towards refer-to dial-peer</td>
</tr>
</tbody>
</table>

SUMMARY STEPS

1. enable
2. configure terminal
3. Enter one of the following:
   • no supplementary-service sip refer in global VoIP configuration mode.
   • no supplementary-service sip refer in dial-peer configuration mode.
4. refer consume in global VoIP configuration mode.
5. (Optional) supplementary-service media-renegotiate in global VoIP configuration mode.
6. end
### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> Enter one of the following:</td>
<td>Configures REFER consumption. An INVITE is sent towards the Refer-to dial peer.</td>
</tr>
<tr>
<td>• no supplementary-service sip refer in global VoIP configuration mode.</td>
<td></td>
</tr>
<tr>
<td>• no supplementary-service sip refer in dial-peer configuration mode.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>In global VoIP configuration mode:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# no supplementary-service sip refer</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>In dial-peer configuration mode:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# dial-peer voice 22 voip</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# no supplementary-service sip refer</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> refer consume</td>
<td>Configures REFER consumption.</td>
</tr>
<tr>
<td>in global VoIP configuration mode.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>In dial-peer configuration mode:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# dial-peer voice 22 voip</td>
<td></td>
</tr>
<tr>
<td>Device(config-dial-peer)# refer consume</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> (Optional) supplementary-service media-renegotiate</td>
<td>Enables end-to-end media renegotiation during the call transfer in REFER consumption mode.</td>
</tr>
<tr>
<td>in global VoIP configuration mode.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>In global VoIP configuration mode:</td>
<td></td>
</tr>
<tr>
<td>Device(config)# voice service voip</td>
<td></td>
</tr>
<tr>
<td>Device(config-voi-serv)# supplementary-service media-renegotiate</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> end</td>
<td>Exits to privileged EXEC mode.</td>
</tr>
</tbody>
</table>
Troubleshooting Tips

Use any of the following debug commands:

- debug ccsip all
- debug voip ccap inout
- debug sccp messages
- debug voip application supplementary-service
- debug voip application state
- debug voip application media negotiation
CHAPTER 56

Cause Code Mapping

With the Cause Code Mapping feature, the NOTIFY message sent by CUBE to a Customer Voice Portal (CVP) contains a proper reason for failure of call transfer based on the information received by CUBE from the caller instead of a 503 Service Unavailable message for all scenarios.

- Feature Information for Cause Code Mapping, on page 655
- Cause Code Mapping, on page 656
- Configuring Cause Code Mapping, on page 657
- Verifying Cause Code Mapping, on page 658

Feature Information for Cause Code Mapping

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause Code Mapping</td>
<td>Cisco IOS 15.5(1)T</td>
<td>With the Cause Code Mapping feature, the NOTIFY message sent by CUBE to a Customer Voice Portal (CVP) contains a proper reason for failure of call transfer based on the information received by CUBE from the caller. Following are the cause codes supported:</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE 3.14S</td>
<td>• 17—486 Busy Here</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS 15.5(1)T3</td>
<td>• 19—503 Service Unavailable</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS 15.5(1)S3</td>
<td>• 21—403 Forbidden</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS 15.5(2)T1</td>
<td>• 31—480 Temporarily Unavailable</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS 15.5(2)S1</td>
<td>• 102—504 Server Time-out</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS 15.4(3)M4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cisco IOS 15.4(3)S4</td>
<td></td>
</tr>
</tbody>
</table>
Feature Information

Releases

Feature Name

With the Cause Code Mapping (Enhancement) feature, additional NOTIFY messages are introduced to inform CVP the proper reason for call failures based on the information received by CUBE from the caller instead of a 503 Service Unavailable message for all scenarios.

The following cause codes were introduced:

- 1 — 404 Not Found
- 20 — 480 Temporarily Unavailable
- 27 — 502 Bad Gateway
- 28 — 484 Address Incomplete
- 38 — 503 Service Unavailable

Table 71: Cause Code Mappings

<table>
<thead>
<tr>
<th>Status Message received by CUBE (Step 3)</th>
<th>Cause Code</th>
<th>Notify message sent to CVP (Step 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>486</td>
<td>17</td>
<td>486 Busy Here</td>
</tr>
<tr>
<td>Status Message received by CUBE (Step 3)</td>
<td>Cause Code</td>
<td>Notify message sent to CVP (Step 4)</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>480</td>
<td>31</td>
<td>480 Temporarily Unavailable</td>
</tr>
<tr>
<td>403</td>
<td>21</td>
<td>403 Forbidden</td>
</tr>
<tr>
<td>480</td>
<td>19</td>
<td>503 Service Unavailable</td>
</tr>
<tr>
<td>504</td>
<td>102</td>
<td>504 Server Time-out</td>
</tr>
<tr>
<td>404</td>
<td>1</td>
<td>404 Not Found</td>
</tr>
<tr>
<td>480</td>
<td>20</td>
<td>480 Temporarily Unavailable</td>
</tr>
<tr>
<td>484</td>
<td>28</td>
<td>484 Address Incomplete</td>
</tr>
<tr>
<td>502</td>
<td>27</td>
<td>502 Bad Gateway</td>
</tr>
<tr>
<td>503</td>
<td>38</td>
<td>503 Service Unavailable</td>
</tr>
</tbody>
</table>

Note: Cause code mappings for cause code 19 and 21 require configurations mentioned in Configuring Cause Code Mapping, on page 657.

Note: This mapping is only for the REFER consume scenario and not for REFER passthrough.

Configuring Cause Code Mapping

SUMMARY STEPS

1. enable
2. configure terminal
3. sip-ua
4. reason-header override
5. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enters privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> sip-ua</td>
<td>Enters the SIP user agent configuration mode.</td>
</tr>
<tr>
<td>Example: Device(config)# sip-ua</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> reason-header override</td>
<td>Configures the sending of a proper reason for failure of call transfer in the NOTIFY message so that the Customer Voice Portal (CVP) can take an appropriate action.</td>
</tr>
<tr>
<td>Example: Device(config-sip-ua)# reason-header override</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> end</td>
<td>Exits to privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device(config-sip-ua)# end</td>
<td></td>
</tr>
</tbody>
</table>

### Verifying Cause Code Mapping

**SUMMARY STEPS**

1. Enter the following:
   - debug csip function
   - debug csip message
   - debug voip application state
   - debug voip application core
   - debug voip ccapi inout

**DETAILED STEPS**

Enter the following:

- debug csip function
- debug csip message
- debug voip application state
- debug voip application core
- debug voip ccapi inout

**Example:**

486 Received by CUBE:
Received:
SIP/2.0 486 Busy Here
Via: SIP/2.0/UDP 9.40.3.231:5060;branch=z9hG4bK1C15625F7
From: <sip:2222@9.40.3.231>;tag=49B0964D-213C
To: <sip:3333@9.0.0.174>;tag=1
Call-ID: 7D7073E4-3F3B11E4-917BF9A9-A90B2232@9.40.3.231
CSeq: 101 INVITE
Allow-Events: telephone-event
Content-Length: 0
Reason: Q.850; cause=17

486 Busy here response sent in NOTIFY by CUBE

Sent:
NOTIFY sip:1111@9.0.0.174:9000 SIP/2.0
Via: SIP/2.0/UDP 9.40.3.231:5060;branch=z9hG4bK1C1571767
From: <sip:2222@9.40.3.231:5060>;tag=49B08E64-1374
To: <sip:1111@9.0.0.174>;tag=1
Call-ID: 1-25970@9.0.0.174
CSeq: 102 NOTIFY
Max-Forwards: 70
Date: Fri, 19 Sep 2014 13:55:46 GMT
User-Agent: Cisco-SIPGateway/IOS-15.5.20140712.124355.
Event: refer
Subscription-State: terminated;reason=nosresource
Contact: <sip:2222@9.40.3.231:5060>
Content-Type: message/sipfrag
Content-Length: 25

SIP/2.0 486 Busy here
Verifying Cause Code Mapping
PART XVII

Cisco Unified Communications Manager Line-Side Support

• Cisco Unified Communications Manager Line-Side Support, on page 663
Cisco Unified Communications Manager Line-Side Support

Cisco Unified Communications Manager is an enterprise-class IP communications processing system. It extends enterprise telephony features and capabilities to IP phones, media processing devices, VoIP gateways, mobile devices, and multimedia applications. Cisco Unified Border Element (Cisco UBE) provides line-side support for Cisco Unified Communications Manager. This support enables communication between devices (such as phones) used by remote users on different logical networks, in both cloud-based and premise-based deployments.

- Feature Information for Cisco Unified Communications Manager Line-Side Support, on page 663
- Restrictions for Cisco Unified Communications Manager Line-Side Support, on page 664
- Information About Cisco Unified Communications Manager Line-Side Support, on page 665

Feature Information for Cisco Unified Communications Manager Line-Side Support

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 72: Feature Information for Cisco Unified Communications Manager Line-Side Support

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco Unified Communications Manager Line-Side Support</td>
<td>15.5(2)T</td>
<td>The Cisco Unified Communications Manager (CUCM) Line-Side Support feature was supported until the release 15.4(2)T. This feature has been deprecated from 15.5(2)T release onwards.</td>
</tr>
<tr>
<td>Feature Name</td>
<td>Releases</td>
<td>Feature Information</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Simplified Line-Side Support of CUCM on CUBE</td>
<td>15.4(2)T</td>
<td>The Simplified Line-Side Support of CUCM on CUBE feature simplifies the complex CUBE configurations required for registering IP Phones on a CUCM through CUBE using a single CLI that automatically applies all the necessary configurations. The following commands were modified by this feature: <code>extension cucm</code> and <code>voice-class sip extension cucm</code>.</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE Release 3.12S</td>
<td></td>
</tr>
<tr>
<td>Cisco Unified Communications Manager Line-Side Support</td>
<td>15.3(3)M</td>
<td>The Cisco Unified Communications Manager Line-Side Support feature provides line-side support for Cisco Unified Communications Manager and IP phones deployed on different logical networks, in both cloud-based and premise-based deployments. The following commands were introduced or modified: <code>access-secure</code>, <code>capf-address</code>, <code>clear voice phone-proxy all-sessions</code>, <code>complete (ctl file)</code>, <code>ctl-file (phone proxy)</code>, <code>debug voice phone-proxy</code>, <code>description (ctl file)</code>, <code>description (phone proxy)</code>, <code>disable service-settings</code>, <code>max-concurrent-sessions</code>, <code>phone-proxy (dial peer)</code>, <code>port-range</code>, <code>record-entry</code>, <code>show voice class ctl-file</code>, <code>show voice class phone-proxy</code>, <code>service-map</code>, <code>session-timeout</code>, <code>tftp-server address</code>, <code>voice-ctl-file</code>, <code>voice-phone-proxy</code>.</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE Release 3.10S</td>
<td></td>
</tr>
</tbody>
</table>

### Restrictions for Cisco Unified Communications Manager Line-Side Support

- In Cisco Unified Communications Manager Line-Side Support deployments, Cisco Unified Border Element does not support TFTP encrypted configuration files.
Information About Cisco Unified Communications Manager Line-Side Support

Cisco UBE Line-Side Deployment

In a typical deployment Cisco Unified Border Element (Cisco UBE) is placed between the Cisco Unified Communications Manager and the endpoint. Before invoking a service the phone contacts the CUBE Trivial File Transfer Protocol (TFTP) server to get configuration information such as the Certificate Trust List (CTL) file and phone-specific configuration settings. The phone then registers with Cisco Unified Communications Manager. In the deployment shown below, Cisco Unified Communications Manager and the phone configuration operate in unsecured mode (TCP to Real-Time Transport Protocol). The phone configuration can be changed to operate in a secure mode (Transport Layer Security Secure to Real-Time Transport Protocol) if needed. When the phone registration is completed the phone can invoke all normal call services.

Figure 59: Cisco UBE Line-Side Deployment

Line-Side Deployment Scenarios

Cisco Unified Call Manager Line-Side support can be deployed in the following ways:

• Line-Side Secure Deployment -

  CUCM line-side secure deployment, provides secure access between phone and CUBE. CUBE terminates the TLS connection from phone and initiates a TCP connection to CUCM to perform TLS-TCP inter-working. Refer to 'Example: Configuring CUCM Secure Line-Side' section for the steps involved in configuring secure deployment.

• Line-Side Non-Secure Deployment -

  CUCM line-side non-secure deployment, provides a non-secure connection between phone and CUBE. Refer to ‘Example: Configuring CUCM Non-Secure Line-Side’ section for the steps involved in configuring non-secure deployment.
Line-Side Support for CUCM on CUBE

For an IP phone to register on a CUCM through CUBE, CUBE must be configured to do the following requirements.

- TCP must be used for registration.
- The MAC address of the device (device ID) and the device name, present in the CONTACT header of the REGISTER message, need to be copied to the outgoing messages and passed to the CUCM intact.

Table 73: Command for Line-Side Support for CUCM on CUBE

<table>
<thead>
<tr>
<th>Dial-Peer Configuration Mode (config-dial-peer)</th>
<th>Global VoIP Configuration mode (config-voi-serv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>voice-class sip extension cucm</td>
<td>sip</td>
</tr>
<tr>
<td></td>
<td>sip extension cucm</td>
</tr>
</tbody>
</table>

When Line Side Support for CUCM on CUBE feature is configured, the following supported, nonmandatory headers are passed through automatically without the need for further configuration:

- Call-Info
- Content-ID
- Allow-Events
- Supported
- Remote-Party-ID
- Require
- Referred-By

Figure 60: Predefined Supported NonMandatory Headers

When Line Side Support for CUCM on CUBE is configured, predefined SIP profiles automatically remove the Cisco-Guide header from the outgoing INVITE.

Figure 61: Predefined SIP Profile

Note

If a user explicitly configures the above configurations, ensure that the configurations are merged with the above automatic configurations.
Configuring a PKI Trustpoint

SUMMARY STEPS

1. `crypto key generate rsa [label key-label] [modulus modulus-size] general-keys`
2. `crypto pki trustpoint name`
3. `enrollment selfsigned`
4. `subject-name [x.500-name]`
5. `subject-alt-name sip-security-profile-name`
6. `revocation-check method1 [method2 [method3]]`
7. `rsakeypair key-label`

DETAILED STEPS

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td><code>crypto key generate rsa [label key-label] [modulus modulus-size] general-keys</code></td>
<td>Generates a RSA key pair.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config)# crypto key generate rsa label pp_rsa modulus 1024 general-keys</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td><code>crypto pki trustpoint name</code></td>
<td>Declares the trustpoint that the device should use and enters ca-trustpoint configuration mode.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config)# crypto pki trustpoint calmg23</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td><code>enrollment selfsigned</code></td>
<td>Specifies self-signed enrollment for a trustpoint.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config-ca-trustpoint)# enrollment selfsigned</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td><code>subject-name [x.500-name]</code></td>
<td>Specifies the subject name in the certificate request.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config-ca-trustpoint)# subject-name CN=ASR1006-CCN-4</td>
<td></td>
</tr>
<tr>
<td>Step 5</td>
<td><code>subject-alt-name sip-security-profile-name</code></td>
<td>Specifies the alternative subject name in the certificate request.</td>
</tr>
<tr>
<td></td>
<td>Example: Device(config-ca-trustpoint)# subject-alt-name 6961_SEC.cisco.com 8941_SEC.cisco.com 8945_SEC.cisco.com 7975_SEC.cisco.com 7970_SEC.cisco.com</td>
<td></td>
</tr>
</tbody>
</table>

Note: A self-signed key can only support a `modulus-size` value of 1024 bits.
# Importing the CUCM and CAPF Key

**Before you begin**

Download the CUCM key (the CallManager.pem file) from the Cisco Unified Communications Manager Operating System Administration web page.

Login to Cisco Unified OS Administration and Security and Certificate Management, download the CUCM key (the CallManager.pem file), and copy and paste the CUCM key to CUBE

## SUMMARY STEPS

1. `crypto pki trustpoint name`
2. `revocation-check method1[ method2 [method3]]`
3. `enrollment terminal`
4. `crypto pki authenticate name`

## DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><strong>crypto pki trustpoint name</strong>&lt;br&gt;Example:&lt;br&gt;Device(config)# crypto pki trustpoint cucm_trustpoint</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td><strong>revocation-check method1[ method2 [method3]]</strong>&lt;br&gt;Example:&lt;br&gt;Device(config-ca-trustpoint)# revocation-check none</td>
</tr>
</tbody>
</table>

---

What to do next

Import the CUCM and CAPF key.
### PurposeCommand or Action | Purpose
--- | ---

**Step 3** | **enrollment terminal**
Example: Device(config-ca-trustpoint)# enrollment terminal

Specifies manual cut-and-paste certificate enrollment.

**Step 4** | **crypto pki authenticate** *name*
Example: Device(config-ca-trustpoint)# crypto pki authenticate cucm_trustpoint

Authenticates the trustpoint. At the prompt to enter the certificate, copy the contents of the CallManager.pem file that you downloaded above and paste it at the prompt. At the prompt to accept the file, enter “yes”. **Note** When you copy the certificate, ensure that you also copy the BEGIN and END lines.

---

### What to do next

Repeat the above steps for the CAPF key (the CAPF.pem file).

---

### Creating a CTL File

#### SUMMARY STEPS

1. **voice-ctl-file** *ctl-filename*
2. **record-entry** selfsigned trustpoint *trustpoint-name*
3. **record-entry** capf trustpoint *trustpoint-name*
4. **record-entry** cucm-tftp trustpoint *trustpoint-name*
5. **complete**

#### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1** | **voice-ctl-file** *ctl-filename*
Example: Device(config)#voice-ctl-file ct1

Creates a CTL file and enters CTL file configuration mode. |

| **Step 2** | **record-entry** selfsigned trustpoint *trustpoint-name*
Example: Device(config-ctl-file)#record-entry selfsigned trustpoint self-trustpoint6s

Configures the trustpoints to be used for creating the CTL file. |
### Configuring a Phone Proxy

**SUMMARY STEPS**

1. `voice-phone-proxy phone-proxy-name`
2. `voice-phone-proxy file-buffer size`
3. `tftp-server-address [ipv4 server-ip-address | domain-name]`
4. `ctl-file ctl-filename`
5. `access-secure`
6. `complete`

**DETAILED STEPS**

| Command or Action                         | Purpose                                                                   |
|-------------------------------------------|                                                                          |
| **Step 1** `voice-phone-proxy phone-proxy-name` | Configures a phone proxy and enters phone-proxy configuration mode.       |
| Example:                                  |                                                                          |
| Device(config)# voice-phone-proxy pp      |                                                                          |
| **Step 2** `voice-phone-proxy file-buffer size` | Configures the phone-proxy file buffering parameter, in MB.              |
| Example:                                  |                                                                          |
| Device(config)# voice-phone-proxy file-buffer 30 |                                                                          |
| **Step 3** `tftp-server-address [ipv4 server-ip-address | domain-name]` | Configures the TFTP server address.                                      |
| Example:                                  |                                                                          |
### Purpose

#### Command or Action

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device(config-phone-proxy)# tftp-server-address ipv4 172.110.36.2</td>
<td>Configures the CTL filename.</td>
</tr>
</tbody>
</table>

#### Step 4

**ctl-file ctl-filename**

**Example:**

Device(config-phone-proxy)# ctl-file ct1

#### Step 5

**access-secure**

**Example:**

Device(config-phone-proxy)# access-secure

#### Step 6

**complete**

**Example:**

Device(config-phone-proxy)# complete

---

### Attaching a Phone Proxy to a Dial Peer

#### SUMMARY STEPS

1. **dial-peer voice tag voip**
2. **phone-proxy phone-proxy-name signal-addr ipv4 ipv4-address ccm ipv4 ipv4-address**
3. **session protocol sipv2**
4. **session target registrar**
5. **session transport {udp | tcp [tls]}**
6. **incoming url {from | request | to | via} tag**
7. **destination uri tag**
8. **voice-class sip call-route url**
9. **voice-class sip profiles number**
10. **voice-class sip registration passthrough [registrar-index index]**
11. **voice-class sip pass-thru headers**
12. **voice-class sip copy-list {tag | system}**
13. **codec transparent**

#### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1**
  | dial-peer voice tag voip |
  | **Example:** |
  | Device(config)# dial-peer voice 10 voip |

Defines a particular dial peer, specifies the method of voice encapsulation, and enters dial peer configuration mode.
<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td><strong>phone-proxy</strong> <strong>phone-proxy-name</strong> <strong>signal-addr</strong> <strong>ipv4</strong>&lt;br&gt;<strong>ipv4-address</strong> <strong>cucm</strong> <strong>ipv4</strong> <strong>ipv4-address</strong></td>
<td>Configures the phone proxy for the related dial peer.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-dial-peer)# phone-proxy ppl&lt;br&gt;signal-addr ipv4 10.0.0.8 cucm ipv4 198.51.100.1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><strong>session protocol</strong> <strong>sipv2</strong></td>
<td>Specifies a session protocol (SIPv2) for calls between local and remote devices.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-dial-peer)# session protocol sipv2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><strong>session target registrar</strong></td>
<td>Specifies that a call from a VoIP dial peer is routed to the registrar end point.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-dial-peer)# session target registrar</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><strong>session transport</strong> {<strong>udp</strong></td>
<td>Configures the underlying transport layer protocol for SIP messages to transport layer security over TCP (TLS over TCP).</td>
</tr>
<tr>
<td>Example:</td>
<td>tcp [tls]}</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# session transport tcp tls</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><strong>incoming uri</strong> {<strong>from</strong></td>
<td>Specifies the voice class used to match the VoIP dial peer to the uniform resource identifier (URI) of an incoming call. Any request matching “uri 11” is destined to this dial peer.</td>
</tr>
<tr>
<td>Example:</td>
<td>request</td>
<td>to</td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# incoming uri request 11</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><strong>destination uri</strong> <strong>tag</strong></td>
<td>Specifies the voice class used to match a dial peer to the destination URI of an outgoing call. Any request matching “uri 12” is destined to this dial peer.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-dial-peer)# destination uri 12</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><strong>voice-class sip call-route url</strong></td>
<td>Enables call routing based on the URL.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-dial-peer)# voice-class sip call-route url</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>voice-class sip profiles</strong> <strong>number</strong></td>
<td>Configures a SIP profile for a voice class.</td>
</tr>
<tr>
<td>Example:</td>
<td>Device(config-dial-peer)# voice-class sip profiles 10</td>
<td></td>
</tr>
<tr>
<td>Step 10</td>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td>voice-class sip registration passthrough [registrar-index index]</td>
<td>Configures the SIP registration pass-through options on the dial peer.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# voice-class sip registration passthrough registrar-index 1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 11</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>voice-class sip pass-thru headers</td>
<td>Configures a list of headers for pass through by referring to a globally configured list.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# voice-class sip pass-thru headers 10</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 12</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>voice-class sip copy-list {tag</td>
<td>system}</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# voice-class sip copy-list 10</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 13</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>codec transparent</td>
<td>Enables codec capabilities to be passed transparently between endpoints in a Cisco Unified Border Element.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device(config-dial-peer)# codec transparent</td>
<td></td>
</tr>
</tbody>
</table>

**Verifying CUCM Lineside Support**

The `show` commands can be entered in any order.

**SUMMARY STEPS**

1. **enable**
2. `show dial-peer voice dial-peer-id | section voice class sip extension`
3. `show dial-peer voice`
4. `show voice class phone-proxy`
5. `show voice class phone-proxy sessions`

**DETAILED STEPS**

**Step 1**

**enable**

Enables privileged EXEC mode.

- Enter your password if prompted.

**Example:**

Device> **enable**
Step 2  
show dial-peer voice dial-peer-id | section voice class sip extension

Example:
CUBE# show dial-peer voice 5678 | section voice class sip extension

voice class sip extension = system,
Displays if extension cucm has not been configured for the dial peer.

Example:
CUBE# show dial-peer voice 5678 | section voice class sip extension

voice class sip extension = cucm,
Displays if extension cucm has been configured for the dial peer.

Example:
CUBE# show dial-peer voice 5678 | section voice class sip extension

voice class sip extension = none,
Displays if extension cucm has been removed for the dial peer using the no form of the command.

Step 3  
show dial-peer voice

Example:
Device# show dial-peer voice 100

voice class sip extension = system,
voice class sip contact-passing = system,
voice class sip requri-passing = system,
voice class phone proxy name: phone_proxy_secure
voice class phone proxy config: complete

Step 4  
show voice class phone-proxy

Example:
Device# show voice class phone-proxy

Phone-Proxy 'phone_proxy':
Description:  
Access Secure: non-secure (default)
Tftp-server address: 20.21.27.146
Capf server address: 20.21.27.146
CUCM service settings: preserve (default)
CTL file name: ctl_file
Session-timeout: 180 seconds
Max-concurrent-sessions: 30
Current sessions: 0
TFTP sessions: 0
HTTP download sessions: 0
HTTP application sessions: 0
CAPF sessions: 0
Config status: complete
SIP dial-peers associated:
  Name
  -----------------
  1
  -----------------------------------------------
Phone-Proxy 'phone_proxy_secure':
Description:
  Access Secure: secure
Tftp-server address: 20.21.27.146
Capf server address: 20.21.27.146
CUCM service settings: preserve (default)
CTL file name: ctl_file
Session-timeout: 180 seconds
Max-concurrent-sessions: 30
Current sessions: 0
TFTP sessions: 0
HTTP download sessions: 0
HTTP application sessions: 0
CAPF sessions: 0
Config status: complete
SIP dial-peers associated:
  Name
  ---------------
  3
dialpeer4

-------------------------------------------------------------
Step 5  show voice class phone-proxy sessions
Example:

Device# show voice class phone-proxy sessions

Phone-Proxy 'phone_proxy_ipad':
  Source Destination
  ----------------------------------- Sessions of Dial-peer 5 -------------------------------
|Access: 10.74.9.219 :45232 10.74.9.209 :6970
|Core : 20.21.29.209 :45300 20.21.27.146 :6970
-----------------------------------------------------------------------------------------------

Example: Configuring a PKI Trustpoint

Device(config)# crypto key generate rsa label pp_rsa modulus 1024 general-keys
Device(config)# crypto pki trustpoint callmg23
Device(config-ca-trustpoint)# enrollment selfsigned
Device(config-ca-trustpoint)# subject-name CN=ASR1006-CCN-4
Device(config-ca-trustpoint)# subject-alt-name 6961_SEC.cisco.com 8941_SEC.cisco.com
Device(config-ca-trustpoint)# subject-alt-name 8945_SEC.cisco.com 7975_SEC.cisco.com 7970_SEC.cisco.com
Device(config-ca-trustpoint)# revocation-check crl
Device(config-ca-trustpoint)# rsakeypair pp1
Example: Importing the CUCM and CAPF Key

The following example shows how to import the CUCM and CAPF key after you have downloaded the CUCM key (the CallManager.pem file) and the CAPF key (the CAPF.pem file) from the Cisco Unified Communications Manager Operating System Administration web page.

```
Device(config)# crypto pki trustpoint cucm_trustpoint
Device(config-ca-trustpoint)# revocation-check none
Device(config-ca-trustpoint)# enrollment terminal
Device(config-ca-trustpoint)# crypto pki authenticate cucm_trustpoint
```

Example: Creating a CTL File

```
Device(config)# voice-ctl-file ct1
Device(config-ctl-file)# record-entry selfsigned trustpoint self-trustpoint6s
Device(config-ctl-file)# record-entry capf trustpoint capf-trustpoint6s
Device(config-ctl-file)# record-entry cucm-tftp trustpoint cucm-trustpoint
Device(config-ctl-file)# complete
```

Example: Configuring a Phone Proxy

```
Device(config)# voice-phone-proxy pp
Device(config-phone-proxy)# voice-phone-proxy pp
Device(config-phone-proxy)# voice-phone-proxy file-buffer size 30
Device(config-phone-proxy)# tftp-server address ipv4 172.110.36.2
Device(config-phone-proxy)# ctl-file ct1
Device(config-phone-proxy)# access-secure
Device(config-phone-proxy)# complete
```

Example: Attaching a Phone Proxy to a Dial Peer

```
Device(config)# dial-peer voice 10 voip
Device(config-dial-peer)# phone-proxy pp1 signal-addr ipv4 10.0.0.8 cucm ipv4 198.51.100.1
Device(config-dial-peer)# session-protocol sipv2
Device(config-dial-peer)# session target registrar
Device(config-dial-peer)# session transport tcp tls
Device(config-dial-peer)# incoming uri request 11
Device(config-dial-peer)# destination uri 12
Device(config-dial-peer)# voice-class sip call-route url
Device(config-dial-peer)# voice-class sip profiles 10
Device(config-dial-peer)# voice-class sip registration passthrough registrar-index 1
Device(config-dial-peer)# voice-class sip passthrough headers 10
Device(config-dial-peer)# voice-class sip copy-list 10
Device(config-dial-peer)# codec transparent
```
Example: Configuring CUCM Secure Line-Side

The details of the IP address used in the below example are as follows:

- CUBE IP address facing phone: 172.18.110.120
- CUBE IP address facing CUCM: 10.50.209.100
- CUCM IP address: 10.50.209.215

Generate and Import Certificate on CUBE

```
Device(config)# crypto pki trustpoint selfsign
Device(config)# enrollment selfsigned
Device(config)# subject-name CN=CUBE, O=CISCO
Device(config)# revocation-check none
Device(config)# rsakeypair selfsign

Device(config)# crypto pki trustpoint ccml
Device(config)# enrollment terminal
Device(config)# revocation-check none

Device(config)# crypto pki trustpoint Cisco_Manufacturing_CA
Device(config)# enrollment terminal
Device(config)# revocation-check none

Device(config)# crypto pki trustpoint selfsignx
Device(config)# enrollment terminal
Device(config)# subject-name cn=3925_pod5
Device(config)# revocation-check none
Device(config)# rsakeypair selfsignx

Device(config)# crypto pki certificate chain ccml
Device(config)# certificate ca 55C2FCBFBC552B7C6CED497D4AD33F8
[Certificate data omitted]

Device(config)# crypto pki certificate chain Cisco_Manufacturing_CA
Device(config)# certificate ca 6A6967B3000000000003
[Certificate data omitted]

Device(config)# crypto pki certificate chain selfsignx
Device(config)# certificate self-signed 01
[Certificate data omitted]
```

Add the Cube Service, Call Flow and Message manipulation configuration.

```
Device(config)# voice service voip
Device(config)# no ip address trusted authenticate
Device(config)# allow-connections sip to sip
Device(config)# fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
Device(config)# sip
Device(config-sip)# session transport tcp
Device(config-sip)# header-passing
Device(config-sip)# registrar server
Device(config-sip)# nat auto
Device(config-sip)# pass-thru headers unsupp
Device(config-sip)# pass-thru subscribe-notify-events all
Device(config-sip)# pass-thru content unsupp
Device(config-sip)# registration passthrough
Device(config-sip)# extension cucm

Device(config)# voice class uri 1 sip
Device(config)# host ipv4:172.18.110.120
```
Device(config)# voice class uri 2 sip
Device(config)# host ipv4:10.50.209.100
Device(config)# voice class uri 3 sip
Device(config)# host ipv4:10.50.209.215

Device(config)# interface GigabitEthernet0/0
Device(config-if)# ip address 10.50.209.100 255.255.255.0
Device(config-if)# duplex auto
Device(config-if)# speed auto

Device(config)# interface GigabitEthernet0/1
Device(config-if)# ip address 172.18.110.120 255.255.255.0
Device(config-if)# duplex auto
Device(config-if)# speed auto

Device(config)# dspfarm profile 1 transcode universal security
Device(config-dspfarm-profile)# codec g722-64
Device(config-dspfarm-profile)# codec g711ulaw
Device(config-dspfarm-profile)# codec g711alaw
Device(config-dspfarm-profile)# codec g729ar8
Device(config-dspfarm-profile)# codec g729abr8
Device(config-dspfarm-profile)# maximum sessions 24
Device(config-dspfarm-profile)# associate application CUBE

Configure CTL and Phone Proxy

Device(config)# voice-ctl-file ctl_secure
Device(config-ctl-file)# record-entry capf trustpoint Cisco_Manufacturing_CA
Device(config-ctl-file)# record-entry selfsigned trustpoint selfsignx
Device(config-ctl-file)# complete

Device(config)# voice-phone-proxy phone_proxy
Device(config-phone-proxy)# tftp-server address ipv4 10.50.209.215 local-addr ipv4 10.50.209.100 acc-addr ipv4 172.18.110.120
Device(config-phone-proxy)# ctl-file ctl_secure
Device(config-phone-proxy)# access-secure
Device(config-phone-proxy)# service-map server-addr ipv4 10.50.209.215 port 8443 acc-addr ipv4 172.18.110.120 port 8443
Device(config-phone-proxy)# service-map server-addr ipv4 10.50.209.215 port 8080 acc-addr ipv4 172.18.110.120 port 8080
Device(config-phone-proxy)# service-map server-addr ipv4 10.50.209.215 port 3804 acc-addr ipv4 172.18.110.120 port 3804
Device(config-phone-proxy)# complete

Device(config)# voice-phone-proxy tftp-address ipv4 10.50.209.100
Device(config-phone-proxy)# port-range 40000 50000
Device(config)# voice-phone-proxy tftp-address ipv4 172.18.110.120
Device(config-phone-proxy)# port-range 40000 50000
Device(config-phone-proxy)# voice-phone-proxy file-buffer size 60

Attaching Phone Proxy to dial Peers

Device(config)# dial-peer voice 1 voip
Device(config-dial-peer)# phone-proxy phone_proxy signal-addr ipv4 172.18.110.120 cucm ipv4 10.50.209.215
*** Access DialPeer Facing Outside ***
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target registrar
Device(config-dial-peer)# session transport tcp tls
Example: Configuring CUCM Non-Secure Line-Side

The details of the IP address used in the below example are as follows:

- CUBE IP address facing phone: 172.18.110.120
- CUBE IP address facing CUCM: 10.50.209.100
- CUCM IP address: 10.50.209.215

Generate and Import Certificate on CUBE

Device(config)# crypto pki trustpoint selfsign
Device(config)# enrollment selfsigned
Device(config)# subject-name CN=CUBE, O=CISCO
Device(config)# revocation-check none
Device(config)# rsakeypair selfsign

Device(config)# crypto pki trustpoint ccm1
Device(config)# enrollment terminal
Device(config)# revocation-check none

Device(config)# crypto pki certificate chain selfsignx
Device(config)# certificate self-signed 01
[Certificate data omitted]

Device(config)# crypto pki certificate chain ccm1
Device(config)# certificate ca 55C2F2BFA552B7C6C6497D4AD33F8
[Certificate data omitted]

Add the Cube Service, Call Flow and Message manipulation configuration.
Device(config)# voice service voip
Device(config)# no ip address trusted authenticate
Device(config)# allow-connections sip to sip
Device(config)# fax protocol t38 version 0 ls-redundancy 0 hs-redundancy 0 fallback none
Device(config)# sip
Device(config-sip)# header-passing
Device(config-sip)# registrar server
Device(config-sip)# nat auto
Device(config-sip)# pass-thru headers unsupp
Device(config-sip)# pass-thru subscribe-notify-events all
Device(config-sip)# pass-thru content unsupp
Device(config-sip)# registration passthrough
Device(config)# voice class uri 1 sip
Device(config)# host ipv4:172.18.110.120
Device(config)# voice class uri 2 sip
Device(config)# host ipv4:10.50.209.100
Device(config)# voice class uri 3 sip
Device(config)# host ipv4:10.50.209.215
Device(config)# interface GigabitEthernet0/0
Device(config-if)# ip address 10.50.209.100 255.255.255.0
Device(config-if)# duplex auto
Device(config-if)# speed auto
Device(config)# interface GigabitEthernet0/1
Device(config-if)# ip address 172.18.110.120 255.255.255.0
Device(config-if)# duplex auto
Device(config-if)# speed auto

Configure CTL and Phone Proxy

Device(config)# voice-ctl-file ctl_secure
Device(config-ctl-file)# record-entry capf trustpoint Cisco_Manufacturing_CA
Device(config-ctl-file)# record-entry selfsigned trustpoint selfsignx
Device(config-ctl-file)# complete

Device(config)# voice-phone-proxy phone_proxy
Device(config-phone-proxy)# tftp-server address ipv4 10.50.209.215 local-addr ipv4 10.50.209.100 acc-addr ipv4 172.18.110.120
Device(config-phone-proxy)# ctl-file ctl_secure
Device(config-phone-proxy)# access-secure
Device(config-phone-proxy)# service-map server-addr ipv4 10.50.209.215 port 8443 acc-addr ipv4 172.18.110.120 port 8443
Device(config-phone-proxy)# service-map server-addr ipv4 10.50.209.215 port 8080 acc-addr ipv4 172.18.110.120 port 8080
Device(config-phone-proxy)# service-map server-addr ipv4 10.50.209.215 port 3804 acc-addr ipv4 172.18.110.120 port 3804
Device(config-phone-proxy)# complete

Device(config)# voice-phone-proxy tftp-address ipv4 10.50.209.100
Device(config-phone-proxy)# port-range 40000 50000
Device (Config)# voice-phone-proxy tftp-address ipv4 172.18.110.120
Device(config-phone-proxy)# port-range 40000 50000
Device(config-phone-proxy)# voice-phone-proxy file-buffer size 60

Attaching Phone Proxy to dial Peers
Device(config)# dial-peer voice 1 voip
Device(config-dial-peer)# phone-proxy phone_proxy signal-addr ipv4 172.18.110.120 cucm ipv4 10.50.209.215
*** Access Dialpeer Facing Outside ***
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target registrar
Device(config-dial-peer)# session transport tcp tls
Device(config-dial-peer)# destination uri 2
Device(config-dial-peer)# incoming uri request 1
Device(config-dial-peer)# voice-class sip extension cucm
Device(config-dial-peer)# voice-class sip conn-reuse
Device(config-dial-peer)# voice-class sip call-route url
Device(config-dial-peer)# voice-class sip registration passthrough registrar-index 1
Device(config-dial-peer)# dtmf-relay rtp-nte
Device(config-dial-peer)# codec transparent

Device(config)# dial-peer voice 2 voip
*** Core Dialpeer Facing CUCM ***
Device(config-dial-peer)# session protocol sipv2
Device(config-dial-peer)# session target ipv4:10.50.209.215
Device(config-dial-peer)# session transport tcp
Device(config-dial-peer)# destination uri 1
Device(config-dial-peer)# incoming uri via 3
Device(config-dial-peer)# voice-class sip call-route url
Device(config-dial-peer)# dtmf-relay rtp-nte
Device(config-dial-peer)# codec transparent

Configuring SIP User Agent

Device(config)# sip-ua
Device(config-sip-ua)# timers connection aging 60
Device(config-sip-ua)# registrar 1 ipv4:10.50.209.215 expires 3600 refresh-ratio 100 tcp
PART XVIII

Licensing

• CUBE Licensing, on page 685
CUBE Licensing

Different Cisco IOS® Software images are available for the various platforms that support Cisco Unified Border Element (CUBE) and Cisco Gatekeeper functions. These Cisco IOS Software feature sets contain different levels of features. In addition to the software image, a feature license is required to turn on the desired function. Both the CUBE and Cisco Gatekeeper are licensed features.

Purchasing the appropriate software image is, in many cases, sufficient to deploy Cisco router features. In other cases, a feature license in addition to the software image is required. All features on platforms with a universal software image require a license.

- Information About CUBE Licensing, on page 685
- CUBE Licensing FAQs, on page 691

Information About CUBE Licensing

The Cisco® 800, 2900, 3900, and 3900E Series Integrated Services Router platforms have a universal Cisco IOS Software image. On these platforms all features are contained in the single software image, and the features that are available for use are determined only by the license(s) purchased. The following are the CUBE deployment use cases:

- Migration from TDM to SIP CUBE.
- CUBE in Contact Center
- CUBE is used as a protocol-interworking device with third party.

Unified Communications Bundles

Cisco® Integrated Services Router Unified Communications Bundles simplify the deployment of a unified communications (UC) solution by packaging a number of needed components in a single part number to make it easy to quote and order. Two types of UC bundles are offered for the Cisco 1861, 2800, and 3800 Series routers: Voice and Voice + Security.

Voice-only UC bundles include:

- The Integrated Services Router
- Cisco IOS® Software based Routing
- Cisco Unified Communications Manager Express for call processing
- Cisco Unity® Express hardware module and licenses for voicemail, integrated messaging, and interactive voice response.
- Digital signal processors (DSPs) for conferencing and connecting to a public switched telephone network (PSTN)
- Phone licenses to deploy Cisco IP phones
- Cisco Unified CallConnector Personal clients for Microsoft Windows desktop integration. This client is offered free of charge as an introductory offer only.

Voice + Security UC bundles also include security features like VPN, Cisco Intrusion Detection System, and Cisco IOS Firewall in addition to all the components in the voice-only UC bundles.

**Note**

CUBE feature license(s) is included in all Cisco ISR UC bundles.

---

**Cisco Unified Border Element License Types**

Two types of Cisco Unified Border Element licenses are available:

- **Pay-as-You-Grow (or session count) license**—This type of license covers the right to use the feature as well as the maximum session count allowed. An example is the FL-CUBE-25 license, which allows up to 25 sessions. This license is designed to allow a specific number of sessions (or calls) on a platform. Purchase only as many sessions as are required in your deployment. You can add more licenses later as your needs expand, thus offering pay-as-you-grow benefits. Session licenses are stackable. These licenses are available on select platforms as shown in Table 1 in the section *CUBE Licenses*, and are available on all software images. Examples include the FL-CUBE-4 and FL-CUBE-100 licenses.

- **Platform (or flat) license**—This type of license covers the right to use the feature up to the maximum session count supported on the chosen platform. An example is the FL-INTVSVRV-2811 license, which allows the maximum number of sessions the Cisco 2811 platform supports. These licenses are available on select platforms as given in Table 1 in the section *CUBE Licenses*. Examples include the FL-INTVSVRV-2801 and FL-GK-3945 licenses.

**CUBE Licenses**

The Cisco Unified Border Element licenses available are listed in the table below.

CUBE redundancy can be deployed in two ways:

- **CUBE regular redundancy**—Two CUBE platforms (ISR-G2 or ASR1K) are positioned in a same local network and are configured in an ACTIVE/STANDBY pairing. The CUBE-RED license allows transferring of the license from the Active to the Standby machine in the event of a failure.

- **CUBE dual redundancy**—CUBE in High Availability configuration in two independent Data Centers with a CUBE Active/Standby pair (ISR-G2 or ASR1K) in each. The CUBE-RED license allows transfer not only within one redundant pair from Active to Standby, but also from one pair to the other.

For Active/Standby redundant configurations, use the “Redundant-Platform” licenses.
Redundancy licenses cost about 30% more than Single-Use licenses.

**Table 74: CUBE License Choices per Platform**

<table>
<thead>
<tr>
<th>Platform</th>
<th>Single-Use Licenses</th>
<th>Redundancy Licenses (1 SKU for Active/Standby Pair)</th>
<th>License Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco 881, 886, 887, 888, 892F, SPIAD</td>
<td>FL-NANOCUBE</td>
<td>N/A</td>
<td>Platform</td>
</tr>
<tr>
<td>Cisco 2901, 2911, and 2921 Integrated Services Routers</td>
<td>FL-CUBEE-5</td>
<td>FL-CUBEE-5-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FL-CUBEE-25</td>
<td>FL-CUBEE-25-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FL-CUBEE-100</td>
<td>FL-CUBEE-100-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td>Cisco 2951 and 3925 Integrated Services Routers</td>
<td>FL-CUBEE-5</td>
<td>FL-CUBEE-5-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FL-CUBEE-25</td>
<td>FL-CUBEE-25-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FL-CUBEE-100</td>
<td>FL-CUBEE-100-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FL-CUBEE-500</td>
<td>FL-CUBEE-500-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td>Cisco 3945, 3925E, and 3945E Integrated Services Routers</td>
<td>FL-CUBEE-5</td>
<td>FL-CUBEE-5-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FL-CUBEE-25</td>
<td>FL-CUBEE-25-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FL-CUBEE-100</td>
<td>FL-CUBEE-100-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FL-CUBEE-500</td>
<td>FL-CUBEE-500-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FL-CUBEE-1000</td>
<td>FL-CUBEE-1000-RED</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td>Cisco ASR 1000 Series Aggregation Services Routers</td>
<td>FLASR1-CUBEE-100P</td>
<td>FLASR1-CUBEE-100P</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FLASR1-CUBEE-500P</td>
<td>FLASR1-CUBEE-500P</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FLASR1-CUBEE-1KP</td>
<td>FLASR1-CUBEE-1KP</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FLASR1-CUBEE-4KP</td>
<td>FLASR1-CUBEE-4KP</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td></td>
<td>FLASR1-CUBEE-16KP</td>
<td>FLASR1-CUBEE-16KP</td>
<td>Pay-as-You-Grow</td>
</tr>
<tr>
<td>Cisco 2800 Series Integrated Services Routers</td>
<td>FL-CUBE-4</td>
<td>FL-CUBE-4</td>
<td>Pay-as-You -Grow</td>
</tr>
<tr>
<td></td>
<td>FL-CUBE-25</td>
<td>FL-CUBE-25</td>
<td>Pay-as-You -Grow</td>
</tr>
<tr>
<td></td>
<td>FL-CUBE-100</td>
<td>FL-CUBE-100</td>
<td>Pay-as-You -Grow</td>
</tr>
<tr>
<td></td>
<td>FL-INTVSVRV-2801</td>
<td>FL-INTVSVRV-2801</td>
<td>Pay-as-You -Grow</td>
</tr>
<tr>
<td></td>
<td>FL-INTVSVRV-2811</td>
<td>FL-INTVSVRV-2811</td>
<td>Pay-as-You -Grow</td>
</tr>
<tr>
<td></td>
<td>FL-INTVSVRV-2821</td>
<td>FL-INTVSVRV-2821</td>
<td>Pay-as-You -Grow</td>
</tr>
<tr>
<td></td>
<td>FL-INTVSVRV-2851</td>
<td>FL-INTVSVRV-2851</td>
<td>Pay-as-You -Grow</td>
</tr>
</tbody>
</table>

Cisco Unified Border Element Configuration Guide
Licensing Requirements for Customer Deployment Scenarios

Two Active CUBEs and No Redundancy

- Scenario—Two active CUBEs, no redundancy (that is no call preservation on failure of box), and no load balancing.
- Expectation—Expecting 500 sessions across each location.
- Licensing Requirement—Two FL-CUBE-500.
Geographic Redundancy

- Scenario—Two active CUBEs, no redundancy, no call preservation on failure of box, but there is load balancing.
- Expectation—Expecting 500 sessions across each location, and in case one location fails, expecting the new 500 calls to failover to the other location.
- Licensing Requirement—**Two FL-CUBEE-500-RED**.

If a box fails in this scenario, the calls on it are lost. The load balancing algorithm ensures that the next call is sent to the non-failed location.

---

**Note**

In this scenario, you can also pool the CUBE licenses—one FL-CUBEE-1000-RED can be used.

Layer 2 Box-to-Box Redundancy with Call Preservation

- Scenario—L2 box-to-box redundancy with call preservation.
- Expectation—Expecting 500 sessions across an active CUBE.
- Licensing Requirement—**One FL-CUBEE-500-RED**.

---

**Note**

If the standby CUBE is at a different location, L2 box-to-box redundancy is not supported across geographical data centers. Typically, it is two boxes in the same rack.
Box-to-Box Redundancy and Load Balancing Across Locations

- Scenarios Covered—Box-to-Box and Redundancy (call preservation on failure within location) and load balancing/redundancy across locations.
  - If R1 or R3 goes down, R2 or R4 respectively will take over.
  - If Location 1 (both R1 and R2) becomes unavailable, RED license allows newer calls to flow to Location 2. RED license allows transfer not only within one redundant pair from Active to Standby, allowing call preservation, but also from one pair to the other, that is from one Data Center to the other for new calls. In that case, Location 2 will handle 1000 sessions. This is called dual redundancy.

- Expectation—Expecting 500 sessions per location.
- Licensing Requirement—Two FL-CUBEE-500-RED, one per Active/Standby pair. In total, you will have one 1000-RED.

In-box Hardware and Software Redundancy

- Licensing Requirement—RED license is not required in this scenario; regular Single-Use CUBE license covers all in-box redundancies.
CUBE Licensing FAQs

Q.  Is CUBE Licensing enforced?
A.  No, CUBE is a paper-based honor license (no file to install) that allows you to run the CUBE RTU (Right-to-Use) feature set after you have the UCK9 license installed.

Q.  Can CUBE licenses be transferred?
A.  No, CUBE licensing is not transferable between chassis at this time.
   • FL-CUBEE-XX licenses can be bought for any ISR-G2 platform, but cannot be transferred between platforms.
   • FL-CUBEE-XX licenses are only for ISR-G2 (that is, you buy FL-CUBEE-5—it applies to a single ISR G2 that you buy it for, which could be a 2901, 2911, 3925, and so on, but only a single platform.)

Q.  Are CUBE licenses incremental?
A.  Yes, CUBE licenses can be added together to provide an aggregate session count. This way, customers can start with a smaller number of sessions and grow their system over time as call volume increases. For example, a customer may buy a FL-CUBEE-5 license to start with allowing a total of 5 sessions, and later add 2 more FL-CUBEE-5 licenses for a total of 15 sessions.

Q.  What constitutes a session?
A.  A session is a single audio or a video call across the CUBE, regardless of call legs. Some vendors consider one call as two sessions.

Q.  Does a call recording solution require additional licensing?
A.  No, sessions created between CUBE and the Call Recording server such as MediaSense® do not require additional licenses and are not counted against the CUBE licensing limit. However, consider the platform capacity numbers.

Q.  Can a customer migrate from a Single-Use to a RED license?
A.  No, currently there are no migration SKUs, that is, if the customer previously purchased a Single-Use license, it cannot be converted into a RED license in future.

Q.  Does CUBE Phone Proxy require licensing?
A.  Yes, licenses will be required for the CUBE Phone Proxy feature just like it is required for trunk-side connections. Licenses will be required for the number of simultaneous off-hook phones, that is the number of phones trying to make calls concurrently.

Q.  For what platforms is NanoCUBE licensing supported?
A.  NanoCUBE licensing (SKU: FL-NANOCUBE) is a single license that allows you to go up to the maximum capacity of the platform. NanoCUBE is available on the platforms: 86X, 88X, and 89X; 2901/2911 is only for service providers.
PART XIX

Security

• SIP TLS Support on CUBE, on page 695
CHAPTER 59

SIP TLS Support on CUBE

The Cisco Unified Border Element (CUBE) supports SIP-to-SIP calls with Transport Layer Security (TLS). TLS provides privacy and data integrity of SIP signaling messages between two applications that communicate. CUBE uses TLS to secure SIP signaling messages. TLS is layered on top of a reliable transport protocol such as TCP. CUBE can be configured at both the global and dial-peer levels for allowing TLS to establish sessions with remote endpoints.

- Feature Information for SIP TLS Support on CUBE, on page 695
- Restrictions, on page 696
- Information About SIP TLS Support on CUBE, on page 696
- How to Configure SIP TLS Support on CUBE, on page 697
- Configuration Examples for SIP TLS Support on CUBE, on page 705

Feature Information for SIP TLS Support on CUBE

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
</table>
| SIP TLS Version 1.0 Support on CUBE | Cisco IOS 12.4(6)T | Support is provided for SIP-to-SIP calls with Transport Layer Security (TLS) version 1.0. The following cipher suites are introduced for release Cisco IOS 12.4(6)T:  
  - SSL_RSA_WITH_RC4_128_MD5  
  - TLS_RSA_WITH_AES_128_CBC_SHA  
  The following commands were introduced or modified: transport tcp tls and crypto signaling default trustpoint cube. |
Support is provided for SIP-to-SIP calls with Transport Layer Security (TLS) version 1.2. The following cipher suites are introduced for release Cisco IOS 15.6(1)T:

- TLS_DHE_RSA_WITH_AES_128_CBC_SHA1
- TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
- TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384

The following commands were introduced or modified: transport tcp tls, crypto signaling default trustpoint cube, and srtp (voice).

### Restrictions

- EDCS ciphers are not supported on TLS version 1.0.

### Information About SIP TLS Support on CUBE

#### Deployment

The following figure illustrates an example of CUBE with SIP TLS connections.

*Figure 62: CUBE with SIP TLS connections*

In a typical deployment, CUBE is placed between CUCM and the service provider. These devices are authenticated and enrolled with a Certificate Authority (CA) server that issues certificates. It can be Cisco or a third-party entity. When a call is made, a TLS handshake is initiated between CUCM and CUBE, and the IOS PKI infrastructure is used to exchange certificates signed by a common trusted CA during the handshake. During the TLS handshake, a dynamically generated symmetric key and cipher algorithms are negotiated between the devices. After the successful TLS handshake, the devices establish a SIP session between the service provider and CUBE. Keys exchanged during the TLS handshake process are used to encrypt or decrypt all SIP signaling messages.
The use of PKI on the Cisco IOS software requires that the clock on the devices be synchronized with the network time to ensure proper validation of certificates.

### TLS Cipher Suite Category

Prior to release Cisco IOS15.6(1)T, CUBE supported TLS v1.0 with the following cipher suites:

- SSL_RSA_WITH_RC4_128_MD5
- TLS_RSA_WITH_AES_128_CBC_SHA

CUBE supports only the mandatory cipher suites for TLS implementation. From Cisco IOS15.6(1)T release onwards, CUBE supports TLS v1.2 which is backward compatible. Following are the cipher suites added:

- TLS_DHE_RSA_WITH_AES_128_CBC_SHA1
- TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
- TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384

Use the `srtp pass-thru` command to globally enable the transparent passthrough of all (supported and unsupported) crypto suites. If SRTP pass-thru feature is enabled, media interworking will not be supported. Ensure that you have symmetric configuration on both the incoming and outgoing dial-peers to avoid media-related issues.

### How to Configure SIP TLS Support on CUBE

#### Configuring SIP TLS on CUBE

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `crypto key generate rsa {general-keys | usage-keys} label key-label [exportable] [modulus modulus-size] [storage device:]`
4. `crypto key generate eckey-size {256 | 384} [label label] [ec key-label]`
5. `crypto pki trustpoint name`
6. `rsakeypair key-label [key-size [encryption-key-size]]`
7. `eckeypair keyname` ! Applicable only for TLS version 1.2.
8. `serial-number [none]`
9. `ip-address {ip-address | interface | none}`
10. `subject-name [x.500-name]`
11. enrollment [mode][retry period minutes][retry count number]url url[pem]
12. crl optional or revocation-check method1[method2[method3]]
13. password string
14. exit
15. crypto ca authenticate name or crypto pki authenticate name
16. crypto ca enroll name or crypto pki enroll name
17. sip-ua
18. crypto signaling[(remote-addr ip address | subnet mask)]default|trustpoint trustpoint-name[ecdsa-cipher] [strict-cipher] ECDSA ciphers are not supported on TLS version 1.0.
19. voice service {pots voatm | vofr | voip}
20. transport tcp tls
21. url {sip | sips | tel}
22. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example: Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> crypto key generator rsa{general-keys</td>
<td>usage-keys}label key-label[exportable ][modulus modulus-size][storage device:]</td>
</tr>
<tr>
<td>Example: Router(config)# crypto key generate rsa general-keys label kp1 exportable</td>
<td>- <strong>general-keys</strong>—Specifies that the general-purpose key pair should be generated.</td>
</tr>
<tr>
<td></td>
<td>- <strong>usage-keys</strong>—Specifies that two RSA special-usage key pairs should be generated (that is, one encryption pair and one signature pair) instead of one general-purpose key pair.</td>
</tr>
<tr>
<td></td>
<td>- <strong>label key-label</strong>—(Optional) Name that is used for an RSA key pair when they are being exported. If a key label is not specified, the fully qualified domain name (FQDN) of the router is used.</td>
</tr>
<tr>
<td></td>
<td>- <strong>exportable</strong>—(Optional) Specifies that the RSA key pair can be exported to another Cisco device, such as a router.</td>
</tr>
<tr>
<td></td>
<td>- <strong>modulus modulus-size</strong>—(Optional) IP size of the key modulus in a range from 350 to 2048. If you do</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
</tbody>
</table>
| crypto key generate eckey-size \{256 | 384\} [labellabel][ec key-label] | not enter the modulus keyword and specify a size, you will be prompted.  
  - storage device:—(Optional) Specifies the key storage location. The name of the storage device is followed by a colon (:).
  - kp1— kp1 is a label name that you select. |
| crypto key generate rsa general-keys label kp1 exportable | Generates EC key pairs. |
| crypto pki trustpoint name | Declares the trustpoint that your router should use.  
  Argument is as follows:  
  - name—Creates a name for the trustpoint that you created.  
  - cube1—Represents the trustpoint name that the user specifies. |
| rsa keypair key-label [key-size [encryption-key-size]] | Specifies which key pair to associate with the certificate.  
  Arguments are as follows:  
  - key-label—Name of the key pair, which is generated during enrollment if it does not already exists or if the auto-enroll regenerate command is configured.  
  - key-size—(Optional) Size of the desired RSA key. If not specified, the existing key size is used.  
  - encryption-key-size—(Optional) Size of the second key, which is used to request separate encryption, signature keys, and certificates. |
| eckeypair keyname ! Applicable only for TLS version 1.2. | Generates EC keys for ECDSA cipher suites. |
| serial-number [none] | Specifies whether the router serial number should be included in the certificate request.  
  Keyword is as follows:  
  - none—(Optional) Specifies that a serial number will not be included in the certificate request. |
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 9** ip-address {ip-address|interface|none} | Specifies a dotted IP address or an interface that will be included as "unstructuredAddress" in the certificate request. Arguments and keyword are as follows:  
  - ip-address—Specifies a dotted IP address that will be included as "unstructuredAddress" in the certificate request.  
  - interface—Specifies an interface, from which the router can get an IP address, that will be included as "unstructuredAddress" in the certificate request.  
  - none—Specifies that an IP address is not to be included in the certificate request. |
| **Example:** | Router(ca-trustpoint)# ip-address 172.18.197.154 |
| **Step 10** subject-name [x.500-name] | Specifies the subject name in the certificate request. Argument is as follows:  
  - x.500-name—(Optional) Specifies the subject name used in the certificate request. |
| **Example:** | Router(ca-trustpoint)# subject-name CN=172.18.197.154 |
| **Step 11** enrollment [mode][retry period minutes][retry count number]url [url][pem] | Specifies the enrollment parameters of a certificate authority (CA). Arguments and keywords are as follows:  
  - mode—(Optional) Registration authority (RA) mode, if your CA system provides an RA. By default, RA mode is disabled.  
  - retry period minutes—(Optional) Specifies the period in which the router will wait before sending the CA another certificate request. The default is 1 minute between retries. (Specify from 1 through 60 minutes.)  
  - retry count number—(Optional) Specifies the number of times a router will resend a certificate request when it does not receive a response from the previous request. The default is 10 retries. (Specify from 1 through 100 retries.)  
  - url—URL of the file system where your router should send certificate requests. For enrollment method options, see the enrollment url command.  
  - pem—(Optional) Adds privacy-enhanced mail (PEM) boundaries to the certificate request. |
| **Example:** | Router (ca-trustpoint)# enrollment url http://172.18.193.103 |
| **Step 12** crl optional or revocation-check method1[method2][method3] | Allows the certificates of other peers to be accepted without trying to obtain the appropriate CRL or checks the revocation status of a certificate. Arguments are as follows:  
  - method1 [method2 [method3]]—Method used by the router to check the revocation status of the certificate. |
| **Example:** | Router(ca-trustpoint)# crl optional |
### Command or Action

<table>
<thead>
<tr>
<th>Command</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| or      | Available methods are as follows:  
| Router(ca-trustpoint)# revocation-check none |   - **crl**—Certificate checking is performed by a certificate revocation list (CRL). This is the default behavior.  
|         |   - **none**—Certificate checking is not required.  
|         |   - **ocsp**—Certificate checking is performed by an online certificate status protocol (OCSP).  
|         | **Note** If the second and the third methods are specified, each method will be used only if the previous method returns an error, such as the server being down. |

### Step 13
**password string**  
**Example:**  
Router(ca-trustpoint)# password password  
**Note** Specifies the revocation password for the certificate.  
**Argument** is as follows:  
   - **string**—Name of the password  

### Step 14
**exit**  
**Example:**  
Router# exit  
**Note** Exists the current mode.  

### Step 15
**crypto ca authenticate name** or **crypto pki authenticate name**  
**Example:**  
Router(config)# crypto ca authenticate cube1  
**Note** Authenticates the CA (by getting the certificate of the CA).  
**Argument** is as follows:  
   - **name**—Specifies the name of the CA. This is the same name used when the CA was declared with the crypto ca identity command.  

### Step 16
**crypto ca enroll name** or **crypto pki enroll name**  
**Example:**  
Router(config)# crypto ca name cube1  
**Note** Obtains the certificates of your router from the certificate authority. The CA server issues two certificates to the trustpoint (CUBE): one to certify the CA server and the other to certify the trustpoint (CUBE).  
**Argument** is as follows:  
   - **name**—Specifies the name of the CA. Use the same name when you declared the CA using the **crypto pki trustpoint** command.  

### Step 17
**sip-ua**  
**Example:**  
Router(config)# sip-ua  
**Note** Enters SIP user-agent configuration mode.
**Purpose**
Configures the SIP gateway to use its trustpoint when it establishes or accepts TLS connection with a remote device with an IP address.

The trustpoint label refers to the CUBE’s certificate that is generated with the Cisco IOS PKI commands as part of the enrollment process. **strict-cipher** means that the SIP TLS process uses only those cipher suites that are mandated by the SIP RFC. When you use the **strict-cipher** command argument, avoids changes to the configuration if SIP should mandate newer ciphers. The SSL layer in Cisco IOS does not support TLS_RSA_WITH_3DES_EDE_CBC_SHA. Therefore, CUBE actively uses only the TLS_RSA_WITH_AES_128_CBC_SHA suite in strict mode.

Keywords and arguments are as follows:

- **remote-addr address**—Associates an IP address to a trustpoint.
- **remote-addr subnet mask**—Associates a subnet mask to a trustpoint.
- **default**—Configures a default trustpoint.
- **trustpoint string**—Refers to the SIP gateways certificate generated as part of the enrollment process using Cisco IOS PKI commands.
- **ecdsa-cipher**—Examples are the following:
  - TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
  - TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384.
  
  **Note** ecdsa-cipher is applicable only for the TLS version 1.2

- **strict-cipher**—Examples are the following:
  - TLS_RSA_WITH_AES_128_CBC_SHA
  - TLS_DHE_RSA_WITH_AES_128_CBC_SHA1
  - TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA1
  - TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256,
  - TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384.

**Step 18**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>`crypto signaling ([remote-addr [ip address</td>
<td>subnet mask]] default trustpoint trustpoint-name [ecdsa-cipher] [strict-cipher]</td>
</tr>
</tbody>
</table>

**Example:**

```
Router(config-sip-ua)# crypto signaling default trustpoint cube1
```

**Step 19**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>`voice service {pots</td>
<td>voatm</td>
</tr>
</tbody>
</table>

**Example:**

```
Router(config)# voice service voip
```
### Command or Action

**Step 20**  
**transport tcp tls**  
**Example:**  
`Router(config-voi-sip)# transport tcp tls`

**Step 21**  
**url {sip|sips|tel}**  
**Example:**  
`Router(config-serv-sip)# url sips`

**Step 22**  
**end**  
**Example:**  
`Router(config-serv-sip)# end`

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 20</strong> transport tcp tls</td>
<td>Enters this command in SIP configuration mode to enable the TLS port on TCP 5061 to listen.</td>
</tr>
</tbody>
</table>
| **Example:**  
`Router(config-voi-sip)# transport tcp tls` |  |
| **Step 21** url {sip|sips|tel} | Configures URLs to either the SIP, SIPS, or TEL format for your VoIP SIP calls. Keywords are as follows:  
- **sip**—Generate URLs in SIP format for VoIP calls. This is the default.  
- **sips**—Generate URLs in SIPS format for VoIP calls.  
- **tel**—Generate URLs in TEL format for VoIP calls.  
**Note** This SIP gateway is now configured to use TLS with endpoints sharing the same CA. |
| **Example:**  
`Router(config-serv-sip)# url sips` |  |
| **Step 22** end | Ends the current mode. |
| **Example:**  
`Router(config-serv-sip)# end` |  |

---

## Verifying SIP TLS Support on CUBE

After a call is made, the **show sip-ua connections tcp tls** command is used to verify whether the transport used for the call is TLS.

Sample output for this command when TLS version is 1.0:

### Detail Output

```
router#show sip-ua connections tcp tls detail  
Total active connections : 1  
No. of send failures : 0  
No. of remote closures : 3  
No. of conn. failures : 0  
No. of inactive conn. ageouts : 0  
Max. tls send msg queue size of 0, recorded for 0.0.0.0:0  
TLS client handshake failures : 0  
TLS server handshake failures : 0

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

Remote-Agent:9.13.46.12, Connections-Count:1
```
Sample output for the `show sip-ua connections tcp tls` command when TLS version is 1.2:

**Detail Output**

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

```
router#show sip-ua connections tcp tls detail
Total active connections : 1
No. of send failures : 0
No. of remote closures : 3
No. of conn. failures : 0
No. of inactive conn. ageouts : 0
Max. tls send msg queue size of 0, recorded for 0.0.0.0:0
TLS client handshake failures : 0
TLS server handshake failures : 0
```

```
---------Printing Detailed Connection Report---------
```

```
Remote-Agent:9.13.46.12, Connections-Count:1
```

```
Remote-Port Conn-Id Conn-State WriteQ-Size Local-Address TLS-Version
============ ====== =========== =========== ============== ============
5061 1 Established 0 10.64.86.88 TLSv1.2
```

Alternatively, the `debug cc sip messages` command can be used to verify the “Via:” header for TLS is included. This output is a sample INVITE request of a call that uses SIP TLS and the “sips:” URI scheme:

```
INVITE sips:777@172.18.203.181 SIP/2.0
Via: SIP/2.0/TLS 172.18.201.173:5060;branch=z9hG4bK2C419
From: <sips:333@172.18.201.173>;tag=581BB98-1663
To: <sip:5555599999@172.18.201.173>
Call-ID: EB5B1948-770611DA-804F9736-BFA4AC35@172.18.201.173
Remote-Party-ID: "Bob" <sips:+14085559999@1.2.3.4>
Contact: <sips:123@host>
Allow: INVITE, OPTIONS, BYE, CANCEL, ACK, PRACK, COMET, REFER, SUBSCRIBE, NOTIFY, INFO
Max-Forwards: 70
Cseq: 104 INVITE
Expires: 60
Timestamp: 730947404
Content-Length: 298
Content-Type: application/sdp

v=0
o=CiscoSystemsSIP-GW-UserAgent 8437 1929 IN IP4 172.18.201.173
s=SIP Call
c=IN IP4 1.1.1.1
t=0 0
m=audio 18378 RTP/AVP 0 19
```
a=rtpmap:19 CN/8000
a=ptime:20

Configuration Examples for SIP TLS Support on CUBE

Example: SIP TLS Support on CUBE

```plaintext
show running-config
Building configuration...

Current configuration : 10894 bytes
!
! Last configuration change at 23:19:20 IST Wed Aug 19 2015
! NVRAM config last updated at 20:25:45 IST Tue Aug 18 2015
!
version 15.6
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
no service password-encryption
!
hostname CUBE
!
boot-start-marker
boot system flash:ctestimg
boot-end-marker
!
aqm-register-fnf
!
logging queue-limit 1000
logging buffered 9999999
no logging rate-limit
no logging console
!
no aaa new-model
ethernet lmi ce
!
clock timezone IST 5 30
!
!
!
!
!
ip traffic-export profile 1 mode capture
  bidirectional
    incoming access-list 123
    outgoing access-list 123
!
!
!
no ip domain lookup
ip cef
no ipv6 cef
!
multilink bundle-name authenticated
!
!
!
crypto pki trustpoint ecadsacert1
enrollment terminal pem
subject-name cn=plutododsn
revocation-check none
eckeypair myeckey

crypto pki trustpoint selfsign
enrollment selfsigned
subject-name cn=plutododsn
revocation-check none
rsakeypair selfsign

crypto pki trustpoint ccm155RSA
enrollment terminal
revocation-check none

crypto pki certificate chain ecadsacert1
certificate 07
30820248 308201CD A0030201 02020107 300A0608 2A8648CE 3D040303 30593112
30100603 5504030C 09706C75 746F3164 6F64310C 300A0603 55040B0C 03544143
310E300C 06035504 0A0C0543 697E3636F 310B3009 06035504 06130242 45311B80
16060355 04070C0F 74757269 6E672D65 7865632D 6C687830 1E170D31 35030831
38313235 3431345A 17033136 3083137 31323534 31345A30 36131330 11060355
0405310A 706C7574 6F646F64 736E311F 30100609 2A86484F F70D0109 21610603
656E7769666963697369676E747265 74722330 76301006 072A8648 CE3D0201 06052B81
04002023 62000446 4E287C2B 9A66C3A4 7D6EB2C7 51CE17F3 D15D12B 7043A9B8
F21825DF 0621A34D 3119E23F DB2A5ACE 1C744F17 789450F5 1071E504 DA7DC56C
5D61CA18 43E9C928 8FBF42A4 84583017 856D513D 5CBE6547 1E023100 AEF7EF8
48AC2C89 884E8C8D 42A9A811 3177582D DBE9973F D67EA687 0CF08620 375628D0
F5F7FDOA 53052711 E493A754 quit
certificate ca 00
3082023B 308201C1 A0030201 02020100 300A0608 2A8648CE 3D040303 30593112
30100603 5504030C 09706C75 746F3164 6F64310C 300A0603 55040B0C 03544143
310E300C 06035504 0A0C0543 697E3636F 310B3009 06035504 06130242 45311B80
16060355 04070C0F 74757269 6E672D65 7865632D 6C687830 1E170D31 35030831
38313235 3431345A 17033136 3083137 31323534 31345A30 36131330 11060355
0405310A 706C7574 6F646F64 736E311F 30100609 2A86484F F70D0109 21610603
656E7769666963697369676E747265 74722330 76301006 072A8648 CE3D0201 06052B81
04002023 62000446 4E287C2B 9A66C3A4 7D6EB2C7 51CE17F3 D15D12B 7043A9B8
F21825DF 0621A34D 3119E23F DB2A5ACE 1C744F17 789450F5 1071E504 DA7DC56C
5D61CA18 43E9C928 8FBF42A4 84583017 856D513D 5CBE6547 1E023100 AEF7EF8
48AC2C89 884E8C8D 42A9A811 3177582D DBE9973F D67EA687 0CF08620 375628D0
F5F7FDOA 53052711 E493A754 quit
certificate chain ecadsacert1
certificate 07
30820248 308201CD A0030201 02020107 300A0608 2A8648CE 3D040303 30593112
30100603 5504030C 09706C75 746F3164 6F64310C 300A0603 55040B0C 03544143
310E300C 06035504 0A0C0543 697E3636F 310B3009 06035504 06130242 45311B80
16060355 04070C0F 74757269 6E672D65 7865632D 6C687830 1E170D31 35030831
38313235 3431345A 17033136 3083137 31323534 31345A30 36131330 11060355
0405310A 706C7574 6F646F64 736E311F 30100609 2A86484F F70D0109 21610603
656E7769666963697369676E747265 74722330 76301006 072A8648 CE3D0201 06052B81
04002023 62000446 4E287C2B 9A66C3A4 7D6EB2C7 51CE17F3 D15D12B 7043A9B8
F21825DF 0621A34D 3119E23F DB2A5ACE 1C744F17 789450F5 1071E504 DA7DC56C
5D61CA18 43E9C928 8FBF42A4 84583017 856D513D 5CBE6547 1E023100 AEF7EF8
48AC2C89 884E8C8D 42A9A811 3177582D DBE9973F D67EA687 0CF08620 375628D0
F5F7FDOA 53052711 E493A754 quit
certificate chain selfsign
certificate self-signed 01
3082023B 3082019E A0030201 02020101 300D0609 2A864886 F70D0101 05050030

Cisco Unified Border Element Configuration Guide
36311330 11060355 0403130A 706C7574 6F646F64 736E311F 301D0609 2A864886 F70D0109 02161063 656E7472 616C6973 65645F72 74722320 1E170D31 35308201 0D06092A86 4886F70D 01010105 00038181 00308189 02818100 A01400F8 9A599812 F5CC7347 1F9E223C E395073B 9138C777 7EA9E97 5E3B9B37 F8B209BF 8F701221 A11C88B1 D2B1FCCB 809FC745 3FC6BD87 725F6B66 E6E6E69A 76597DDF 56876706 1D6D6719 2D5E5C71 9B6212A0
BECC9B7E 384C42D9 DBDC2293 02030100 01A53503 51500F06 03551D13 0101FF04 05300301 01FF301F 0603551D 23041830 1680141D 5971FE06 061D6A37 67DBA6C3 E02E020C 044300D0 6092A68E 486F70FD 01010505 00358100 033BC90 8AF1DFBD B03AC032 ABBD80B7 7418402B 0689E0EB 341CB523 7077570C CD496E9B 47A1B53B C878C693 A491B433 383E3F85 9B1C7B85 450B0DE1 76AC2C6B 5157F42A 462607F0 841DF81F 733A14FE 918F43F4 9BABAA49 227B5014 9864048B 3E98E373 7A361696 F0AD3ACC C9B101DF 2F80CCF7 E3
quit
crypto pki certificate chain ccm155RSA
certificate ca 4E23E56C7339CC679FD444D77F7A463F
3008230A 30820293 A0030201 0202104E 235E6C73 39CC679F D44D77F 7A463F30 0D06092A 864886F7 0D0110B0 0503003A 310B3009 06035504 06130249 4E310E30 0C060355 040AC0C5 63697363 6F310D30 0B060355 040B0C04 73727467 314301D0 0101FF04 3008230A 30820293 A0030201 0202104E 235E6C73 39CC679F D44D77F 7A463F30 0D06092A 864886F7 0D0110B0 0503003A 310B3009 06035504 06130249 4E310E30 0C060355 040AC0C5 63697363 6F310D30 0B060355 040B0C04 73727467 314301D0 0101FF04 05300301 01FF301F 0603551D 23041830 1680141D 5971FE06 1D6D6719 2D5E5C71 9B6212A0
BECC9B7E 384C42D9 DBDC2293 02030100 01A53503 51500F06 03551D13 0101FF04 05300301 01FF301F 0603551D 23041830 1680141D 5971FE06 1D6D6719 2D5E5C71 9B6212A0
quit
cisco unified border element configuration guide
asymmetric payload full
srtp negotiate cisco

voice iec syslog

mta send mail-from username $s$
license udi pid CISCO2921/K9 sn FGL1538116L
hw-module pvdm 0/0

no memory lite
redundancy

interface Embedded-Service-Engine0/0
no ip address
shutdown

interface GigabitEthernet0/0
ip address 9.45.38.192 255.255.0.0
shutdown
duplex auto
speed auto

interface GigabitEthernet0/1
ip address 10.64.86.177 255.255.255.0
ip traffic-export apply 1 size 5000000
duplex auto
speed auto
no clns route-cache

interface GigabitEthernet0/2
no ip address
shutdown
duplex auto
speed auto

ip forward-protocol nd

ip http server
no ip http secure-server

ip rtcp report interval 9000
ip route 0.0.0.0 0.0.0.0 10.64.86.1
ip route 10.0.0.0 255.0.0.0 10.64.86.1

access-list 123 permit udp any
access-list 123 permit tcp any
control-plane

call treatment on
!
!
!
!
mgcp behavior rsip-range tgcp-only
mgcp behavior comedia-role none
mgcp behavior comedia-check-media-src disable
mgcp behavior comedia-sdp-force disable
!
mgcp profile default
!
sccp local GigabitEthernet0/1
sccp ccm 10.64.86.154 identifier 1 version 7.0
!
!
dial-peer voice 1 voip
destination-pattern 6003
session protocol sipv2
session target ipv4:10.64.86.206:5061
session transport tcp tls
incoming called-number 7003
codec g711ulaw
!
dial-peer voice 2 voip
destination-pattern 7003
session protocol sipv2
session target ipv4:10.64.86.206:5061
session transport tcp tls
incoming called-number 6003
codec g711ulaw
!
!
sip-ua
  transport tcp tls v1.2
  connection-reuse
crypto signaling default trustpoint ecdsacert1 ecdsa-cipher
!
!
gatekeeper
shutdown
!
!
line con 0
exec-timeout 0 0
speed 115200
line aux 0
line 2
no activation-character
no exec
transport preferred none
transport output pad telnet rlogin lapb-ta mop udptn v120 ssh
stopbits 1
line vty 0 4
login
transport input none
!
!
end
PART XX

Voice Quality in CUBE

- CUBE Call Quality Statistics Enhancement, on page 713
- Voice Quality Monitoring, on page 719
CUBE Call Quality Statistics Enhancement

Call quality statistics in CUBE, such as packet loss, jitter, and round trip delay can be added to the call detail record (CDR), and these voice metrics can be calculated in IOS. For more information, refer to Voice Quality Enhancements on Cisco Unified Border Element.

The call quality statistics feature is enhanced to provide the following capabilities:

- Enable or disable Quality of Service (QoS) for CUBE.
- Enable or disable Real-time Transport Protocol (RTP) Control Protocol (RTCP) passthrough.
- Configure call quality criteria parameters.

- Feature Information for Call Quality Statistics Enhancement, on page 713
- Restrictions for Call Quality Statistics Enhancement, on page 714
- Information About Call Quality Statistics Enhancement, on page 714
- How to Configure Call Quality Parameters, on page 715
- Configuration Example for Call Quality Statistics, on page 717

Feature Information for Call Quality Statistics Enhancement

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
Table 75: Feature Information for Call Quality Statistics Enhancement

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
</table>
| Call Quality Statistics Enhancement | Cisco IOS XE 3.14S | Call quality statistics in CUBE, such as packet loss, jitter, and round trip delay can be added to the call detail record (CDR), and these voice metrics can be calculated in IOS. For more information, refer to Voice Quality Enhancements on Cisco Unified Border Element. The call quality statistics feature is enhanced to provide the following capabilities:  
  - Enable or disable Quality of Service (QoS) for CUBE.  
  - Enable or disable Real-time Transport Protocol (RTP) Control Protocol (RTCP) passthrough.  
  - Configure call quality criteria parameters. |

Restrictions for Call Quality Statistics Enhancement

- Only SIP-to-SIP call quality statistics calculation is supported.
- The RTCP field is not recalculated, as it is end-to-end statistics.
- The round trip delay is only retrieved by RTCP, which means the round trip delay is not calculated if there is no related RTCP.
- Only three codec types are supported for one media flow to calculate the jitter; considering the data path performance, these three codecs would be the maximum number in one cache line.
- Only one RTP synchronization source (SSRC) is supported concurrently per media flow, which is indicated in the m-line of the session description protocol (SDP).
- Round trip delay calculation for transcoding calls is not supported.

Information About Call Quality Statistics Enhancement

Call quality configuration parameters include max_dropout, max_reorder, and clock_rate. A maximum of three codecs (codec_number, payload_type, clock_rate) per media flow is collected by the PI and sent to CPP, which uses these values in statistics calculation. Calculated statistics such as Jitter, Packet Loss, and Delay are then fetched from the CPP to the CDR. These statistics can be viewed in the command line interface.

The CDR has the following data per call leg of the call:

- Packet Loss—Calculated based on methods shown in RFC3550. The RTCP sender/receiver reports are recalculated, and not just copied from the inbound leg to the outbound leg.
- Delay—Calculated based on timestamp received or timestamp of packets sent.
- Jitter—Variation of delay.

# How to Configure Call Quality Parameters

## Configuring Call Quality Criteria Parameters

### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `voice service voip`
4. `call-quality`
5. `max-dropout number-of-packets`
6. `max-reorder number-of-packets`
7. `clock-rate payload-type-number frequency`
8. `clock-rate dynamic-default frequency`
9. `exit`
10. `rtcp all-pass-through`
11. `end`

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 1** enable | Enables privileged EXEC mode.  
  Example: `Device>` enable |
<p>| Example: Enteryourpasswordifprompted. | |
| <strong>Step 2</strong> configure terminal | Enters global configuration mode. |
| Example: <code>Device# configure terminal</code> | |
| <strong>Step 3</strong> voice service voip | Enters global VoIP configuration mode. |
| Example: <code>Device(config)# voice service voip</code> | |
| <strong>Step 4</strong> call-quality | Enters call quality configuration mode; this is the global call quality of service setup. |
| Example: <code>Device(conf-voi-serv)# call-quality</code> | |
| <strong>Step 5</strong> max-dropout number-of-packets | Configures the acceptable out of sequence future packets to drop. The range is from 2 to 2000 packets. The default value is 100. |
| Example: <code>Device(conf-serv-call-quality)# max-dropout 300</code> | |</p>
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 6</strong> max-reorder number-of-packets</td>
<td>Configures the acceptable out of sequence late packets. The range is from 2 to 2000 packets. The default value is 100.</td>
</tr>
<tr>
<td>Example: Device(conf-serv-call-quality)# max-reorder 500</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> clock-rate payload-type-number frequency</td>
<td>Sets the payload type number and frequency. Clock rate is the RTP timestamp field's sampling frequency.</td>
</tr>
<tr>
<td>Example: Device(conf-serv-call-quality)# clock-rate 5 1500</td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong> clock-rate dynamic-default frequency</td>
<td>(Optional) Changes the default clock rate for all the dynamic payload types. The frequency range (in Hz) is from 1000 to 192000.</td>
</tr>
<tr>
<td>Example: Device(conf-serv-call-quality)# clock-rate dynamic-default 10000</td>
<td></td>
</tr>
<tr>
<td><strong>Step 9</strong> exit</td>
<td>Exits to global VoIP configuration mode.</td>
</tr>
<tr>
<td>Example: Device(conf-serv-call-quality)# exit</td>
<td></td>
</tr>
<tr>
<td><strong>Step 10</strong> rtcp all-pass-through</td>
<td>(Optional) Passes through all RTCP in data path.</td>
</tr>
<tr>
<td>Example: Device(conf-voi-serv)# rtcp all-pass-through</td>
<td></td>
</tr>
<tr>
<td><strong>Step 11</strong> end</td>
<td>Returns to privileged EXEC mode.</td>
</tr>
<tr>
<td>Example: Device(conf-voi-serv)# end</td>
<td></td>
</tr>
</tbody>
</table>

### Troubleshooting Call Quality Statistics

Use the following `debug` and `show` commands to enable the logs, which helps in debugging:

- `debug ccsp verbose`
- `debug voip fpi all`
- `debug platform hardware qfp active feature sbc dbe datapath all`
- `debug platform hard qfp act feature sbc dbe client all`
- `debug ccsp message`
- `debug ccsp info`
- `show call active voice`
- `show platform hardware qfp active feature sbc data path call call-id`

The following are some show command outputs that would be useful in troubleshooting:

- `Device# show call active voice | include LostPackets`
LostPackets=0

LostPackets=36 --->//Lost packets detail present in show call active voice output. View the complete command output based on the filters such as call-id to check the packet loss for a particular call leg.

• Device# show call active voice | include PlayDelayJitter

PlayDelayJitter=0

PlayDelayJitter=38 --->//Jitter detail present in show call active voice output. View the complete command output based on the filters such as call-id to check the Jitter for a particular call leg.

**Configuration Example for Call Quality Statistics**

voice service voip  
no ip address trusted authenticate  
callmonitor  
rtcp all-pass-through  
media statistics  
media bulk-stats  
allow-connections sip to sip  
call-quality  
max-dropout 2  
max-reorder 2  
sip  
g729 annexb-all  
no call service stop
### Voice Quality Monitoring

The Voice Quality Monitoring (VQM) feature gives information on the voice quality metrics related to media (voice) quality, such as conversational mean opinion score (MOS), packet loss rate, and so on. VQM enables you to monitor the quality of calls traversing your VoIP network, and you can diagnose the cause of voice quality issues and troubleshoot them.

The Voice Quality Statistics feature provides information about the quality of the Time-Division Multiplexing Internet Protocol (TDM-IP) voice call.

- Feature Information for Voice Quality Monitoring, on page 719
- Prerequisites for Voice Quality Monitoring, on page 720
- Restrictions for Voice Quality Monitoring and Voice Quality Statistics, on page 720
- Information About Voice Quality Monitoring, on page 721
- How to Configure Voice Quality Monitoring, on page 722
- Configuration Examples for Voice Quality Monitoring, on page 725

### Feature Information for Voice Quality Monitoring

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

**Table 76: Feature Information for Voice Quality Monitoring and Voice Quality Statistics**

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice Quality Statistics</td>
<td>Cisco IOS XE Everest 16.5.1b</td>
<td>Voice quality statistics provides information about the quality of the voice TDM-IP call. This feature is already implemented on ISR-G2, and the feature gap is filled in ISR 4000 series.</td>
</tr>
</tbody>
</table>
Feature Information

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice Quality Monitoring</td>
<td>Cisco IOS XE Denali 16.3.1</td>
<td>The Voice Quality Monitoring (VQM) feature provides information on the voice quality metrics related to media (voice) quality, such as conversational mean opinion score (MOS), packet loss rate, and so on. VQM enables you to monitor the quality of calls traversing your VoIP network, and you can diagnose the cause of voice quality issues and troubleshoot them.</td>
</tr>
</tbody>
</table>

**Prerequisites for Voice Quality Monitoring**

The following commands must be executed to configure the voice quality metrics:

- callmonitor
- rtcp all-pass-through
- media statistics
- media bulk-stats
- call-quality
  - max-dropout 2
  - max-reorder 2

**Restrictions for Voice Quality Monitoring and Voice Quality Statistics**

- Only SIP-to-SIP call quality statistics calculation is supported.
- The RTCP field is not recalculated, as it is end-to-end statistics.
- The round trip delay is only retrieved by RTCP, which means the round trip delay is not calculated if there is no related RTCP.
- Only three codec types are supported for one media flow to calculate the jitter; considering the data path performance, these three codecs would be the maximum number in one cache line.
- Only one RTP synchronization source (SSRC) is supported concurrently per media flow, which is indicated in the m-line of the session description protocol (SDP).
- Round trip delay calculation for transcoding calls is not supported.
- VQM MOS values are not calculated for DSP based calls.
• The voice quality statistics covers only the TDM-IP call. The implementation focuses on filling the following statistics based on query response from DSP for TDM-SIP and TDM-H323 call:
  • RoundTripDelay
  • GapFillWithSilence
  • GapFillWithPrediction
  • GapFillWithInterpolation
  • GapFillWithRedundancy
  • HiWaterPlayoutDelay
  • LoWaterPlayoutDelay
  • PlayDelayJitter

Information About Voice Quality Monitoring

The VQM (Voice Quality Monitor) gives information on the voice quality metrics. The VQM on Cisco IOS XE platforms enables statistics gathering based on the received RTCP packets. From these statistics, a voice quality measurement is developed to show the quality of the call. The output is in a simple format, using a system of good, poor, and bad types of ratings.

The following metrics exists in Call Detail Record (CDR) and Management Information Base (MIB) in CUBE, indicating voice quality:

1. MOSQe (conversational quality MOS)
2. Round-trip-delay.
4. Packet-Loss-Rate.

The CDR is sent at the end of a call if AAA accounting is configured.

A CDR example is as follows:

```
<MOS-Con>4.4072</MOS-Con>
<round-trip-delay>1 ms</round-trip-delay>
<receive-delay>64 ms</receive-delay>
<voice-quality-total-packet-loss>0.0000 %</voice-quality-total-packet-loss>
```

VQM Metrics

The following are the metrics exported by VQM:
How to Configure Voice Quality Monitoring

Enabling Media Statistics Globally

Perform this task to globally enable media statistics in voice-service configuration mode to estimate the values for packet loss, jitter, and round-trip time.

SUMMARY STEPS

1. enable
2. configure terminal
3. voice service voip
4. media statistics
5. end

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
</tr>
<tr>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
</tr>
<tr>
<td>voice service voip</td>
<td>Enters voice service VoIP configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
</tbody>
</table>
Purpose

Device(config)# voice service voip

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enables media statistics to estimate the values of packet loss, jitter, and Round Trip Time (RTT) statistics.</td>
</tr>
</tbody>
</table>

Step 4

media statistics

Example:
Device(conf-voi-serv)# media statistics

- The statistics are displayed using the `show voice history` and `show call active voice` commands.
- If the `media statistics` command is disabled, the values will be zero.

Step 5

end

Example:
Device(conf-voi-serv)# end

Returns to privileged EXEC mode.

### Verifying Voice Quality Monitoring

Perform this task to verify the configuration for voice quality monitoring. The `show` commands can be entered in any order.

**SUMMARY STEPS**

1. `enable`
2. `show call active voice | include LostPackets`
3. `show call active voice | include ReceiveDelay`
4. `show call active voice brief | sec RTT`
5. `show call active voice stats | sec MC`

**DETAILED STEPS**

Step 1

`enable`

Enables privileged EXEC mode.

**Example:**
Device> `enable`

Step 2

`show call active voice | include LostPackets`

Displays statistics on the CUBE if the Voice Quality Metrics feature is configured.

**Example:**
Device# `show call active voice | include LostPackets`

LostPackets=0
LostPackets=0

Step 3

`show call active voice | include ReceiveDelay`
Displays statistics on the CUBE if the Voice Quality Metrics feature is configured.

**Example:**
```
Device# show call active voice | include ReceiveDelay
```

```
ReceiveDelay=0
ReceiveDelay=0
```

**Step 4**
```
show call active voice brief | sec RTT
```
Displays a truncated version of call information for voice calls in CUBE if the Voice Quality Metrics feature is configured.

**Note**
This command is not applicable for TDM-IP voice calls.

**Example:**
```
Device# show call active voice brief | sec RTT
```

```
IP 173.39.65.81:7078 SRTP: off rtt:12ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g711ulaw
TextRelay: off Transcoded: No ICE: Off
IP 10.127.17.141:18920 SRTP: off rtt:12ms pl:0/0ms lost:0/0/0 delay:0/0/0ms g711ulaw
TextRelay: off Transcoded: No ICE: Off
```

**Step 5**
```
show call active voice stats | sec MC
```
Displays R-Factor Statistics (G.107 MOS) on the CUBE if the Voice Quality Metrics feature is configured. A sample output is provided below for a voice call using G.711ulaw, VAD on, and at 5 percent packet loss rate.

**Example:**
```
Device# show call active voice stats | sec MC
```

```
DSP/RF: ML=, MC=, R1=, R2=, IF=, ID=, IE=, BL=, R0=, VR=
DSP/RF: ML=4.2346, MC=4.2346, R1=92, R2=92, IF=0, ID=0, IE=0, BL=0, R0=93, VR=2.0
DSP/RF: ML=4.2346, MC=4.2346, R1=92, R2=92, IF=0, ID=0, IE=0, BL=0, R0=93, VR=2.0
```

The following is an example output for the SNMP MIB:
```
cmqVoIPCallActiveRxPred107RMosConv.8520964.1 = 423 (MC)
```

For more information on the SNMP MIB "cmqVoIPCallActiveRxPred107RMosConv", see SNMP Object Navigator.

In the sample output, the following can be noted:

- **ML** for codec G.711ulaw is 4.2346.
- **MC** for codec G.711ulaw is 4.2346.
- **IE** for codec G.711 is 0.
- **R0** is 93.

The following table defines the abbreviations used in the sample output.

**Table 77: Router Output Definitions for the show call active voice stats command**

<table>
<thead>
<tr>
<th>Type</th>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
</table>

Cisco Unified Border Element Configuration Guide
<table>
<thead>
<tr>
<th>DSP/RF: R-Factor Statistics (G.107 MOS)</th>
<th>ML</th>
<th>R-factor MOS listening quality objective</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MC</td>
<td>R-factor MOS-CQE</td>
</tr>
<tr>
<td></td>
<td>R1</td>
<td>R-factor for LQ profile1</td>
</tr>
<tr>
<td></td>
<td>R2</td>
<td>R-factor for LQ</td>
</tr>
<tr>
<td></td>
<td>IF</td>
<td>Effective codec impairment (IeEff')</td>
</tr>
<tr>
<td></td>
<td>ID</td>
<td>Delay factors</td>
</tr>
<tr>
<td></td>
<td>IE</td>
<td>Codec baseline score (Ie)</td>
</tr>
<tr>
<td></td>
<td>BL</td>
<td>Codec baseline (Bpl)</td>
</tr>
<tr>
<td></td>
<td>R0</td>
<td>Nominal value for R0 (default)</td>
</tr>
<tr>
<td></td>
<td>VR</td>
<td>R-Factor version</td>
</tr>
</tbody>
</table>

**Troubleshooting Tips**

Use the following debug commands to troubleshoot the Voice Quality Monitoring feature:

- `debug voip rtp packets`
- `debug performance monitor`
- `debug radius accounting`
- `debug aaa accounting`

**Configuration Examples for Voice Quality Monitoring**

**Example: Configuring Media Statistics Globally**

```bash
Device> enable
Device# configure terminal
Device(config)# voice service voip
Device(config-voi-serv)# media statistics
Device(config-voi-serv)# end
```

**Example: CDR Enabled MOS Output**

At the end of a call, the MOSQe output is displayed in CDR only if the `debug radius accounting` is enabled.

The `show log | sec MOS-Con` command displays the MOS-Con value as shown below:

```bash
Device# show log | sec MOS-Con
```
Example: CDR Enabled MOS Output

PART XXI

Serviceability

• Support for Session Identifier, on page 729
Support for Session Identifier

Cisco Unified Border Element (CUBE) supports “Session Identifier” for end-to-end tracking of a SIP session in IP-based multimedia communication systems. Support for session identifier is in compliance with RFC 7206 and draft-ietf-insipid-session-id-15.

- Feature Information for Session Identifier Support, on page 729
- Restrictions, on page 730
- Information About Session Identifier, on page 730
- Configuring Support for Session Identifier, on page 731
- Troubleshooting Tips, on page 731

Feature Information for Session Identifier Support

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
### Table 78: Feature Information for Session Identifier Support

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support for Session Identifier</td>
<td>Cisco IOS 15.6(2)T</td>
<td>This feature enables CUBE to support “Session Identifier” for end-to-end tracking of a SIP session in IP-based multimedia communication systems in compliance with RFC 7206 and draft-ietf-insipid-session-id-15.</td>
</tr>
<tr>
<td></td>
<td>Cisco IOS XE Denali 16.3.1</td>
<td>A new keyword <code>session-id</code> is added to the following commands:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• show call active voice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• show call active video</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• show call history voice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• show call history video</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• show call active voice brief</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• show call active video brief</td>
</tr>
</tbody>
</table>

### Restrictions

- Session Identifier is not supported for SIP-H.323, H.323-SIP, and H.323-H.323 calls.

### Information About Session Identifier

CUBE supports “Session Identifier” that overcomes the limitations with the existing call-identifiers and allows end-to-end tracking of a SIP session. To support session identifier, “Session-ID” header is added in the SIP request and response messages.

#### Note

"Session Identifier" refers to the value of the identifier, whereas "Session-ID" refers to the header field used to convey the identifier.

The Session-ID comprises of Universally Unique Identifier (UUID) for each user agent participating in a call. Each call consists of two UUID known as local UUID and remote UUID. Local UUID is the UUID generated from the originating user agent and remote UUID is generated from the terminating user agent. The UUID values are presented as strings of lower-case hexadecimal characters, with the most significant octet of the...
UUID appearing first. Session Identifier comprises of 32 characters and remains same for the entire session. Refer to RFC 4122 for more information on UUID.

**Example for Session ID header**

Session-ID: ab30317f1a784dc48ff824d0d3715d86; remote=47755a9de7794ba387653f2099600ef2

In the above example:

Local UUID =
ab30317f1a784dc48ff824d0d3715d86

Remote UUID =
47755a9de7794ba387653f2099600ef2

**Feature Behavior**

- If all the user agents associated with CUBE support session-id, then CUBE allows pass-through of the Session ID header in all SIP request and response messages for the session.

- CUBE looks for the Session ID header present in the SIP messages and validates the SessionID header syntax as defined in draft-ietf-insipid-session-id-15. Session ID format earlier to draft-ietf-insipid-session-id-15 is considered as unsupported.

- If some of the user agents do not support session ID, CUBE generates local UUID on behalf of the user agent and sends the generated UUID in SIP request and response. CUBE generates UUID based on version 5 (SHA-1).

- If a Session ID is received in the format as defined in RFC 7329, CUBE considers it as unsupported. CUBE generates local UUID on behalf of the user agent and sends the generated UUID in SIP request and response.

- In a mid call scenario, where user a session is switched from supporting session identifier to non-supporting session identifier, CUBE saves the previous non-NULL session identifier and sends the saved non-NULL session identifier in re-invite messages as needed.

- For high availability, session ID is check pointed in active and re-created in standby.

**Configuring Support for Session Identifier**

Session Identifier support is enabled on CUBE by default. No additional configuration required.

**Troubleshooting Tips**

The following show commands helps you to troubleshoot any issues with session identifier.

- *show call active voice session-id WORD*
• show call active voice brief session-id \textit{WORD}
• show call active video session-id \textit{WORD}
• show call active video brief session-id \textit{WORD}

\textit{WORD} can be complete session identifier (local, remote, or both), or wildcard pattern of local or remote UUID. The valid wildcard patterns for search are *, 0-9, a-f, A-F.

The following session identifier is considered in the below examples:

- SessionIDLocaluuid=db248b6cbdc547bbc6c6fdfb6916eeb
- SessionIDRemoteuuid=4fd24d9121935531a7f8d750ad16e19

\textbf{Valid Search Patterns}

You can search for the session identifier using complete Session ID header as shown below:

\begin{verbatim}
Device# show call active voice session-id db248b6cbdc547bbc6c6fdfb6916eeb; remote=4fd24d9121935531a7f8d750ad16e19
\end{verbatim}

Telephony call-legs: 0
SIP call-legs: 1
H323 call-legs: 0
SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 1

You can search for the session identifier using complete local UUID as shown below:

\begin{verbatim}
Device# show call active voice session-id db248b6cbdc547bbc6c6fdfb6916eeb
\end{verbatim}

Telephony call-legs: 0
SIP call-legs: 1
H323 call-legs: 0
SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 1

You can search for the session identifier using complete remote UUID as shown below:

\begin{verbatim}
Device# show call active voice session-id 4fd24d9121935531a7f8d750ad16e19
\end{verbatim}

Telephony call-legs: 0
SIP call-legs: 1
H323 call-legs: 0
SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 1
SCCP call-legs: 0  
Multicast call-legs: 0  
Total call-legs: 1

You can search for session id using wildcard pattern match as shown below:

Device# show call active voice session-id 4fd2*  
Telephony call-legs: 0  
SIP call-legs: 2  
H323 call-legs: 0

Device# show call active voice session-id *f*16e*  
Telephony call-legs: 0  
SIP call-legs: 2  
H323 call-legs: 0

Device# show call active voice brief session-id *  
Telephony call-legs: 0  
SIP call-legs: 2  
H323 call-legs: 0
Invalid Search Patterns

The following wildcard search patterns are invalid:

- Device# show call active voice session-id *; remote=*
  Invalid Pattern. Pattern can have a string with ^[0-9a-fA-F*]+$ only OR a string with ^[0-9a-fA-F*];remote=[0-9a-fA-F*]+$.

- Device# show call active voice session-id *;remote=*
  Invalid Pattern. Pattern can have a string with ^[0-9a-fA-F*]+$ only OR a string with ^[0-9a-fA-F*];remote=[0-9a-fA-F*]+$.

- Device# show call active voice session-id 4fd24d9*;remote=*16eeb
  Incorrect format for Session-ID Wildcard Pattern regular expression must be of the form ^[0-9A-Fa-f*]+$.
  Invalid Pattern. Pattern can have a string with ^[0-9a-fA-F*]+$ only OR a string with ^[0-9a-fA-F*];remote=[0-9a-fA-F*]+$.
Search using Null session identifier

If one of the session identifier is null, you can search for the session identifiers using 0 as wildcard pattern. The following session identifier is considered in the below example:

```
SessionIDLocaluuid=00000000000000000000000000000000
SessionIDRemoteuuid=4fd24d9121935531a7f8d750ad16e19

Device# show call active voice session-id 0
Telephony call-legs: 0
SIP call-legs: 2
H323 call-legs: 0

SessionIDLocaluuid=00000000000000000000000000000000
SessionIDRemoteuuid=4fd24d9121935531a7f8d750ad16e19

SCCP call-legs: 0
Multicast call-legs: 0
Total call-legs: 2
```

Correlation between Session Identifier and Call Identifier

The following session identifier is considered in the below examples:

```
SessionIDLocaluuid=db248b6cbdc547bbc6c6f6dfb6916eeb
SessionIDRemoteuuid=4fd24d9121935531a7f8d750ad16e19

You can search for session identifier using the local UUID as shown below:

Device# show call active voice session-id d82c680a3eaecd5c29ac6ceeea225061
Telephony call-legs: 0
SIP call-legs: 2
H323 call-legs: 0
Call agent controlled call-legs: 0
SCCP call-legs: 0
Multicast call-legs: 0

ConnectionId[0x8CDAC180 0x10000 0x1B7 0x5B56400A]
IncomingConnectionId[0x8CDAC180 0x10000 0x1B7 0x5B56400A]
LOCALID=1022
GlobalCallId={0xC3DAB665 0x770C11E5 0x80318550 0x5A000ED7}
SessionIDLocaluuid=d82c680a3eaecd5c29ac6ceeea225061
SessionIDRemoteuuid=6497636d0b747785241cbfaa225064
```

Cisco Unified Border Element Configuration Guide
RemoteSignallingPort=5060
RemoteMediaIPAddress=10.127.17.142
RemoteMediaPort=16614
CoderTypeRate=g711ulaw
.
.
.
GlobalCallId=[0xC3DAB665 0x770C11E5 0x80318550 0x5A000ED7]
SessionIDLocaluuid=64976636d0b747785241cfbf5aa225064
SessionIDRemoteuuid=d82c680a3eaecd5c29ac6ceeaa225061
RemoteIPAddress=10.64.86.91
RemoteUDPPort=21978
RemoteSignallingIPAddress=10.64.86.91
RemoteSignallingPort=5060
RemoteMediaIPAddress=10.127.17.188
RemoteMediaPort=21978

From the above output, you get to know that 1022 (highlighted) is the call identifier associated with the local session identifier d82c680a3eaecd5c29ac6ceeaa225061. You can now use this call identifier to get further details and debugging of the desired call as shown below:

```
Device# show sip-ua calls callid 1022

SIP CALL INFO of CCAPI callid 1022
Call 1
SIP Call ID : 8dcd180-627159d8-9cd-5b56400a@10.64.86.91
State of the call : STATE_ACTIVE (7)
Substate of the call : SUBSTATE_NONE (0)
Calling Number : 4443332212
Called Number : 4443332211
Called URI : sip:4443332211@10.64.86.132:5060
Bit Flags : 0xC0401C 0x10000100 0x80004
CC Call ID : 1022
Source IP Address (Sig) : 10.64.86.132
Destn SIP Req Addr:Port : [10.64.86.91]:5060
Destn SIP Resp Addr:Port: [10.64.86.91]:5060
Destination Name : 10.64.86.91
Number of Media Streams : 1
Number of Active Streams: 1
RTP Fork Object : 0x0
Media Mode : flow-through
Media Stream 1
State of the stream : STREAM_ACTIVE
Stream Call ID : 1022
Stream Type : voice-only (0)
Stream Media Addr Type : 1
Negotiated Codec : g711ulaw (160 bytes)
Codec Payload Type : 0
Negotiated Dtmf-relay : inband-voice
Dtmf-relay Payload Type : 0
QoS ID : -1
Local QoS Strength : BestEffort
Negotiated QoS Strength : BestEffort
Negotiated QoS Direction : None
Local QoS Status : None
Media Source IP Addr:Port: [10.64.86.132]:16424
Media Dest IP Addr:Port : [10.127.17.142]:16614

Options-Ping ENABLED:NO ACTIVE:NO
```

SIP CALL INFO of peer leg CCAPI callid 1023
Example for video Calls

The following session identifier is considered in the below example:

```
SessionIDLocaluuid=6f0a93a3a79451aebeb6d83f79a3359f
SessionIDRemoteuuid=a55b0f45861551b88f57d1fb5bb23f89
```

---

**Note**

All the search patterns listed above for voice calls are also valid for video calls.

You can search for the session identifier using complete UUID (local, remote, or both) or use a wildcard pattern.

```
Device# show call active video session-id 6f*
```
PeerSubAddress=
PeerId=1
PeerIfIndex=14
LogicalIfIndex=0
CallDuration=00:00:56 sec
CallState=4
CallOrigin=2
ChargedUnits=0
InfoType=video
TransmitPackets=0
TransmitBytes=0
ReceivePackets=0
ReceiveBytes=0
VOIP:
ConnectionId[0x6083CB92 0x466511E5 0xFFFFFFFF8018F617 0xFFFFFFFFA7C45A02]
IncomingConnectionId[0x6083CB92 0x466511E5 0xFFFFFFFF8018F617 0xFFFFFFFFA7C45A02]
CallID=11
GlobalCallId=[0x6083F24F 0x466511E5 0xFFFFFFFF801BF617 0xFFFFFFFFA7C45A02]
CallReferenceId=0
CallServiceType=Unknown
RTP Loopback Call=FALSE
SessionIDLocaluuid=6f0a93a3a79451aebbab6d83f79a3359f
SessionIDRemoteuuid=a55b0f45861551b88f57d1fb5bb23f89
RemoteIPAddress=10.64.86.70
RemoteSignallingIPAddress=10.64.86.70
RemoteSignallingPort=5061
RemoteMediaIPAddress=10.64.86.70
RemoteMediaPort=6003
RoundTripDelay=0 ms
tx_DtmfRelay=inband-voice
FastConnect=FALSE
PART XXII

Appendixes

- Additional References, on page 741
- Glossary, on page 745
The following sections provide references related to the CUBE Configuration Guide.

- Related References, on page 741
- Standards, on page 742
- MIBs, on page 742
- RFCs, on page 742
- Technical Assistance, on page 744

## Related References

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feature Navigator</td>
<td>For information about platforms supported, and Cisco IOS software image support, search by Feature Name listed in Feature Information Table in <a href="http://www.cisco.com/go/cfih">www.cisco.com/go/cfih</a></td>
</tr>
<tr>
<td>Bug Search Tool Kit</td>
<td>For information about latest caveats and feature information, see Bug Search Tool Kit</td>
</tr>
</tbody>
</table>

**Related Application Guides**
### Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITU-T G.711</td>
<td>—</td>
</tr>
</tbody>
</table>

### MIBs

<table>
<thead>
<tr>
<th>MIB</th>
<th>MIBs Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>• CISCO-PROCESS MIB</td>
<td>To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
</tr>
<tr>
<td>• CISCO-MEMORY-POOL-MIB</td>
<td></td>
</tr>
<tr>
<td>• CISCO-SIP-UA-MIB</td>
<td></td>
</tr>
<tr>
<td>• DIAL-CONTROL-MIB</td>
<td></td>
</tr>
<tr>
<td>• CISCO-VOICE-DIAL-CONTROL-MIB</td>
<td></td>
</tr>
<tr>
<td>• CISCO-DSP-MGMT-MIB</td>
<td></td>
</tr>
<tr>
<td>• IF-MIB</td>
<td></td>
</tr>
<tr>
<td>• IP-TAP-MIB</td>
<td></td>
</tr>
<tr>
<td>• TAP2-MIB</td>
<td></td>
</tr>
<tr>
<td>• USER-CONNECTION-TAP-MIB</td>
<td></td>
</tr>
</tbody>
</table>

### RFCs

<table>
<thead>
<tr>
<th>RFC</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFC 1889</td>
<td><em>RTP: A Transport Protocol for Real-Time Applications</em></td>
</tr>
<tr>
<td>RFC 2131</td>
<td><em>Dynamic Host Configuration Protocol</em></td>
</tr>
<tr>
<td>RFC</td>
<td>Title</td>
</tr>
<tr>
<td>----------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>RFC 2132</td>
<td>DHCP Options and BOOTP Vendor Extensions</td>
</tr>
<tr>
<td>RFC 2198</td>
<td>RTP Payload for Redundant Audio Data</td>
</tr>
<tr>
<td>RFC 2327</td>
<td>SDP: Session Description Protocol</td>
</tr>
<tr>
<td>RFC 2543</td>
<td>SIP: Session Initiation Protocol</td>
</tr>
<tr>
<td>RFC 2543-bis-04</td>
<td>SIP: Session Initiation Protocol, draft-ietf-sip-rfc2543bis-04.txt</td>
</tr>
<tr>
<td>RFC 2782</td>
<td>A DNS RR for Specifying the Location of Services (DNS SRV)</td>
</tr>
<tr>
<td>RFC 2806</td>
<td>URLs for Telephone Calls</td>
</tr>
<tr>
<td>RFC 2833</td>
<td>RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals</td>
</tr>
<tr>
<td>RFC 3203</td>
<td>DHCP reconfigure extension</td>
</tr>
<tr>
<td>RFC 3261</td>
<td>SIP: Session Initiation Protocol</td>
</tr>
<tr>
<td>RFC 3262</td>
<td>Reliability of Provisional Responses in Session Initiation Protocol (SIP)</td>
</tr>
<tr>
<td>RFC 3323</td>
<td>A Privacy Mechanism for the Session Initiation Protocol (SIP)</td>
</tr>
<tr>
<td>RFC 3325</td>
<td>Private Extensions to the Session Initiation Protocol (SIP) for Asserted Identity within Trusted Networks</td>
</tr>
<tr>
<td>RFC 3515</td>
<td>The Session Initiation Protocol (SIP) Refer Method</td>
</tr>
<tr>
<td>RFC 3361</td>
<td>Dynamic Host Configuration Protocol (DHCP-for-IPv4) Option for Session Initiation Protocol (SIP) Servers</td>
</tr>
<tr>
<td>RFC 3455</td>
<td>Private Header (P-Header) Extensions to the Session Initiation Protocol (SIP) for the 3rd-Generation Partnership Project (3GPP)</td>
</tr>
<tr>
<td>RFC 3608</td>
<td>Session Initiation Protocol (SIP) Extension Header Field for Service Route Discovery During Registration</td>
</tr>
<tr>
<td>RFC 3711</td>
<td>The Secure Real-time Transport Protocol (SRTP)</td>
</tr>
<tr>
<td>RFC 3925</td>
<td>Vendor-Identifying Vendor Options for Dynamic Host Configuration Protocol version 4 (DHCPv4)</td>
</tr>
</tbody>
</table>
# Technical Assistance

<table>
<thead>
<tr>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cisco Support website provides extensive online resources, including</td>
<td><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></td>
</tr>
<tr>
<td>documentation and tools for troubleshooting and resolving technical issues</td>
<td></td>
</tr>
<tr>
<td>with Cisco products and technologies.</td>
<td></td>
</tr>
<tr>
<td>To receive security and technical information about your products, you can</td>
<td></td>
</tr>
<tr>
<td>subscribe to various services, such as the Product Alert Tool (accessed from</td>
<td></td>
</tr>
<tr>
<td>Field Notices), the Cisco Technical Services Newsletter, and Really Simple</td>
<td></td>
</tr>
<tr>
<td>Syndication (RSS) Feeds.</td>
<td></td>
</tr>
<tr>
<td>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</td>
<td></td>
</tr>
</tbody>
</table>
Glossary

AMR-NB — Adaptive Multi Rate codec - Narrow Band.
Allow header — Lists the set of methods supported by the UA generating the message.
bind — In SIP, configuring the source address for signaling and media packets to the IP address of a specific interface.
call — In SIP, a call consists of all participants in a conference invited by a common source. A SIP call is identified by a globally unique call identifier. A point-to-point IP telephony conversation maps into a single SIP call.
call leg — A logical connection between the router and another endpoint.
CLI — command-line interface.
Content-Type header — Specifies the media type of the message body.
CSeq header — Serves as a way to identify and order transactions. It consists of a sequence number and a method. It uniquely identifies transactions and differentiates between new requests and request retransmissions.
delta — An incremental value. In this case, the delta is the difference between the current time and the time when the response occurred.
dial peer — An addressable call endpoint.
DNS — Domain Name System. Used to translate H.323 IDs, URLs, or e-mail IDs to IP addresses. DNS is also used to assist in locating remote gatekeepers and to reverse-map raw IP addresses to host names of administrative domains.
DNS SRV — Domain Name System Server. Used to locate servers for a given service.
DSP — Digital Signal Processor.
DTMF — dual-tone multifrequency. Use of two simultaneous voice-band tones for dialing (such as touch-tone).
EFXS — IP phone virtual voice ports.
FQDN — fully qualified domain name. Complete domain name including the host portion; for example, serverA.companyA.com.
FXS — analog telephone voice ports.

gateway — A gateway allows SIP or H.323 terminals to communicate with terminals configured to other protocols by converting protocols. A gateway is the point where a circuit-switched call is encoded and repackaged into IP packets.

H.323 — An International Telecommunication Union (ITU-T) standard that describes packet-based video, audio, and data conferencing. H.323 is an umbrella standard that describes the architecture of the conferencing system and refers to a set of other standards (H.245, H.225.0, and Q.931) to describe its actual protocol.

iLBC — internet Low Bitrate Codec.

INVITE — A SIP message that initiates a SIP session. It indicates that a user is invited to participate, provides a session description, indicates the type of media, and provides insight regarding the capabilities of the called and calling parties.

IP — Internet Protocol. A connectionless protocol that operates at the network layer (Layer 3) of the OSI model. IP provides features for addressing, type-of-service specification, fragmentation and reassemble, and security. Defined in RFC 791. This protocol works with TCP and is usually identified as TCP/IP. See TCP/IP.

ISDN — Integrated Services Digital Network.

Minimum Timer — Configured minimum value for session interval accepted by SIP elements (proxy, UAC, UAS). This value helps minimize the processing load from numerous INVITE requests.

Min-SE — Minimum Session Expiration. The minimum value for session expiration.

multicast — A process of transmitting PDUs from one source to many destinations. The actual mechanism (that is, IP multicast, multi-unicast, and so forth) for this process might be different for LAN technologies.

originator — User agent that initiates the transfer or Refer request with the recipient.

PDU — protocol data units. Used by bridges to transfer connectivity information.

PER — Packed Encoding Rule.

proxy — A SIP UAC or UAS that forwards requests and responses on behalf of another SIP UAC or UAS.

proxy server — An intermediary program that acts as both a server and a client for the purpose of making requests on behalf of other clients. Requests are serviced internally or by passing them on, possibly after translation, to other servers. A proxy interprets and, if necessary, rewrites a request message before forwarding it.

recipient — User agent that receives the Refer request from the originator and is transferred to the final recipient.

redirect server — A server that accepts a SIP request, maps the address into zero or more new addresses, and returns these addresses to the client. It does not initiate its own SIP request or accept calls.

re-INVITE — An INVITE request sent during an active call leg.

Request URI — Request Uniform Resource Identifier. It can be a SIP or general URL and indicates the user or service to which the request is being addressed.

RFC — Request For Comments.

RTP — Real-Time Transport Protocol (RFC 1889)

SCCP — Skinny Client Control Protocol.

SDP — Session Description Protocol. Messages containing capabilities information that are exchanged between gateways.
**session** — A SIP session is a set of multimedia senders and receivers and the data streams flowing between the senders and receivers. A SIP multimedia conference is an example of a session. The called party can be invited several times by different calls to the same session.

**session expiration** — The time at which an element considers the call timed out if no successful INVITE transaction occurs first.

**session interval** — The largest amount of time that can occur between INVITE requests in a call before a call is timed out. The session interval is conveyed in the Session-Expires header. The UAS obtains this value from the Session-Expires header of a 2xx INVITE response that it sends. Proxies and UACs determine this value from the Session-Expires header in a 2xx INVITE response they receive.

**SIP** — Session Initiation Protocol. An application-layer protocol originally developed by the Multiparty Multimedia Session Control (MMUSIC) working group of the Internet Engineering Task Force (IETF). Their goal was to equip platforms to signal the setup of voice and multimedia calls over IP networks. SIP features are compliant with IETF RFC 2543, published in March 1999.

**SIP URL** — Session Initiation Protocol Uniform Resource Locator. Used in SIP messages to indicate the originator, recipient, and destination of the SIP request. Takes the basic form of `user@host`, where `user` is a name or telephone number, and `host` is a domain name or network address.

**SPI** — service provider interface.

**socket listener** — Software provided by a socket client to receives datagrams addressed to the socket.

**stateful proxy** — A proxy in keepalive mode that remembers incoming and outgoing requests.

**TCP** — Transmission Control Protocol. Connection-oriented transport layer protocol that provides reliable full-duplex data transmissions. TCP is part of the TCP/IP protocol stack. See also TCP/IP and IP.

**TDM** — time-division multiplexing.

**UA** — user agent. A combination of UAS and UAC that initiates and receives calls. See UAS and UAC.

**UAC** — user agent client. A client application that initiates a SIP request.

**UAS** — user agent server. A server application that contacts the user when a SIP request is received and then returns a response on behalf of the user. The response accepts, rejects, or redirects the request.

**UDP** — User Datagram Protocol. Connectionless transport layer protocol in the TCP/IP protocol stack. UDP is a simple protocol that exchanges datagrams without acknowledgments or guaranteed delivery, requiring that error processing and retransmission be handled by other protocols. UDP is defined in RFC-768.

**URI** — Uniform Resource Identifier. Takes a form similar to an e-mail address. It indicates the user’s SIP identity and is used for redirection of SIP messages.

**URL** — Universal Resource Locator. Standard address of any resource on the Internet that is part of the World Wide Web (WWW).

**User Agent** — A combination of UAS and UAC that initiates and receives calls. See UAS and UAC.

**VFC** — Voice Feature Card.

**VoIP** — Voice over IP. The ability to carry normal telephone-style voice over an IP-based Internet with POTS-like functionality, reliability, and voice quality. VoIP is a blanket term that generally refers to the Cisco standards-based approach (for example, H.323) to IP voice traffic.