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Change History

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<tr>
<th>Date</th>
<th>Change</th>
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<tr>
<td>March 2019</td>
<td>Clarify that from X12.5, local DNS no longer requires <code>cisco-uds._tcp.&lt;domain&gt;</code> SRV records (still recommended).</td>
<td>Document correction.</td>
</tr>
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<td>February 2019</td>
<td>Clarify that from X12.5, local DNS no longer requires <code>_cisco-uds._tcp.&lt;domain&gt;</code> SRV records (still recommended).</td>
<td>Content enhancement</td>
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</tr>
<tr>
<td>January 2019</td>
<td>Add Jabber 12.5 clients to supported endpoints for ICE passthrough (subject to Unified CM 12.5).</td>
<td>Software dependency change</td>
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<tr>
<td>January 2019</td>
<td>Updated for X12.5.</td>
<td>X12.5 release</td>
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<td>September 2018</td>
<td>Updated for X8.11.2 (change to limitations for chat/messaging if user authentication by OAuth refresh).</td>
<td>X8.11.2 release</td>
</tr>
<tr>
<td>September 2018</td>
<td>Updated for Webex and Spark platform rebranding, and for X8.11.1 maintenance release. Also add to Unsupported Expressway Features and Limitations section, a known issue with chat/messaging services over MRA if user authentication is by OAuth refresh (self-describing tokens).</td>
<td>X8.11.1 release Clarification</td>
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<tr>
<td>July 2018</td>
<td>Include Hunt Group support, subject to Cisco Unified Communications Manager 11.5(1)SU5 or later fixed version.</td>
<td>Software dependency change</td>
</tr>
<tr>
<td>July 2018</td>
<td>Updated for X8.11. Also removed port reference topic, which is now available in the Cisco Expressway IP Port Usage Guide.</td>
<td>X8.11 release</td>
</tr>
<tr>
<td>May 2018</td>
<td>Clarify MFT over MRA is not supported when using an unrestricted version of IM and Presence Service.</td>
<td>Clarification</td>
</tr>
<tr>
<td>March 2018</td>
<td>Clarify no Jabber support for redundant UDS services.</td>
<td>Clarification</td>
</tr>
<tr>
<td>December 2017</td>
<td>Add configuration step to enable SIP protocol (disabled by default on new installs).</td>
<td>Content defect</td>
</tr>
<tr>
<td>November 2017</td>
<td>Clarify which Cisco IP Phones in the 88xx series support MRA (Configuration Overview section).</td>
<td>Content defect</td>
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<tr>
<td>September 2017</td>
<td>Add links to information about supported features for MRA-connected endpoints. Add information about Collaboration Solutions Analyzer.</td>
<td>Content enhancement</td>
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Table 1  Mobile and Remote Access Through Cisco Expressway Deployment Guide Change History

Preface
<table>
<thead>
<tr>
<th>Date</th>
<th>Change</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 2017</td>
<td>Deskphone control functions bullet removed from &quot;Unsupported Contact Center Features&quot; as not applicable.</td>
<td>Content defect</td>
</tr>
<tr>
<td>July 2017</td>
<td>Clarify required versions for Unified Communications software. Corrected duplicated prerequisites for Push Notifications feature.</td>
<td>Content defect</td>
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<tr>
<td>July 2017</td>
<td>Updated.</td>
<td>X8.10 release</td>
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<tr>
<td>April 2017</td>
<td>Added details on partial support for Cisco Jabber SDK features.</td>
<td>Content defect</td>
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<tr>
<td>January 2017</td>
<td>Updated section on unsupported features when using MRA. Added description of Maintenance Mode. Clarified that Expressway-C and Expressway-E need separate IP addresses.</td>
<td>X8.9.1 release</td>
</tr>
<tr>
<td>December 2016</td>
<td>Updated.</td>
<td>X8.9 release</td>
</tr>
<tr>
<td>September 2016</td>
<td>Unsupported deployments section updated. Minimum versions note about TLS added.</td>
<td>Clarification to avoid misconfiguration</td>
</tr>
<tr>
<td>August 2016</td>
<td>Updated DNS prerequisite to create reverse lookup entries for Expressway-E.</td>
<td>Customer found defect</td>
</tr>
<tr>
<td>June 2016</td>
<td>HTTP Allow list feature updates.</td>
<td>X8.8 release</td>
</tr>
<tr>
<td></td>
<td>Entries before X8.x removed for clarity.</td>
<td></td>
</tr>
</tbody>
</table>
This Guide Does not Apply for the VCS

**IMPORTANT!** New features in software version X12.5 and later are not supported for the Cisco TelePresence Video Communication Server product (VCS). They apply only to the Cisco Expressway Series product (Expressway). This software version is provided for the VCS for maintenance and bug fixing purposes only.

From version X12.5 onwards, this guide applies only to the Cisco Expressway Series product (Expressway) and no longer applies to the Cisco VCS product (VCS). Older VCS guides on Cisco.com are still valid for the VCS versions they apply to—as specified on the title page of each guide.

Related Documentation

Information contained in the following documents and sites may be required to assist in setting up your Unified Communications environment:

- **Expressway Basic Configuration (Expressway-C with Expressway-E) Deployment Guide**
- **Expressway Cluster Creation and Maintenance Deployment Guide**
- **Certificate Creation and Use With Expressway Deployment Guide**
- **Cisco Expressway IP Port Usage Configuration Guide**, for your version, on the Cisco Expressway Series configuration guides page.
- **Expressway Administrator Guide**
- **Configuration and Administration of IM and Presence Service on Cisco Unified Communications Manager** (for your version), at Cisco Unified Communications Manager Configuration Guides
- **Directory Integration and Identity Management** in the Cisco Collaboration System 10.x Solution Reference Network Designs (SRND) document
- **SAML SSO Deployment Guide for Cisco Unified Communications Applications** (for your version), at Cisco Unified Communications Manager Maintain and Operate Guides
- Jabber client configuration details:
  - **Cisco Jabber for Windows**
  - **Cisco Jabber for iPad**
  - **Cisco Jabber for Android**
  - **Cisco Jabber for Mac**
  - **Cisco Jabber DNS Configuration Guide**
Mobile and Remote Access Overview

Cisco Unified Communications Mobile and Remote Access is a core part of the Cisco Collaboration Edge Architecture. It allows endpoints such as Cisco Jabber to have their registration, call control, provisioning, messaging and presence services provided by Cisco Unified Communications Manager (Unified CM) when the endpoint is not within the enterprise network. The Expressway provides secure firewall traversal and line-side support for Unified CM registrations.

The overall solution provides the following functions:

- **Off-premises access**: a consistent experience outside the network for Jabber and EX/MX/SX Series clients
- **Security**: secure business-to-business communications
- **Cloud services**: enterprise grade flexibility and scalable solutions providing rich Cisco Webex integration and service provider offerings
- **Gateway and interoperability services**: media and signaling normalization, and support for non-standard endpoints

**Figure 1  Unified Communications: Mobile and Remote Access**

Note: Third-party SIP or H.323 devices can register to the Expressway-C and, if necessary, interoperate with Unified CM-registered devices over a SIP trunk.

**Figure 2  Typical call flow – signaling and media paths**

Unified CM provides call control for both mobile and on-premises endpoints.
Signaling traverses the Expressway solution between the mobile endpoint and Unified CM. Media traverses the Expressway solution and is relayed between endpoints directly.

All media is encrypted between the Expressway-C and the mobile endpoint.

Deployment Scope

The following major Expressway-based deployments do not work together. They cannot be implemented together on the same Expressway (or traversal pair):

- Mobile and Remote Access
- Microsoft interoperability, using the Expressway-C-based B2BUA
- Jabber Guest services

Mobile & Remote Access Ports

Information about MRA ports is available in the Cisco Expressway IP Port Usage Configuration Guide at the Cisco Expressway Series Configuration Guides page. This includes ports that can potentially be used between the internal network (where the Expressway-C is located) and the DMZ (where the Expressway-E is located), and between the DMZ and the public internet.

Jabber Client Connectivity Without VPN

The MRA solution supports a hybrid on-premises and cloud-based service model. This provides a consistent experience inside and outside the enterprise. MRA provides a secure connection for Jabber application traffic without having to connect to the corporate network over a VPN. It is a device and operating system agnostic solution for Cisco Jabber clients on Windows, Mac, iOS and Android platforms.

MRA allows Jabber clients that are outside the enterprise to do the following:

- Use instant messaging and presence services
- Make voice and video calls
- Search the corporate directory
- Share content
- Launch a web conference
- Access visual voicemail

Note: Cisco Jabber Video for TelePresence (Jabber Video) does not work with MRA, although it is supported as a general client registered to Expressway.
Deployment Scenarios

This section describes the supported deployment environments:

- Single network elements
- Single clustered network elements
- Multiple clustered network elements
- Hybrid deployment
- Unsupported deployments

**Note:** The only supported Mobile and Remote Access deployments are based on one-to-one Unified Communications zones between Expressway-C clusters and Expressway-E clusters.

**Figure 3  Supported MRA Traversal Connections**

---

**Single Network Elements**

In this scenario there are single (non-clustered) Unified CM, IM & Presence, Expressway-C and Expressway-E servers.
Deployment Scenarios

Single Clustered Network Elements

In this scenario each network element is clustered.

Multiple Clustered Network Elements

In this scenario there are multiple clusters of each network element.

- Jabber clients can access their own cluster through any route.
- Expressway-C uses round robin to select a node (publisher or subscriber) when routing home cluster discovery requests.
- Each combination of Unified CM and IM and Presence Service clusters must use the same domain.
- Intercluster Lookup Service (ILS) must be active on the Unified CM clusters.
- Intercluster peer links must be configured between the IM and Presence Service clusters, and the Intercluster Sync Agent (ICSA) must be active.
Hybrid Deployment

In this scenario, IM and Presence services for Jabber clients are provided via the WebEx cloud.

Unsupported Deployments

**VPN Links**

VPN links, between the Expressway-C and the Unified CM services / clusters, are not supported.

**Traversal Zones Between VCS Series and Expressway Series**

"Mixed" traversal connections are not supported. That is, we do not support traversal zones, or Unified Communications traversal zones, between Cisco VCS and Cisco Expressway even though it is possible to configure these zones.
Explicitly, we do not support VCS Control traversal to Expressway-E, nor do we support Expressway-C traversal to VCS Expressway.

**Unclustered or Many-to-One Traversal Connections**

We do not support Unified Communications zones from one Expressway-C cluster to multiple unclustered Expressway-Es.

We also do not support multiple Unified Communications zones from one Expressway-C cluster to multiple Expressway-Es or Expressway-E clusters.
Nested Perimeter Networks

MRA is not currently supported over chained traversal connections (using multiple Expressway-Es to cross multiple firewalls).

This means that you cannot use Expressway-E to give Mobile and Remote Access to endpoints that must traverse a nested perimeter network to call internal endpoints.

Expressway-C in DMZ with Static NAT

We do not support Expressway-C in a DMZ that uses static NAT. This is because the Expressway-C does not perform the SDP rewriting that is required to traverse static NAT-enabled firewalls. You should use the Expressway-E for this purpose.

You could potentially place the Expressway-C in a DMZ that does not use static NAT, but we strongly discourage this deployment because it requires a lot of management on the inmost firewall. We always recommend placing the Expressway-C in the internal network.
Key Supported and Unsupported Features with Mobile and Remote Access

Not all features are supported in every deployment scenario when using Mobile and Remote Access (MRA). This section provides information about:

- Supported clients and endpoints. Where to get information about MRA-compatible devices, and what features they support when connected over MRA.
- Key unsupported features for clients and endpoints. Lists client and endpoint features that are known not to work in certain MRA situations. **This is not an exhaustive list** and for full details please refer to the documentation for the endpoint or client concerned.
- Unsupported Expressway features that are known not to work in certain MRA situations.

Clients and Endpoints Supported with MRA

Details of which clients and endpoints are MRA-compatible are in MRA-Compatible Client and Endpoint Versions, page 18

For information about which features are supported over MRA for specific clients and endpoints, refer to the relevant product documentation:

- Jabber clients
- IP Phone 7800 Series
  See Phone Features Available for Mobile and Remote Access Through Expressway in the Phone Features and Setup chapter, Cisco IP Phone 7800 Series Administration Guide for Cisco Unified Communications Manager on the Maintain and Operate Guides page.
- IP Phone 8811, 8841, 8845, 8861 and 8865
  See Phone Features Available for Mobile and Remote Access Through Expressway in the Phone Features and Setup chapter, Cisco IP Phone 8800 Series Administration Guide for Cisco Unified Communications Manager on the Maintain and Operate Guides page.

Known Unsupported Client and Endpoint Features

This section is not exhaustive, but for convenience it lists some key client and endpoint features which we know do not work with MRA-connected devices.

- This item applies if you have multiple IM and Presence Service clusters configured on Cisco Expressway-C, and some of them run software earlier than version 11.5n. In this case, because Cisco Expressway-C may select any cluster (round robin approach), it might select a cluster on an older software version. If so, IM and Presence Service features that require 11.5 are unavailable for endpoints connected over MRA.
- In Expressway-E systems that use dual network interfaces, XCP connections (for IM&P XMPP traffic) always use the non-external (i.e. internal) interface. So XCP connections may fail in deployments where the Expressway-E internal interface is on a separate network segment and is used for system management purposes only, and where the traversal zone on the Expressway-C connects to the Expressway-E’s external interface.
- For supported Cisco Jabber clients connected over MRA, the E911NotificationURL feature requires a static HTML page for the notification, to ensure that the web page renders correctly. Scripts and link tags are not supported.
- Directory access mechanisms other than the Cisco User Data Service (UDS) are not supported for Jabber clients over MRA.
Endpoint failover behavior:
- Cisco Jabber clients support IM and Presence Service failover over MRA. However, they don’t support any other type of MRA-related redundancy or failover–including SIP, voicemail, and User Data Services (UDS). The clients use a single UDS server only.

  **Note:** This also applies on premises, and not just over MRA.

- If an Expressway-C or Expressway–E node fails, active MRA calls through the failed Expressway node will be lost. This applies to all device types, including Jabber clients.

  SIP *registration* failover is supported over MRA, for Cisco IP Phones and devices running TC or CE software. This includes failure of Cisco Expressway-C, Cisco Expressway-E, or a Cisco Unified Communications Manager node. SIP registration failover is subject to certain conditions:

  If an Expressway node fails, another active node must be available in the Expressway cluster.

  To support Cisco Unified Communications Manager failover over MRA, Cisco IP Phones need clustered Expressway–C and Expressway–E servers. Devices running TC or CE software do not need clustered Expressway servers for this case.

- Cisco Jabber 12.5 or later is needed if you want chat/messaging services over MRA with authentication using OAuth refresh (self-describing tokens) and you configure IM and Presence Service presence redundancy groups. With this release of Expressway, user login failures will occur in this scenario if Jabber versions before 12.5 are in use.

These limitations exist for recording over MRA connections:
- Recording only works for direct person-to-person calls, not for conferences. This includes Built-in-Bridge (BiB) recording.
- Recording is not currently supported for the Silent Monitoring and Whisper Coaching features.
- Call recording for Cisco Jabber endpoints has the following limitations (which also apply on premises):
  - Cisco Unified Communications Manager does not allow Jabber mobile devices to be CTI-monitored.
  - Jabber does not support injecting recording tones into the media stream.

The Expressway does not encrypt the iX protocol on behalf of other entities. So iX must be encrypted end to end, with the endpoints and conferencing server doing the encryption, or it must be unencrypted end to end.

  **Note:** For iX to work over MRA, the conferencing server must be configured with an encrypted trunk to Cisco Unified Communications Manager and the endpoints/Jabber must be running a suitable, iX–capable software version.

Certificate provisioning to remote endpoints is not supported over MRA. For example, the Certificate Authority Proxy Function (CAPF). If you can do the first-time configuration on premises (inside the firewall) including CAPF enrolment, then these endpoints can use encrypted TFTP configuration files over MRA. But you can’t do the CAPF enrolment over MRA, so you must bring the endpoints back on-premises for subsequent certificate operations.

SIP UPDATE for session refresh support over MRA has some limitations. For example, the following features that rely on the SIP UPDATE method (RFC 3311) will fail:
- Request to display the security icon on MRA endpoints for end-to-end secure calls.
- Request to change the caller ID to display name or number on MRA endpoints.

Peers-to-peer file transfer when using IM and Presence Service and Jabber is not supported over MRA.

Managed File Transfer (MFT) over MRA is supported when using IM and Presence Service 10.5.2 and later and Jabber 10.6 and later clients. MFT over MRA is not supported when using an *unrestricted* version of IM and Presence Service.

File transfer with WebEx Messenger Service and Cisco Jabber is supported.

Additional mobility features including GSM handoff and session persistence are not supported over MRA.

Hunt groups (including hunt pilots and hunt lists) are supported over MRA when using Cisco Unified Communications Manager version 11.5(1)SUS, or any later version that has the relevant change.

The Cisco Unified Communications Self Care Portal is not supported over MRA.
Unsupported Expressway Features and Limitations

- We don’t support third-party network load balancers between MRA clients and Expressway-E.
- The Expressway cannot be used for Jabber Guest when it’s used for Mobile and Remote Access (MRA).
- The Expressway-C used for MRA cannot also be used for Microsoft gateway service. Microsoft gateway service requires a dedicated Expressway-C.
- Maintenance mode is not supported over MRA for endpoints running CE software. The Expressway drops MRA calls from these endpoints when you enable maintenance mode.
- As Expressway only supports IPv4 mode for MRA connections, the IP configuration settings "IPv6 only" or "Both" are not supported. In the case of "Both", as Expressway does not proxy IPv6 MRA traffic from clients, intermittent issues may arise if clients send IPv6 instead of IPv4.
- Endpoint management capability (SNMP, SSH/HTTP access) is not supported.
- Multidomain and multicompany support is limited as follows:
  - Before X8.5, each Expressway deployment supported only one IM&P domain. (Even though IM and Presence Service 10.0 and later supports Multiple Presence Domains.)
  - As of X8.5, you can create multiple deployments on the Expressway-C, but this feature is still limited to one domain per deployment.
  - As of X8.5.1, a deployment can have Multiple Presence Domains. However, this feature is in preview status only, and we currently recommend that you do not exceed 50 domains.
- Deployments on Large VM servers are limited to 2500 proxied registrations to Unified CM.
- The Expressway does not support some Cisco Unified Contact Center Express (Unified CCX) features for contact center agents or other users who connect over MRA. Jabber for Mac and Jabber for Windows cannot provide deskphone control over MRA, because the Expressway pair does not traverse the CTI-QBE protocol. However, if these Jabber applications, or other CTI applications, can connect to CUCM CTIManager (directly or through the VPN) they can provide deskphone control of MRA-connected clients.
- For ICE passthrough calls, if Host and Server-reflexive addresses cannot negotiate successfully, endpoints can utilize relay address of the TURN server to establish optimized media path. However, when Expressway is used as a TURN server and if static NAT is configured on the Expressway-E, the media cannot be passed using the relay address (CDETS CSCv85709 refers). In this case, default traversal path is used to traverse the media. That is, the media passes through Expressway-C and Expressway-E.
- The Expressway-E does not support TURN relay over TCP for ICE passthrough calls.
Prerequisites for MRA

This section summarizes the steps to configure the Unified Communications system for Mobile and Remote Access (MRA). It assumes that the following items are already set up:

- A basic Expressway-C and Expressway-E configuration, as specified in the *Expressway Basic Configuration (Expressway-C with Expressway-E) Deployment Guide*. (The document describes the networking options for deploying Expressway-E in the DMZ.)
- Unified CM and IM and Presence Service are configured as specified in the configuration and management guides for your version, at Cisco Unified Communications Manager Configuration Guides.

Required Versions

MRA through Cisco Expressway requires the following components. These are *minimum* requirements, and some individual MRA features need later software versions which are specified where applicable in the relevant part of the guide.

Infrastructure Product Versions

- Expressway X8.1.1 or later (this document describes X12.5).
- Unified CM 10.0 or later.
- IM and Presence Service 10.0 or later.
- Cisco Unity Connection 10.0 or later.

MRA-Compatible Client and Endpoint Versions

- Cisco Jabber for Windows 9.7 or later.
- Cisco Jabber for iPhone and iPad 9.6.1 or later.
- Cisco Jabber for Android 9.6 or later.
- Cisco Jabber for Mac 9.6 or later.
- Cisco IP Phones 7811, 7821, 7841 and 7861 and Cisco IP Phones 8811, 8841, 8845, 8851, 8861 and 8865, running 11.0(1) or later. Requires Cisco Expressway X8.6 or later.
  - Cisco IP Phones 7832 and 8832 require version 12.1(1) or later.
- Cisco TelePresence endpoints/codecs running software version TC7.0.1 or later, or CE software.
  - These Cisco TelePresence endpoints/codecs running TC7.0.1 or later:
    - SX Series, EX Series, MX Series, Profile Series, C Series
  - These Cisco TelePresence and Cisco Webex endpoints/codecs running CE8 or CE9:
    - DX70, DX80, MX700, MX800, MX800 Dual, SX10, SX20, SX80, MX200 G2, MX300 G2
  - These Cisco Webex endpoints/codecs running CE9:
    - Cisco Webex Room Kit, Cisco Webex Codec Plus, Cisco Webex Room 55, Cisco Webex Room 70 Single, Cisco Webex Room 70 Dual
- Android-based Cisco DX650, DX70, and DX80 devices running firmware 10.2.4(99) or later. Requires Cisco Expressway X8.6 or later.

Considerations for Android-based DX650, DX80, and DX70 devices and supported IP Phone 7800/8800 models

If you deploy these devices to register with Cisco Unified Communications Manager through MRA, be aware of the following points. For DX endpoints, these considerations only apply to Android-based devices and do not apply to DX70 or DX80 devices running CE software:
Prerequisites for MRA

- **Trust list:** You cannot modify the root CA trust list on IP Phone 7800/8800 devices. Make sure that the Expressway-E’s server certificate is signed by one of the CAs that the devices trust, and that the CA is trusted by the Expressway-C and the Expressway-E.

- **Off-hook dialing:** The way KPML dialing works between these devices and Unified CM means that you need CUCM 10.5(2)SU2 or later to be able to do off-hook dialing via MRA. You can work around this dependency by using on-hook dialing.

Configuration Recommendations and Requirements

IP Addresses

Assign separate IP addresses to the Expressway-C and the Expressway-E. Do not use a shared address for both elements, as the firewall cannot distinguish between them.

Network Domain and DNS

The ideal scenario for MRA is to have a single domain with a split DNS configuration, and this is the recommended approach. This is not always possible, so there are some other approaches to deal with various alternative scenarios.

**Note:** The domain to which the calls are routed must match with the MRA domain to which the endpoints were registered. For example, if endpoints are registered with the domain `exp.example.com`, the calls must be routed to this domain, and it must not be routed to the domain `cluster1.exp.example.com`.

**Single domain with split DNS – recommended**

A single domain means that you have a common domain (`example.com`) with separate internal and external DNS servers. This allows DNS names to be resolved differently by clients on different networks depending on DNS configuration, and aligns with basic Jabber service discovery requirements.

**Dual domain without split DNS**

From X12.5, the Cisco Expressway Series supports the case where MRA clients use an external domain to lookup the `_collab-edge` SRV record, and the `_cisco-uds` SRV record for that same external domain cannot be resolved by the Expressway-C. This is typically the case when split DNS is not available for the external domain. And prior to X12.5 this required a pinpoint subdomain or some other DNS workaround on the Expressway-C, to satisfy the client requirements for resolving the `_cisco-uds` record.

**Limitation:** This case is not supported for CUCM nodes identified by IP addresses, only for FQDNs.

This feature also supports a secondary case, for MRA deployments that only allow Jabber access over MRA even if users are working on–premises. In this case only one domain is required and typically the DNS records are publicly resolvable (although this is not required if MRA access is disallowed for users when off premises). The change in X12.5 means that there is no need to have a `_cisco-uds._tcp.<external-domain>` DNS SRV record available to Cisco Expressway-C or to the Jabber clients.

**Single domain without split DNS**

Deployments that require Jabber clients to always connect over MRA also benefit from the X12.5 update that no longer requires the Expressway-C to resolve the `_cisco-uds` DNS SRV record. So administrators only need to configure the `_collab-edge` DNS SRV record, and Jabber clients using service discovery will only have the option of connecting over MRA.

**SRV Records**

This section summarizes the public (external) and local (internal) DNS requirements for MRA. For more information, see the *Cisco Jabber Planning Guide* for your version on the Jabber Install and Upgrade Guides page.

**Important!** From version X8.8 onward, you must create forward and reverse DNS entries for all Expressway-E systems, so that systems making TLS connections to them can resolve their FQDNs and validate their certificates.
Prerequisites for MRA

Public DNS (external domains)

The public, external DNS must be configured with `_collab-edge._tls.<domain>` SRV records so that endpoints can discover the Expressway-Es to use for Mobile and Remote Access. You also need SIP service records for general deployment (not specifically for MRA). For example, for a cluster of 2 Expressway-E systems:

<table>
<thead>
<tr>
<th>Domain</th>
<th>Service</th>
<th>Protocol</th>
<th>Priority</th>
<th>Weight</th>
<th>Port</th>
<th>Target host</th>
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</thead>
<tbody>
<tr>
<td>example.com</td>
<td>collab-edge</td>
<td>tls</td>
<td>10</td>
<td>10</td>
<td>8443</td>
<td>expe1.example.com</td>
</tr>
<tr>
<td>example.com</td>
<td>collab-edge</td>
<td>tls</td>
<td>10</td>
<td>10</td>
<td>8443</td>
<td>expe2.example.com</td>
</tr>
<tr>
<td>example.com</td>
<td>sips</td>
<td>tcp</td>
<td>10</td>
<td>10</td>
<td>5061</td>
<td>expe1.example.com</td>
</tr>
<tr>
<td>example.com</td>
<td>sips</td>
<td>tcp</td>
<td>10</td>
<td>10</td>
<td>5061</td>
<td>expe2.example.com</td>
</tr>
</tbody>
</table>

Local DNS (internal domains)

Although we recommend that the local, internal DNS is configured with `_cisco-uds._tcp.<domain>` SRV records, from X12.5 this is no longer a requirement. Example records:

<table>
<thead>
<tr>
<th>Domain</th>
<th>Service</th>
<th>Protocol</th>
<th>Priority</th>
<th>Weight</th>
<th>Port</th>
<th>Target host</th>
</tr>
</thead>
<tbody>
<tr>
<td>example.com</td>
<td>cisco-uds</td>
<td>tcp</td>
<td>10</td>
<td>10</td>
<td>8443</td>
<td>cucmserver1.example.com</td>
</tr>
<tr>
<td>example.com</td>
<td>cisco-uds</td>
<td>tcp</td>
<td>10</td>
<td>10</td>
<td>8443</td>
<td>cucmserver2.example.com</td>
</tr>
</tbody>
</table>

Create internal DNS records, for both forward and reverse lookups, for all Unified Communications nodes used with MRA. This allows Expressway-C to find the nodes when IP addresses or hostnames are used instead of FQDNs.

Ensure that the `cisco-uds` SRV records are NOT resolvable outside of the internal network, otherwise the Jabber client will not start MRA negotiation via the Expressway-E.

Firewall Configuration

- Ensure that the relevant ports have been configured on your firewalls between your internal network (where the Expressway-C is located) and the DMZ (where the Expressway-E is located) and between the DMZ and the public internet. See the Cisco Expressway IP Port Usage Configuration Guide, for your version, on the Cisco Expressway Series configuration guides page.

- Do not use a shared address for the Expressway-E and the Expressway-C, as the firewall cannot distinguish between them. If you use static NAT for IP addressing on the Expressway-E, make sure that any NAT operation on the Expressway-C does not resolve to the same traffic IP address. We do not support shared NAT addresses between Expressway-E and Expressway-C.

- If your Expressway-E has one NIC enabled and is using static NAT mode, the following requirement applies:
  
  You must enter the FQDN of the Expressway-E, as it is seen from outside the network, as the peer address on the Expressway-C’s secure traversal zone. The reason for this is that in static NAT mode, the Expressway-E requests that incoming signaling and media traffic should be sent to its external FQDN, rather than its private name.

  This also means that the external firewall must allow traffic from the Expressway-C to the Expressway-E’s external FQDN. This is known as NAT reflection, and may not be supported by all types of firewalls.

  For more information, see the Advanced network deployments appendix in the Expressway Basic Configuration (Expressway-C with Expressway-E) Deployment Guide.

Bandwidth Restrictions

The **Maximum Session Bit Rate for Video Calls** on the default region on Cisco Unified Communications Manager is 384 kbps by default. The **Default call bandwidth** on Expressway-C is also 384 kbps by default. These settings may be too low to deliver the expected video quality for MRA-connected devices.
EX/MX/SX Series Endpoints (Running TC Software)

Ensure that the provisioning mode is set to Cisco UCM via Expressway.

These devices must verify the identity of the Expressway-E they are connecting to by validating its server certificate. To do this, they must have the certificate authority that was used to sign the Expressway-E’s server certificate in their list of trusted CAs.

The devices ship with a list of default CAs which cover the most common providers (including Verisign and Thawte). If the relevant CA is not included, it must be added (for instructions, see the endpoint administrator guide).

Mutual authentication is optional, and these devices are not required to provide client certificates. If you do want to configure mutual TLS, you cannot use CAPF enrolment to provision the client certificates. Instead, manually apply the certificates to the devices. The client certificates must be signed by an authority that is trusted by the Expressway-E.

Jabber Clients

Jabber clients verify the identity of the Expressway-E they are connecting to by validating its server certificate. To do this, they must have the certificate authority that was used to sign the Expressway-E’s server certificate in their list of trusted CAs.

Jabber uses the underlying operating system's certificate mechanism:

- Windows: Certificate Manager
- MAC OS X: Key chain access
- IOS: Trust store
- Android: Location & Security settings

Jabber client configuration details for MRA are provided in the installation and configuration guide for the relevant client:

- Cisco Jabber for Windows
- Cisco Jabber for iPad
- Cisco Jabber for Android
- Cisco Jabber for Mac (requires X8.2 or later)

Unified CM

1. If you have multiple Unified CM clusters, you must configure ILS (Intercluster Lookup Service) on all of the clusters. The Expressway needs to communicate with each user’s home Unified CM cluster, and to discover the home cluster it sends a UDS (User Data Service) query to any one of the Unified CM nodes.

   For details, search for "Intercluster Lookup Service" in the Unified CM documentation for your version.
2. Ensure that the **Maximum Session Bit Rate for Video Calls** between and within regions (System > Region Information > Region) is set to a suitable upper limit for your system, for example 6000 kbps.

![Region Configuration Table](image)

See **Region setup** for more information.

3. These items apply to the Phone Security Profiles in Unified CM (System > Security > Phone Security Profile):

   a. If a Phone Security Profile has **TFTP Encrypted Config** checked, you can’t use these devices through MRA. The MRA solution does not support devices interacting with CAPF (Certificate Authority Proxy Function).

   b. Phone Security Profiles that are configured for TLS and used for devices requiring remote access must have a **Name** in the form of an FQDN that includes the enterprise domain. For example, `jabber.secure.example.com`. (This is because those names must be present in the list of Subject Alternate Names in the Expressway-C’s server certificate.)

   **Note:** Secure profiles must set **Device Security Mode** to **Encrypted**, because the Expressway does not allow unencrypted TLS connections. When **Device Security Mode** is set to **Authenticated**, Unified CM only offers the NULL-SHA cipher suite, which the Expressway rejects.
4. If Unified CM servers (System > Server) are configured by Host Name (rather than IP address), then ensure that those host names are resolvable by the Expressway-C.

5. If you are using secure profiles, ensure that the root CA of the authority that signed the Expressway-C certificate is installed as a CallManager-trust certificate (Security > Certificate Management in the Cisco Unified OS Administration application).

6. Ensure that the Cisco AXL Web Service is active on the Unified CM publishers you will be using to discover the Unified CM servers that are to be used for remote access. To check this, select the Cisco Unified Serviceability application and go to Tools > Service Activation.

7. Ensure that the IP Addressing Mode for all MRA-configured devices is set to IPV4_ONLY.

8. We recommend that MRA devices are configured to use publicly accessible NTP servers, either directly or by Device Mobility.
   a. Configure a public NTP server System > Phone NTP Reference.
   b. Add the Phone NTP Reference to a Date/Time Group (System > Date/Time Group).
   c. Assign the Date/Time Group to the Device Pool of the endpoint (System > Device Pool).

IM and Presence Service

Ensure that the Cisco AXL Web Service is active on the IM and Presence Service publishers that will discover other IM and Presence Service nodes for remote access. To check this, select the Cisco Unified Serviceability application and go to Tools > Service Activation.

If you are deploying Mobile and Remote Access with multiple IM and Presence Service clusters, you must configure Intercluster peer links between the clusters, and the Intercluster Sync Agent (ICSA) must be active on all clusters. This ensures that the user database is replicated between clusters, allowing Expressway-C to correctly route XMPP traffic.


Expressway Configuration Summary

The following steps summarize the configuration required on the Expressway-E and the Expressway-C. Full details are described in section Configuring Mobile and Remote Access on Expressway, page 30

1. Ensure that System host name and Domain name are specified for every Expressway, and that all Expressway systems are synchronized to a reliable NTP service.
   Note: The hostname can contain only letters, digits, hyphens, and underscores. The first character must be a letter, and the last character must be a letter or a digit.

2. Enable the SIP protocol on the Expressway-E and on the Expressway-C.
   (SIP is disabled by default on new installs.)

3. [Recommended] Disable automated intrusion protection on the Expressway-C and configure it on Expressway-E.
   From X8.9, this feature is enabled by default on new installations. See Expressway Automated Intrusion Protection, page 77.

4. Set Unified Communications mode to Mobile and Remote Access.

5. Configure the Unified CM, IM and Presence Service, and Cisco Unity Connection servers on the Expressway-C.

6. Configure the domains on the Expressway-C for which services are to be routed to Unified CM.

7. [Optional] Create additional deployments and associate domains and UC services with them.

8. Install appropriate server certificates and trusted CA certificates.
Unified Communications Prerequisites

9. Configure a Unified Communications traversal zone connection between the Expressway-E and the Expressway-C.

10. If required, configure the HTTP server allow list for any web services inside the enterprise that need to be accessed from remote Jabber clients.

11. [Optional] Configure SSO over collaboration edge, to allow for common identity between external Jabber clients and the users’ Unified CM profiles

Configuration changes on the Expressway generally take immediate effect. If a system restart or other action is required, you are notified through a banner message or an alarm.

Unified Communications Prerequisites

Configuring a Secure Traversal Zone Connection for Unified Communications

Unified Communications features such as Mobile and Remote Access or Jabber Guest, require a Unified Communications traversal zone connection between the Expressway-C and the Expressway-E. This involves:

- Installing suitable security certificates on the Expressway-C and the Expressway-E.
- Configuring a Unified Communications traversal zone between the Expressway-C and the Expressway-E.

**Note:** Configure only one **Unified Communications traversal zone** per Expressway traversal pair. That is, one **Unified Communications traversal zone** on the Expressway-C cluster, and one corresponding **Unified Communications traversal zone** on the Expressway-E cluster.

Installing Expressway Security Certificates

You must set up trust between the Expressway-C and the Expressway-E:

1. Install a suitable server certificate on both the Expressway-C and the Expressway-E.
   - The certificate must include the **Client Authentication** extension. The system will not let you upload a server certificate without this extension when Unified Communications features are enabled.
   - The Expressway includes a built-in mechanism to generate a certificate signing request (CSR) and is the recommended method for generating a CSR:
     - Ensure that the CA that signs the request does not strip out the client authentication extension.
     - The generated CSR includes the client authentication request and any relevant subject alternate names for the Unified Communications features that have been enabled (see **Server Certificate Requirements for Unified Communications**, page 26).
   - To generate a CSR and/or to upload a server certificate to the Expressway, go to **Maintenance > Security > Server certificate**. You must restart the Expressway for the new server certificate to take effect.
2. Install on both Expressways the trusted Certificate Authority (CA) certificates of the authority that signed the Expressway’s server certificates.

There are additional trust requirements, depending on the Unified Communications features being deployed.

For Mobile and Remote Access deployments:

- The Expressway-C must trust the Unified CM and IM&P tomcat certificate.
- If appropriate, both the Expressway-C and the Expressway-E must trust the authority that signed the endpoints’ certificates.

For Jabber Guest deployments:

- When the Jabber Guest server is installed, it uses a self-signed certificate by default. However, you can install a certificate that is signed by a trusted certificate authority. You must install on the Expressway-C either the self-signed certificate of the Jabber Guest server, or the trusted CA certificates of the authority that signed the Jabber Guest server’s certificate.

To upload trusted Certificate Authority (CA) certificates to the Expressway, go to Maintenance > Security > Trusted CA certificate. You must restart the Expressway for the new trusted CA certificate to take effect.


**Configuring Encrypted Expressway Traversal Zones**

To support Unified Communications features via a secure traversal zone connection between the Expressway-C and the Expressway-E:

- The Expressway-C and Expressway-E must be configured with a zone of type Unified Communications traversal. This automatically configures an appropriate traversal zone (a traversal client zone when selected on Expressway-C or a traversal server zone when selected on Expressway-E) that uses SIP TLS with **TLS verify mode** set to On, and **Media encryption mode** set to Force encrypted.

- Both Expressways must trust each other’s server certificate. As each Expressway acts both as a client and as a server you must ensure that each Expressway's certificate is valid both as a client and as a server.

- If an H.323 or a non-encrypted connection is also required, a separate pair of traversal zones must be configured.

To set up a secure traversal zone, configure your Expressway-C and Expressway-E as follows:

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></th>
<th>Expressway-C</th>
<th>Expressway-E</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name</strong></td>
<td>&quot;Traversal zone&quot; for example</td>
<td>&quot;Traversal zone&quot; for example</td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td><em>Unified Communications traversal</em></td>
<td><em>Unified Communications traversal</em></td>
</tr>
<tr>
<td><strong>Connection credentials</strong> section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Username</td>
<td>&quot;exampleauth&quot; for example</td>
<td>&quot;exampleauth&quot; for example</td>
</tr>
<tr>
<td>Password</td>
<td>&quot;ex4mpl3.c0m&quot; for example</td>
<td>Click <em>Add/Edit local authentication database</em>, then in the popup dialog click <em>New</em> and enter the <strong>Name</strong> (<em>exampleauth</em>) and <strong>Password</strong> (<em>ex4mpl3.c0m</em>) and click <em>Create credential</em>.</td>
</tr>
<tr>
<td><strong>SIP</strong> section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port</td>
<td>Must match the Expressway-E setting.</td>
<td>7001 (default. See the <em>Cisco Expressway IP Port Usage Configuration Guide</em>, for your version, on the <em>Cisco Expressway Series configuration guides page</em>. )</td>
</tr>
<tr>
<td>TLS verify subject name</td>
<td>Not applicable</td>
<td>Enter the name to look for in the traversal client's certificate (must be in either the Subject Common Name or the Subject Alternative Name attributes). If there is a cluster of traversal clients, specify the cluster name here and ensure that it is included in each client's certificate.</td>
</tr>
<tr>
<td><strong>Authentication</strong> section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authentication policy</td>
<td><em>Do not check credentials</em></td>
<td><em>Do not check credentials</em></td>
</tr>
<tr>
<td><strong>Location</strong> section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peer 1 address</td>
<td>Enter the FQDN of the Expressway-E.</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Note that if you use an IP address (not recommended), that address must be present in the Expressway-E server certificate.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peer 2...6 address</td>
<td>Enter the FQDNs of additional peers if it is a cluster of Expressway-Es.</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

4. Click *Create zone*.

**Server Certificate Requirements for Unified Communications**

**Cisco Unified Communications Manager Certificates**

Two Cisco Unified Communications Manager certificates are significant for Mobile and Remote Access:
Unified Communications Prerequisites

- CallManager certificate
- tomcat certificate

These certificates are automatically installed on the Cisco Unified Communications Manager and by default they are self-signed and have the same common name (CN).

We recommend using CA-signed certificates. However, if you do use self-signed certificates, the two certificates must have different common names. The Expressway does not allow two self-signed certificates with the same CN. So if the CallManager and tomcat self-signed certificates have the same CN in the Expressway’s trusted CA list, the Expressway can only trust one of them. This means that either secure HTTP or secure SIP, between Expressway-C and Cisco Unified Communications Manager, will fail.

Also, when generating tomcat certificate signing requests for any products in the Cisco Collaboration Systems Release 10.5.2, you need to be aware of CSCus47235. You need to work around this issue to ensure that the FQDNs of the nodes are in the certificates as Subject Alternative Name (SAN) entries. The Expressway X8.5.3 Release Note on the Release Notes page has details of the workarounds.

IM and Presence Service Certificates

Two IM and Presence Service certificates are significant if you use XMPP:

- cup-xmpp certificate
- tomcat certificate

We recommend using CA-signed certificates. However, if you do use self-signed certificates, the two certificates must have different common names. The Expressway does not allow two self-signed certificates with the same CN. If the cup-xmpp and tomcat (self-signed) certificates have the same CN, Expressway only trusts one of them, and some TLS attempts between Cisco Expressway-E and IM and Presence Service servers will fail. For more details, see CSCve56019.

Expressway Certificates

The Expressway certificate signing request (CSR) tool prompts for and incorporates the relevant Subject Alternative Name (SAN) entries as appropriate for the Unified Communications features that are supported on that Expressway.

The following table shows which CSR alternative name elements apply to which Unified Communications features:

<table>
<thead>
<tr>
<th>Add these items as subject alternative names</th>
<th>When generating a CSR for these purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mobile and Remote Access</td>
</tr>
<tr>
<td>Unified CM registrations domains (despite their name, these have more in common with service discovery domains than with Unified CM SIP registration domains)</td>
<td>Required on Expressway-E only</td>
</tr>
<tr>
<td>XMPP federation domains</td>
<td>–</td>
</tr>
<tr>
<td>IM and Presence chat node aliases (federated group chat)</td>
<td>–</td>
</tr>
<tr>
<td>Unified CM phone security profile names</td>
<td>Required on Expressway-C only</td>
</tr>
</tbody>
</table>
### Unified Communications Prerequisites

<table>
<thead>
<tr>
<th>Add these items as subject alternative names</th>
<th>When generating a CSR for these purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Clustered systems only) Expressway cluster name</td>
<td>Mobile and Remote Access</td>
</tr>
<tr>
<td></td>
<td>Required on Expressway-C only</td>
</tr>
</tbody>
</table>

**Note:**

- You may need to produce a new server certificate for the Expressway-C if chat node aliases are added or renamed. Or when IM and Presence nodes are added or renamed, or new TLS phone security profiles are added.
- You must produce a new Expressway-E certificate if new chat node aliases are added to the system, or if the Unified CM or XMPP federation domains are modified.
- You must restart the Expressway for any new uploaded server certificate to take effect.

More details about the individual feature requirements per Expressway-C / Expressway-E are described below.

#### Expressway-C server certificate requirements

The Expressway-C server certificate needs to include the following elements in its list of subject alternate names:

- **Unified CM phone security profile names**: the names of the Phone Security Profiles in Unified CM that are configured for encrypted TLS and are used for devices requiring remote access. Use the FQDN format and separate multiple entries with commas.

  Having the secure phone profiles as alternative names means that Unified CM can communicate via TLS with the Expressway-C when it is forwarding messages from devices that use those profiles.

- **IM and Presence chat node aliases (federated group chat)**: the Chat Node Aliases (e.g. chatroom1.example.com) that are configured on the IM and Presence servers. These are required only for Unified Communications XMPP federation deployments that intend to support group chat over TLS with federated contacts.

  The Expressway-C automatically includes the chat node aliases in the CSR, providing it has discovered a set of IM&P servers.

  We recommend that you use DNS format for the chat node aliases when generating the CSR. You must include the same chat node aliases in the Expressway-E server certificate’s alternative names.

**Figure 4  Entering subject alternative names for security profiles and chat node aliases on the Expressway-C’s CSR generator**

#### Expressway-E server certificate requirements

The Expressway-E server certificate needs to include the following elements in its list of subject alternative names (SAN):
Unified Communications Prerequisites

- **Unified CM registrations domains**: all of the domains which are configured on the Expressway-C for Unified CM registrations. Required for secure communications between endpoint devices and Expressway-E.

  The Unified CM registration domains used in the Expressway configuration and Expressway-E certificate, are used by Mobile and Remote Access clients to lookup the _collab-edge DNS SRV record during service discovery. They enable MRA registrations on Unified CM, and are primarily for service discovery.

  These service discovery domains may or may not match the SIP registration domains. It depends on the deployment, and they don’t have to match. One example is a deployment that uses a .local or similar private domain with Unified CM on the internal network, and public domain names for the Expressway-E FQDN and service discovery. In this case, you need to include the public domain names in the Expressway-E certificate as SANs. There is no need to include the private domain names used on Unified CM. You only need to list the edge domain as a SAN.

  Select the **DNS** format and manually specify the required FQDNs. Separate the FQDNs by commas if you need multiple domains. You may select **CollabEdgeDNS** format instead, which adds the prefix _collab-edge_ to the domain that you enter. This format is recommended if you do not want to include your top level domain as a SAN (see example in following screenshot).

- **XMPP federation domains**: the domains used for point-to-point XMPP federation. These are configured on the IM&P servers and should also be configured on the Expressway-C as domains for XMPP federation.

  Select the **DNS** format and manually specify the required FQDNs. Separate the FQDNs by commas if you need multiple domains. Do not use the **XMPPAddress** format as it may not be supported by your CA, and may be discontinued in future versions of the Expressway software.

- **IM and Presence chat node aliases (federated group chat)**: the same set of **Chat Node Aliases** as entered on the Expressway-C’s certificate. They are only required for voice and presence deployments which will support group chat over TLS with federated contacts.

  Note that you can copy the list of chat node aliases from the equivalent **Generate CSR** page on the Expressway-C.

**Figure 5  Entering subject alternative names for Unified CM registration domains, XMPP federation domains, and chat node aliases, on the Expressway-E’s CSR generator**

<table>
<thead>
<tr>
<th>Alternative name</th>
<th>FQDN of Expressway cluster plus FQDN of this peer</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject alternative names</td>
<td>FQDN of Expressway cluster plus FQDN of this peer</td>
<td>CollabEdgeDNS</td>
</tr>
<tr>
<td>Additional alternative names (comma separated)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unified CM registrations domains</td>
<td>example.com</td>
<td>CollabEdgeDNS</td>
</tr>
<tr>
<td>XMPP federation domains</td>
<td>example.com</td>
<td>DNS</td>
</tr>
<tr>
<td>IM and Presence chat node aliases (federated group chat)</td>
<td>:chatnode1.example.com,chatnode2.example.com</td>
<td>DNS</td>
</tr>
</tbody>
</table>

See **Cisco Expressway Certificate Creation and Use Deployment Guide** on the Expressway configuration guides page.
Configuring Mobile and Remote Access on Expressway

This section describes how to enable and configure Mobile and Remote Access features on Expressway-C and Expressway-E, and how to discover the Unified CM servers and IM&P servers used by the service. It also describes MRA access control settings.

- Installing Expressway Security Certificates and Setting Up a Secure Traversal Zone, page 30
- Setting Up the Expressway-C for Mobile and Remote Access, page 30
- Discover Unified Communications Servers and Services for Mobile and Remote Access, page 32
- About the HTTP Allow List on Expressway-C, page 43
- Setting Up the Expressway-E for Mobile and Remote Access, page 45
- Checking the Status of Unified Communications Services, page 43
- (Optional) Using Deployments to Partition Unified Communications Services, page 53
- (Optional) Configuring SAML SSO Authentication Over the Edge, page 46

Installing Expressway Security Certificates and Setting Up a Secure Traversal Zone

Unified Communications features such as Mobile and Remote Access or Jabber Guest, require a Unified Communications traversal zone connection between the Expressway-C and the Expressway-E. This involves:

- Installing suitable security certificates on the Expressway-C and the Expressway-E.
- Configuring a Unified Communications traversal zone between the Expressway-C and the Expressway-E.

For information about how to do this, see:

- Configuring a Secure Traversal Zone Connection for Unified Communications, page 24 (if your system does not already have a secure traversal zone in place)
- Server Certificate Requirements for Unified Communications, page 26

If you want to use XMPP federation, the IM&P servers must be discovered on the Expressway-C. So that all relevant information is available when generating certificate signing requests.

Setting Up the Expressway-C for Mobile and Remote Access

This section describes the configuration steps required on the Expressway-C for Mobile and Remote Access.

Configuring DNS and NTP Settings

Make sure that the following basic system settings are configured on Expressway:

1. **System host name** and **Domain name** are specified (**System > DNS**).
2. Local DNS servers are specified (**System > DNS**).
3. All Expressway systems are synchronized to a reliable NTP service (**System > Time**). Use an Authentication method in accordance with your local policy.

If you have a cluster of Expressways you must do this for every peer.

Enable SIP Protocol

SIP and H.323 protocols are disabled by default on new installs of X8.9.2 and later versions.

1. On the Expressway-C, go to **Configuration > Protocols > SIP**.
2. Set **SIP mode** to **On** and **Save** the page.
[Recommended] Disabling Automated Intrusion Protection on Expressway–C

If your Expressway–C is newly installed from X8.9 onwards, the automated intrusion protection service is running by default. This could prevent your deployment working properly, so we recommend you disable it on the Expressway–C as follows:

1. Go to System > Administration.
2. Switch Automated protection service to Off.
3. Click Save.

See Automated Intrusion Protection, page 1.

Enabling the Expressway–C for Mobile and Remote Access

To enable Mobile and Remote Access functionality:

1. Go to Configuration > Unified Communications > Configuration.
2. Set Unified Communications mode to Mobile and Remote Access.
3. Click Save.

You must select Mobile and Remote Access before you can configure the relevant domains and traversal zones.

Configuring the Domains to Route to Unified CM

You must configure the domains for which registration, call control, provisioning, messaging and presence services are to be routed to Unified CM.

1. On Expressway–C, go to Configuration > Domains.
2. Select the domains (or create a new domain, if not already configured) for which services are to be routed to Unified CM.
3. For each domain, turn On the services for that domain that Expressway is to support. The available services are:

   - SIP registrations and provisioning on Expressway: the Expressway is authoritative for this SIP domain. The Expressway acts as a SIP registrar for the domain (and Presence Server in the case of VCS systems), and accepts registration requests for any SIP endpoints attempting to register with an alias that includes this domain.

   - SIP registrations and provisioning on Unified CM: Endpoint registration, call control and provisioning for this SIP domain is serviced by Unified CM. The Expressway acts as a Unified Communications gateway to provide secure firewall traversal and line–side support for Unified CM registrations.

   - IM and Presence Service: Instant messaging and presence services for this SIP domain are provided by the Unified CM IM and Presence service.

   - XMPP federation: Enables XMPP federation between this domain and partner domains.

   - Deployment: Associates the domain with the selected deployment, if there are multiple deployments. This setting is absent if there is only one deployment (there is always at least one).

Turn On all of the applicable services for each domain. For example, the same domain may be used by endpoints such as Jabber or EX Series devices that require line–side Unified Communications support, and by other endpoints such as third–party SIP or H.323 devices that require Expressway support. (In this scenario, the signaling messages sent from the endpoint indicate whether line–side unified communications or Expressway support is required.)

Note that these settings are not entirely independent. You cannot disable SIP registration and provisioning on Unified CM while using IM and Presence. You can disable IM and Presence while SIP registrations and provisioning on Unified CM is On, but the reverse is not true. So, if you switch IM and Presence Service On, then your setting for SIP registrations and provisioning on Unified CM is ignored and the Expressway–C behaves as though it was On.
Enabling Shared Line / Multiple Lines for MRA Endpoints

Requires Unified CM 11.5(1)SU3 or later.

If you want MRA endpoints to be able to register multiple lines, or to share lines with other endpoints, then you must enable SIP Path headers on the Expressway-C. Due to a known issue in Unified CM 11.5(1)SU2, only enable SIP Path headers if you are running Unified CM version 11.5(1)SU3 or later (CDETS CSCvd84831 refers).

The default behavior is for the Expressway-C to rewrite the Contact header in REGISTER messages. When you turn SIP Path headers on, the Expressway-C does not rewrite the Contact header, but adds its address into the Path header instead.

1. On the Expressway-C, go to Configuration > Unified Communications > Configuration.
2. Change SIP Path headers to On.
3. Click Save.
   The Expressway-C puts its address in the Path headers of registrations from now on, and preserves the Contact header.
4. Refresh your Unified CM servers (Configuration > Unified Communications > Unified CM servers, click Refresh servers).

Note: This feature is disabled by default, because it impacts some features on earlier versions of Unified CM.

If you are using a Unified CM version before 11.5(1)SU3, and you enable SIP Path headers on Expressway-C, the following Unified CM features will report the MRA devices’ IP addresses instead of the Expressway’s IP address:

- Device Mobility
- Real-Time Monitoring Tool (RTMT)
- Cisco Emergency Responder (CER)

Other features may also be affected by this change. The devices’ IP addresses are not useful for determining their location, as they are typically from reserved private ranges and could overlap with your organization’s internal range.

Discover Unified Communications Servers and Services for Mobile and Remote Access

The Expressway-C must be configured with the address details of the Unified Communications services/nodes that are going to provide registration, call control, provisioning, voicemail, messaging, and presence services to MRA users.

IM and Presence Service configuration is not required if you’re deploying the hybrid model, as these services are provided by the Cisco Webex cloud.
The connections configured in this procedure are static. After you reconfigure or upgrade any of the discovered Unified Communications nodes, you must refresh the configuration on the Expressway-C as described in the tasks below (Configuration > Unified Communications > <UC server type>; click Refresh servers). More detail about why this is needed is in Why It’s Necessary to Refresh Discovered Nodes, page 36. Be aware that as described in that section, Jabber and other endpoints cannot connect during the refresh.

Trust the Certificates Presented to the Expressway-C

If TLS verify mode is On when discovering Unified Communications services, then you must configure the Expressway-C to trust the certificates presented by the IM and Presence Service nodes and Unified CM servers.

1. Determine the relevant CA certificates to upload:
   - If the servers’ tomcat and CallManager certificates are CA-signed, the Expressway-C’s trusted CA list must include the root CA of the certificate issuer.
   - If the servers are using self-signed certificates, the Expressway-C’s trusted CA list must include the self-signed certificates from all discovered IM and Presence Service nodes, Cisco Unity Connection servers, and Unified CM servers.
2. Upload the required certificates to the Expressway-C (Maintenance > Security > Trusted CA certificate).
3. Restart the Expressway-C (Maintenance > Restart options).

Discover Unified CM Servers

1. On Expressway-C, go to Configuration > Unified Communications > Unified CM servers.
   The page lists any Unified CM nodes that have already been discovered.
2. Add the details of a Unified CM publisher node:
   a. Click New.
   b. Enter the Unified CM publisher address.
      You must enter an FQDN when TLS verify mode is On.
   c. Enter the Username and Password of an account that can access this server.
      Note: These credentials are stored permanently in the Expressway database. The corresponding Unified
      CM user must have the Standard AXL API Access role.
   d. [Recommended] Leave TLS verify mode switched On to ensure Expressway verifies the node’s
      certificates.
      The Unified CM node presents its tomcat certificate for AXL and UDS queries, and its CallManager
      certificate for subsequent SIP traffic. If the Unified CM server is using self-signed certificates, the
      Expressway-C’s trusted CA list must include a copy of the tomcat certificate and the CallManager
      certificate from every Unified CM server.
   e. [Optional] To enable support for AES GCM media encryption, set AES GCM support to On.
   f. [Optional] Select which deployment this node/cluster will belong to.
      The Deployment field does not show if you have not created multiple deployments. All nodes belong to the
      default deployment if you choose not to use multiple deployments.
   g. Click Add address
      If you enabled TLS verify mode, then the Expressway tests whether a secure connection can be
      established. It does this so you can find any TLS configuration errors before it continues the discovery
      process.
      If the secure connection test was successful, or if you did not enable TLS verify mode, then the system
      attempts to contact the publisher and retrieve details of its associated nodes.

3. Repeat the discovery procedure for other Unified CM nodes/clusters, if required.

4. Click Refresh servers to refresh all the node details after configuring multiple publisher addresses.

Discover IM and Presence Service Nodes

1. On Expressway-C, go to Configuration > Unified Communications > IM and Presence Service nodes.
   The page lists any IM and Presence Service nodes that have already been discovered.
2. Add the details of an IM and Presence Service database publisher node:
   a. Click **New**.
   b. Enter the address of the **IM and Presence Service database publisher node**.
      You must enter an FQDN when **TLS verify mode** is **On**.
   c. Enter the **Username** and **Password** of an account that can access this server.
      **Note:** These credentials are stored permanently in the Expressway database. The corresponding IM and
      Presence Service user must have the **Standard AXL API Access** role.
   d. [Recommended] Leave **TLS verify mode** switched **On** to ensure Expressway verifies the node's tomcat
      certificate (for XMPP-related communications).
   e. [Optional] Select which deployment this node/cluster will belong to.
      The **Deployment** field does not show if you have not created multiple deployments. All nodes belong to the
      default deployment if you choose not to use multiple deployments.
   f. Click **Add address**.
      If you enabled TLS verify mode, then the Expressway tests whether a secure connection can be
      established. It does this so you can find any TLS configuration errors before it continues the discovery
      process.
      If the secure connection test was successful, or if you did not enable TLS verify mode, then the system
      attempts to contact the publisher and retrieve details of its associated nodes.

   ![IM and Presence Service nodes](image)

   **Note:** The status of the discovered node will be **Inactive** unless a valid traversal zone connection exists
   between the Expressway-C and the Expressway-E (may not yet be configured).

3. Repeat the discovery procedure for other IM and Presence Service nodes/clusters, if required.

4. Click **Refresh servers** to refresh all the node details after configuring multiple publisher addresses.

Discover Cisco Unity Connection Servers

1. On Expressway-C, go to **Configuration > Unified Communications > Unity Connection servers**.
   The page lists any Cisco Unity Connection nodes that have already been discovered.
2. Add the details of a Cisco Unity Connection publisher node:
   a. Click **New**.
   b. Enter the **Unity Connection address**.
      You must enter an FQDN when **TLS verify mode** is **On**.
   c. Enter the **Username** and **Password** of an account that can access this server.
      **Note:** These credentials are stored permanently in the Expressway database.
   d. [Recommended] Leave **TLS verify mode** switched **On** to ensure Expressway verifies the node's tomcat certificate.
   e. [Optional] Select which deployment this node/cluster will belong to.
      The **Deployment** field does not show if you have not created multiple deployments. All nodes belong to the default deployment if you choose not to use multiple deployments.
   f. Click **Add address**.
      If you enabled TLS verify mode, then the Expressway tests whether a secure connection can be established. It does this so you can find any TLS configuration errors before it continues the discovery process.
      If the secure connection test was successful, or if you did not enable TLS verify mode, then the system attempts to contact the publisher and retrieve details of its associated nodes.

3. Repeat the discovery procedure for other Cisco Unity Connection nodes/clusters, if required.

4. Click **Refresh servers** to refresh all the node details after configuring multiple publisher addresses.

### Automatically Generated Zones and Search Rules

Expressway-C automatically generates non-configurable neighbor zones between itself and each discovered Unified CM node. A TCP zone is always created, and a TLS zone is created also if the Unified CM node is configured with a **Cluster Security Mode (System > Enterprise Parameters > Security Parameters)** of 1 **(Mixed)** (so that it can support devices provisioned with secure profiles). The TLS zone is configured with its **TLS verify mode** set to **On** if the Unified CM discovery had **TLS verify mode** enabled. This means that the Expressway-C will verify the CallManager certificate for subsequent SIP communications. Each zone is created with a name in the format 'CEtcp-<node name>' or 'CEtls-<node name>'.

From version X12.5, Expressway automatically generates a neighbor zone named "CEOAuth <Unified CM name>" between itself and each discovered Unified CM node when SIP OAuth Mode is enabled on Unified CM. For details, see **Configuring OAuth with Refresh (Self-Describing) on Unified CM SIP Lines**, page 42.

A non-configurable search rule, following the same naming convention, is also created automatically for each zone. The rules are created with a priority of 45. If the Unified CM node that is targeted by the search rule has a long name, the search rule will use a regex for its address pattern match.

Note that load balancing is managed by Unified CM when it passes routing information back to the registering endpoints.

### Why It's Necessary to Refresh Discovered Nodes

When the Expressway-C discovers a Unified Communications node, it establishes a connection to read the information required to create zones and search rules to proxy requests originating from outside of the network in towards that node. **This configuration information is static.** The Expressway only reads it when you manually initiate discovery of a new node, or refresh the configuration of previously discovered nodes. If any related configuration has changed on a node after you discover it, the mismatch between the new configuration and what the Expressway-C knows of that node is likely to cause some kind of failure.

The information that the Expressway-C reads from the Unified Communications node is different for each node type/role. These are examples of UC configuration that you can expect to require a refresh from the Expressway. The list is not exhaustive. If you suspect that a configuration change on a node is affecting MRA services, you should refresh those nodes to eliminate one known source of potential problems.
Changing cluster (such as adding or removing a node)
- Changing security parameters (such as enabling Mixed Mode)
- Changing connection sockets (such as SIP port configuration)
- Changing TFTP server configuration
- Upgrading node software

Devices cannot connect during the refresh

It takes some time to restore services after a server refresh and while the refresh is in progress, Jabber clients and other endpoints are unable to connect over MRA. It's not possible to provide accurate timings as they vary depending on the deployment. For straightforward deployments the refresh typically takes 5 to 10 seconds, but very complex configurations may take upwards of 45 seconds.

Configuring MRA Access Control

To define how clients must authenticate for Mobile and Remote Access (MRA) requests, on the Expressway-C go to Configuration > Unified Communications > Configuration > MRA Access Control.

Caution: If you are upgrading from X8.9 or earlier, the settings applied after the upgrade are not the same as listed here. Please refer instead to the upgrade instructions in the Expressway Release Notes.

Authorization and authentication compared

We use the concepts "authorization" and "authentication" in documentation and the user interface. At a high level, these terms can be explained using a hotel analogy:

**Authentication.** Equates to hotel registration by a visitor. Defines the initial check-in process to allow you access into the hotel, where you prove who you are by presenting credentials like a passport or driving license.

**Authorization.** Equates to a hotel key card given to a visitor. Controls the specific hotel room and other services that you are allowed to use during your stay.

The fields you actually see in the Web UI depend on whether MRA is enabled (Unified Communications mode set to Mobile and remote access) and on the selected authentication path. Not all the fields in the table are necessarily displayed.
### Configuring Expressway (Expressway-C)

**Table 2  Settings for MRA access control**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
</table>
| **Authentication path**                    | Hidden field until MRA is enabled. Defines how MRA authentication is controlled.  

**SAML SSO authentication:** Clients are authenticated by an external IdP.  

**UCM/LDAP basic authentication:** Clients are authenticated locally by the Unified CM against their LDAP credentials.  

**SAML SSO and UCM/LDAP:** Allows either method.  

*None:* No authentication is applied. The default until MRA is first enabled. The "None" option is required (rather than just leaving MRA turned off) because some deployments must turn on MRA to allow functions which are not actually MRA. (Such as the Web Proxy for Meeting Server, or XMPP Federation.) Only these customers should use "None". **It is not recommended in other cases.** |
| Authorize by OAuth token with refresh      | This option requires self-describing tokens for authorization. It's our recommended authorization option for all deployments that have the infrastructure to support them.  

Only Jabber clients are currently capable of using this authorization method. Other MRA endpoints do not currently support it. The clients must also be in OAuth token with refresh authorization mode.  

**Important:** From X8.10.1, the Expressway fully supports the benefits of self-describing tokens (including token refresh, fast authorization, and access policy support). However, not all of the benefits are actually available throughout the wider solution. Depending on what other products you use (Unified CM, IM and Presence Service, Cisco Unity Connection) and what versions they are on, not all products fully support all benefits of self-describing tokens.  

If you use this option on Expressway, **you must also enable OAuth with refresh on the Unified CMs, and on Cisco Unity Connection if used.** The process is summarized below. |
| Authorize by OAuth token (previously SSO Mode) | Available if **Authentication path** is SAML SSO or SAML SSO and UCM/LDAP.  

This option requires authentication through the IdP. Currently, only Jabber clients are capable of using this authorization method, which is not supported by other MRA endpoints. |

None before MRA turned on  
UCM/LDAP after MRA turned on | On | Off |
### Table 2  Settings for MRA access control (continued)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorize by user credential</td>
<td>Available if <strong>Authentication path</strong> is UCM/LDAP or SAML SSO and UCM/LDAP. Clients attempting to perform authentication by user credentials are allowed through MRA. This includes Jabber, and supported IP phone and TelePresence devices.</td>
<td>Off</td>
</tr>
</tbody>
</table>
| Identity providers: Create or modify IdPs | Available if **Authentication path** is SAML SSO or SAML SSO and UCM/LDAP. **Selecting an Identity Provider** Cisco Collaboration solutions use SAML 2.0 (Security Assertion Markup Language) to enable SSO (single sign-on) for clients consuming Unified Communications services. If you choose SAML-based SSO for your environment, note the following:  
  - SAML 2.0 is not compatible with SAML 1.1 and you must select an IdP that uses the SAML 2.0 standard.  
  - SAML-based identity management is implemented in different ways by vendors in the computing and networking industry, and there are no widely accepted regulations for compliance to the SAML standards.  
  - The configuration of and policies governing your selected IdP are outside the scope of Cisco TAC (Technical Assistance Center) support. Please use your relationship and support contract with your IdP Vendor to assist in configuring the IdP properly. Cisco cannot accept responsibility for any errors, limitations, or specific configuration of the IdP.  
  Although Cisco Collaboration infrastructure may prove to be compatible with other IdPs claiming SAML 2.0 compliance, only the following IdPs have been tested with Cisco Collaboration solutions:  
  - OpenAM 10.0.1  
  - Active Directory Federation Services 2.0 (AD FS 2.0)  
  - PingFederate® 6.10.0.4 | – |
### Table 2  Settings for MRA access control (continued)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAML Metadata</td>
<td>Available if <strong>Authentication path</strong> is SAML SSO or SAML SSO and UCM/LDAP.</td>
<td>For new deployments, the SAML Metadata mode always defaults to Cluster. For existing deployments, the mode defaults to Cluster if SAML SSO was disabled in your previous Expressway release, or to Peer if SAML SSO was previously enabled.</td>
</tr>
<tr>
<td></td>
<td>Determines how to generate the metadata file for the SAML agreement. The possible modes are:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ <strong>Cluster</strong>: Generates a single cluster-wide SAML metadata file. You must import only this file to IdP for the SAML agreement.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ <strong>Peer</strong>: Generates the metadata files for each peer in a cluster. You must import each metadata file into IdP for the SAML agreement.</td>
<td></td>
</tr>
<tr>
<td>Identity providers: Export SAML data</td>
<td>Available if <strong>Authentication path</strong> is SAML SSO or SAML SSO and UCM/LDAP.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>For details about working with SAML data, see SAML SSO Authentication Over the Edge, page 46.</td>
<td></td>
</tr>
<tr>
<td>Allow Jabber iOS clients to use embedded Safari</td>
<td>By default the IdP or Unified CM authentication page is displayed in an embedded web browser (not the Safari browser) on iOS devices. That default browser is unable to access the iOS trust store, and so cannot use any certificates deployed to the devices.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>This setting optionally allows Jabber on iOS devices to use the native Safari browser. Because the Safari browser is able to access the device trust store, you can now enable password-less authentication or two-factor authentication in your OAuth deployment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A potential security issue exists for this option. The mechanism to return browser control from Safari to Jabber after the authentication completes, uses a custom URL scheme that invokes a custom protocol handler. It’s possible that another application other than Jabber could intercept the scheme and gain control from iOS. In that case, the application would have access to the OAuth token in the URL.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If you are confident that your iOS devices will not have other applications that register the Jabber custom URL scheme, for example because all mobile devices are managed, then it’s safe to enable the option. If you are concerned about the possibility of another app intercepting the custom Jabber URL, then do not enable the embedded Safari browser.</td>
<td></td>
</tr>
</tbody>
</table>
Table 2  Settings for MRA access control (continued)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
</table>
| Check for internal authentication availability | Available if Authorize by OAuth token with refresh or Authorize by OAuth token is enabled.  
The default is No, for optimal security and to reduce network traffic.  
Controls how the Expressway-E reacts to remote client authentication requests by selecting whether or not the Expressway-C should check the home nodes.  
The request asks whether the client may try to authenticate the user by OAuth token, and includes a user identity with which the Expressway-C can find the user’s home cluster:  
Yes: The get_edge_sso request will ask the user’s home Unified CM if OAuth tokens are supported. The home Unified CM is determined from the identity sent by the Jabber client’s get_edge_sso request.  
No: If the Expressway is configured not to look internally, the same response will be sent to all clients, depending on the Edge authentication settings.  
The option to choose depends on your implementation and security policy. If all Unified CM nodes support OAuth tokens, you can reduce response time and overall network traffic by selecting No. Or select Yes if you want clients to use either mode of getting the edge configuration - during rollout or because you can’t guarantee OAuth on all nodes.  
Caution: Setting this to Yes has the potential to allow rogue inbound requests from unauthenticated remote clients. If you specify No for this setting, the Expressway prevents rogue requests. | No |
| Allow activation code onboarding           | This setting enables onboarding by activation code in the Expressway. It is provided as Preview status only, until all relevant products in the wider solution support the feature. | No |
| SIP token extra time to live               | Available if Authorize by OAuth token is On.  
Optionally extends the time-to-live for simple OAuth tokens (in seconds). Gives users a short window to accept calls after their credentials expire. However, it increases the potential security exposure. | 0 seconds |

Configuring Cisco Unified Communications Manager / Cisco Unity Connection for OAuth with Refresh

To use self-describing tokens on Expressway (Authorize by OAuth token with refresh), you must also enable OAuth with refresh on Unified CM, and on Unity Connection if you use it. The settings are summarized here for convenience. For details, refer to the Cisco Unified CM / Unity Connection documentation.
Configuring Mobile and Remote Access on Expressway

- For Unified CM, enable **OAuth with Refresh Login Flow**, and **Caching**, in the System > Enterprise Parameters.
- For Unity Connection, enable **OAuth with Refresh Login Flow** and add CUCM Publisher to the Authz server settings.

**How to check Unified CM support**

You can check what authorization methods your Unified CM servers support, on the Expressway Configuration > Unified Communications > Unified CM servers page. This displays the version numbers in use.

**Configuring OAuth with Refresh (Self-Describing) on Unified CM SIP Lines**

From version X12.5, OAuth is supported on the Unified CM SIP line interface for Jabber clients only. When OAuth is enabled on the Unified CM SIP line and Jabber client, on-premises clients are authorized using self-describing tokens instead of client certificates.

Support for OAuth on the Unified CM SIP line from X12.5 means that secure SIP and SRTP is possible without Certificate Authority Proxy Function (CAPF). It enables end-to-end encryption of ICE and ICE passthrough calls over MRA.

**How to enable OAuth on the Unified CM SIP line interface**

1. On Unified CM node, do the following:
   a. Enable SIP OAuth Mode using the CLI command `utils sip-oauth enable`.
   b. Verify if SIP OAuth is set to listen on default ports (System > Cisco Unified CM).
      
      The default ports are 5090 for on-premises and 5091 for MRA. To avoid port conflicts, ensure that these ports are not configured to listen any existing SIP Trunk in Unified CM.
      
      The settings to enable SIP OAuth on the SIP line on Unified CM are summarized here for convenience. For detailed information, see the Cisco Unified Communications Manager documentation.

2. After you enable Unified CM for SIP OAuth, discover or refresh the Unified CM nodes in Expressway-C.
   
   A new CEOAuth (TLS) zone is created automatically in Expressway-C. For example, `CEOAuth <Unified CM name>`. A search rule is created to proxy the requests originating from the on-premises endpoints towards the Unified CM node. This zone uses TLS connections irrespective of whether Unified CM is configured with mixed mode. To establish trust, Expressway-C also sends the hostname and Subject Alternative Name (SAN) details to the Unified CM cluster.

3. Upgrade the Jabber clients to 12.5. Cisco Jabber 12.5 or later is required for either MRA or on-premises clients to connect using OAuth.

4. Enable OAuth authorization on the Phone Security Profile (System > Security > Phone Security Profile) and apply the Phone Security Profile on the Jabber clients.

**Refresh Servers on the Expressway-C**

You must refresh the Cisco Unified CM / Unity Connection nodes defined on the Expressway-C. This fetches keys that the Expressway needs to decrypt the tokens.

- For Unified CM, go to Configuration > Unified Communications > Unified CM servers and click Refresh servers.
- For Unity Connection, go to Configuration > Unified Communications > Unity Connection servers and click Refresh servers.
Checking the Status of Unified Communications Services

You can check the status of the Unified Communications services on both Expressway-C and Expressway-E.

1. Go to **Status > Unified Communications**.
2. Review the list and status of domains, zones and (Expressway-C only) Unified CM and IM&P servers.

Any configuration errors listed along with links to the relevant configuration page from where you can address the issue.

About the HTTP Allow List on Expressway-C

Expressway-C automatically adds rules (inbound and outbound) to the HTTP allow list.

For example, it adds inbound rules to allow external clients to access the Unified Communications nodes discovered during MRA configuration. These include Unified CM nodes (running CallManager and TFTP service), IM and Presence Service nodes, and Cisco Unity Connection nodes.

Inbound rules are viewable at **Configuration > Unified Communications > HTTP allow list > Automatic inbound rules**. Outbound rules are viewable at **Configuration > Unified Communications > HTTP allow list > Automatic outbound rules**.

Can I edit the allow list?

- You can’t add outbound rules to the list.
- You can add your own inbound rules, if clients from outside need to access other web services inside the enterprise. For example, these services may require you to configure the allow list:
  - Jabber Update Server
  - Cisco Extension Mobility
  - Directory Photo Host
  - Advanced File Transfer (AFT)
  - Problem Report Tool server
- You can’t edit or delete auto-added rules in the list.

**AFT feature**

For the AFT feature to work across Expressway, make sure that all Unified CM IM and Presence Service nodes are on the allow list, whether manually or automatically added.

Automatic Inbound Rules

Expressway automatically edits the HTTP allow list when you discover or refresh Unified Communications nodes. This page shows the discovered nodes, and the rules that apply to those nodes.

The first list is Discovered nodes, and contains all the nodes currently known to this Expressway-C. For each node, the list contains the node’s address, its type, and the address of its publisher.

The second list is the rules that have been added for you, to control client access to the different types of Unified Communications nodes. For each type of node in your MRA configuration, you’ll see one or more rules in this list. They are shown in the same format as the editable rules, but you cannot modify these rules.
Table 3  Properties of Automatically Added Allow List Rules

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>This rule affects all nodes of the listed type:</td>
</tr>
<tr>
<td></td>
<td>- Unified CM servers: Cisco Unified Communications Manager nodes</td>
</tr>
<tr>
<td></td>
<td>- IM and Presence Service nodes: Cisco Unified Communications Manager IM and Presence Service nodes</td>
</tr>
<tr>
<td></td>
<td>- Unity Connection servers: Cisco Unity Connection nodes</td>
</tr>
<tr>
<td></td>
<td>- TFTP: TFTP nodes</td>
</tr>
<tr>
<td><strong>Protocol</strong></td>
<td>The protocol on which the rule allows clients to communicate with these types of nodes.</td>
</tr>
<tr>
<td><strong>Ports</strong></td>
<td>The ports on which the rule allows clients to communicate with these types of nodes.</td>
</tr>
<tr>
<td><strong>Match type</strong></td>
<td><em>Exact or Prefix.</em> Depends on the nature of the service the clients access with the help of this rule.</td>
</tr>
<tr>
<td><strong>Path</strong></td>
<td>The path to the resource that clients access with the help of this rule. This may not be present, or may only be a partial match of the actual resource, if the rule allows <em>Prefix</em> match.</td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td>The HTTP methods that will be allowed through by this rule (such as GET).</td>
</tr>
</tbody>
</table>

Edit the HTTP Allow List

1. Go to **Configuration > Unified Communications > HTTP allow list > Editable inbound rules** to view, create, modify, or delete HTTP allow list rules.

   The page has two areas; one for controlling the default HTTP methods, and the other showing the editable rules.

2. [Optional] Use the checkboxes to modify the set of default HTTP methods, then click **Save**.

   You can override the defaults while you’re editing individual rules. If you want to be as secure as possible, clear all methods from the default set and specify methods on a per rule basis.

   **Note:** When you change the default methods, all rules that you previously created with the default methods will use the new defaults.

3. [Recommended] Delete any rules you don’t need by checking the boxes in the left column, then clicking **Delete**.

4. Click **New** to create a rule.
5. Configure the rule to your requirements. Here is some advice for each of the fields:

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Enter a meaningful description for this rule, to help you recognize its purpose.</td>
</tr>
<tr>
<td>URL</td>
<td>Specify a URL that MRA clients are allowed to access. For example, to allow access to <a href="https://www.example.com:8080/resource/path">https://www.example.com:8080/resource/path</a> just type it in exactly like that.</td>
</tr>
<tr>
<td></td>
<td>a. The protocol the clients are using to access the host must be http:// or https://</td>
</tr>
<tr>
<td></td>
<td>b. Specify a port when using a non-default port eg. :8080 (Default ports are 80 (http) and 443 (https))</td>
</tr>
<tr>
<td></td>
<td>c. Specify the path to limit the rule scope (more secure), eg. /resource/path</td>
</tr>
<tr>
<td></td>
<td>If you select Prefix match for this rule, you can use a partial path or omit the path. Be aware that this could be a security risk if the target resources are not resilient to malformed URLs.</td>
</tr>
<tr>
<td>Allowed methods</td>
<td>Select Use defaults or Choose methods.</td>
</tr>
<tr>
<td></td>
<td>If you choose specific HTTP methods for this rule, they will override the defaults you chose for all rules.</td>
</tr>
<tr>
<td>Match type</td>
<td>Select Exact match or Prefix match.</td>
</tr>
<tr>
<td></td>
<td>Your decision here depends on your environment. It is more secure to use exact matches, but you may need more rules. It is more convenient to use prefix matches, but there is some risk of unintentionally exposing server resources.</td>
</tr>
<tr>
<td>Deployment</td>
<td>If you are using multiple deployments for your MRA environment, you also need to choose which deployment uses the new rule. You won’t see this field unless you have more than one deployment.</td>
</tr>
</tbody>
</table>

6. Click Create Entry to save the rule and return to the editable allow list.

7. [Optional] Click View/Edit to change the rule.

Upload Rules to the HTTP Allow List

**Note:** You cannot upload outbound rules.

1. Go to Configuration > Unified Communications > HTTP allow list > Upload rules.
2. Browse to and select the CSV file containing your rule definitions.
3. Click Upload.
   The Expressway responds with a success message and displays the Editable inbound rules page.

Setting Up the Expressway–E for Mobile and Remote Access

This section describes the configuration steps required on the Expressway–E for Mobile and Remote Access.

Configuring DNS and NTP Settings

Make sure that the following basic system settings are configured on Expressway:
Configuring Mobile and Remote Access on Expressway

1. **System host name** and **Domain name** are specified (System > DNS).
2. Public DNS servers are specified (System > DNS).
3. All Expressway systems are synchronized to a reliable NTP service (System > Time). Use an Authentication method in accordance with your local policy.

If you have a cluster of Expressways you must do this for every peer.

**Note:** The combination of **System host name**, **Domain name** is the FQDN of this Expressway-E. Ensure that this FQDN is resolvable in public DNS.

If you have a cluster of Expressway-Es, make sure that the **Domain name** is identical on each peer, and it is case-sensitive.

Enable SIP Protocol

SIP and H.323 protocols are disabled by default on new installs of X8.9.2 and later versions.

1. On the Expressway-E, go to Configuration > Protocols > SIP.
2. Set SIP mode to On and Save the page.

Enabling the Expressway-E for Mobile and Remote Access

To enable Mobile and Remote Access functionality:

1. Go to Configuration > Unified Communications > Configuration.
2. Set Unified Communications mode to Mobile and Remote Access.
3. Click Save.

SAML SSO Authentication Over the Edge

SAML-based SSO is an option for authenticating Unified Communications service requests. The requests can originate inside the enterprise network, or, as described here, from clients requesting Unified Communications services from outside through MRA.

SAML SSO authentication over the edge requires an external identity provider (IdP). It relies on the secure traversal capabilities of the Expressway pair at the edge, and on trust relationships between the internal service providers and an externally resolvable IdP.

The endpoints do not need to connect via VPN. They use one identity and one authentication mechanism to access multiple Unified Communications services. Authentication is owned by the IdP, and there is no authentication at the Expressway, nor at the internal Unified CM services.

The Expressway supports two types of OAuth token authorization with SAML SSO:

- Simple (standard) tokens. These always require SAML SSO authentication.
- Self-describing tokens with refresh. These can also work with Unified CM-based authentication.

About Simple OAuth Token Authorization

**Prerequisites**

- Cisco Jabber 10.6 or later. Jabber clients are the only endpoints supported for OAuth token authorization through Mobile and Remote Access (MRA).
- Cisco Unified Communications Manager 10.5(2) or later
- Cisco Unity Connection 10.5(2) or later
- Cisco Unified Communications Manager IM and Presence Service 10.5(2) or later

**How it works**
Configuring Mobile and Remote Access on Expressway

Cisco Jabber determines whether it is inside the organization’s network before requesting a Unified Communications service. If Jabber is outside the network, it requests the service from the Expressway-E on the edge of the network. If SAML SSO authentication is enabled at the edge, the Expressway-E redirects Jabber to the IdP with a signed request to authenticate the user.

The IdP challenges the client to identify itself. When this identity is authenticated, the IdP redirects Jabber’s service request back to the Expressway-E with a signed assertion that the identity is authentic.

The Unified Communications service trusts the IdP and the Expressway-E, so it provides the service to the Jabber client.

**Figure 6 Simple OAuth token-based authorization for on-premises UC services**

![Diagram of OAuth token-based authorization](image)

**About Self-Describing OAuth Token Authorization with Refresh**

We introduced this feature in X8.10 in preview status only. It’s fully supported from X8.10.1.

Expressway supports using self-describing tokens as an MRA authorization option. (Set "Authorize by OAuth token with refresh" to Yes.) Self-describing tokens offer significant benefits:

- Token refresh capability, so users don’t have to repeatedly re-authenticate.
- Fast authorization.
- Access policy support. The Expressway can enforce MRA access policy settings applied to users on the Unified CM.
- Roaming support. Tokens are valid on-premises and remotely, so roaming users don’t need to re-authenticate if they move between on-premises and off-premises.

The Expressway uses self-describing tokens in particular to facilitate Cisco Jabber users. Jabber users who are mobile or work remotely, can authenticate while away from the local network (off-premises). If they originally authenticate on the premises, they don’t have to re-authenticate if they later move off-premises. Similarly, users don’t have to re-authenticate if they move on-premises after authenticating off-premises. Either case is subject to any configured access token or refresh token limits, which may force re-authentication.

For users with Jabber iOS devices, the high speeds supported by self-describing tokens optimize Expressway support for Apple Push Notifications (APNs).

We recommend self-describing token authorization for all deployments, assuming the necessary infrastructure exists to support it. Subject to proper Expressway configuration, if the Jabber client presents a self-describing token then the Expressway simply checks the token. No password or certificate-based authentication is needed. The token is
issued by Unified CM (regardless of whether the configured authentication path is by external IdP or by the Unified CM). Self-describing token authorization is used automatically if all devices in the call flow are configured for it.

The Expressway–C performs token authorization. This avoids authentication and authorization settings being exposed on Expressway–E.

**Prerequisites**

- Expressway is already providing Mobile and Remote Access for Cisco Jabber.
- All other devices in the call flow are similarly enabled.
- You have the following minimum product versions installed, or later:
  - Expressway X8.10.1 (preview status only in X8.10)
  - Cisco Jabber iOS 11.9
    - If you have a mix of Jabber devices, with some on an older software version, the older ones will use simple OAuth token authorization (assuming SSO and an IdP are in place).
  - Cisco Unified Communications Manager 11.5(SU3)
  - Cisco Unified Communications Manager IM and Presence Service 11.5(SU3)
  - Cisco Unity Connection 11.5(SU3)
- Make sure that self-describing authentication is enabled on the Cisco Expressway–C ("Authorize by OAuth token with refresh" setting) and on Unified CM and/or IM and Presence Service ("OAuth with Refresh Login Flow" enterprise parameter).
- You must refresh the Unified CM nodes defined on the Expressway. This fetches keys from the Unified CM that the Expressway needs to decrypt the tokens.

**OAuth Token Authorization Prerequisites**

**On the Expressway pair:**

- An Expressway–E and an Expressway–C are configured to work together at your network edge.
- A Unified Communications traversal zone is configured between the Expressway–C and the Expressway–E.
- The SIP domain that will be accessed via OAuth is configured on the Expressway–C.
- The Expressway–C has MRA enabled and has discovered the required Unified CM resources.
- The required Unified CM resources are in the HTTP allow list on the Expressway–C.
- If you are using multiple deployments, the Unified CM resources to be accessed by OAuth are in the same deployment as the domain to be called from Jabber clients.

**On the Cisco Jabber clients:**

- Clients are configured to request the internal services using the correct domain names / SIP URIs / Chat aliases.
- The default browser can resolve the Expressway–E and the IdP.

**On Unified CM:**

- Users who are associated with non-OAuth MRA clients or endpoints, have their credentials stored in Unified CM. Or Unified CM is configured for LDAP authentication.

**On the Identity Provider:**

The domain that is on the IdP certificate must be published in the DNS so that clients can resolve the IdP.

**Selecting an Identity Provider**

Cisco Collaboration solutions use SAML 2.0 (Security Assertion Markup Language) to enable SSO (single sign-on) for clients consuming Unified Communications services.

If you choose SAML–based SSO for your environment, note the following:
Configuring Mobile and Remote Access on Expressway

- SAML 2.0 is not compatible with SAML 1.1 and you must select an IdP that uses the SAML 2.0 standard.
- SAML-based identity management is implemented in different ways by vendors in the computing and networking industry, and there are no widely accepted regulations for compliance to the SAML standards.
- The configuration of and policies governing your selected IdP are outside the scope of Cisco TAC (Technical Assistance Center) support. Please use your relationship and support contract with your IdP Vendor to assist in configuring the IdP properly. Cisco cannot accept responsibility for any errors, limitations, or specific configuration of the IdP.

Although Cisco Collaboration infrastructure may prove to be compatible with other IdPs claiming SAML 2.0 compliance, only the following IdPs have been tested with Cisco Collaboration solutions:

- OpenAM 10.0.1
- Active Directory Federation Services 2.0 (AD FS 2.0)
- PingFederate® 6.10.0.4

High Level Task List

1. If you intend to use self-describing token authorization (Authorize by OAuth token with refresh) we recommend getting it working on-premises first, before attempting to enable if for MRA clients.
2. Configure a synchronizable relationship between the identity provider and your on-premises directory such that authentication can securely be owned by the IdP. See Directory Integration and Identity Management in the Cisco Collaboration System 11.x Solution Reference Network Designs (SRND) document.
3. Export SAML metadata file from the IdP. Check the documentation on your identity provider for the procedure. For example, see Enable SAML SSO through the OpenAM IdP in the SAML SSO Deployment Guide for Cisco Unified Communications Applications.
4. Import the SAML metadata file from the IdP to the Unified CM servers and Cisco Unity Connection servers that will be accessed by single sign-on. See the Unified Communications documentation or help for more details.
5. Export the SAML metadata files from the Unified CM servers and Cisco Unity Connection servers. For example, see High-Level Circle of Trust Setup in the SAML SSO Deployment Guide for Cisco Unified Communications Applications.
6. Create the Identity Provider on the Expressway-C, by importing the SAML metadata file from the IdP.
7. Associate the IdP with SIP domain(s) on the Expressway-C.
8. Export the SAML metadata file(s) from the (primary) Expressway-C; ensure that it includes the externally resolvable address of the (primary) Expressway-E.
   The SAML metadata file from the Expressway-C contains the X.509 certificate for signing and encrypting SAML interchanges between the edge and the IdP, and the binding(s) that the IdP needs to redirect clients to the Expressway-E (peers).
9. Import the SAML metadata files from the Unified CM servers and Cisco Unity Connection servers to the IdP. An example using OpenAM is in the SAML SSO Deployment Guide for Cisco Unified Communications Applications.
10. If you intend to use single, cluster-wide metadata file for SAML agreement, configure the mandatory attribute uid on the IdP. Through this attribute, a Service Provider identifies the identity of an authenticated user. For information about attribute mapping, refer the IdP product documentation.  
    **Note:** This uid attribute must match the LDAP synchronized user id attribute that is used in Unified Communications applications.
11. Similarly, import the SAML metadata file from the Expressway-C to the IdP. See your IdP documentation for details.
12. Turn on SAML SSO at the edge, on the Expressway-C. See Configuring MRA Access Control, page 37
Configuring Mobile and Remote Access on Expressway

Importing the SAML Metadata from the IdP

1. On the Expressway-C, go to Configuration > Unified Communications > Identity providers (IdP).
   You only need to do this on the primary peer of the cluster.
2. Click Import new IdP from SAML.
3. Use the Import SAML file control to locate the SAML metadata file from the IdP.
4. Set the Digest to the required SHA hash algorithm.
   The Expressway uses this digest for signing SAML authentication requests for clients to present to the IdP. The
   signing algorithm must match the one expected by the IdP for verifying SAML authentication request signatures.
5. Click Upload.
   The Expressway-C can now authenticate the IdP’s communications and encrypt SAML communications to the
   IdP.
   
   **Note:** You can change the signing algorithm after you have imported the metadata, by going to Configuration
   > Unified Communications > Identity Providers (IdP), locating your IdP row then, in the Actions column,
   clicking Configure Digest).

Associating Domains with an IdP

You need to associate a domain with an IdP if you want the MRA users of that domain to authenticate through the
IdP. The IdP adds no value until you associate at least one domain with it.

There is a many-to-one relationship between domains and IdPs. A single IdP can be used for multiple domains, but
you may associate just one IdP with each domain.

**On the Expressway-C:**

1. Open the IdP list (Configuration > Unified Communications > Identity providers (IdP)) and verify that your IdP
   is in the list.
   The IdPs are listed by their entity IDs. The associated domains for each are shown next to the ID.
2. Click Associate domains in the row for your IdP.
   This shows a list of all the domains on this Expressway-C. There are checkmarks next to domains that are
   already associated with this IdP. It also shows the IdP entity IDs if there are different IdPs associated with
   other domains in the list.
3. Check the boxes next to the domains you want to associate with this IdP.
   If you see (Transfer) next to the check box, checking it breaks the domain’s existing association and
   associates the domain with this IdP.
4. Click Save.
   The selected domains are associated with this IdP.

Exporting the SAML Metadata from the Expressway-C

From X12.5, Cisco Expressway supports using a single, cluster-wide metadata file for SAML agreement with an IdP.
Previously, you had to generate metadata files per peer in an Expressway-C cluster (for example, six metadata files
for a cluster with six peers). Now, both cluster-wide and per-peer modes are supported. The settings are on
Configuration > Unified Communications > Configuration > SAML Metadata. For the cluster-wide mode, export the
metadata file from the primary peer for the SAML agreement. You must not export it from the other peers. If you
change the primary peer for any reason, you must again export the metadata file from the new primary peer, and then
reimport the metadata file to the IdP. Additionally for the cluster-wide mode, you must generate a self-signed
certificate. The certificate is distributed among the peers for verifying SAML responses from the IdP. The metadata
file exported from this cluster contains the public key of this certificate. The IdP uses the public key to sign the SAML
responses.
Configuring Mobile and Remote Access on Expressway

Note: The Expressway-C must have a valid connection to the Expressway-E before you can export the Expressway-C’s SAML metadata.

1. Go to Configuration > Unified Communications > Configuration.
2. In MRA Access Control section, choose a mode from the SAML Metadata list:
   - Cluster: Generates a single cluster-wide SAML metadata file. You must import only this file to an IdP for the SAML agreement.
   - Peer: Generates the metadata files for each peer in a cluster. You must import each metadata file to IdP for the SAML agreement. The Peer option is selected by default when Expressway is upgraded from an earlier SAML SSO enabled release to 12.5.

Note: For new deployments, the SAML Metadata mode always defaults to Cluster.

Note: For existing deployments, the mode defaults to Cluster if SAML SSO was disabled in your previous Expressway release, or to Peer if SAML SSO was previously enabled.

3. Click Export SAML data.
   This page lists the connected Expressway-E, or all the Expressway-E peers if it’s a cluster. These are listed because data about them is included in the SAML metadata for the Expressway-C.

4. If you choose Cluster for SAML Metada, click Generate Certificate.

5. Do the following:
   - On cluster-wide mode, to download the single cluster-wide metadata file, click Download.
   - On per-peer mode, to download the metadata file for an individual peer, click Download next to the peer. To export all in a .zip file, click Download All.

6. Copy the resulting file(s) to a secure location that you can access when you need to import SAML metadata to the IdP.

Configuring IdPs
This topic covers any known additional configurations that are needed when using a particular IdP for OAuth token-based authorization over MRA.

These configuration procedures are required in addition to the prerequisites and high level tasks already mentioned, some of which are outside of the document’s scope.

Active Directory Federation Services 2.0
After creating Relying Party Trusts for the Expressway-Es, you must set some properties of each entity, to ensure that AD FS formulates the SAML responses as Expressway-E expects them.

You also need to add a claim rule, for each relying party trust, that sets the uid attribute of the SAML response to the AD attribute value that users are authenticating with.

These procedures were verified on AD FS 2.0, although the same configuration is required if you are using AD FS 3.0. You need to:

- Sign the whole response (message and assertion)
- Add a claim rule to send identity as uid attribute

To sign the whole response:
In Windows PowerShell®, repeat the following command for each Expressway-E’s <EntityName>:

Set-ADFSRelyingPartyTrust -TargetName "<EntityName>" -SAMLResponseSignature MessageAndAssertion
To add a claim rule for each Relying Party Trust:

1. Open the Edit Claims Rule dialog, and create a new claim rule that sends AD attributes as claims
2. Select the AD attribute to match the one that identify the OAuth users to the internal systems, typically email or SAMAccountName
3. Enter uid as the Outgoing Claim Type
Using Deployments to Partition Unified Communications Services

A deployment is an abstract boundary used to enclose a domain and one or more Unified Communications service providers (such as Unified CM, Cisco Unity Connection, and IM and Presence Service nodes). The purpose of multiple deployments is to partition the Unified Communications services available to Mobile and Remote Access (MRA) users. So different subsets of MRA users can access different sets of services over the same Expressway pair.

We recommend that you do not exceed ten deployments.

Example

Consider an implementation of two sets of Unified Communications infrastructure to provide a live MRA environment and a staging environment, respectively. This implementation might also require an isolated environment for sensitive communications, as a third set.

Figure 7  Multiple deployments to partition Unified Communications services accessed from outside the network

Deployments and their associated domains and services are configured on the Expressway-C.

One primary deployment (called “Default deployment” unless you rename it) automatically encloses all domains and services until you create and populate additional deployments. This primary deployment cannot be deleted, even if it is renamed or has no members.

To partition the services that you provide through Mobile and Remote Access, create as many deployments as you need. Associate a different domain with each one, and then associate the required Unified Communications resources with each deployment.

You cannot associate one domain with more than one deployment. Similarly, each Unified Communications node may only be associated with one deployment.

To create a new deployment:

1. Log in to the Expressway-C.
2. Go to Configuration > Unified Communications > Deployments and click New.
3. Give the deployment a name and click **Create deployment**.
   The new deployment is listed on the **Deployments** page and is available to select when editing domains or UC services.

**To associate a domain with a deployment:**

1. Go to **Configuration > Domains**.
   The domains and their associated services are listed here. The deployment column shows where the listed domains are associated.
2. Click the domain name, or create a new domain.
3. In the **Deployment** field, select the deployment which will enclose this domain.
4. Click **Save**.

**To associate a Unified CM or other server/service with the deployment:**

1. Go to **Configuration > Unified Communications > Unified CM servers**, or **IM and Presence Service nodes**, or **Unity Connection servers**.
   Any previously discovered service nodes of the selected type are listed here. The deployment column shows where the listed nodes are associated.
   If the list is not properly populated, see Discover Unified Communications Servers and Services for Mobile and Remote Access, page 32.
2. Click the server / service node name.
3. In the **Deployment** field, select which deployment will enclose this server / service node.
4. Click **Save**.
   **Note:** When you save this change, the Expressway-C refreshes the connection to the node, which may temporarily disrupt the service to the connected users.
5. Repeat for any other Unified Communications services that will belong to the deployment.
Dial via Office–Reverse through MRA

Mobile workers need the same high quality, security and reliability as when they place calls in the office. You can assure them of that when you enable the Dial via Office–Reverse (DVO–R) feature and they are using Cisco Jabber on a dual-mode mobile device. DVO–R routes Cisco Jabber calls through the enterprise automatically.

DVO–R handles call signaling and voice media separately. Call signaling, including the signaling for Mobile and Remote Access on Expressway, traverses the IP connection between the client and Cisco Unified Communications Manager. Voice media traverses the cellular interface and hairpins at the enterprise Public Switched Telephone Network (PSTN) gateway. Moving audio to the cellular interface ensures high-quality calls and securely maintained audio even when the IP connection is lost.

You can configure DVO–R so that, when a user makes a call, the return call from Cisco Unified Communications Manager goes to either:

- The user’s Mobile Identity (mobile number).
- An Alternate Number for the user (such as a hotel room).

Prerequisites

This feature is dependent on the following versions of related systems:

- Cisco Unified Communications Manager 11.0(1) or later
- Cisco Jabber 11.1 or later

Call flows

Figure 8  DVO–R calling
Dial via Office-Reverse through MRA

Figure 9  DVO-R using Mobility Identity

Figure 10  DVO-R using Alternate Number
Built-in-Bridge Recording through MRA

How DVO-R works with Expressway Mobile and Remote Access

1. When you dial a number, a signal is sent to Cisco Unified Communications Manager over the IP path (WLAN or mobile network). See stage 1 of Figure 2 or Figure 3.
2. Cisco Unified Communications Manager calls your mobile number or the Alternate Number you set (see stage 2 of Figure 2 or Figure 3.)
3. When you answer, Cisco Unified Communications Manager extends the call to the number you dialed and you hear ring back (see stage 3 of Figure 2 or Figure 3).
4. When the person answers, the ongoing call is hairpinned at the enterprise PSTN gateway.
   - If you made the call using a Mobile Identity, your call is anchored at the enterprise gateway. The call is active on your mobile and desk phone, so you can switch between the two (see stage 4 of Figure 2).
   - If you specified an Alternate Number, your ongoing call is not anchored and you cannot pick up on your desk phone (see stage 4 of Figure 3).

Notes:

- You can use Dual Tone Multi Frequency-based (DTMF) mid-call features (for example *81 for hold) on anchored calls if there is out-of-band DTMF relay between the PSTN gateway and Cisco Unified Communications Manager. You cannot utilize mid-call features when using an Alternate Number.
- To prevent the callback leg from Cisco Unified Communications Manager routing to your voicemail – thus stopping the voicemail call going through to the person you are dialing – Cisco recommends that you set your DVO-R voicemail policy to ‘user controlled’. This ensures you must generate a DTMF tone by pressing any key on the keypad before your call can proceed.

Note: Although this feature now works for users calling over Mobile and Remote Access, there is no configuration on the Expressway. There is some configuration required on the Unified CM nodes and Cisco Jabber clients.

Configuration checklist for DVO-R

1. Set up Cisco Unified Communications Manager to support DVO-R.
2. Set up DVO-R for each device.
3. Set up user-controlled voicemail avoidance.

More information


Built-in-Bridge Recording through MRA

The Expressway supports Built-in-Bridge (BiB) recording over MRA. This feature can help organizations to comply with the phone recording requirements of the European Union’s Markets in Financial Instruments Directive (MiFID II).

How it works

BiB can be used to record the audio portion of calls that are made or received by users working off-premises.

- BiB is always enabled on the Expressway.
- BiB is configurable on Cisco Unified Communications Manager. When BiB is enabled, Unified CM forks the call to and from the endpoint to a media recording server.

Bandwidth and call capacity impacts

If you plan to use this feature, be aware that it has significant impact on bandwidth and call capacity.
It requires additional network bandwidth to be provisioned. Details are provided in the Cisco Collaboration System 12.x Solution Reference Network Designs (SRND), section Capacity Planning for Monitoring and Recording. Enabling BiB for MRA endpoints typically needs double bandwidth as, assuming both sides of the call are recorded, each BiB-enabled call consumes double the usual bandwidth.

Enabling BiB on MRA endpoints reduces the overall call capacity of Expressway nodes down to approximately one-third of their original capacity. This is because each call that is being recorded has two additional SIP dialogs associated with it (so essentially equivalent to three calls).

Prerequisites

BiB over MRA requires the following components, or later:

- Any compatible clients:
  - Cisco Jabber for Windows 11.9
  - Cisco Jabber for Mac 11.9
  - Cisco Jabber for iPhone and iPad 11.9
  - Cisco Jabber for Android 11.9
  - Cisco IP Phone 7800 Series or 8800 Series devices which support MRA (not all these phones are MRA-compatible)
    The 7800/8800 Series phones which currently support MRA are listed in the "Prerequisites" section of this guide, or ask your Cisco representative for details.
- Registrar/call control agent: Cisco Unified Communications Manager 11.5(1)SU3
  BiB is not supported on Expressway-registered endpoints.
- Edge traversal: Expressway X8.11.1
- Recording server: Out of scope for this document. (Information about configuring recording for Cisco Unified Communications Manager is available in the Feature Configuration Guide for Cisco Unified Communications Manager.)

How to configure BiB over MRA

1. Verify that the BiB recording system in the Unified CM works correctly, before you configure BiB for MRA.
2. Make sure that the prerequisites listed above are in place.
3. SIP Path headers must be enabled on Cisco Expressway-C:
   a. On the Cisco Expressway-C, go to Configuration > Unified Communications > Configuration.
   b. Set SIP Path headers to On.

Note: The default Cisco Expressway-C behavior is to rewrite the Contact header in REGISTER messages. When you turn SIP Path headers on, Cisco Expressway-C does not rewrite the Contact header, but adds its address into the Path header instead.
Enabling Support for Apple Push Notifications (APNS)

This feature applies if you have Cisco Jabber users with iOS devices (Cisco Jabber for iPhone and iPad) who sign in remotely. Expressway deployments that are configured for MRA can support Apple’s cloud-based Push Notification Service (APNS). From X8.9.1, we supported Push Notifications for IM and Presence Service instant messages. From X8.10, we support them for voice and video calls too. Push Notifications are only used for Jabber for iPhone and iPad clients. Android, Windows, and Mac users are unaffected.

Note: If Unified CM detects a remote or mobile Jabber for iPhone and iPad connection, it always sends a Push Notification as well as a SIP Invite.

Prerequisites and recommendations

No specific configuration is needed on the Expressway for Push Notifications, assuming Expressway-E is already providing Mobile and Remote Access (MRA) for Jabber iOS devices. However, these prerequisites and recommendations apply:

- Push Notifications in the Expressway require a network connection between Expressway and the Cisco WebEx cloud, and between Cisco Jabber and the Push Notification servers in the Apple cloud. They cannot work in a private network, with no internet connection.
- Expressway is already providing Mobile and Remote Access for Jabber for iPhone and iPad. MRA must be fully configured (domain, zone, server settings).
- Depending on your Unified CM configuration, the Unified CM may need a forward proxy to send Push Notifications to the Cisco Collaboration Cloud.
- We recommend using self-describing token authorization.
- Expressway-E restart required for Push Notifications with instant messages. After you enable Push Notifications on the IM and Presence Service you need to restart the Expressway-E. Until the restart, Expressway-E can’t recognize the push capability on IM and Presence Service, and does not send PUSH messages to the Jabber clients.
- You need the following Push Notification-enabled software versions, or later:
  - Expressway X8.10.1 (preview status only in X8.10)
  - Cisco Jabber iOS 11.9
  - Cisco Unified Communications Manager 11.5(SU3)
  - Cisco Unified Communications Manager IM and Presence Service 11.5(SU3)
  - Cisco Unity Connection 11.5(SU3)

Why have we implemented support for Push Notifications?

Apple now deprecates the VoIP Background Mode that allows Jabber iOS to keep a SIP session open even when the app is running in the background. Push Notifications allow Unified CM to tell Jabber about incoming calls and messages. Then Jabber can reconnect to Unified CM to retrieve the message or answer the call. Jabber uses the new self-describing token feature in this release to help it to do this quickly.
Enabling Support for Apple Push Notifications (APNS)

Information about Push Notifications in Unified Communications products

For information about Push Notifications in Unified CM and IM and Presence Service, see Deploying Push Notifications for Cisco Jabber on iPhone and iPad available from the Cisco Unified Communications Manager documentation pages on Cisco.com.

Process to use Apple Push Notifications in Expressway

1. Configure OAuth token validation on the Expressway (see Configuring MRA Access Control, page 37).
2. Unified CM must be able to make HTTPS connections to Cisco’s cloud services. To allow that you may have to configure Unified CM to use a forward proxy server (depending on your requirements for external requests from iOS devices).

CAUTION: Although the built-in forward proxy is in the Expressway interface, it is not currently supported and it should not be used.
ICE Passthrough for Media Optimization

From X12.5, we support Interactive Connectivity Establishment (ICE) passthrough to allow MRA-registered endpoints to pass media directly between endpoints by bypassing the WAN and the Cisco Expressway Series.

ICE passthrough can be used with the currently supported MRA features. See Key Supported and Unsupported Features with Mobile and Remote Access, page 15 section for more information on supported MRA features.

This feature uses the ICE protocol (RFC 5245). Background information about ICE is provided in About ICE and TURN Services in the Cisco Expressway Administrator Guide on the Maintain and Operate Guides page.

How ICE Passthrough Works

Before Expressway X12.5, ICE is supported only with the Expressway-C B2BUA as one of the ICE endpoints. When B2BUA acts as an endpoint, ICE candidates are negotiated between the endpoints and B2BUA. Therefore the media always traverses through Expressway-E and Expressway-C.

The following figure shows the MRA call without ICE passthrough. The media traverses through both the Expressway-E and the Expressway-C.

**Figure 12 MRA Call Flow without ICE Passthrough**

With ICE passthrough introduced in Expressway X12.5, each endpoint can pass the ICE candidates to the other endpoint through zones that traverse the SIP signaling. As a result, endpoints use the ICE protocol to negotiate the most optimal path for media. The most optimal path may be one of the following:

- **Host address**: Represents the host IP address of the endpoint which is behind the NAT device.
- **Server-reflexive address**: Represents the publicly accessible address of the endpoint on the NAT device.
- **Relay address**: Represents the relay address of the endpoint configured on the TURN server.

In all ICE passthrough calls, initially media traverses through the Expressway E and Expressway C and then switches the media path depending on the negotiated ICE candidate type. This ensures that if endpoints are not ICE-capable, Expressway can use the legacy traversal path to pass media without disruption.

The following figure shows the MRA call with ICE passthrough. The media directly passes between the endpoints using the Host address, because the endpoints reside in the same network with no firewall between them.
The following figure shows the MRA call with ICE passthrough where endpoints are behind a firewall. The media passes between the endpoints using Server-reflexive addressing, because the endpoints are behind different firewalls.

In cases where the Host and Server-reflexive addresses cannot negotiate successfully, like deployments with a symmetric NAT, endpoints can utilize TURN Relay as the ICE optimized media path. The following figure shows endpoints using the Relay address of the Expressway TURN server to send media between endpoints.
ICE Passthrough for Media Optimization

**Figure 15  MRA Call Flow with ICE Passthrough (using Relay Address)**

Supported Deployments

**Expressway-based Deployments**
Currently, ICE passthrough support exists only on MRA deployments. It is not tested and supported on the following service deployments:

- Cisco Webex Hybrid Services
- Jabber Guest
- Microsoft Gateway
- Collaboration Meeting Rooms (CMR) Cloud
- Business to Business Calling

**HCS Deployments**
ICE passthrough can be used to optimize the media path of the MRA calls in the following HCS deployment types:

- HCS Shared Architecture
- HCS Dedicated Server and HCS Dedicated Instance
- Customer-owned Collaboration Architecture

*Note*: HCS Contact Center does not support ICE passthrough.

Supported Components

- HCS 11.5 or later
- Cisco Unified Communications Manager (Unified CM) 11.5 or later
- Expressway-C and Expressway-E X12.5 or later

Supported Endpoints

The following ICE-capable endpoints can send media directly to each other when they are MRA-registered and ICE passthrough is enabled:
ICE Passthrough for Media Optimization

- Cisco Jabber clients, version 12.5 or later subject to using Cisco Unified Communications Manager 12.5 or later
- Cisco IP Phone 8800 Series, version 12.5 or later
- Cisco IP Phone 7800 Series, version 12.5 or later
- Cisco TelePresence DX, MX, SX Series, CE version 9.6.1 or later
Configuring ICE Passthrough

This section summarizes the steps to configure the following MRA components for ICE passthrough:

- Cisco Unified Communications Manager (Unified CM)
- Expressway-C
- Expressway-E

Prerequisites

Before you start, make sure the following conditions are in place:

- Standard MRA configuration is done on Unified CM, Expressway-C, and Expressway-E.
- Endpoints are registered using MRA, and can make calls.

Set Up Unified CM for ICE Passthrough

The following steps summarize the configuration required on the Unified CM:

2. Create a phone security profile with encrypted TLS and associate with the endpoints. See Apply Phone Security Profile with Encrypted TLS on Endpoints, page 65.
3. Create a common phone profile with the configuration required for ICE Passthrough and associate with the endpoints. See Apply Common Phone Profile with ICE Configuration on Endpoints, page 66.

Verify the Unified CM Cluster Security Mode

The ICE MRA call path must be encrypted end-to-end. See Encrypt the Signaling Path Between Expressway-C and Unified CM, page 68 for details. From release 12.5, Cisco Unified CM is in Secure mode by default.

If you deploy an earlier version of Unified CM, you must place the Unified CM cluster in Mixed mode. You cannot change the Unified CM security mode from Cisco Unified CM Administration. To change the security mode, use the Cisco CTL Client or the `utils ctl` CLI command, as follows:

- To use the Cisco CTL client to set the cluster security mode to Mixed mode, see the Update Cisco Unified Communications Manager Security Mode section in the Security Guide for Cisco Unified Communications Manager on the Maintain and Operate Guides page.
- To use the `utils ctl` CLI command to set the cluster security mode to Mixed mode, see the `utils ctl` section in the Command Line Interface Reference Guide for Cisco Unified Communications Solutions on the Maintain and Operate Guides page.

Note: A new license key is required on Unified CM for Mixed mode. You can order this license through Product Upgrade Tool (PUT) tool and install the license on Unified CM.

Apply Phone Security Profile with Encrypted TLS on Endpoints

1. Create a phone security profile (`System > Security > Phone Security Profile`) with encrypted TLS for endpoints participating in ICE. Ensure that the following settings are configured in the phone security profile:
   - **Device Security Mode** is set to *Encrypted*.
   - **Transport Type** is set to *TLS*.

Caution: If endpoints are not configured with secure mode, ICE Passthrough calls fail even if ICE is configured on the endpoints.
ICE Passthrough for Media Optimization

2. Associate the phone security profile with the endpoints participating in ICE.
3. Verify that the endpoints can register over MRA with the phone security profile and make calls.

For more information on how to create and associate phone security profile to the endpoints, see the Security Guide for Cisco Unified Communications Manager on the Maintain and Operate Guides page.

Apply Common Phone Profile with ICE Configuration on Endpoints

1. Create a common phone profile (Device > Device Settings > Common Phone Profile > Standard Common Phone Profile) with the following ICE configuration under Interactive Connectivity Establishment (ICE):
   - ICE: Choose Enabled so that endpoints can support ICE calls.
   - Default candidate type: Choose Host. The host address is signaled in the initial endpoint Session Description Protocol (SDP) offer or answer.
     Note: For ICE for MRA calls, we do not support Relay as a default candidate type.
   - Server Reflexive Address: Choose Enabled so that the endpoints include server reflexive candidates in the initial SDP offer or answer.
   - Primary TURN Server Host Name or IP Address: Enter the FQDN of the first Expressway-E node in the MRA Expressway cluster.
   - Secondary TURN Server Host Name or IP Address: Enter the FQDN of the second Expressway-E node in the MRA Expressway cluster.
     Note: Endpoints currently ignore the secondary TURN server.
   - TURN Server Transport Type: Choose Auto.
   - TURN Server Username: Enter the user ID configured on the Expressway-E TURN server.
   - TURN Server Password: Enter the password configured on the Expressway-E TURN server.

2. Go to Device > Phone and associate the endpoints with the common phone profile.
   Note: Currently, you must manually configure the ICE on the endpoints running Collaboration Edge (CE) software.

Set Up Expressway-C for ICE Passthrough

The following steps summarize the configuration required on Expressway-C:

1. Generate a new CSR and install appropriate server certificates and trusted CA certificates on Expressway-C. See Install Server Certificates, page 66.
2. Change the existing CEtcp neighbor zone to CEtls neighbor zones. See Change CEtcp Neighbor Zones to CEtls Neighbor Zones, page 67.
3. Set up the UC Traversal Zone. See Set Up the UC Traversal Zone for ICE Passthrough Support, page 67.
4. Set up the UC Neighbor Zone. See Set Up the UC Neighbor Zone for ICE Passthrough Support, page 67.

Install Server Certificates

1. Generate a new CSR for the server certificate (Maintenance > Security > Server Certificate). For more information, see Generating a certificate signing request (CSR) section in the Cisco Expressway Administrator Guide on the Maintain and Operate Guides page.
2. While generating the CSR, include the name of the phone security profile that you have associated with the endpoints in the Subject Alternate Names (SAN). For more information, see Server Certificate Requirements for Unified Communications, page 26.
3. Install the server certificate that is signed from the trusted certificate authority on Expressway-C
ICE Passthrough for Media Optimization

This certificate allows the endpoints using the phone security profile to register over the TLS connection between Expressway-C and Unified CM.

Change CEtcp Neighbor Zones to CEtls Neighbor Zones

**Note:** Ensure that Unified CM is in Secure mode.

On Expressway-C, change the existing CEtcp neighbor zones that are already configured for MRA to CEtls neighbor zones.

1. Go to **Configuration > Unified Communications > Unified CM servers**.
2. Select the Unified CM Servers that you already discovered, and click **Refresh Servers** to update the configuration.
3. Verify that the Unified CM status shows **TLS: Active**.

If there is not already a CEtcp neighbor zone created for MRA, discover new Unified CM servers (Configuration > Unified Communications > Unified CM servers). See Discover Unified Communications Servers and Services for Mobile and Remote Access, page 32 section for more information.

Expressway-C automatically generates non-configurable CEtls neighbor zones between itself and each discovered Unified CM node if Unified CM node cluster is in Secure mode. For more information, see Automatically Generated Zones and Search Rules, page 36.

Set Up the UC Traversal Zone for ICE Passthrough Support

1. In Expressway-C, go to **Configuration > Zones > Zones**.
2. Choose the Unified Communications traversal zone to Expressway-E.
3. In the SIP pane, set **ICE Passthrough support** to **On** and **ICE Support** to **Off**.

**Note:** ICE Passthrough support takes precedence over ICE Support. Best practice is to turn on ICE Passthrough support and turn off ICE support.

Set Up the UC Neighbor Zone for ICE Passthrough Support

1. In Expressway-C, go to **Configuration > Unified Communications > Unified CM Servers**.
2. Choose a server.
3. In the Unified CM server lookup pane, set **ICE Passthrough support** to **On**.

Use CLI to Configure ICE Passthrough on Expressway Zones

The ICE Passthrough option in Expressway is a per-zone setup. You must enable ICE Passthrough on each Unified Communication traversal client zone and CEtls neighbor zone.

You can use the CLI, instead of the web interface, to configure zones for ICE Passthrough.

1. Go to **Configuration > Zones** and click the United CM Traversal zone to Expressway-E.
2. In the URL, note the ID of the zone. For example, in the following URL, 4 is the zone ID:
   ```
   https://expressway.example.com/editzone?id=4
   ```
3. Repeat steps 1 and 2 for the CEtls neighbor zone.
4. Log in to the CLI of the Expressway-C as administrator.
5. Run the following command to enable ICE Passthrough on Unified Communication traversal client zone:
   ```
   Configure Zones Zone <Unified Communication Traversal client zone ID> TraversalClient SIP Media ICEPassThrough Support: On
   ```
6. Run the following command to enable ICE Passthrough on the CEItls neighbor zone:

```
xConfiguration Zones Zone <CEItls Neighbor zone ID> Neighbor SIP Media ICEPassThrough Support: On
```

Set Up Expressway-E as TURN Server

You can use the Expressway-E server where the TURN server is running to allocate relay address and to retrieve the server reflexive address. This is typically an Expressway-E in the cluster used for MRA, but it is not required to be an Expressway-E server. You can use any compliant TURN server.

The following steps summarize the configuration required on the Expressway-E TURN server:

1. Configure the TURN server (Configuration > Traversal > TURN) with the following settings:
   - **TURN services**: Set to On.
   - **TCP 443 TURN service**: Set to Off.
   - **TURN port multiplexing**: Set to Off. This option is available only on Large system.
   - **TURN requests port**: Retain the default values. On Small and Medium systems, the default port is 3478. On Large systems, the default port range is 3478 to 3483.
     
     **Note**: On a Large system, the **TURN request port** field is available only if **TURN port multiplexing** is set to On.
   - **TURN requests port range start**: Retain the default values.
   - **TURN requests port range end**: Retain the default values.
     
     **Note**: The **TURN requests port range start** and **TURN requests port range end** options are available only on Large systems and if **TURN port multiplexing** is set to Off.
   - **Delegated credential checking**: Retain the default values.
   - **Authentication realm**: Retain the default value. The default value is TANDBERG.
   - **Media port range start**: Retain the default value. The default value is 24000.
   - **Media port range end**: Retain the default value. The default value is 29999.

2. Configure the credentials (Configuration > Authentication > Devices > Local database) for TURN clients to authenticate with the TURN server.

3. Click **Save**.

4. Verify if the TURN server status is changed to **Active** under TURN server status.

For more information on the steps to configure TURN services on Expressway-E, see Configuring TURN Services section in the Cisco Expressway Administrator Guide on the Maintain and Operate Guides page.

Encrypt the Signaling Path Between Expressway-C and Unified CM

Security and encryption are important factors when considering direct endpoint-to-endpoint messaging. Because MRA endpoints are sending signaling and media over the internet, they are forced to operate in encrypted mode. In normal MRA mode (without ICE), encryption is always required between the endpoint and the Expressway-C but optional between the Expressway-C and Unified CM. This is possible because the Expressway-C can terminate the media stream and decrypt the packets if the internal leg is unencrypted.

The following figure shows the encryption without ICE Passthrough where encryption is forced between MRA endpoints and Expressway-C, and optional in the internal network. On an MRA call, a different encryption key is exchanged on each leg (Key 1 and Key 2), and the Expressway-C decrypts and re-encrypts the media between the 2 legs. The invite to Unified CM does not need a key if the internal leg is not encrypted.
However, with ICE passthrough mode, the endpoints must be able to exchange their crypto keys end-to-end because the media packets are sent to each other directly and not through the Expressway-C. Whenever crypto keys are included in a SIP message, the message must be sent over TLS to protect the key. Because the SIP signaling path must be encrypted end-to-end to send the crypto keys end-to-end, the internal leg between the Expressway-C and Unified CM must be encrypted. If the signaling path is unencrypted, the crypto keys are dropped during call setup.

The following figure shows the encryption required with ICE Passthrough where the signaling leg between the Expressway-C and Unified CM is also encrypted.
Working with ICE Passthrough Metrics

This section describes how to work with metrics for ICE passthrough in Expressway:

- View ICE Passthrough Metrics in Expressway-C
- Use the collectd Daemon to Gather Metrics
- View Call Types in the Call History
- Bandwidth Manipulation

View ICE Passthrough Metrics in Expressway-C

In Expressway-C, you can view metrics data for completed ICE passthrough calls. Various metrics are available for each server that is configured to route ICE passthrough calls. Values are updated once every 24 hours.

To access ICE passthrough metrics, in Expressway-C, go to Status > ICE Passthrough metrics.

Figure 18  ICE Passthrough Metrics
ICE Passthrough for Media Optimization

- The Peer field shows the IP address or hostname of each node.
- The most recent 24-hour interval of data is shown.
- Each peer address is a link that takes you to the history for that node.
- The interval start time reflects the time of day of the most recent server restart.
- Each column shows information for a separate cluster.

**Page layout**

The page is organized into these sections:

- **Metrics.** For each peer, the time interval for which metrics are shown. For this interval, the number of B2BUA connected calls, the number of ICE calls, and the percentage of ICE vs total B2BUA calls. N/A values result when no ICE calls were processed during this 24-hour interval.
- **Call types.** For each call type, the percentage of placed ICE calls with each call type.
- **Advanced.** Other metrics that can help with troubleshooting.

**User functions**

For a detailed description of any field, click the “i” icon next to the field name.

To sort, click a column name and then the Up or Down arrow, to sort the data by that column.

Click **Export to CSV** to create a spreadsheet of the values on the page you are displaying.

**Display history values for a cluster**

Click the IP address or hostname for a cluster to display the **ICE Call Metrics History** page, which shows a history of values for that cluster.

- Each column shows a separate parameter.
- Each row shows the values for a different interval, with the most recent shown first.
- Each value is a raw value, not a percentage.
- The page can display up to 60 records (that is, the 60 most recent 24-hour intervals).

**Use the collectd Daemon to Gather Metrics**

As an alternative to viewing metrics for ICE passthrough calls, you can use the **collectd** daemon to gather the metrics. Details about setting up the server for collection are in the **Cisco Expressway Serviceability Guide** on the **Expressway Maintain and Operate Guides** page, in the **Introducing System Metrics Collection** section.

**View Call Types in the Call History**

For ICE passthrough calls, the call type is shown in the call history.

1. In Expressway-C, navigate to **Status > Calls > History**.
2. Click the value in the **Start time** column to view the call detail record (CDR). Or choose View in the **Actions** column.
3. Examine the value in the **ICE Passthrough call type** field. Possible values are:
   - *none*: Indicates optimized media path was not used for the call. The call is processed and connected using Expressway B2BUA.
   - *host_to_host*: Indicates optimized media path for the call was established using the host addresses of the endpoints.
   - *host_to_srvfix*: Indicates optimized media path for the call was established between the host address of one of the endpoints and the server-reflexive address of the other endpoint.
   - *host_to relay*: Indicates optimized media path for the call was established between the host address of one of the endpoints and the TURN relay address of the other endpoint.
   - *srvfix_to_srvfix*: Indicates optimized media path for the call was established using the server-reflexive addresses of the endpoints..
   - *srvfix_to relay*: Indicates optimized media path for the call was established between the server-reflexive address of one of the endpoints and the TURN relay address of the other endpoint.
   - *relay_to relay*: Indicates optimized media path for the call was established using the relay addresses of the endpoints.

4. (Optional) To view the details of the B2BUA call leg, choose the call leg that shows the B2BUA type in the **Call components** section.

**Bandwidth Manipulation**

When ICE is negotiated, media moves off the Expressway, which results in a reduction in media bandwidth. When the **Status > Bandwidth > Links** page displays current bandwidth, the total current usage reflects less utilization when ICE is in use.

**Note:** Bandwidth usage does not include the bandwidth that the TURN server uses.
Activation Code Onboarding through MRA

Although this feature is in the Cisco Expressway Series from X12.5, it has external software dependencies and cannot currently be used until these dependencies are satisfied and the feature is fully implemented in the solution.

This feature optionally allows MRA-compliant devices to easily and securely register over MRA using an activation code. It's enabled with the Allow activation code onboarding setting on the Configuration > Unified Communications > Configuration page.

Onboarding with an activation code requires mutual TLS (mTLS) authentication. TLS is automatically enabled or disabled on the MRA port 8443, depending on whether onboarding with an activation code is enabled or disabled.

Existing deployments need to refresh CUCMs before this feature can be used

If you have upgraded an existing Expressway from an earlier release than X12.5, refresh the currently configured Unified CMs on Expressway before you use this feature. To do this, go to Unified Communications > Configuration, select all the configured Unified CMs and click Refresh. This task is not necessary for any Unified CMs that you add later.
Additional Information

This section contains miscellaneous information about using MRA with Expressway.

Maintenance Mode on the Expressway

Maintenance mode on the Expressway has been enhanced so that you can bring an MRA system down in a managed way.

When you engage maintenance mode, the Expressway stops accepting new calls or proxy (MRA) traffic. Existing calls and chat sessions are not affected.

As users end their sessions normally, the system comes to a point when it is not processing any traffic of a certain type, and then it shuts that service down.

If users try to make new calls or start new chat sessions while the Expressway is in maintenance mode, the clients will receive a service unavailable response, and they might then choose to use another peer (if they are capable). This fail-over behavior depends on the client, but restarting the client should resolve any connection issues if there are active peers in the cluster.

The Unified Communications status pages also show (Maintenance Mode) in any places where MRA services are affected.

<table>
<thead>
<tr>
<th>Status</th>
<th>System</th>
<th>Configuration</th>
<th>Applications</th>
<th>Users</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unified Communications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unified Communication</td>
<td>Enabled</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CM registrations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HTTP proxy service</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port forwarding mesh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provisioning server</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XMPR router</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>IM and Presence Service</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HTTP proxy service</td>
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<tr>
<td>Port forwarding mesh</td>
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<tr>
<td>Provisioning server</td>
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<tr>
<td>XMPP Federation</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Single Sign-On support</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Maintenance mode:** Maintenance mode is not supported over MRA for endpoints running CE software. The Expressway drops MRA calls from these endpoints when you enable maintenance mode.

Unified CM Dial Plan

The Unified CM dial plan is not impacted by devices registering via Expressway. Remote and mobile devices still register directly to Unified CM and their dial plan will be the same as when it is registered locally.

Deploying Unified CM and Expressway in Different Domains

Unified CM nodes and Expressway peers can be located in different domains. For example, your Unified CM nodes may be in the enterprise.com domain and your Expressway system may be in the edge.com domain.

In this case, Unified CM nodes must use IP addresses or FQDNs for the **Server host name / IP address** to ensure that Expressway can route traffic to the relevant Unified CM nodes.

Unified CM servers and IM&P servers must share the same domain.
SIP Trunks Between Unified CM and Expressway-C

Expressway deployments for Mobile and Remote Access do not require SIP trunk connections between Unified CM and Expressway-C. Note that the automatically generated neighbor zones between Expressway-C and each discovered Unified CM node are not SIP trunks.

However, you may still configure a SIP trunk if required. (For example, to enable B2B callers or endpoints registered to Expressway to call endpoints registered to Unified CM.)

If a SIP trunk is configured, you must ensure that it uses a different listening port on Unified CM from that used for SIP line registrations to Unified CM. An alarm is raised on Expressway-C if a conflict is detected.

Configuring line registration listening ports on Unified CM

The listening ports used for line registrations to Unified CM are configured via System > Cisco Unified CM.

The SIP Phone Port and SIP Phone Secure Port fields define the ports used for TCP and TLS connections respectively and are typically set to 5060/5061.

Configuring SIP trunk listening ports

The ports used for SIP trunks are configured on both Unified CM and Expressway.

On Unified CM:

1. Go to System > Security > SIP Trunk Security Profile and select the profile used for the SIP trunk.
   If this profile is used for connections from other devices, you may want to create a separate security profile for the SIP trunk connection to Expressway.
2. Configure the Incoming Port to be different from that used for line registrations.
3. Click Save and then click Apply Config.

On Expressway:

1. Go to Configuration > Zones > Zones and select the Unified CM neighbor zone used for the SIP trunk.
   (Note that the automatically generated neighbor zones between Expressway-C and each discovered Unified CM node for line side communications are non-configurable.)
2. Configure the SIP Port to the same value as the Incoming Port configured on Unified CM.
3. Click Save.

See Cisco TelePresence Cisco Unified Communications Manager with Expressway (SIP Trunk) Deployment Guide for more information about configuring a SIP trunk.

See Configuring OAuth with Refresh (Self-Describing) on Unified CM SIP Lines, page 42 for information about OAuth-based authorization on SIP trunks.

Configuring Secure Communications

This deployment requires secure communications between the Expressway-C and the Expressway-E, and between the Expressway-E and endpoints located outside the enterprise. This involves the mandating of encrypted TLS communications for HTTP, SIP and XMPP, and, where applicable, the exchange and checking of certificates. Jabber endpoints must supply a valid username and password combination, which will be validated against credentials held in Unified CM. All media is secured over SRTP.

Expressway-C automatically generates non-configurable neighbor zones between itself and each discovered Unified CM node. A TCP zone is always created, and a TLS zone is created also if the Unified CM node is configured with a Cluster Security Mode (System > Enterprise Parameters > Security Parameters) of 1 (Mixed) (so that it can support devices provisioned with secure profiles). The TLS zone is configured with its TLS verify mode set to On if the Unified CM discovery had TLS verify mode enabled. This means that the Expressway-C will verify the CallManager certificate for subsequent SIP communications.
**Note:** Secure profiles are downgraded to use TCP if Unified CM is not in mixed mode.

The Expressway neighbor zones to Unified CM use the names of the Unified CM nodes that were returned by Unified CM when the Unified CM publishers were added (or refreshed) to the Expressway. The Expressway uses those returned names to connect to the Unified CM node. If that name is just the host name then:

- it needs to be routable using that name
- this is the name that the Expressway expects to see in the Unified CM’s server certificate

If you are using secure profiles, ensure that the root CA of the authority that signed the Expressway-C certificate is installed as a CallManager-trust certificate (Security > Certificate Management in the Cisco Unified OS Administration application).

**Media Encryption**

Media encryption is enforced on the call legs between the Expressway-C and the Expressway-E, and between the Expressway-E and endpoints located outside the enterprise.

The encryption is physically applied to the media as it passes through the B2BUA on the Expressway-C.

**Limitations**

For information about endpoint or Expressway features which are not supported over MRA, see Key Supported and Unsupported Features with Mobile and Remote Access, page 15

**Protocol Summary**

The table below lists the protocols and associated services used in the Unified Communications solution.

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Security</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIP</td>
<td>TLS</td>
<td>Session establishment ~ Register, Invite etc.</td>
</tr>
<tr>
<td>HTTPS</td>
<td>TLS</td>
<td>Logon, provisioning/configuration, directory, visual voicemail</td>
</tr>
<tr>
<td>RTP</td>
<td>SRTP</td>
<td>Media - audio, video, content sharing</td>
</tr>
<tr>
<td>XMPP</td>
<td>TLS</td>
<td>Instant Messaging, Presence, Federation</td>
</tr>
</tbody>
</table>

**Clustered Expressway Systems and Failover Considerations**

You can configure a cluster of Expressway-Cs and a cluster of Expressway-Es to provide failover (redundancy) support as well as improved scalability.

Details about how to set up Expressway clusters are contained in Expressway Cluster Creation and Maintenance Deployment Guide and information about how to configure Jabber endpoints and DNS are contained in Configure DNS for Cisco Jabber.

Note that when discovering Unified CM and IM&P servers on Expressway-C, you must do this on the primary peer.

**Authorization Rate Control**

The Expressway can limit the number of times that any user’s credentials can be used, in a given configurable period, to authorize the user for collaboration services. This feature is designed to thwart inadvertent or real denial of service attacks, which can originate from multiple client devices authorizing the same user, or from clients that reauthorize more often than necessary.
Additional Information

Each time a client supplies credentials to authorize the user, the Expressway checks whether this attempt would exceed the **Maximum authorizations per period** within the previous number of seconds specified by the **Rate control period**.

If the attempt would exceed the chosen maximum, then the Expressway rejects the attempt and issues the HTTP error 429 "Too Many Requests".

The authorization rate control settings are configurable in the **Advanced** section of the **Configuration > Unified Communications > Configuration** page.

**Credential Caching**

**Note**: These settings do not apply to clients that are using SSO (common identity) for authenticating via MRA.

The Expressway caches endpoint credentials which have been authenticated by Unified CM. This caching improves overall performance because the Expressway does not always have to submit endpoint credentials to Unified CM for authentication.

The caching settings are configurable in the **Advanced** section of the **Configuration > Unified Communications > Configuration** page.

**Credentials refresh interval** specifies the lifetime of the authentication token issued by the Expressway to a successfully authenticated client. A client that successfully authenticates should request a refresh before this token expires, or it will need to re-authenticate. The default is 480 minutes (8 hours).

**Credentials cleanup interval** specifies how long the Expressway waits between cache clearing operations. Only expired tokens are removed when the cache is cleared, so this setting is the longest possible time that an expired token can remain in the cache. The default is 720 minutes (12 hours).

**Unified CM Denial of Service Threshold**

High volumes of Mobile and Remote Access calls may trigger denial of service thresholds on Unified CM. This is because all the calls arriving at Unified CM are from the same Expressway-C (cluster).

If necessary, we recommend that you increase the level of the **SIP Station TCP Port Throttle Threshold** (**System > Service Parameters**), and select the **Cisco CallManager service** to 750 KB/second.

**Expressway Automated Intrusion Protection**

From X8.9 onwards, automated intrusion protection is enabled, by default, for the following categories:

- http-ce-auth
- http-ce-intrusion
- sshpfwd-auth
- sshpfwd-intrusion
- xmpp-intrusion

This change affects new systems. Upgraded systems keep their existing protection configuration.

**On Expressway-C:**

The Expressway-C receives a lot of inbound traffic from Unified CM and from the Expressway-E when it is used for Mobile and Remote Access.

If you want to use automated protection on the Expressway-C, you should add exemptions for all hosts that use the automatically created neighbor zones and the Unified Communications secure traversal zone. The Expressway does not automatically create exemptions for discovered Unified CM or related nodes.

**On Expressway-E:**

You should enable the **Automated protection service** (**System > System administration**) if it is not yet running.
To protect against malicious attempts to access the HTTP proxy, you can configure automated intrusion protection on the Expressway-E (System > Protection > Automated detection > Configuration).

We recommend that you enable the following categories on the Expressway-E:

- **HTTP proxy authorization failure** and **HTTP proxy protocol violation**.
  
  **Note:** Do not enable the **HTTP proxy resource access failure** category.

- **XMPP protocol violation**

  **Note:** The Automated protection service uses Fail2ban software. It protects against brute force attacks that originate from a single source IP address.

### Partial Support for Cisco Jabber SDK

You can use the following supported Cisco Jabber SDK features over MRA:

- Sign in/ sign out
- Register phone services
- Make or receive audio/ video calls
- Hold and resume, mute/ unmute, and call transfer

For more information, see the [Getting Started Guide for Cisco Jabber SDK](#).
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General Techniques

Checking Alarms and Status

When troubleshooting, first check if any alarms have been raised (Status > Alarms). If alarms exist, follow the instructions in the Action column. Check the alarms on both Expressway-C and Expressway-E.

Next, review the status summary and configuration information (Status > Unified Communications). Check the status page on both Expressway-C and Expressway-E. If any required configuration is missing or invalid, an error message and a link to the relevant configuration page is shown.

You may see invalid services or errors if you change the following items on Expressway, for which a system restart is required to be sure the configuration changes take effect:

■ Server or CA certificates
■ DNS configuration
■ Domain configuration

Using the Collaboration Solutions Analyzer

The Collaboration Solutions Analyzer (CSA) tool set provided by TAC, can be used to help with deploying and troubleshooting MRA. (See the Expressway release notes for instructions about how to access the CSA.)

1. First, you can use the CollabEdge validator tool to validate your MRA deployment. It simulates a Jabber client sign in process, and provides feedback on the result.
2. If the CollabEdge validator can’t identify the issue, we suggest that you collect logs from the Expressway while attempting to sign in. Then use the log analysis component in the CSA to analyze the logs.

Taking Diagnostic Logs

Jabber for Windows

The Jabber for Windows log file is saved as csf-unified.log under C:\Users\<UserID>\AppData\Local\Cisco\Unified Communications\Jabber\CSF\Logs.
Appendix 1: Troubleshooting

The configuration files are located under C:\Users\<UserID>\AppData\Roaming\Cisco\Unified Communications\Jabber\CSF\Config.

Performing Expressway diagnostic logging

The diagnostic logging tool in Expressway can be used to assist in troubleshooting system issues. It allows you to generate a diagnostic log of system activity over a period of time, and then to download the log.

Before taking a diagnostic log, you must configure the log level of the relevant logging modules:

1. Go to Maintenance > Diagnostics > Advanced > Support Log configuration.
2. Select the following logs:
   - developer.edgeconfigprovisioning
   - developer.trafficserver
   - developer.xcp
3. Click Set to debug.

You can now start the diagnostic log capture:

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 Collect log.
8. When the log collection completes, click Download log to save the diagnostic log archive to your local file system.
   - You are prompted to save the archive (the exact wording depends on your browser).

To download logs again

If you want to download the logs again, you can re-collect them by using the Collect log button. If the button is grayed out, first refresh the page in your browser.

After you have completed your diagnostic logging, return to the Support Log configuration page and reset the modified logging modules back to INFO level.

Checking DNS Records

You can use the Expressway’s DNS lookup tool (Maintenance > Tools > Network utilities > DNS lookup) to assist in troubleshooting system issues. The SRV record lookup includes those specific to H.323, SIP, Unified Communications and TURN services.

Note that performing the DNS lookup from the Expressway-C will return the view from within the enterprise, and that performing it on the Expressway-E will return what is visible from within the DMZ which is not necessarily the same set of records available to endpoints in the public internet.

The DNS lookup includes the following SRV services that are used for Unified Communications:
Appendix 1: Troubleshooting

- \_collab-edge\_tls
- \_cisco-uds\_tcp

Checking Reachability of the Expressway-E

Ensure that the FQDN of the Expressway-E is resolvable in public DNS.

The FQDN is configured at **System > DNS** and is built as `<System host name>.<Domain name>`.  

Checking Call Status

Call status information can be displayed for both current and completed calls:

- **Current calls**: the Call status page (**Status > Calls > Calls**) lists all the calls currently taking place to or from devices registered with the Expressway, or that are passing through the Expressway.

- **Completed calls**: the Call history page (**Status > Calls > History**) lists all the calls that are no longer active. The list is limited to the most recent 500 calls, and only includes calls that have taken place since the Expressway was last restarted.

The same set of call status information is also shown on the **Calls by registration** page (accessed via the Registration details page).

If the Expressway is part of a cluster, all calls that apply to any peer in the cluster are shown, although the list is limited to the most recent 500 calls per peer.

**Identifying Mobile and Remote Access calls**

The call status and call history pages show all call types. Unified CM remote sessions (if Mobile and Remote Access is enabled) as well as VCS traversal and non-traversal calls, or Expressway RMS sessions.

To distinguish between the call types, you must drill down into the call components. Mobile and Remote Access calls have different component characteristics depending on whether the call is being viewed on the Expressway-C or Expressway-E:

- On the Expressway-C, a Unified CM remote session has three components (as it uses the B2BUA to enforce media encryption). One of the Expressway components routes the call through one of the automatically generated neighbor zones (with a name prefixed by either CEtcp or CEtls) between Expressway and Unified CM.

- On the Expressway-E, there is one component and that routes the call through the **CollaborationEdgeZone**.

If both endpoints are outside of the enterprise (that is, off premises), you will see this treated as two separate calls.

**Rich media sessions (for Expressway only)**

If your system has a rich media session key installed and thus supports business-to-business calls, and interworked or gatewayed calls to third-party solutions and so on, those calls are also listed on the call status and call history pages.

Checking Devices Registered to Unified CM via Expressway

**Identifying devices in Unified CM**

To identify devices registered to Unified CM via Expressway:

1. In Unified CM, go to **Device > Phone** and click **Find**.
2. Check the **IP Address** column. Devices that are registered via Expressway will display an **IP Address** of the Expressway-C it is registered through.

**Identifying provisioned sessions in Expressway-C**

To identify sessions that have been provisioned via Expressway-C:
Appendix 1: Troubleshooting

1. In Expressway-C, go to Status > Unified Communications.
2. In the Advanced status information section, click View provisioning sessions.
   This shows a list of all current and recent (shown in red) provisioning sessions.

Ensuring that Expressway-C is Synchronized to Unified CM

Changes to Unified CM cluster or node configuration can lead to communication problems between Unified CM and Expressway-C. This includes changes to the following items:

- Number of nodes within a Unified CM cluster
- Host name or IP address of an existing node
- Listening port numbers
- Security parameters
- Phone security profiles

You must ensure that any such changes are reflected in the Expressway-C. To do this you must rediscover all Unified CM and IM and Presence Service nodes (on Expressway go to Configuration > Unified Communications).

Checking MRA Authentication Status and Tokens

You can check and clear standard (non-refresh) OAuth user tokens on Users > View and manage OAuth without refresh token holders. This could help identify problems with a particular user's OAuth access.

You can check statistics for MRA authentication on Status > Unified Communications > View detailed MRA authentication statistics. Any unexpected requests or responses on this page could help identify configuration or authorization issues.

Expressway Certificate / TLS Connectivity Issues

Modifications to the Expressway's server certificate or trusted CA certificates need a Expressway restart for the changes to take effect.

If you are using secure profiles, ensure that the root CA of the authority that signed the Expressway-C certificate is installed as a CallManager-trust certificate (Security > Certificate Management in the Cisco Unified OS Administration application).

CiscoSSL 5.4.3 Rejects Diffie-Hellman Keys with Fewer than 1024 Bits

If you are running version 9.x, or earlier, of Unified CM or Unified CM IM&P, with Expressway version X8.7.2 or later, then the SSL handshake between the two systems will fail by default.

The symptom is that all MRA endpoints fail to register or make calls after you upgrade to Expressway X8.7.2 or later.

The cause of this issue is an upgrade of the CiscoSSL component to 5.4.3 or later. This version rejects the default (768 bit) key provided by Unified CM when using D-H key exchange.

You must either upgrade your infrastructure or consult the Cisco Technical Assistance Center to check whether it's possible to modify the default configurations for Unified CM and/or Unified CM IM&P to support TLS (CSCuy59366 refers).
Cisco Jabber Sign In Issues

Jabber triggers automated intrusion protection

**Conditions:**
- Your MRA solution is configured for authorization by OAuth token (with or without refresh)
- The Jabber user’s access token has expired
- Jabber does one of these:
  - Resumes from desktop hibernate
  - Recovers network connection
  - Attempts fast login after it has been signed out for several hours

**Behavior:**
- Some Jabber modules attempt to authorize at Expressway-E using the expired access token.
- The Expressway-E (correctly) denies these requests.
- If there are more than 5 such requests from a particular Jabber client, the Expressway-E blocks that IP address for ten minutes (by default).

**Symptoms:**
The affected Jabber clients’ IP addresses are added to the Expressway-E’s **Blocked addresses** list, in the HTTP proxy authorization failure category. You can see these on System > Protection > Automated detection > Blocked addresses.

**Workaround:**
There are two ways you can work around this issue; you can increase the detection threshold for that particular category, or you can create exemptions for the affected clients. We describe the threshold option here because the exemptions may well be impractical in your environment.

1. Go to System > Protection > Automated detection > Configuration.
2. Click HTTP proxy authorization failure.
3. Change the **Trigger level** from 5 to 10. 10 should be enough to tolerate the Jabber modules that present expired tokens.
4. Save the configuration, which takes effect immediately.
5. Unblock any affected clients.

**Jabber popup warns about invalid certificate when connecting from outside the network**

This is a symptom of an incorrectly configured server certificate on the Expressway-E. The certificate could be self-signed, or it may not have the external DNS domain of your organization listed as a subject alternative name (SAN).

This is expected behavior from Jabber. We recommend that you install a certificate issued by a CA that Jabber trusts, and that the certificate has the domains Jabber is using included in its list of SANs. See Server Certificate Requirements for Unified Communications, page 26.

**Jabber Does Not Register for Phone Services**

There is a case handling mismatch between the Expressway and the UDS (User Data Service) that prevents Jabber from registering for phone services if the supplied user ID does not match the case of the stored ID. Jabber still signs in but cannot use phone services.

Users can avoid this issue by signing in with the user ID exactly as it is stored in UDS.
Appendix 1: Troubleshooting

Users can recover from this issue by signing out and resetting Jabber. See CSCu16696.

Jabber Cannot Sign In due to XMPP Bind Failure

The Jabber client may be unable to sign in ("Cannot communicate with the server" error messages) due to XMPP bind failures.

This will be indicated by resource bind errors in the Jabber client logs, for example:

```
XmppSDK.dll #0, 201, Recv:<iq id='uid:527a7fe7:00000cfe:00000000' type='error'>
 xmlns='urn:ietf:params:xml:ns:xmpp-bind'/><error code='409' type='cancel'>
<conflict xmlns='urn:ietf:params:xml:ns:xmpp-stanzas'/></error></iq>
```

XmppSDK.dll #0, CXmppClient::onResourceBindError
```
CXmppClient::onResourceBindError
XmppSDK.dll #0, 39, CXmppClient::HandleDisconnect, reason:16
```

This typically occurs if the IM and Presence Intercluster Sync Agent is not working correctly. See IM and Presence intercluster deployment configuration for more information.

Jabber Cannot Sign In due to SSH Tunnels Failure

Jabber can fail to sign in due to the SSH tunnels failing to be established. The traversal zone between the Expressway-C and Expressway-E will work normally in all other respects. Expressway will report 'Application failed - An unexpected software error was detected in portforwarding.pyc'.

This can occur if the Expressway-E DNS hostname contains underscore characters. Go to System > DNS and ensure that the System host name only contains letters, digits and hyphens.

Jabber Cannot Sign In When Connecting to Different Peers in a Cluster of Expressway-Es

Jabber sign in failures have been seen when there is inconsistency of the DNS domain name between Expressway-E peers. The domain names must be identical, even with respect to case, on all peers in the cluster.

Go to System > DNS on each peer to make sure that Domain name is identical on all peers.

Expressway Returns "401 Unauthorized" Failure Messages

A "401 unauthorized" failure message can occur when the Expressway attempts to authenticate the credentials presented by the endpoint client. The reasons for this include:

- The client is supplying an unknown username or the wrong password.
- ILS (Intercluster Lookup Service) has not been set up on all of the Unified CM clusters. This may result in intermittent failures, depending upon which Unified CM node is being used by Expressway for its UDS query to discover the client’s home cluster.

Call Failures due to "407 Proxy Authentication Required" or "500 Internal Server Error" Errors

Call failures can occur if the traversal zones on Expressway are configured with an Authentication policy of Check credentials. Ensure that the Authentication policy on the traversal zones used for Mobile and Remote Access is set to Do not check credentials.

Call Bit Rate is Restricted to 384 kbps / Video Issues when Using BFCP (Presentation Sharing)

This can be caused by video bit rate restrictions within the regions configured on Unified CM.

Ensure that the Maximum Session Bit Rate for Video Calls between and within regions (System > Region Information > Region) is set to a suitable upper limit for your system, for example 6000 kbps.
Appendix 1: Troubleshooting

Endpoints Cannot Register to Unified CM

Endpoints may fail to register for various reasons:

- Endpoints may not be able to register to Unified CM if there is also a SIP trunk configured between Unified CM and Expressway-C. If a SIP trunk is configured, you must ensure that it uses a different listening port on Unified CM from that used for SIP line registrations to Unified CM. See SIP Trunks Between Unified CM and Expressway-C, page 75 for more information.
- Secure registrations may fail ("Failed to establish SSL connection" messages) if the server certificate on the Expressway-C does not contain in its Subject Alternate Name list, the names of all of the Phone Security Profiles in Unified CM that are configured for encrypted TLS and are used for devices requiring remote access. Note that these names — in both Unified CM and in the Expressway’s certificate — must be in FQDN format.

IM and Presence Service Realm Changes

Provisioning failures can occur when the IM and Presence Service realm has changed and the realm data on the Expressway-C has not been updated.

For example, this could happen if the address of an IM and Presence Service node has changed, or if a new peer has been added to an IM and Presence Service cluster.

The diagnostic log may contain an INFO message like "Failed to query auth component for SASL mechanisms" because the Expressway-C cannot find the realm.

Go to Configuration > Unified Communications > IM and Presence Service nodes and click Refresh servers and then save the updated configuration. If the provisioning failures persist, verify the IM and Presence Service nodes configuration and refresh again.

No Voicemail Service ("403 Forbidden" Response)

Ensure that the Cisco Unity Connection (CUC) hostname is included on the HTTP server allow list on the Expressway-C.

"403 Forbidden" Responses for Any Service Requests

Services may fail ("403 Forbidden" responses) if the Expressway-C and Expressway-E are not synchronized to a reliable NTP server. Ensure that all Expressway systems are synchronized to a reliable NTP service.

Client HTTPS Requests are Dropped by Expressway

This can be caused by the automated intrusion protection feature on the Expressway-E if it detects repeated invalid attempts (404 errors) from a client IP address to access resources through the HTTP proxy.

To prevent the client address from being blocked, ensure that the HTTP proxy resource access failure category (System > Protection > Automated detection > Configuration) is disabled.

Unable to Configure IM&P Servers for Remote Access

'Failed: <address> is not a IM and Presence Server'

This error can occur when trying to configure the IM&P servers used for remote access (via Configuration > Unified Communications > IM and Presence servers). It’s due to missing CA certificates on the IM&P servers and applies to systems running 9.1.1. More information and the recommended solution is described in bug CSCul05131.
Invalid SAML Assertions

If clients fail to authenticate via SSO, one potential reason is that invalid assertions from the IDP are being rejected by the Expressway-C.

Check the logs for "Invalid SAML Response".

One example is when ADFS does not have a claim rule to send the users' IDs to the Expressway-C. In this case you will see "No uid Attribute in Assertion from IdP" in the log.

The Expressway is expecting the user ID to be asserted by a claim from ADFS that has the identity in an attribute called uid. You need to go into ADFS and set up a claim rule, on each relying party trust, to send the users' AD email addresses (or sAMAccountNames, depending on your deployment) as "uid" to each relying party.

"502 Next Hop Connection Failed" Messages

A 502 message on the Expressway-E indicates that the next hop failed (typically to the Expressway-C). Try the following steps:

1. Go to the Status > Unified Communications page on the Expressway-E. Did the Expressway-E report any issues?

2. If the status looks normal, click the SSH tunnel status link at the foot of the status page. If one or more tunnels to the Expressway-C node is down, that is probably causing the 502 error.
Allow List Rules File Reference

You can define rules using a CSV file. This topic provides a reference to acceptable data for each rule argument, and demonstrates the format of the CSV rules.

<table>
<thead>
<tr>
<th>Argument index</th>
<th>Parameter name</th>
<th>Required/Optional</th>
<th>Sample value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Url</td>
<td>Required</td>
<td>protocol://host[:port][/path]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Where:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- protocol is http or https</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- host may be a DNS name or IP address</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- :port is optional, and may only be : followed by one number in the range 0-65535, eg.: 8443</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- If the port is not specified, then the Expressway uses the default port for the supplied protocol (80 or 443)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- /path is optional and must conform to HTTP specification</td>
</tr>
<tr>
<td>1</td>
<td>Deployment</td>
<td>Optional</td>
<td>Name of the deployment that uses this rule. Required when you have more than one deployment, otherwise supply an empty argument.</td>
</tr>
<tr>
<td>2</td>
<td>HttpMethods</td>
<td>Optional</td>
<td>Comma-delimited list of HTTP methods, optionally in double-quotes, eg. &quot;GET,PUT&quot;</td>
</tr>
<tr>
<td>3</td>
<td>MatchType</td>
<td>Optional</td>
<td>exact or prefix. Default is prefix</td>
</tr>
<tr>
<td>4</td>
<td>Description</td>
<td>Optional</td>
<td>Text description of the rule. Enclose with double quotes if there are spaces.</td>
</tr>
</tbody>
</table>

Example CSV file

```
Url,Deployment,HttpMethods,MatchType,Description
https://myServer1:8443/myPath1,myDomain1,GET,,"First Rule"
http://myServer2:8000/myPath2,myDomain200,"GET,PUT",exact,
https://myServer3:8080/myPath3,myDomain1,,prefix,"Third Rule"
https://myServer4/myPath4,myDomain1,,prefix,"Fourth Rule"
http://myServer5/myPath5,myDomain1,,prefix,"Fifth Rule"
```

- List the parameter names (as shown) in the first line of the file
- One rule per line, one line per rule
- Separate arguments with commas
- Correctly order the rule values as shown in the table above
- Enclose values that have spaces in them with double quotes
Allow List Tests File Reference

You can define tests using a CSV file. This topic provides a reference to acceptable data for each test argument, and demonstrates the format of the CSV tests.

### Table 6  Allow List Test Arguments

<table>
<thead>
<tr>
<th>Argument index</th>
<th>Parameter name</th>
<th>Required/Optional</th>
<th>Sample value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Url</td>
<td>Required</td>
<td>protocol://host[:port][/path]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Where:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>■ protocol is http or https</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>■ host may be a DNS name or IP address</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>■ :port is optional, and may only be : followed by one number in the range 0-65535</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>■ /path is optional and must conform to HTTP specification</td>
</tr>
<tr>
<td>1</td>
<td>ExpectedResult</td>
<td>Required</td>
<td>allow or block. Specifies whether the test expects that the rules should allow or block the specified URL.</td>
</tr>
<tr>
<td>2</td>
<td>Deployment</td>
<td>Optional</td>
<td>Name of the deployment to test with this URL. If you omit this argument, the test will use the default deployment.</td>
</tr>
<tr>
<td>3</td>
<td>Description</td>
<td>Optional</td>
<td>Text description of the rule. Enclose with double quotes if there are spaces.</td>
</tr>
<tr>
<td>4</td>
<td>HttpMethod</td>
<td>Optional</td>
<td>Specify one HTTP method to test eg. PUT. Defaults to GET if not supplied.</td>
</tr>
</tbody>
</table>

### Example CSV file

```
Url,ExpectedResult,Deployment,Description,HttpMethod
https://myServer1:8443/myPath1,block,"my deployment","a block test".,GET
http://myServer2:8000/myPath2,allow,"my deployment","an allow test",PUT
https://myServer4/myPath4,allow,,.GET
http://myServer4/myPath4,block,.,POST
```

- List the parameter names (as shown) in the first line
- One test per line, one line per test
- Separate arguments with commas
- Correctly order the test values as shown in the table above
- Enclose values that have spaces in them with double quotes
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