Cisco Unified Communications Manager with Cisco Expressway (SIP Trunk)

Deployment Guide

Cisco Expressway X8.1
CUCM 8.6.x, 9.x

January 2015
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**Introduction**

This deployment guide provides guidelines on how to configure the Cisco Expressway (Expressway) version X8.1 and Cisco Unified Communications Manager (Unified CM) versions 8.6.x and 9.x to interwork via a SIP trunk.

**Deployment scenario**

A company already has Unified CM running their telephone/video system. They want to integrate this via a SIP trunk to an Expressway-C to provide further services such as integration with Jabber Guest servers or another Expressway managing integration to Microsoft Lync.

For the purposes of this example, the existing Unified CM system uses telephone (digit-only) numbers to specify who to call:

- Endpoints connected to the Unified CM are identified by 3xxx extension numbers.
- Endpoints and systems that are contacted via the Expressway-C are identified by 4xxx extension numbers.

Note that more complicated dial plans can also be supported, including alphanumeric dialing; they would require additional transforms/routing configuration.

Unified CM and the Expressway-C are connected together using a SIP trunk across an IP network; the Expressway-C domain is exp.domain. Calls sent to Unified CM will have the domain portion set to the Expressway domain; calls from Unified CM to Expressway will arrive with the domain portion set as <FQDN of Expressway>:5060 for TCP and <FQDN of Expressway>:5061 for TLS.

This guide specifies how to configure both the Unified CM and the Expressway-C so that SIP calls can be routed between each system. It does not describe how to configure the onward routing, such as additional neighbor zones from the Expressway to other systems (such as another Expressway, Jabber Guest servers or a Cisco VCS).

Initially the configuration use non-secure TCP connections, as this allows for easier troubleshooting. It then describes how to secure the video network over TLS.
Configuring Unified CM for an Expressway trunk

Prerequisites

Ensure that Unified CM contains a basic configuration and has already set up at least:

- System > Server
- System > Cisco Unified CM
- System > Cisco Unified CM Group
- System > Date / Time Group
- System > Presence Group
- System > Region Information
- System > Device Pool
- System > DHCP
- System > Location
- System > Physical location
- System > Presence Group
- System > Region Information

Configuration summary

The configuration on Unified CM contains the following tasks:

- Configuring the SIP Profile for Expressway (already exists if using version 9.x)
- Configuring the region with an appropriate session bit rate for video calls
- Configuring a SIP Profile for phone devices
- Adding a phone device: add the new phone device to the list of supported endpoints on Unified CM
- Configuring the device directory number: specify the telephone number that will cause this phone to ring
- Configuring the SIP Trunk security profile
- Configuring the SIP Trunk device
- Configuring the Cluster Fully Qualified Domain Name
- Allowing numeric dialing from Cisco phones to Expressway
- Allowing dialing to Expressway domain from Cisco phones
- Checking the message size limit on Unified CM

These tasks are explained in detail below.

Configuring the SIP Profile for Expressway

Note that you can skip this step if you are using version 9.x as a "Standard SIP Profile For Cisco VCS" will already exist (the Cisco VCS profile may be used with Expressway).

1. On Unified CM, go to Device > Device Settings > SIP Profile.
2. Click Copy against the Standard SIP Profile.
3. Configure the fields as follows (leave other fields as default values):

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>&quot;Standard SIP Profile For Cisco VCS&quot; (the profile is named &quot;for Cisco VCS&quot; for consistency with other Unified CM versions)</td>
</tr>
<tr>
<td>Default MTP Telephony Event Payload Type</td>
<td>101</td>
</tr>
<tr>
<td>Redirect by Application</td>
<td>Select the check box</td>
</tr>
<tr>
<td>Use Fully Qualified Domain in SIP Requests</td>
<td>Select the check box</td>
</tr>
<tr>
<td>Allow Presentation Sharing using BFCP</td>
<td>Select the check box (in Unified CM 8.6.1 or later)</td>
</tr>
<tr>
<td>Timer Invite Expires</td>
<td>180</td>
</tr>
<tr>
<td>Timer Register Delta</td>
<td>5</td>
</tr>
<tr>
<td>Timer Register Expires</td>
<td>3600</td>
</tr>
<tr>
<td>Timer T1</td>
<td>500</td>
</tr>
<tr>
<td>Timer T2</td>
<td>Leave as default (typically 4000 or 5000)</td>
</tr>
<tr>
<td>Retry INVITE</td>
<td>6</td>
</tr>
<tr>
<td>Retry non-INVITE</td>
<td>10</td>
</tr>
<tr>
<td>Start Media Port</td>
<td>16384</td>
</tr>
<tr>
<td>Stop Media Port</td>
<td>32766</td>
</tr>
<tr>
<td>Call Pickup URI</td>
<td>x-cisco-serviceuri-pickup</td>
</tr>
<tr>
<td>Call Pickup Group Other URI</td>
<td>x-cisco-serviceuri-opickup</td>
</tr>
<tr>
<td>Call Pickup Group URI</td>
<td>x-cisco-serviceuri-gpickup</td>
</tr>
<tr>
<td>Meet Me Service URI</td>
<td>x-cisco-serviceuri-meetme</td>
</tr>
<tr>
<td>Timer Keep Alive Expires</td>
<td>120</td>
</tr>
<tr>
<td>Timer Subscribe Expires</td>
<td>120</td>
</tr>
<tr>
<td>Timer Subscribe Delta</td>
<td>5</td>
</tr>
<tr>
<td>Maximum Redirections</td>
<td>70</td>
</tr>
<tr>
<td>Off Hook To First Digit Timer</td>
<td>15000</td>
</tr>
<tr>
<td>Call Forward URI</td>
<td>x-cisco-serviceuri-cfwdall</td>
</tr>
<tr>
<td>Abbreviated Dial URI</td>
<td>x-cisco-serviceuri-abbrdial</td>
</tr>
<tr>
<td>Reroute Incoming Request to new Trunk based on</td>
<td>Never</td>
</tr>
</tbody>
</table>
4. Click **Save**.

![SIP Profile Configuration](image)

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
<th>Default MTI Telephony Event Payload Type</th>
<th>Resource Priority Namespace ULI</th>
<th>Early Offer for G.733 Cells</th>
<th>SDP Session-level Bandwidth Modifier for Early Offer and Re-invite</th>
<th>User-Agent and Server header information</th>
<th>Redirect by Application</th>
<th>Disable early Media on 180</th>
<th>Outgoing T.38 INVITE include audio mingle</th>
<th>Enable AMT</th>
<th>Require SDP inactive Exchange for Mid-Cell Media Change</th>
<th>Use Fully Qualified Domain Name in SIP Requests</th>
<th>Allow Presentation Sharing using BFCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status: Ready</td>
<td></td>
<td>Default SIP Profile</td>
<td></td>
<td>&lt; None &gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| SIP Profile Information | | Standard SIP Profile for Cisco XCS | | 102 | | | | | | | | | | |

<table>
<thead>
<tr>
<th>Parameters used in Phase</th>
<th></th>
<th>180</th>
<th>5</th>
<th>3600</th>
<th>500</th>
<th>4030</th>
<th>6</th>
<th>10</th>
<th>16384</th>
<th>52766</th>
<th>x=cisco-servicem-up</th>
<th>x=cisco-servicem-up</th>
<th>x=cisco-servicem-up</th>
<th>x=cisco-servicem-up</th>
</tr>
</thead>
</table>
Configuring the region with an appropriate session bit rate for video calls

Ensure that your regions have an appropriate session bit rate for video calls:

1. Go to System > Region Information > Region.
2. Select the region (for example the Default region).
3. Set Maximum Session Bit Rate for Video Calls to a suitable upper limit for your system, for example 6000 kbps.
4. Click Save and then click Apply Config.

Configuring the SIP Profile for phone devices

This creates the SIP Profile that is to be applied to all phone devices.

1. On Unified CM, go to Device > Device Settings > SIP Profile.
2. Click Copy against the Standard SIP Profile.
3. Configure the following fields, leaving everything else as its default value:

| Name | Standard SIP Profile – for phone devices |
Use Fully Qualified Domain in SIP Requests | Select the check box
---|---
Allow Presentation Sharing using BFCP | Select the check box if BFCP (Dual video / presentation sharing) is required.

4. Click **Save**.

### Adding a phone device

1. Go to **Device > Phone**.
2. Click **Add New**.
3. Select a **SIP Profile** of *Standard SIP Profile – for phone devices*.
4. Configure the other fields as required.
5. Click **Save** and click **OK**.
6. Click **Apply Config** and click **OK**.

Alternatively, if there is already another phone configured, copy its configuration by selecting “super copy”, entering the new phone’s MAC address and then changing the description (especially correct the MAC address part of the description).

### Configuring the device directory number

1. Go to **Device > Phone**.
2. Select the relevant device name.
3. On the left hand side, select a line.
4. Set up the required directory number (for this example use a 3xxx number).

### Configuring the SIP Trunk security profile

**Version 8.6.x**

1. Go to **System > Security > SIP Trunk Security Profile**.
2. Click **Add New**.
3. Configure the fields as follows:

<table>
<thead>
<tr>
<th>Name</th>
<th>Non Secure SIP Trunk Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Security Mode</td>
<td>Non Secure</td>
</tr>
<tr>
<td>Incoming Transport Type</td>
<td>TCP+UDP</td>
</tr>
<tr>
<td>Outgoing Transport Type</td>
<td>TCP</td>
</tr>
<tr>
<td>Incoming Port</td>
<td>5060</td>
</tr>
<tr>
<td>Accept Unsolicited Notification</td>
<td>Select this check box</td>
</tr>
<tr>
<td>Accept Replaces Header</td>
<td>Select this check box</td>
</tr>
</tbody>
</table>
4. Click **Save**.

**Version 9.x**

In version 9.x, the Non Secure SIP Trunk Profile will already exist, but it **must be modified**.

1. On Unified CM, go to **System > Security > SIP Trunk Security Profile**.
2. Select **Non Secure SIP Trunk Profile**.
3. Modify the fields as follows:

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accept Unsolicited Notification</strong></td>
<td>Select this check box</td>
</tr>
<tr>
<td><strong>Accept Replaces Header</strong></td>
<td>Select this check box</td>
</tr>
</tbody>
</table>

4. Click **Save**.

![SIP Trunk Security Profile Configuration](image)

**Configuring the SIP Trunk device**

1. On Unified CM, go to **Device > Trunk**.
2. Click **Add New**.
3. Select a **Trunk Type** of **SIP Trunk**.
   - **Device Protocol** displays **SIP**.
   - If asked for a **Trunk Service Type**, select **None (Default)**.
4. Click **Next**.
5. Configure the **Device Information** fields as follows:
<table>
<thead>
<tr>
<th>Device Name</th>
<th>As required, such as Expressway_system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Pool</td>
<td>(As set up in System &gt; Device Pool)</td>
</tr>
<tr>
<td>Call classification</td>
<td>OnNet</td>
</tr>
<tr>
<td>Location</td>
<td>(As set up in System &gt; Location)</td>
</tr>
<tr>
<td>Packet Capture Mode</td>
<td>None</td>
</tr>
<tr>
<td>Media Termination</td>
<td>Clear this check box if any video</td>
</tr>
<tr>
<td>Point Required</td>
<td>phones registered to Unified CM are</td>
</tr>
<tr>
<td></td>
<td>to make or receive video calls with</td>
</tr>
<tr>
<td></td>
<td>endpoints routed via Expressway.</td>
</tr>
<tr>
<td></td>
<td>Select this check box if audio</td>
</tr>
<tr>
<td></td>
<td>devices only are registered to</td>
</tr>
<tr>
<td></td>
<td>Unified CM.</td>
</tr>
<tr>
<td>SRTP Allowed</td>
<td>Select this check box</td>
</tr>
<tr>
<td>Run On All Active</td>
<td>Select this check box</td>
</tr>
<tr>
<td>Unified CM Nodes</td>
<td></td>
</tr>
</tbody>
</table>

6. Configure the **Call Routing Information > Inbound Calls** fields as follows:

<table>
<thead>
<tr>
<th>Significant digits</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connected Line ID Presentation</td>
<td>Default</td>
</tr>
<tr>
<td>Connected Name Presentation</td>
<td>Default</td>
</tr>
<tr>
<td>Calling Search Space</td>
<td>(As set up in Call Routing &gt; Class of Control &gt; Calling Search Space)</td>
</tr>
<tr>
<td>Prefix DN</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>Redirecting Diversion Header Delivery – Inbound</td>
<td>Select this check box</td>
</tr>
</tbody>
</table>

7. Configure the **Call Routing Information > Outbound Calls** fields as follows:

<table>
<thead>
<tr>
<th>Calling Party Selection</th>
<th>Originator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calling Line ID Presentation</td>
<td>Default</td>
</tr>
<tr>
<td>Calling Name Presentation</td>
<td>Default</td>
</tr>
<tr>
<td>Caller ID DN</td>
<td>&lt;blank&gt;</td>
</tr>
<tr>
<td>Caller Name</td>
<td>&lt;blank&gt;</td>
</tr>
</tbody>
</table>

8. Configure the **SIP Information** fields as follows:

| Destination address is an SRV | Select this check box if a domain is specified for the destination address, and the DNS server uses DNS SRV records to direct the domain to a cluster of Expressways. Do not select this check box if an IP address is specified as the Destination address. |
### Destination address
- `<FQDN of Expressway / Expressway cluster>`. Alternatively you can enter the `<IP address of Expressway>`. If you are not using SRV records and need to specify multiple peers, click [ ] to add extra Destination address rows.
- The content of the Expressway transform configured at Configuring Expressway routing [p. 17] depends on which form of address is entered here.

### Destination port
- 5060 (this displays as zero if you are using SRV records)

### Presence Group
- Standard Presence Group (or whichever presence group has been configured in System > Presence Group)

### SIP Trunk Security Profile
- Non Secure SIP Trunk Profile

### SIP Profile
- Standard SIP Profile for Cisco VCS

### DTMF Signaling Method
- RFC 2833

### Normalization Script
- `vcs-interop` (if available, the vcs-interop script may be used with Expressway)

### Configuration Steps
9. Click **Save**.
10. Click **Reset**.
11. Click **Reset**.
Configuring Unified CM for an Expressway trunk

Intercompany Media Engine (IME)

Multilevel Precedence and Preemption (MLPP) Information

Call Routing Information

Inbound Calls

Redirecting Diversion Header Delivery - Inbound

Incoming Calling Party Settings

If the administrator sets the prefix as Default this indicates call processing will use prefix at the next level setting (DevicePool/Service Parameter). Otherwise, the value configured is used as the prefix unless the field is empty in which case there is no prefix assigned.

Connected Party Settings

Outbound Calls

Redirecting Diversion Header Delivery - Outbound

Use Device Pool Redirecting Party Transformation CSS

SIP Information

Destination

Redirecting Party Transformation CSS

SIP Trunk Security Profile

Ready Call Search Space

Out-Of-Dialog-Retrieve Calling Search Space

SIP Profile

DTMF Signaling Method

Normalization Script

Enable Trace

Geolocation Configuration

GeoLocation

Send GeoLocation Information

Save
Configuring the Cluster Fully Qualified Domain Name

Unified CM must be configured with a **Cluster Fully Qualified Domain Name** so that it can receive calls to addresses in the format `<address>@domain`. (It is also required when Unified CM is clustered so that Expressway can send the call to any Unified CM node.)

1. Go to **System > Enterprise parameters**, and find the **Clusterwide Domain Configuration** section.
2. Set the **Cluster Fully Qualified Domain Name** to the same domain as the video network, for example `exp.domain`.
   This parameter defines one or more Fully Qualified Domain Names (FQDNs) for this cluster. Multiple FQDNs must be separated by a space. Requests containing URLs (for example, SIP calls) whose host portion matches any of the FQDNs in this parameter will be recognized as a request destined for this cluster and/or devices attached to it.
3. Click **Save**.

### Allowing numeric dialing from Cisco phones to Expressway

Unified CM can be configured to take a prefix and route calls to a SIP trunk based on a specific prefix.

Configure Unified CM to route calls dialed as 4xxx to the Expressway:

1. On Unified CM, go to **Call Routing > Route/Hunt > Route Pattern**.
2. Click **Add New**.
3. Configure a Route Pattern to route calls dialed 4xxx to the Expressway trunk (no change to dialed number).

<table>
<thead>
<tr>
<th><strong>Pattern Definitions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Route Pattern</strong></td>
</tr>
<tr>
<td><strong>Route Partition</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Gateway/Route List</strong></td>
</tr>
<tr>
<td><strong>Call Classification</strong></td>
</tr>
<tr>
<td><strong>Provide Outside Dial Tone</strong></td>
</tr>
<tr>
<td><strong>Called Party Transformations</strong></td>
</tr>
<tr>
<td><strong>Discard Digits</strong></td>
</tr>
</tbody>
</table>
Allowing dialing to Expressway domain from Cisco phones

Configure a SIP route pattern that tells Unified CM that anything with, for example, a domain exp.domain needs to be sent down the Expressway SIP trunk. This is required to permit dialing from endpoints that support SIP URIs with domains, and also for enabling the reverse path to the Expressway for certain signaling.

1. On Unified CM, go to **Call Routing > SIP Route Pattern**.
2. Click **Add New**.
3. Configure the fields as follows:

<table>
<thead>
<tr>
<th>Pattern Usage</th>
<th>Domain Routing</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPv4 Pattern</td>
<td>Domain for calls, for example exp.domain</td>
</tr>
<tr>
<td>Route Partition</td>
<td>Default is &quot;&lt;None&gt;&quot;; set according to dial plan restrictions</td>
</tr>
<tr>
<td>SIP Trunk</td>
<td>Required Trunk to route calls to the Expressway-C</td>
</tr>
</tbody>
</table>

4. Click **Save**.
When nnnn@exp.domain is dialed by an endpoint registered to Unified CM, Unified CM will route the call to the Expressway as nnnn@<FQDN of Expressway>:5060 (TCP) or nnnn@<FQDN of Expressway>:5061 (TLS). (The domain may alternatively be the IP address of Expressway, depending on what is configured as the SIP Trunk Destination Address.)

Checking the message size limit on Unified CM

SIP messages for video are considerably larger than SIP messages for audio calls, in particular, when a Cisco TelePresence Server is used in the video network.

Ensure that the **SIP Max Incoming Message Size** on Unified CM is set to 11000:

1. Go to System > Service Parameters.
2. Select the appropriate server.
3. Select Cisco CallManager (Active) as the service.
4. Select Advanced.
5. In the Clusterwide Parameters (Device – SIP) configure the field as follows:

   **SIP Max Incoming Message Size** 11000

6. Click Save.
Configuring Expressway routing

Prerequisites
The Expressway-C must be configured with IP address, DNS and NTP information, and is accessible for management via its web interface (see Expressway Basic Configuration Deployment Guide). Rich media session licenses must be installed.

Configuration summary
The configuration on Expressway-C contains the following tasks:

- Creating a transform to ensure a consistent URI format
- Configuring a neighbor zone that contains the Unified CM
- Configuring a search rule to route calls to that zone
- Configuring a transform that converts number@<IP address of cucm> to number@exp.domain
- Configuring a transform to convert other Unified CM-supplied domain variants to number@exp.domain

These tasks are explained in detail below.

Ensuring a consistent URI format
In this deployment scenario, users want to be able to route calls via the Expressway to other devices or endpoints (not registered to Unified CM) that have a 4xxx extension number. Unified CM endpoints are to be dialed using a 3xxx number. This dialing model can be supported by H.323 (if the endpoint registers the 4-digit E.164 alias), however, SIP does not support dialing by numbers alone. If a number (without a domain appended) is dialed from a SIP endpoint the endpoint will automatically append its own domain.

For consistency with both SIP and H.323 dialing, this deployment scenario always uses the URI form for routing calls (that is, dialed_digits@domain). When the Expressway receives a call request, the dialed number:

- will contain the 4 digit extension number that identifies the specific endpoint to route to
- may or may not include a domain (only included when a SIP endpoint is making the call)

Thus, a transform is needed to ensure that the dialed number is transformed into a consistent form, in this case to add the domain (exp.domain) if required. To achieve this, a regex is used: ([^@]*) transforms to \1@exp.domain (any dialed information which does not contain a domain – does not contain an ‘@’ – has the '@exp.domain' added.)

See the Regular Expression Reference in the Appendices section of Expressway Administrator Guide for further details, or alternatively search the internet for the term "Regular Expression".

To create the transform:
1. Go to Configuration > Dial plan > Transforms.
2. Click New.
3. Configure the fields as follows:
### Configuring Expressway routing

<table>
<thead>
<tr>
<th>Priority</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>“Add domain where none exists” for example</td>
</tr>
<tr>
<td>Pattern type</td>
<td>Regex</td>
</tr>
<tr>
<td>Pattern string</td>
<td>([^@]*)</td>
</tr>
<tr>
<td>Pattern behavior</td>
<td>Replace</td>
</tr>
<tr>
<td>Replace string</td>
<td>\<a href="mailto:1@exp.domain">1@exp.domain</a></td>
</tr>
<tr>
<td>State</td>
<td>Enabled</td>
</tr>
</tbody>
</table>

4. Click Create transform.

#### Creating a neighbor zone for Unified CM

1. Go to Configuration > Zones > Zones.
2. Click New.
3. Configure the fields as follows (leave all other fields with default values):

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>CUCM Neighbor</td>
</tr>
<tr>
<td>Type</td>
<td>Neighbor</td>
</tr>
<tr>
<td>Hop count</td>
<td>15</td>
</tr>
<tr>
<td>H.323 mode</td>
<td>Off (H.323 access is not required for communication with Unified CM)</td>
</tr>
<tr>
<td>SIP mode</td>
<td>On</td>
</tr>
<tr>
<td>SIP port</td>
<td>5060 (if the SIP access port on Unified CM is not 5060, change SIP Port value to be the same as used by Unified CM)</td>
</tr>
<tr>
<td>Transport</td>
<td>TCP</td>
</tr>
<tr>
<td>Media encryption mode</td>
<td>Auto</td>
</tr>
</tbody>
</table>
### SIP authentication trust mode

**Off**

### Peer 1 address

IP address of Unified CM, or the FQDN of Unified CM.

If you are planning to ultimately use a TLS connection, then typically you will need to specify the FQDN of Unified CM here as this is the name that will be used to authenticate the certificate presented by Unified CM.

### Zone profile (Advanced section)

This depends upon your version of Unified CM:

- Select *Cisco Unified Communications Manager* for versions prior to 8.6.1
- Select *Cisco Unified Communications Manager (8.6.1 or later)* for 8.6.1 or 8.6.2
- Select *Custom* for 9.x or later and:
  - Set **Call signaling routed mode** to **Always**
  - Leave all the other fields as their default values

Note that Unified CM 8.6.1 or later is required for BFCP (dual video / presentation sharing).

---

This configures the Expressway to use SIP over TCP to communicate with the Unified CM. To use TLS, complete the configuration as described here for TCP and then see [Connecting Expressway to Unified CM using TLS](#).

4. Click **Create zone**.
Creating a search rule to route calls to the Unified CM neighbor zone

Search rules specify the range of telephone numbers / URIs to be handled by this neighbor Unified CM. They can also be used to transform URIs before they are sent to the neighbor.

In this example deployment, the transforms set up in Ensuring a consistent URI format ensure that dial strings are in URI format number@exp.domain.

1. Go to Configuration > Dial plan > Search rules.
2. Click New.
3. Configure the fields as follows to route the call to Unified CM:

<table>
<thead>
<tr>
<th>Rule name</th>
<th>Route to CUCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>For example: Send <a href="mailto:3xxx@exp.doman">3xxx@exp.doman</a> calls to CUCM</td>
</tr>
<tr>
<td>Priority</td>
<td>100</td>
</tr>
<tr>
<td>Protocol</td>
<td>Any</td>
</tr>
<tr>
<td>Source</td>
<td>Any</td>
</tr>
<tr>
<td>Request must be authenticated</td>
<td>Configure this setting according to your authentication policy</td>
</tr>
<tr>
<td>Mode</td>
<td>Alias pattern match</td>
</tr>
<tr>
<td>Pattern type</td>
<td>Regex</td>
</tr>
<tr>
<td>Pattern string</td>
<td>(3\d(3))@exp.domain(*)</td>
</tr>
<tr>
<td>Pattern behavior</td>
<td>Leave</td>
</tr>
<tr>
<td>On successful match</td>
<td>Stop</td>
</tr>
<tr>
<td>Target zone</td>
<td>CUCM Neighbor</td>
</tr>
<tr>
<td>State</td>
<td>Enabled</td>
</tr>
</tbody>
</table>

4. Click Create search rule.

See the “Zones and Neighbors” section of *Expressway Administrator Guide* for further details.
Creating a transform that converts number@<IP address of cucm> to number@exp.domain

When a call is made from Unified CM to Expressway, the callback address is presented as number@<ip address of cucm>. If the destination endpoint returns the call, the Expressway needs to be able to route it back to Unified CM. To enable this, the domain portion of the address must have the IP address removed and the video domain added (so that the existing search rule can route the call to Unified CM). A transform is required:

1. Go to Configuration > Dial plan > Transforms.
2. Click New.
3. Configure the fields as follows:

<table>
<thead>
<tr>
<th>Priority</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>“CUCM IP to domain” for example</td>
</tr>
<tr>
<td>Pattern type</td>
<td>Regex</td>
</tr>
<tr>
<td>Pattern string</td>
<td>(.<em>)(.</em>@&lt;ip address of Unified CM&gt;)(;</td>
</tr>
<tr>
<td>Pattern behavior</td>
<td>Replace</td>
</tr>
<tr>
<td>Replace string</td>
<td>\<a href="mailto:1@exp.domain">1@exp.domain</a>\2</td>
</tr>
<tr>
<td>State</td>
<td>Enabled</td>
</tr>
</tbody>
</table>

4. Click Create transform.

Creating a transform to convert other Unified CM-supplied domain variants to number@exp.domain

This transform converts URIs received from Unified CM to the format used in the Expressway’s neighbor zones.
The domain portion of the URI received from Unified CM depends on its SIP Trunk configuration (see Configuring the SIP Trunk device [p. 10]). Thus, this could be the IP address:port of the Expressway or the FQDN of the Expressway or Expressway cluster.

In this example, it is matching URIs received from Unified CM in the form 4xxx@exp-name.exp.domain:<port> and converting it into 4xxx@exp.domain.

1. Go to Configuration > Dial plan > Transforms.
2. Click New.
3. Configure the fields as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Convert Unified CM supplied domain information to the Expressway SIP domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority</td>
<td>Enter a high priority such as 5 (the priority of this transform should be before any transforms that need to be applied for searching neighbor zones)</td>
</tr>
<tr>
<td>Pattern type</td>
<td>Regex</td>
</tr>
<tr>
<td>Pattern string</td>
<td>For example: (4\d(3))@exp-name.exp.domain(:.*)?</td>
</tr>
<tr>
<td>Pattern behavior</td>
<td>Replace</td>
</tr>
<tr>
<td>Replace string</td>
<td>For example: \<a href="mailto:1@exp.domain">1@exp.domain</a></td>
</tr>
<tr>
<td>State</td>
<td>Enabled</td>
</tr>
</tbody>
</table>

4. Click Create transform.

![Create transform](image_url)
Connecting Expressway to Unified CM using TLS

These instructions explain how to take a system that is already configured and working using a TCP interconnection between Expressway and Unified CM, and to convert that connection to use TLS instead. This process involves:

- Ensuring certificate trust between Unified CM and Expressway
- Setting the Cluster Security Mode of the Unified CM to 1 (Mixed Mode)
- Configuring a SIP trunk security profile on Unified CM
- Updating the Unified CM trunk to Expressway to use TLS
- Updating the Expressway neighbor zone to Unified CM to use TLS

Ensuring certificate trust between Unified CM and Expressway

For Unified CM and Expressway to establish a TLS connection with each other:

- Expressway and Unified CM must both have valid server certificates loaded (you must replace the Expressway’s default server certificate with a valid server certificate)
- Unified CM must trust Expressway’s server certificate (the root CA of the Expressway server certificate must be loaded onto Unified CM)
- Expressway must trust Unified CM’s server certificate (the root CA of the Unified CM server certificate must be loaded onto Expressway)

See Expressway Certificate Creation and Use Deployment Guide for full details about loading certificates and how to generate CSRs on Expressway to acquire certificates from a Certificate Authority (CA).

Note that in a clustered environment, you must install CA and server certificates on each peer/node individually.

We strongly recommend that you do not use self-signed certificates in a production environment.

Loading server and trust certificates on Expressway

Expressway server certificate

Expressway has only one server certificate. By default, this is a certificate signed by a temporary certificate authority. We recommend that it is replaced by a certificate generated by a trusted certificate authority.

To upload a server certificate:

2. Use the Browse button to select and upload the server certificate PEM file.
3. If you used an external system to generate the certificate request you must also upload the server private key PEM file that was used to encrypt the server certificate. (The private key file will have been automatically generated and stored earlier if the Expressway was used to produce the signing request for this server certificate.)
   - The server private key must not be password protected.
   - You cannot upload a server private key if a certificate signing request is in progress.
4. Click Upload server certificate data.
Expressway trusted CA certificate

The Trusted CA certificate page (Maintenance > Security certificates > Trusted CA certificate) allows you to manage the list of certificates for the Certificate Authorities (CAs) trusted by this Expressway. Certificates presented to the Expressway must be signed by a trusted CA on this list and there must be a full chain of trust (intermediate CAs) to the root CA.

The root CA of the Unified CM server certificate must be loaded into the Expressway's trusted CA certificate list.

To upload a new file of CA certificates, Browse to the required PEM file and click Append CA certificate. This will append any new certificates to the existing list of CA certificates. Note that if you are replacing existing certificates for a particular issuer and subject, you have to manually delete the previous certificates.

Repeat this process on every Expressway that will communicate with this Unified CM.

Loading server and trust certificates on Unified CM

Certificate management for Unified CM is performed in the Cisco Unified OS Administration application. All existing certificates are listed under Security > Certificate Management. Server certificates are of type certs and trusted CA certificates are of type trust-certs.

Unified CM server certificate

By default, Unified CM has a self-signed server certificate CallManager.pem installed. We recommend that this is replaced with a certificate generated from a trusted certificate authority.

Unified CM trusted CA certificate

To load the root CA certificate of the authority that issued the Expressway certificate (if it is not already loaded):

2. Select a Certificate Name of CallManager-trust.
3. Click Browse and select the file containing the root CA certificate of the authority that issued the Expressway certificate.
4. Click Upload File.

Repeat this process on every Unified CM server that will communicate with Expressway. Typically this is every node that is running the CallManager service.

Setting the Cluster Security Mode to Mixed Mode

The Cisco Unified Communications Manager cluster must be in Mixed Mode to allow the registration of both secure devices and non-secure devices. This allows for best effort encryption between the Expressway and the Cisco Unified Communications Manager. Read Setting up secure RTP between UCM and VCS for background on best effort encryption between Expressway and Unified CM.

As of version 10.0, you can use the CLI to change the cluster security mode. On earlier versions, you must use the Cisco CTL Client plugin to change the cluster security mode. The security mode change updates the CTL file, so you must restart the Cisco CallManager and Cisco Tftp services after the change.

The process is summarized below, but you should refer to the Cisco Unified Communications Manager Security Guide for your version, which you can find on the Cisco Unified Communications Manager (CallManager) Maintain and Operate Guides page.
1. Obtain access to the Unified CM publisher node, including hardware security tokens (if using the CTL Client plugin).

2. (Pre 10.0) Download and install the Cisco CTL Client plugin from Unified CM.

3. Run the CTL Client plugin to enable Mixed Mode. On 10.0 or later, you can use `utils ctl set-cluster mixed-mode` at the CLI.

   ![Cisco CTL Client](image)

   - Cluster Security Mode
     - Set Cisco Unified CallManager Cluster to Mixed Mode
     - Set Cisco Unified CallManager Cluster to Non-Secure Mode
     - Update CTL File

4. Update the CTL file (via the plugin or `utils ctl update CTLFile`).

5. Restart the Cisco CallManager and Cisco Tftp services (via Cisco Unified Serviceability).

**Configuring a SIP trunk security profile on Unified CM**

On Unified CM:

1. Select **Cisco Unified CM Administration**, click **Go** and log in.

2. Go to **System > Security > SIP Trunk Security Profile**.

3. Click **Add New**.

4. Configure the fields as follows:

<table>
<thead>
<tr>
<th>Name</th>
<th>A name indicating that this is an encrypted profile.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Enter a textual description as required.</td>
</tr>
<tr>
<td>Device Security Mode</td>
<td>Encrypted.</td>
</tr>
<tr>
<td>Incoming Transport Type</td>
<td>TLS.</td>
</tr>
<tr>
<td>Outgoing Transport Type</td>
<td>TLS.</td>
</tr>
<tr>
<td>Enable Digest Authentication</td>
<td>Leave unselected.</td>
</tr>
</tbody>
</table>
X.509 Subject Name

The subject name or an subject alternate name provided by the Expressway in its certificate. For Expressway clusters, ensure that this list includes all of the names contained within all of the peers’ certificates. To specify multiple X.509 names, separate each name by a space, comma, semicolon or colon.

Incoming Port

5061

Accept Unsolicited Notification

Select this check box

Accept Replaces Header

Select this check box

Other parameters

Leave all other parameters unselected.

5. Click Save.

Updating the Unified CM trunk to Expressway to use TLS

On Unified CM:

1. Go to Device > Trunk.
2. Using Find, select the Device Name previously set up for the trunk to the Expressway.
3. Configure the following fields:

   SIP Information section
   
   Destination Port
   5061 (unless using DNS SRV, in which case ensure the SRV records are set up correctly).
   Note that some versions of Unified CM cannot perform TLS SRV lookups. See TLS calls fail when Unified CM uses SRV trunk destinations [p.32] for more information.

   SIP Trunk Security Profile
   Select the trunk profile set up above.

   Leave other parameters as previously configured.

4. Click Save.
5. Click Reset.

Updating the Expressway neighbor zone to Unified CM to use TLS

Note that Expressway will report that the Unified CM zone is active even while it is communicating with Unified CM over TCP. The changes below are necessary to enable communications over TLS.

On Expressway:

1. Go to Configuration > Zones > Zones, then select the zone to Unified CM.
2. Configure the following fields:

   SIP section
### Verifying that the TLS connection is operational

To verify correct TLS operation, check that the Expressway zone reports its status as active and then make some test calls.

1. Check the Expressway zone is active:
   a. Go to Configuration > Zones > Zones.
   b. Check the SIP status of the zone.
      - If the zone is not active, try resetting or restarting the trunk again on Unified CM.

2. Make a test call from a system routed through an Expressway to a Unified CM phone.
3. Make a test call from a Unified CM phone to a system routed through an Expressway.

### Network of Expressways

If there is a network of Expressways behind this Expressway neighbored to Unified CM, then, either:

- Unified CM must trust the certificates of all the Expressways in the network (‘optimal’ routing mode), or
- The Expressway neighbor zone to Unified CM must ‘always’ route the signaling. In effect this sets up this Expressway as a gateway to Unified CM, and is the preferred option. The Cisco Unified Communications Manager and Cisco Unified Communications Manager (8.6.1 or later) zone profiles are pre-configured to ‘always’ route the signaling, thus no additional configuration is required providing one of these profiles is used.

### Encrypted calls to endpoints registered to Unified CM

Endpoints registered to Unified CM need to be configured with a “SIP Secure profile” to provide encrypted media and call negotiation. If such a profile is not available by default, it will need to be created via System > Security > Phone Security.

See Securing Cisco TelePresence Products for further information on using the Cisco CTL Client and configuring Unified CM for secure communications.
Appendix 1: Troubleshooting

Problems connecting Expressway-C local calls

Look at “Search history” to check the applied transforms

Search history entries report on any searches initiated from a SETUP/ARQ /LRQ in H323 and from an INVITE/OPTIONS in SIP.

1. Go to Status > Search history.
   The summary shows the source and destination call aliases, and whether the destination alias was found.
2. Select the relevant search attempt.

The search history for that search attempt shows:

- the incoming call’s details
- any transforms applied by admin or user policy or CPL
- and in priority order, zones which matched the required (transformed) destination, reporting on:
  - any transforms the zone may apply
  - found or not found status
  - if not found, the error code as seen in the zone’s search response
  - repeated until a zone is found that can accept the call, or all zone matches have been attempted
    (the search may be “not found” due to lack of bandwidth or because the search from the zone resulted in an H.323 rejection reason or a non 2xx response to a SIP request)

If the search indicates:

- Found: False
- Reason: 480 Temporarily Not Available

this could be because the Expressway zone links are not correctly set up. From the command line execute xcommand DefaultLinksAdd to set up the required links for the Expressway’s default zones; also check the links for other zones that have been created.

Note that each H.323 call will have two entries in the search history:

- The first for an ARQ to see if the endpoint can be found.
- The second for the Setup to actually route the call.

The ARQ search does not depend on links or link bandwidth, and so if links do not exist or link bandwidth is insufficient it may still pass, even though the Setup search will subsequently fail.

Each SIP call will usually have only a single search history entry for the SIP INVITE.

Look at call history to check how the call progressed

1. Go to Status > Calls > History.
   The summary shows the source and destination call aliases, call duration and protocol (including any interworking).
2. Select the relevant call attempt and then the relevant call components.
   This shows the incoming and outgoing call leg details and the zone and subzone routing.
Check for errors

Check the Event Log which is accessible from the web browser: Status > Logs > Event Log.

Tracing calls

Tracing calls at SIP / H.323 level in Expressway

1. Go to Maintenance > Diagnostics > Diagnostic logging.
2. Optionally, select Take tcpdump while logging.
3. Click Start new log.
4. (Optional) Enter some Marker text and click Add marker.
   - The marker facility can be used to add comment text to the log file before certain activities are performed. This helps to subsequently identify the relevant sections in the downloaded diagnostic log file.
   - You can add as many markers as required, at any time while the diagnostic logging is in progress.
   - Marker text is added to the log with a "DEBUG_MARKER" tag.
5. Reproduce the system issue you want to trace in the diagnostic log.
6. Click Stop logging.
7. Click Download log to save the diagnostic log to your local file system. You are prompted to save the file (the exact wording depends on your browser).
8. If appropriate, click Download tcpdump to also download the tcpdump file to your local file system.

Call failures with Cisco TelePresence Server

SIP messages from Cisco TelePresence Server can be > 5,000 bytes (which is the default SIP Max Incoming Message Size configured in Unified CM).

Increase the SIP Max Incoming Message Size – see Checking the message size limit on Unified CM [p.16].

In-call problems

Calls clear down when a call transfer from a video phone on Unified CM transfers a call to Expressway

Even if use of a media termination point (MTP) is not requested on the SIP trunk between Unified CM and Expressway, if DTMF signaling method is configured as “No preference” on the SIP trunk on Unified CM, Unified CM will try and use a Media Transfer Point and the call will fail.

To resolve this, ensure that DTMF signaling method is configured as RFC 2833 on Unified CM on the SIP trunk from Unified CM to Expressway.

Poor video quality from Unified CM

Ensure that your Unified CM region has an appropriate session bit rate for video calls as described in Configuring the region with an appropriate session bit rate for video calls [p.8].
Taking a trace on Unified CM using RTMT

RTMT is a tool that lets you monitor system health, view graphs and collect logs from Unified CM. There are versions for both Linux and Windows. Unified CM must also be configured to specify what can be traced.

Configure Unified CM to enable tracing

1. Log in to Unified CM.
2. In the Navigation drop-down select Cisco Unified Serviceability and click Go.
3. Go to the Troubleshooting Trace Settings page (Trace > Troubleshooting Trace Settings).
4. Select the Check All Services check box.
5. Click Save.

Installing RTMT – Real Time Monitoring Tool

1. Log in to Unified CM using a Linux or Windows PC.
2. Go to Application > Plugins.
3. Select Find with ‘Name begins with <blank>’ and ‘Plugin Type equals Installation’.
5. Click on the Download link.
6. When downloaded, run the downloaded install file.
7. Follow the instructions in the install wizard.
8. When complete, click Done to exit the installer.

Running RTMT

1. Run RTMT. (For example, under windows this is in Start > All Programs > Cisco > CallManager Serviceability > Real-Time Monitoring Tool.)
2. In the Login window enter the Host IP Address, User Name and Password.
3. Click OK.

Taking a trace using RTMT

1. Select Trace & Log Central.
2. Double-click on Real Time Trace.
3. Double-click View Real Time Data.
4. Select a Node – the Unified CM instance that is to have the trace run on it.
5. Click Next >.
6. Select the following:
   - Products = UCM
   - Services = Cisco CallManager
   - Trace File Type = sdi
7. Click Finish.
Note that:

- Logs can take a while to download.
- The sdi (System Diagnostic Interface) trace contains alarms, error information and SIP stack trace information.

**Call failures**

**TLS calls fail when Unified CM uses SRV trunk destinations**

Calls from Unified CM may fail if they use a TLS trunk security profile and SRV trunk destinations (requiring ".sips._tcp" SRV record lookups in DNS).

See bug CSCue37440 in the Cisco Bug Search Tool for up-to-date information regarding the versions of Unified CM in which this issue has been fixed.

If you need to address one or more Expressway peers you can work around this problem by not using SRV records. Instead, in the SIP trunk, specify each Expressway **Destination Address** individually using DNS A-records or static IP addresses. However, note that these addresses affect the domain portion of the URI received by Expressway from Unified CM. You may need to set up appropriate transforms on the Expressway to cater for this (see Creating a transform to convert other Unified CM-supplied domain variants to number@exp.domain [p.22]).

**Encrypted call failures**

Calls between endpoints registered to Unified CM and endpoints proxied via Expressway will fail if the Unified CM endpoint requests best effort encryption and the other endpoint does not support encryption. (Unified CM has a proprietary method for indicating fall back to no encryption - X-cisco-srtp-fallback – which Expressway currently does not support.)
Appendix 2: Connecting Unified CM to an Expressway cluster

From Unified CM version 8.5, to connect Unified CM with a cluster of Expressway peers there are 2 methods of providing Unified CM with the addresses of the Expressway cluster peers:

- the trunk to Expressway specifies the DNS SRV address for the Expressway cluster
- the trunk to Expressway specifies a list of Expressway peers

Prior to Unified CM 8.5, the trunk to Expressway had to specify the DNS SRV address for the Expressway cluster.

Configuring the trunk to Expressway to specify the DNS SRV address for the Expressway cluster

Ensure that in the DNS server used by Unified CM a DNS SRV record exists for the cluster of Expressway peers; in the DNS SRV record each peer should be set with equal priority and equal weight.

1. On Unified CM, go to Device > Trunk.
2. Select the previously configured Trunk.
3. Scroll down and configure the SIP Information section fields as follows:

<table>
<thead>
<tr>
<th>Destination address</th>
<th>&lt;DNS SRV name of Expressway cluster&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destination address is an SRV</td>
<td>Select this check box.</td>
</tr>
</tbody>
</table>

4. Click Save.
5. Click Reset.
6. Click Reset.
7. On Expressway, ensure that the cluster name is configured as a SIP domain (Configuration > Domains).
Configuring the trunk to Expressway to specify a list of Expressway peers

1. On Unified CM, go to Device > Trunk.
2. Select the previously configured Trunk.
3. Scroll down and configure the SIP Information fields as follows:
   (Click + to obtain additional destination address entries.)

<table>
<thead>
<tr>
<th>Destination address is an SRV</th>
<th>Ensure that this check box is not selected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Destination address 1</strong> and</td>
<td>IP address or DNS name of Expressway peer 1</td>
</tr>
<tr>
<td><strong>Destination port 1</strong></td>
<td>5060 or 5061 depending on connectivity (TCP/TLS)</td>
</tr>
<tr>
<td><strong>Destination address 2</strong> and</td>
<td>IP address or DNS name of Expressway peer 2</td>
</tr>
<tr>
<td><strong>Destination port 2</strong></td>
<td>5060 or 5061 depending on connectivity (TCP/TLS)</td>
</tr>
<tr>
<td><strong>Destination address 3</strong> and</td>
<td>IP address or DNS name of Expressway peer 3 – if it exists</td>
</tr>
<tr>
<td><strong>Destination port 3</strong></td>
<td>5060 or 5061 depending on connectivity (TCP/TLS)</td>
</tr>
<tr>
<td>... up to <strong>Destination address 6</strong> and</td>
<td>... repeat up to IP address or DNS name of Expressway peer 6 – where they exist</td>
</tr>
<tr>
<td><strong>Destination port 6</strong></td>
<td></td>
</tr>
</tbody>
</table>

4. Click **Save**.
5. Click **Reset**.
6. Click **Reset**.
Appendix 3: Connecting Expressway to a cluster of Unified CM nodes

When connecting Expressway to a cluster of Unified CM nodes, Expressway needs to be able to route calls to each Unified CM node.

This can be done in 2 ways, in order of preference:

1. With a single neighbor zone in Expressway with the Unified CM nodes listed as location peer addresses.
2. By using DNS SRV records and an Expressway DNS zone.

Note that both options ensure that the Expressway to Unified CM call load is shared across Unified CM nodes.

Option 1: Using a single neighbor zone

Unified CM configuration

When in a cluster, Unified CM needs to accept calls routed to number@domain (instead of number@<ip address of Unified CM>) so that Expressway can send the call to any Unified CM node without having to make sure that the domain portion matches the IP address of the node that the call is being sent to.

Ensure that the Cluster Fully Qualified Domain Name (System > Enterprise parameters, in the Clusterwide Domain Configuration section) is set to the same domain as the video network, for example exp.domain.

Expressway-C configuration

The Expressway configuration requires an update to the neighbor zone:

1. Go to Configuration > Zones.
2. Select the Unified CM neighbor zone.
3. Configure the fields as follows:

<table>
<thead>
<tr>
<th>Peer 1 address</th>
<th>IP address of Unified CM node 1, or the domain of Unified CM node 1.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer 2 address</td>
<td>IP address or the domain of Unified CM node 2.</td>
</tr>
<tr>
<td>Peer 3 address</td>
<td>IP address or the domain of Unified CM node 3, or blank if no Unified CM node 3.</td>
</tr>
<tr>
<td>.... up to Peer 6 address</td>
<td>... repeat up to the IP address or the domain of Unified CM node 6, or leaving it blank if there is no Unified CM node.</td>
</tr>
</tbody>
</table>

Option 2: Using a DNS zone

Unified CM configuration

Ensure that the Cluster Fully Qualified Domain Name (System > Enterprise parameters, in the Clusterwide Domain Configuration section) is set to the same domain as the video network, for example exp.domain.
DNS server configuration

Configure the DNS server (that is used by the Expressway) with DNS SRV records for the Unified CM cluster.

- `_sips._tcp.fqdn_of_cucm_cluster` records for TLS connectivity (one record for each Unified CM node); or
- `_sip._tcp.fqdn_of_cucm_cluster` records for TCP connectivity (one record for each Unified CM node)

Expressway-C configuration

Expressway configuration requires 3 steps:

- Create a Unified CM DNS zone
- Adjust search rule to use the DNS zone
- Delete the old Unified CM neighbor zone

Creating a Unified CM DNS zone

1. Go to Configuration > Zones > Zones.
2. Click New.
3. Configure the fields as follows:

<table>
<thead>
<tr>
<th>Name</th>
<th>CUCM Cluster Neighbor DNS Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>DNS</td>
</tr>
<tr>
<td>Hop count</td>
<td>15</td>
</tr>
<tr>
<td>H.323 mode</td>
<td>Off</td>
</tr>
<tr>
<td>SIP mode</td>
<td>On</td>
</tr>
<tr>
<td>TLS verify mode</td>
<td>Off</td>
</tr>
<tr>
<td>Media encryption mode</td>
<td>Auto</td>
</tr>
<tr>
<td>Include address record</td>
<td>Off</td>
</tr>
</tbody>
</table>

Zone profile

Select Cisco Unified Communications Manager or Cisco Unified Communications Manager (8.6.1 or later) as appropriate.

4. Click Create zone.
Adjusting the search rule

Change the search rule to point to this Unified CM DNS zone.

1. Go to Configuration > Dial plan > Search rules.
2. Select the existing “Route to Unified CM” search rule.
3. Update the Target zone to use the CUCM Cluster Neighbor DNS Zone created above.
4. Click Save.

Deleting the old Unified CM neighbor zone

Delete the now unused neighbor zone “Unified CM Neighbor”.

1. Go to Configuration > Zones > Zones.
2. Select the check box next to the “CUCM Neighbor” zone.
3. Click Delete.
Appendix 4: Additional information

IP address dialing

Unified CM cannot dial out to IP addresses, but the Expressway can. To support IP address dialing from endpoints registered to Unified CM, we recommend the following procedure:

1. Define a prefix to use for dialing the IP address, for example 8.
2. Add a Route Pattern in Unified CM to match the prefix and send it via the SIP trunk to Expressway.
3. On Expressway, add a search rule (or transform) with a regex to match, for example:

```
8 \(\d\ \\d\ \\d\ \\d\)* and then replace it with \1.\2.\3.\4
```

This example regex matches an IP address dialed in the format of 12 digits (inserting the leading zeroes in each octet), so for example 64.102.6.247 would be dialed as prefix 8 followed by 064102006247. The replace string then inserts dots after the 3rd, 6th and 9th digits.

Characters allowed in SIP URIs

The following character set is allowed in SIP URIs (further details may be found in RFC 3261):

- a-z / A-Z / 0-9 / "." / "," / "/" / ":" / "@" / "\" / "!" / "~" / "+" / "$" / "," / ":" / "?" / """

If other characters are needed they must be "escaped" using "%" followed by a pair of hexadecimal digits that represents the ASCII value for the required character.

For example, "alice smith@example.com" must be encoded as alice%20smith@example.com (where %20 represents the space character).
Document revision history

The following table summarizes the changes that have been applied to this document.

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 2015</td>
<td>Updated with summary of enabling Mixed Mode on CUCM.</td>
</tr>
<tr>
<td>December 2013</td>
<td>Initial release.</td>
</tr>
</tbody>
</table>
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