Configuring Security

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This chapter describes the phone authentication support in Cisco Unified Communications Manager Express (Cisco Unified CME) and the Media Encryption (SRTP) on Cisco Unified CME feature which provide the following secure voice call capabilities:

- Secure call control signaling and media streams in Cisco Unified CME networks using Secure Real-Time Transport Protocol (SRTP) and H.323 protocols.
- Secure supplementary services for Cisco Unified CME networks using H.323 trunks.
- Secure Cisco VG224 Analog Phone Gateway endpoints.

Finding Feature Information in This Module

Your Cisco Unified CME version may not support all of the features documented in this module. For a list of the versions in which each feature is supported, see the "Feature Information for Security" section on page 477.

Contents

Prerequisites for Security

Phone Authentication

- Cisco Unified CME phone authentication requires the Cisco IOS feature set Advanced Enterprise Services (adventerprisek9) or Advanced IP Services (advipservicesk9) on supported platforms.
- Set the system clock using one of these methods:
  - Configure Network Time Protocol (NTP).
  - Manually set the software clock using the **clock set** command.

  Both methods are explained in the "Performing Basic System Management" chapter of the *Cisco IOS Network Management Configuration Guide* for your Cisco IOS release.

Media Encryption

- Cisco Unity 4.2 or later version
- Cisco Unified CME 4.2 or a later version
- Cisco IOS Release 12.4(11)XW or a later release on the Cisco VG224 Analog Phone Gateway

Restrictions for Security

Phone Authentication

- Cisco Unified CME phone authentication is not supported on the Cisco IAD 2400 series or the Cisco 1700 series.

Media Encryption

- Secure three-way software conference is not supported. A secure call beginning with SRTP will always fall back to nonsecure Real-Time Transport Protocol (RTP) when it is joined to a conference.
- If a party drops from a three-party conference, the call between the remaining two parties returns to secure if the two parties are SRTP-capable local Skinny Client Control Protocol (SCCP) endpoints to a single Cisco Unified CME and the conference creator is one of the remaining parties. If either of the two remaining parties are only RTP-capable, the call remains nonsecure. If the two remaining parties are connected through FXS, PSTN, or VoIP, the call remains nonsecure.
- Calls to Cisco Unity Express are not secure.
- Music on Hold (MOH) is not secure.
- Video calls are not secure.
- Modem relay and T.3 fax relay calls are not secure.
- Media flow-around is not supported for call transfer and call forward.
- Conversion between inband tone and RFC 2833 DTMF is not supported. RFC 2833 DTMF handling is supported when encryption keys are sent to secure DSP farm devices but is not supported for codec passthrough.
- Secure Cisco Unified CME does not support SIP trunks; only H.323 trunks are supported.

Table 23 lists supported gateways, network modules, and codecs for Media Encryption (SRTP) on Cisco Unified CME.

Table 23 Supported Gateways, Network Modules, and IP Phones for Media Encryption (SRTP) on Cisco Unified CME

Supported Gateways	Supported Network Modules	Supported SCCP Endpoints
• Cisco 2801 • Cisco 2811 • Cisco 2821 • Cisco 2851 • Cisco 3725 • Cisco 3745 • Cisco 3825 • Cisco 3845	• AIM-VOICE-30 • AIM-ATM-VOICE-30 • NM-HDA-4FXS • NM-HDV • NM-HDV2 • NM-HDV2-1T1/E1 • NM-HDV2-2T1/E1 • NM-HD-1V • NM-HD-2V • NM-HD-2VE • PVDM2	• Cisco IP Phone 7931 • Cisco IP Phone 7940 • Cisco IP Phone 7941 • Cisco IP Phone 7941GE • Cisco IP Phone 7960 • Cisco IP Phone 7961 • Cisco IP Phone 7961GE • Cisco IP Phone 7970 • Cisco IP Phone 7971 • Cisco IP Phone 7911 • Cisco IP Phone 7921 • Cisco VG224 Analog Phone Gateway

Information About Security

To enable security, you should understand the following concepts:

Phone Authentication

- Phone Authentication Overview, page 412
- Public Key Infrastructure, page 413
- Phone Authentication Components, page 413
- Phone Authentication Process, page 416
- Startup Messages, page 417
- Configuration File Maintenance, page 417
- CTL File Maintenance, page 418
- CTL Client and Provider, page 418
- Manually Importing MIC Root Certificate, page 419

Media Encryption

- Feature Design of Media Encryption, page 419
- Secure Cisco Unified CME, page 420
- Secure Supplementary Services, page 421
- Secure Transcoding for Remote Phones with DSP Farm Transcoding Configured, page 422
- Secure Cisco Unified CME with Cisco Unity Express, page 423

- Secure Cisco Unified CME with Cisco Unity, page 423

Phone Authentication Overview

Phone authentication is a security infrastructure for providing secure SCCP signaling between Cisco Unified CME and IP phones. The goal of Cisco Unified CME phone authentication is to create a secure environment for a Cisco Unified CME IP telephony system.

Phone authentication addresses the following security needs:

- Establishing the identity of each endpoint in the system
- Authenticating devices
- Providing signaling-session privacy
- Providing protection for configuration files

Cisco Unified CME phone authentication implements authentication and encryption to prevent identity theft of the phone or Cisco Unified CME system, data tampering, call-signaling tampering, or media-stream tampering. To prevent these threats, the Cisco Unified IP telephony network establishes and maintains authenticated communication streams, digitally signs files before they are transferred to phones, and encrypts call signaling between Cisco Unified IP phones.

Cisco Unified CME phone authentication depends upon the following processes:

- Phone Authentication, page 412
- File Authentication, page 412
- Signaling Authentication, page 412

Phone Authentication

The phone authentication process occurs between the Cisco Unified CME router and a supported device when each entity accepts the certificate of the other entity; only then does a secure connection between the entities occur. Phone authentication relies on the creation of a Certificate Trust List (CTL) file, which is a list of known, trusted certificates and tokens. Phones communicate with Cisco Unified CME using a secure transport-layer-session (TLS) connection, which requires that the following criteria be met:

- A certificate must exist on the phone.
- A phone configuration file must exist on the phone, and the Cisco Unified CME entry and certificate must exist in the file.

File Authentication

The file authentication process validates digitally signed files that a phone downloads from a Trivial File Transfer Protocol (TFTP) server—for example, configuration files, ring list files, locale files, and CTL files. When the phone receives these types of files from the TFTP server, the phone validates the file signatures to verify that file tampering did not occur after the files were created.

Signaling Authentication

The signaling authentication process, also known as signaling integrity, uses the TLS protocol to validate that signaling packets have not been tampered with during transmission. Signaling authentication relies on the creation of the CTL file.

Public Key Infrastructure

Cisco Unified CME phone authentication uses the public-key-infrastructure (PKI) capabilities in Cisco IOS software for certificate-based authentication of IP phones. PKI provides customers with a scalable, secure mechanism for distributing, managing, and revoking encryption and identity information in a secured data network. Every entity (a person or a device) participating in the secured communication is enrolled in the PKI using a process in which the entity generates a Rivest-Shamir-Adleman (RSA) key pair (one private key and one public key) and has its identity validated by a trusted entity (also known as a certification authority [CA] or trustpoint).

After each entity enrolls in a PKI, every peer (also known as an end host) in a PKI is granted a digital certificate that has been issued by a CA.

When peers must negotiate a secured communication session, they exchange digital certificates. Based on the information in the certificate, a peer can validate the identity of another peer and establish an encrypted session with the public keys contained in the certificate.

For more information about PKI, see the "Implementing and Managing a PKI" section of the *Cisco IOS Security Configuration Guide* for your Cisco IOS release.

Phone Authentication Components

A variety of components work together to ensure secure communications in a Cisco Unified CME system. Table 24 describes the Cisco Unified CME phone authentication components.

Table 24 Cisco Unified CME Phone Authentication Components

Component	Definition
certificate	An electronic document that binds a user's or device's name to its public key. Certificates are commonly used to validate digital signatures. Certificates are needed for authentication during secure communication. An entity obtains a certificate by enrolling with the CA.
signature	An assurance from an entity that the transaction it accompanies is authentic. The entity's private key is used to sign transactions and the corresponding public key is used for decryption.
RSA key pair	RSA is a public key cryptographic system developed by Ron Rivest, Adi Shamir, and Leonard Adleman. An RSA key pair consists of a public key and a private key. The public key is included in a certificate so that peers can use it to encrypt data that is sent to the router. The private key is kept on the router and used both to decrypt the data sent by peers and to digitally sign transactions when negotiating with peers. You can configure multiple RSA key pairs to match policy requirements, such as key length, key lifetime, and type of keys, for different certificate authorities or for different certificates.
certificate server trustpoint	A certificate server generates and issues certificates on receipt of legitimate requests. A trustpoint with the same name as the certificate server stores the certificates. Each trustpoint has one certificate plus a copy of the CA certificate.

Table 24 Cisco Unified CME Phone Authentication Components (continued)

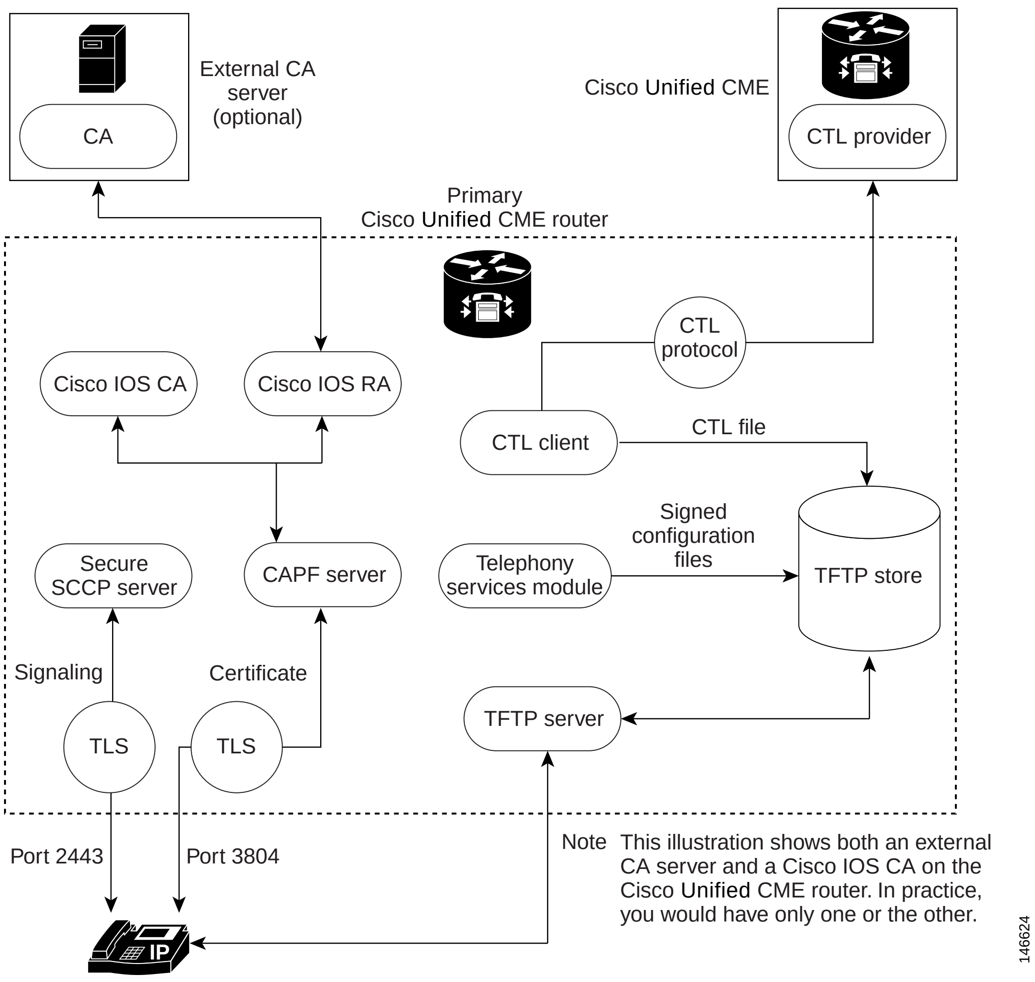
Component	Definition
certification authority (CA)	The root certificate server. It is responsible for managing certificate requests and issuing certificates to participating network devices. This service provides centralized key management for participating devices and is explicitly trusted by the receiver to validate identities and to create digital certificates. The CA can be a Cisco IOS CA on the Cisco Unified CME router, a Cisco IOS CA on another router, or a third-party CA.
registration authority (RA)	Records or verifies some or all of the data required for the CA to issue certificates. It is required when the CA is a third-party CA or Cisco IOS CA is not on the Cisco Unified CME router.
certificate trust list (CTL) file CTL client CTL provider	A mandatory structure that contains the public key information (server identities) of all the servers with which the IP phone needs to interact (for example, the Cisco Unified CME server, TFTP server, and CAPF server). The CTL file is digitally signed by the system administrator security token (SAST). After you configure the CTL client, it creates the CTL file and makes it available in the TFTP directory. The CTL file is signed using the SAST certificate's corresponding private key. An IP phone is then able to download this CTL file from the TFTP directory. The filename format for each phone's CTL file is CTLSEP<mac-addr>.tlv. When the CTL client is run on a router in the network that is not a Cisco Unified CME router, you must configure a CTL provider on each Cisco Unified CME router in the network. Similarly, if a CTL client is running on one of two Cisco Unified CME routers in a network, a CTL provider must be configured on the other Cisco Unified CME router. The CTL protocol transfers information to and from the CTL provider that allows the second Cisco Unified CME router to be trusted by phones and vice versa.
certificate revocation list (CRL)	File that contains certificate expiration dates and used to determine whether a certificate that is presented is valid or revoked.
system administrator security token (SAST)	Part of the CTL client that is responsible for signing the CTL file. The Cisco Unified CME certificate and its associated key pair are used for the SAST function. There are actually two SAST records pertaining to two different certificates in the CTL file for security reasons. They are known as SAST1 and SAST2. If one of the certificates is lost or compromised, then the CTL client regenerates the CTL file using the other certificate. When a phone downloads the new CTL file, it verifies with only one of the two original public keys that was installed earlier. This mechanism is to prevent IP phones from accepting CTL files from unknown sources.

Table 24 Cisco Unified CME Phone Authentication Components (continued)

Component	Definition
certificate authority proxy function (CAPF)	Entity that issues certificates (LSCs) to phones that request them. The CAPF is a proxy for the phones, which are unable to directly communicate with the CA. The CAPF can also perform the following certificate-management tasks: • Upgrade existing locally significant certificates on the phones. • Retrieve phone certificates for viewing and troubleshooting. • Delete locally significant certificates on the phone.
manufacture-installed certificate (MIC) locally significant certificate (LSC)	Phones need certificates to engage in secure communications. Many phones come from the factory with MICs, but MICs may expire or become lost or compromised. Some phones do not come with MICs. LSCs are certificates that are issued locally to the phones using the CAPF server.
transport Layer Security (TLS) protocol	IETF standard (RFC 2246) protocol, based on Netscape Secure Socket Layer (SSL) protocol. TLS sessions are established using a handshake protocol to provide privacy and data integrity. The TLS record layer fragments and defragments, compresses and decompresses, and performs encryption and decryption of application data and other TLS information, including handshake messages.

Figure 19 shows the components in a Cisco Unified CME phone authentication environment.

Figure 19 Cisco Unified CME Phone Authentication



Note This illustration shows both an external CA server and a Cisco IOS CA on the Cisco Unified CME router. In practice, you would have only one or the other.

Phone Authentication Process

The following is a high-level summary of the phone-authentication process.

To enable Cisco Unified CME phone authentication:

1. Certificates are issued.

   The CA issues certificates to Cisco Unified CME, SAST, CAPF, and TFTP functions.

2. The CTL file is created, signed and published.

   a. The CTL file is created by the CTL client, which is configuration driven. Its goal is to create a CTLfile.tlv for each phone and deposit it in the TFTP directory. To complete its task, the CTL client needs the certificates and public key information of the CAPF server, Cisco Unified CME server, TFTP server, and SASTs.

   b. The CTL file is signed by the SAST credentials. There are two SAST records pertaining to two different certificates in the CTL file for security reasons. If one of the certificates is lost or compromised, then the CTL client regenerates the CTL file using the other certificate. When a phone downloads the new CTL file, it verifies the download with only one of the two original public keys that was installed earlier. This mechanism prevents IP phones from accepting CTL files from unknown sources.

c. The CTL file is published on the TFTP server. Because an external TFTP server is not supported in secure mode, the configuration files are generated by the Cisco Unified CME system itself and are digitally signed by the TFTP server's credentials. The TFTP server credentials can be the same as the Cisco Unified CME credentials. If desired, a separate certificate can be generated for the TFTP function if the appropriate trustpoint is configured under the CTL-client interface.

3. The telephony service module signs phone configuration files and each phone requests its file.
4. When an IP phone boots up, it requests the CTL file (CTLfile.tlv) from the TFTP server and downloads its digitally signed configuration file, which has the filename format of SEP<mac-address>.cnf.xml.sgn.
5. The phone then reads the CAPF configuration status from the configuration file. If a certificate operation is needed, the phone initiates a TLS session with the CAPF server on TCP port 3804 and begins the CAPF protocol dialogue. The certificate operation can be an upgrade, delete, or fetch operation. If an upgrade operation is needed, the CAPF server makes a request on behalf of the phone for a certificate from the CA. The CAPF server uses the CAPF protocol to obtain the information it needs from the phone, such as the public key and phone ID. After the phone successfully receives a certificate from the server, the phone stores it in its flash memory.
6. With the certificate in its flash, the phone initiates a TLS connection with the secure Cisco Unified CME server on a well-known TCP port (2443), if the device security mode settings in the .cnf.xml file are set to authenticated or encrypted. This TLS session is mutually authenticated by both parties. The IP phone knows the Cisco Unified CME server's certificate from the CTL file, which it initially downloaded from the TFTP server. The phone's LSC is a trusted party for the Cisco Unified CME server, because the issuing CA certificate is present in the router.

Startup Messages

If the certificate server is part of your startup configuration, you may see the following messages during the boot procedure:

```
% Failed to find Certificate Server's trustpoint at startup
% Failed to find Certificate Server's cert.
```

These messages are informational messages that show a temporary inability to configure the certificate server because the startup configuration has not been fully parsed yet. The messages are useful for debugging, if the startup configuration has been corrupted.

Configuration File Maintenance

In a secure environment, several types of configuration files must be digitally signed before they can be hosted and used. The filenames of all signed files have a .sgn suffix.

The Cisco Unified CME telephony service module creates phone configuration files (.cnf.xml suffix) and hosts them on a Cisco IOS TFTP server. These files are signed by the TFTP server's credentials.

In addition to the phone configuration files, other Cisco Unified CME configuration files such as the network and user-locale files must be signed. These files are internally generated by Cisco Unified CME, and the signed versions are automatically created in the current code path whenever the unsigned versions are updated or created.

Other configuration files that are not generated by Cisco Unified CME, such as ringlist.xml, distinctiveringlist.xml, audio files, and so forth, are often used for Cisco Unified CME features. Signed versions of these configuration files are not automatically created. Whenever a new configuration file that has not been generated by Cisco Unified CME is imported into Cisco Unified CME, use the **load-cfg-file** command, which does all of the following:

- Hosts the unsigned version of the file on the TFTP server.
- Creates a signed version of the file.
- Hosts the signed version of the file on the TFTP server.

You can also use the **load-cfg-file** command instead of the **tftp-server** command when only the unsigned version of a file needs to be hosted on the TFTP server.

CTL File Maintenance

The CTL file contains the SAST records and other records. (A maximum of two SAST records may exist.) The CTL file is digitally signed by one of the SAST credentials that are listed in the CTL file before the CTL file is downloaded by the phone and saved in its flash. After receiving the CTL file, a phone trusts a newer or changed CTL file only if it is signed by one of the SAST credentials that is present in the original CTL file.

For this reason, you should take care to regenerate the CTL file only with one of the original SAST credentials. If both SAST credentials are compromised and a CTL file must be generated with a new credential, you must reset the phone to its factory defaults.

CTL Client and Provider

The CTL client generates the CTL file. The CTL client must be provided with the names of the trustpoints it needs for the CTL file. It can run on the same router as Cisco Unified CME or on another, standalone router. When the CTL client runs on a standalone router (not a Cisco Unified CME router), you must configure a CTL provider on each Cisco Unified CME router. The CTL provider securely communicates the credentials of the Cisco Unified CME server functions to the CTL client that is running on another router.

When the CTL client is running on either a primary or secondary Cisco Unified CME router, you must configure a CTL provider on each Cisco Unified CME router on which the CTL client is not running.

The CTL protocol is used to communicate between the CTL client and a CTL provider. Using the CTL protocol ensures that the credentials of all Cisco Unified CME routers are present in the CTL file and that all Cisco Unified CME routers have access to the phone certificates that were issued by the CA. Both elements are prerequisites to secure communications.

To enable CTL clients and providers, see the "Configuring the CTL Client" section on page 441 and the "Configuring the CTL Provider" section on page 446.

Manually Importing MIC Root Certificate

When a phone uses a MIC for authentication during the TLS handshake with the CAPF server, the CAPF server must have a copy of the MIC in order to verify it. Different certificates are used for different types of IP phones.

A phone uses a MIC for authentication when it has a MIC but no LSC. For example, you have a Cisco Unified IP Phone 7970 that has a MIC by default but no LSC. When you schedule a certificate upgrade with the authentication mode set to MIC for this phone, the phone presents its MIC to the Cisco Unified CME CAPF server for authentication. The CAPF server must have a copy of the MIC's root certificate to verify the phone's MIC. Without this copy, the CAPF upgrade operation fails.

To ensure that the CAPF server has copies of the MICs it needs, you must manually import certificates to the CAPF server. The number of certificates that you must import depends on your network configuration. Manual enrollment refers to copy-and-paste or TFTP transfer methods.

For more information on certificate enrollment, see the "Configuring Cut-and-Paste Certificate Enrollment" section of the "Configuring Certificate Enrollment for a PKI" chapter in the *Cisco IOS Security Configuration Guide* for your Cisco IOS release.

To manually import the MIC root certificate, see the "Manually Importing MIC Root Certificate" section on page 434.

Feature Design of Media Encryption

Companion voice security Cisco IOS features provide an overall architecture for secure end-to-end IP telephony calls on supported network devices that enable the following:

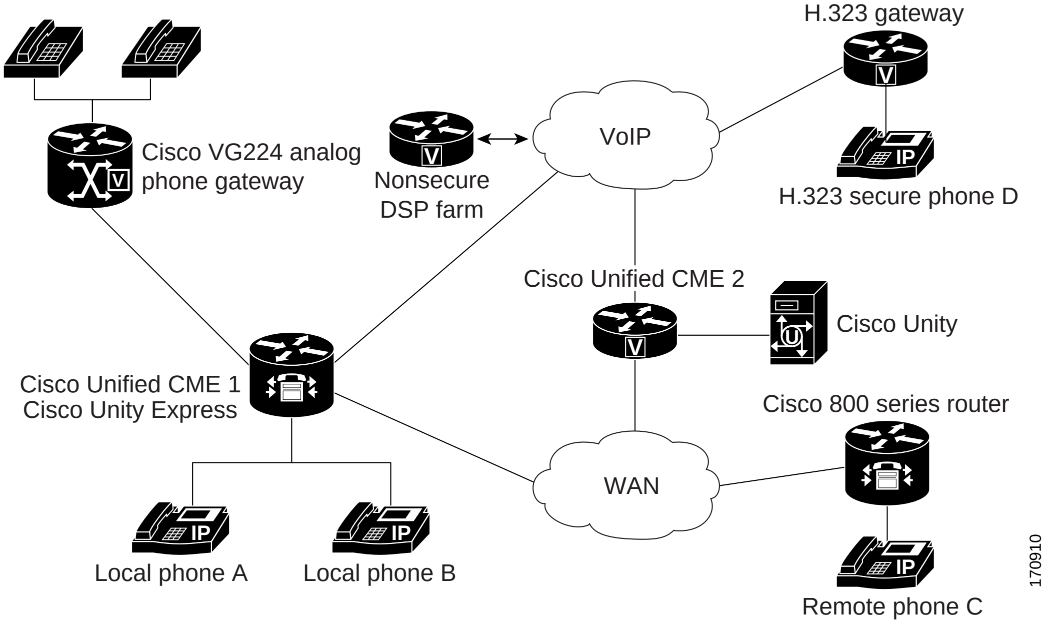
- SRTP capable Cisco Unified CME networks with secure interoperability
- Secure Cisco IP phone calls
- Secure Cisco VG224 Analog Phone Gateway endpoints
- Secure supplementary services

We implement these features using media and signaling authentication and encryption in Cisco IOS H.323 networks. H.323, the ITU-T standard that describes packet-based video, audio, and data conferencing, refers to a set of other standards, including H.450, to describe its actual protocols. H.323 allows dissimilar communication devices to communicate with each other by using a standard communication protocol, and defines a common set of codecs, call setup and negotiating procedures, and basic data transport methods. H.450, a component of the H.323 standard, defines signaling and procedures that are used to provide telephony-like supplementary services. We use H.450 messages in H.323 networks to implement secure supplementary service support, and also empty capability set (ECS) messaging for media capability negotiation.

Secure Cisco Unified CME

The secure Cisco Unified CME solution includes secure-capable voice ports, SCCP endpoints, and a secure H.323 trunk between Cisco Unified CME and Cisco Unified Communications Manager for audio media. SIP trunks are not supported. Figure 20 shows the components of a secure Cisco Unified CME system.

Figure 20 Secure Cisco Unified CME System



Secure Cisco Unified CME implements call control signaling using Transport Layer Security (TLS) or IPsec (IP Security) for the secure channel, and uses SRTP for media encryption. Secure Cisco Unified CME manages the SRTP keys to endpoints and to gateways.

The Media Encryption (SRTP) on Cisco Unified CME feature supports the following features:

- Secure voice calls using SRTP for SCCP endpoints
- Secure voice calls in a mixed shared line environment that allows both RTP and SRTP capable endpoints; shared line media security depends on the endpoint configuration.
- Secure supplementary services using H.450 including:
  - Call forward
  - Call transfer
  - Call hold and resume
  - Call park and call pickup
  - Nonsecure software conference

Note SRTP conference calls over H.323 may experience a 0 to 2 second noise interval when the call is joined to the conference.

- Secure calls in a nonH.450 environment

- Secure Cisco Unified CME interaction with secure Cisco Unity
- Secure Cisco Unified CME interaction with Cisco Unity Express (interaction is supported and calls are downgraded to nonsecure mode)
- Secure transcoding for remote phones with DSP farm transcoding configured

These features are discussed in the following sections.

Secure Supplementary Services

The Media Encryption (SRTP) feature supports secure supplementary services in both H.450 and nonH.450 Cisco Unified CME networks. A secure Cisco Unified CME network should be either H.450 or nonH.450, not a hybrid.

Secure Cisco Unified CME in an H.450 Environment

Signaling and media encryption among secure endpoints is supported, enabling supplementary services such as call transfer (H.450.2) and call forward (H.450.3) between secure endpoints. Call park and pick up use H.450 messages. Secure Cisco Unified CME is H.450-enabled by default; however, secure music on hold (MOH) and secure conferences (three-way calling) are not supported. For example, when supplementary services are initiated as shown in Figure 21, ECS and Terminal Capabilities Set (TCS) are used to negotiate the initially secure call between A and B down to RTP so A can hear MOH. When B resumes the call to A, the call goes back to SRTP. Similarly, when a transfer is initiated, the party being transferred is put on hold, and the call is negotiated down to RTP. When the call is transferred, it goes back to SRTP if the other end is SRTP capable.

Figure 21 Music on Hold in an H.450 Environment

Secure Cisco Unified CME in a NonH.450 Environment

Security for supplementary services requires midcall key negotiation or midcall media renegotiation. In an H.323 network where there are no H.450 messages, media renegotiation is implemented using ECS for scenarios such as mismatched codecs and secure calls. If you disable H.450 on the router globally, the configuration is applied to RTP and SRTP calls. The signaling path is hairpin on XOR for Cisco Unified CME and Cisco Unified Communications Manager. For example, in Figure 22 the signaling path goes from A through B, the supplementary services initiator, to C. When deploying voice security in this scenario, consider that the media security keys will pass through XOR, that is, through B, the endpoint that issued the transfer request. To avoid the man-in-the-middle attack, the XOR must be a trusted entity.

Figure 22 Transfer in a NonH.45 Environment

The media path is optional. The default media path for Cisco Unified CME is hairpin. However, whenever possible media flow around can be configured on Cisco Unified CME. When configuring media flow through, which is the default, remember that chaining multiple XOR gateways in the media path introduces more delay and thus reduces voice quality. Router resources and voice quality limit the number of XOR gateways that can be chained. The requirement is platform dependent, and may vary between signaling and media. The practical chaining level is three.

A transcoder is inserted when there is a codec mismatch and ECS and TCS negotiation fails. For example, if Phone A and Phone B are SRTP capable, but Phone A uses the G.711 codec and Phone B uses the G.729 codec, a transcoder is inserted if Phone B has one. However, the call is negotiated down to RTP to fulfill the codec requirement, so the call is not secure.

Secure Transcoding for Remote Phones with DSP Farm Transcoding Configured

Transcoding is supported for remote phones that have the **dspfarm-assist** keyword of the **codec** command configured. A remote phone is a phone that is registered to a Cisco Unified CME and that is residing on a remote location across the WAN. To save bandwidth across the WAN connection, calls to such a phone can be made to use the G.729r8 codec by configuring the **codec g729r8 dspfarm assist** command for the ephone. The **g729r8** keyword forces calls to such a phone to use the G.729 codec. The **dspfarm-assist** keyword enables using available DSP resources, if an H.323 call to the phone needs to be transcoded.

Note Transcoding is enabled only if an H.323 call with a different codec from the remote phone tries to make a call to the remote phone. If a local phone on the same Cisco Unified CME as the remote phone makes a call to remote phone, the local phone is forced to change its codec to G.729 instead of using transcoding.

Secure transcoding for point-to-point SRTP calls can only occur when both the SCCP phone which is to be serviced by Cisco Unified CME transcoding and its peer in the call are SRTP-capable and have successfully negotiated the SRTP keys. Secure transcoding for point-to-point SRTP calls cannot occur when only one of the peers in the call is SRTP-capable.

If Cisco Unified CME transcoding is to be performed on a secure call, the Media Encryption (SRTP) on Cisco Unified CME feature allows Cisco Unified CME to provide the DSP farm with the encryption keys for the secure call as additional parameters, so that Cisco Unified CME transcoding can be performed successfully. Without the encryption keys, the DSP farm would not be able to read the encrypted voice data in order to transcode it.

Note The secure transcoding described here does not apply to IP-IP gateway transcoding.

Cisco Unified CME transcoding is different from IP-to-IP gateway transcoding because it is invoked for an SCCP endpoint only, instead of for bridging VoIP call legs. Cisco Unified CME transcoding and IP-to-IP gateway transcoding are mutually exclusive, that is, only one type of transcoding can be invoked for a call. If no DSP farm capable of SRTP transcoding is available, Cisco Unified CME secure transcoding is not performed and the call goes through using G.711.

Secure Cisco Unified CME with Cisco Unity Express

Note Cisco Unity Express does not support secure signaling and media encryption. Secure Cisco Unified CME interoperates with Cisco Unity Express, but calls between Cisco Unified CME and Cisco Unity Express are not secure.

In a typical Cisco Unity Express deployment with Cisco Unified CME in a secure H.323 network, Session Initiation Protocol (SIP) is used for signaling, and the media path is G.711 with RTP. For Call Forward No Answer (CFNA) and Call Forward All (CFA), before the media path is established, signaling messages are sent to negotiate an RTP media path. If codec negotiation fails, a transcoder is inserted. The Media Encryption (SRTP) on Cisco Unified CME feature's H.323 service provider interface (SPI) supports fast start calls. In general, calls transferred or forwarded back to Cisco Unified CME from Cisco Unity Express fall into existing call flows and are treated as regular SIP and RTP calls.

The Media Encryption (SRTP) on Cisco Unified CME feature supports blind transfer back to Cisco Unified CME only. When midcall media renegotiation is configured, the secure capability for the endpoint is renegotiated regardless of which transfer mechanism, H.450.2 or Empty Capability Set (ECS), was used.

Secure Cisco Unified CME with Cisco Unity

The Media Encryption (SRTP) on Cisco Unified CME feature supports Cisco Unity 4.2 or a later version and Cisco Unity Connection 1.1 or a later version using SCCP. Secure Cisco Unity for Cisco Unified CME acts like a secure SCCP phone. Some provisioning is required before secure signaling can be established. Cisco Unity receives Cisco Unified CME device certificates from the Certificate Trust List (CTL) and Cisco Unity certificates are inserted into Cisco Unified CME manually. Cisco Unity with SIP is not supported.

The certificate for the Cisco Unity Connection is in the Cisco Unity administration web application under the “port group settings.”

How to Configure Security

This section contains the following tasks:

Phone Authentication

- Configuring the Cisco IOS Certification Authority, page 424 (required)
- Verifying the Cisco IOS Certification Authority, page 428 (optional)
- Configuring the Registration Authority, page 428 (optional)
- Verifying the Registration Authority, page 431 (optional)
- Authenticating Certificates for Server Functions, page 431 (required)
- Verifying Certificates for Server Functions, page 434 (optional)
- Manually Importing MIC Root Certificate, page 434 (optional)
- Configuring Telephony-Service Security Parameters, page 436 (required)
- Verifying Telephony-Service Security Parameters, page 441 (optional)
- Configuring the CTL Client, page 441 (required)
- Verifying the CTL Client, page 446 (optional)
- Configuring the CTL Provider, page 446 (optional)
- Verifying the CTL Provider, page 448 (optional)
- Configuring the CAPF Server, page 448 (required)
- Verifying the CAPF Server, page 451 (optional)
- Entering the Authentication String on the Phone, page 452 (optional)
- Verifying the Authentication String on the Phone, page 453 (optional)

Media Encryption

- Configuring Secure Calls Between Cisco Unified CMEs Across an H.323 Trunk, page 453 (required)
- Configuring Cisco Unified CME SRTP Fallback for H.323 Dial Peers, page 455 (optional)
- Configuring Cisco Unity for Secure Cisco Unified CME Operation, page 457 (optional)

Configuring the Cisco IOS Certification Authority

To configure a root certificate server, also called a certification authority (CA), on a Cisco IOS router, perform the following steps. The router can be the Cisco Unified CME router or an external router.

Setting up a Cisco IOS CA is a standard PKI task. The basic steps are included here for ease of use. For more information, see the “Configuring and Managing a Cisco IOS Certificate Server for PKI Deployment” section in “Part 5: Implementing and Managing a PKI” in the *Cisco IOS Security Configuration Guide* for your Cisco IOS release.

Note If you use a third-party CA, follow the provider’s instructions instead of performing these steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip http server**
4. **crypto pki server** *label*
5. **database level** {**minimal** | **names** | **complete**}
6. **database url** *root-url*
7. **lifetime certificate** *time*
8. **issuer-name CN=***label*
9. **exit**
10. **crypto pki trustpoint** *label*
11. **enrollment url** *ca-url*
12. **exit**
13. **crypto pki server** *label*
14. **grant auto**
15. **no shutdown**
16. **end**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**`enable`**
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		• Enter your password if prompted.

Step 2	**`configure terminal`**
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	**`ip http server`**
	Example:
	`Router(config)# ip http server`
		Enables the Cisco web-browser user interface on the local Cisco Unified CME router.

Step 4	**`crypto pki server`** *`label`*
	Example:
	`Router(config)# crypto pki server sanjose1`
		Defines a label for the certificate server and enters certificate-server configuration mode.
		• *label*—Name for CA certificate server.

	Command or Action	Purpose

Step 5	**`database level {minimal | names | complete}`**
	Example:
	`Router(config-cs-server)# database level complete`
		(Optional) Controls the type of data stored in the certificate enrollment database.
		• **minimal**—Enough information is stored only to continue issuing new certificates without conflict. This is the default value.
		• **names**—In addition to the minimal information given, the serial number and subject name of each certificate.
		• **complete**—In addition to the information given in the minimal and names levels, each issued certificate is written to the database.
		Note The **complete** keyword produces a large amount of information; so specify an external TFTP server in which to store the data by using the **database url** command.

Step 6	**`database url`** *`root-url`*
	Example:
	`Router(config-cs-server)# database url nvram:`
		(Optional) Specifies the location where all database entries for the certificate server are to be written out. If this command is not specified, all database entries are written to NVRAM.
		• *root-url*—Location where database entries will be written out. The URL can be any URL that is supported by the Cisco IOS file system.
		Note If the CA is going to issue a large number of certificates, select an appropriate storage location like flash or other storage device to store the certificates.
		Note When the storage location chosen is flash and the file system type on this device is Class B (LEFS), make sure to check free space on the device periodically and use the **squeeze** command to free the space used up by deleted files. This process may take several minutes and should be done during scheduled maintenance periods or off-peak hours.

Step 7	**`lifetime certificate`** *`time`*
	Example:
	`Router(config-cs-server) lifetime certificate 888`
		(Optional) Specifies the lifetime, in days, of certificates issued by this CA server.
		• *time*—Number of days until a certificate expires. Range is 1 to 1825. Default is 1 year. The maximum certificate lifetime is 1 month less than the lifetime of the CA certificate.
		Note If you want to use this command is used, use it before the server is enabled with the **no shutdown** command.

Step 8	**`issuer-name CN=`***`name`*
	Example:
	`Router(config-cs-server)# issuer-name CN=sanjose1`
		(Optional) Specifies a distinguished name (DN) as the certification-authority (CA) issuer name for the certificate server.
		If the issuer name is not configured, CN = CA label.

	Command or Action	Purpose

Step 9	**`exit`**
	Example:
	`Router(config-cs-server)# exit`
		Exits certificate-server configuration mode.

Step 10	**`crypto pki trustpoint`** *`label`*
	Example:
	`Router(config)# crypto pki trustpoint sanjose1`
		(Optional) Declares a trustpoint and enters ca-trustpoint configuration mode.
		- *label*—Name for the trustpoint.
		- A trustpoint for the CA is automatically generated by the router when the CA is started. If you must use a specific RSA key for the CA, you can create your own trustpoint by using the same label used in the **crypto pki server** command in Step 13. If the router sees a configured trustpoint with the same label as that of the "crypto pki server," it uses this trustpoint and does not automatically create a trustpoint.
		Note Use this command and the **enrollment url** command if this CA is local to the Cisco Unified CME router. These commands are not needed for a CA on an external router.

Step 11	**`enrollment url`** *`ca-url`*
	Example:
	`Router(config-ca-trustpoint)# enrollment url http://ca-server.company.com`
		Specifies the enrollment URL of the issuing CA certificate server (root certificate server).
		- *ca-url*—URL of the router on which the root CA is installed.

Step 12	**`exit`**
	Example:
	`Router(config-ca-trustpoint)# exit`
		Exits ca-trustpoint configuration mode.

Step 13	**`crypto pki server`** *`label`*
	Example:
	`Router(config)# crypto pki server sanjose1`
		Enters certificate-server configuration mode.
		- *label*—Name for CA certificate server.

Step 14	**`grant auto`**
	Example:
	`Router(config-cs-server)# grant auto`
		(Optional) Allows certificates to be issued automatically to any requester.
		- Default and recommended method is manual enrollment.
		Tip Use this command only when testing and building simple networks. Use the **no grant auto** command after configuration is complete to prevent certificates from being automatically granted.

	Command or Action	Purpose
Step 15	**no shutdown** **Example:** `Router(config-cs-server)# no shutdown`	(Optional) Enables the CA. **Note** You should use this command only after you have completely configured the CA.

Step 16	**end**
	Example:
	`Router(config-cs-server)# end`
		Returns to privileged EXEC mode.

Verifying the Cisco IOS Certification Authority

Step 1 Use the **show crypto pki server** command to display the status of the certificate server.

Step 2 Use the **show running-config** command to display the running configuration, including the certificate-server configuration.

The following example defines a CA named authority1 running locally on the Cisco Unified CME router:

```
ip http server

crypto pki server authority1
 database level complete
 database url nvram:

crypto pki trustpoint authority1
 enrollment url http://ca-server.company.com

crypto pki server authority1
 no grant auto
 no shutdown
```

Configuring the Registration Authority

This task is required if the CA is a third-party CA or if the CA is on a Cisco IOS router external to the Cisco Unified CME router. In these cases, the CAPF server requires an RA to issue certificates to phones.

The RA is the authority charged with recording or verifying some or all of the data required for the CA to issue certificates. In many cases the CA undertakes all of the RA functions itself, but where a CA operates over a wide geographical area or when there is security concern over exposing the CA at the edge of the network, it may be advisable to delegate some of the tasks to an RA and let the CA concentrate on its primary tasks of signing certificates.

You can configure a Cisco IOS certificate server to run in RA mode. When the RA receives a manual or Simple Certificate Enrollment Protocol (SCEP) enrollment request, the administrator can either reject or grant it on the basis of local policy. If the request is granted, it is forwarded to the issuing CA, and the CA automatically generates the certificate and returns it to the RA. The client can later retrieve the granted certificate from the RA.

To configure an RA, perform the following steps on the Cisco Unified CME router.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **crypto pki trustpoint** *label*
4. **enrollment url** *ca-url*
5. **revocation-check** *method1* [*method2* [*method3*]]
6. **serial-number** [**none**]
7. **rsakeypair** *key-label* [*key-size* [*encryption-key-size*]]
8. **exit**
9. **crypto pki server** *label*
10. **mode ra**
11. **lifetime certificate** *time*
12. **grant auto**
13. **no shutdown**
14. **end**

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		• Enter your password if prompted.

Step 2	`configure terminal`
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	`crypto pki trustpoint` *`label`*
	Example:
	`Router(config)# crypto pki trustpoint ra12`
		Declares the trustpoint that your RA mode certificate server should use and enters CA-trustpoint configuration mode.
		• *label*—Name for the trustpoint and RA. The certificate-server label that you use here is also used in the **crypto pki server** command in Step 9.
		Note This name is also specified in the **cert-enroll-trustpoint** command when you set up the CA proxy as described in the "Configuring the CAPF Server" section on page 448.

Step 4	`enrollment url` *`ca-url`*
	Example:
	`Router(config-ca-trustpoint)# enrollment url http://ca-server.company.com`
		Specifies the enrollment URL of the issuing CA certificate server (root certificate server).
		• *ca-url*—URL of the router on which the root CA has been installed.

	Command or Action	Purpose
Step 5	**revocation-check** *method1* [*method2* [*method3*]] **Example:** `Router(config-ca-trustpoint)# revocation-check none`	(Optional) Checks the revocation status of a certificate and specifies one or more methods to check the status. If a second and third method are specified, each method is used only if the previous method returns an error, such as a server being down. Valid values for *methodn* are as follows: • **crl**—Certificate checking is performed by a certificate revocation list (CRL). This is the default behavior. • **none**—Certificate checking is not required. • **ocsp**—Certificate checking is performed by an Online Certificate Status Protocol (OCSP) server.
Step 6	**serial-number** [**none**] **Example:** `Router(config-ca-trustpoint)# serial-number`	(Optional) Specifies whether the router serial number should be included in the certificate request. When this command is not used, you are prompted for the serial number during certificate enrollment. • **none**—(Optional) A serial number is not included in the certificate request.
Step 7	**rsakeypair** *key-label* [*key-size* [*encryption-key-size*]] **Example:** `Router(config-ca-trustpoint)# rsakeypair exampleCAkeys 1024 1024`	(Optional) Specifies an RSA key pair to use with a certificate. • *key-label*—Name of the key pair, which is generated during enrollment if it does not already exist or if the **auto-enroll regenerate** command is used. • *key-size*—(Optional) Size of the desired RSA key. If not specified, the existing key size is used. • *encryption-key-size*—(Optional) Size of the second key, which is used to request separate encryption, signature keys, and certificates. **Note** Multiple trustpoints can share the same key.
Step 8	**exit** **Example:** `Router(config-ca-trustpoint)# exit`	Exits ca-trustpoint configuration mode.
Step 9	**crypto pki server** *label* **Example:** `Router(config)# crypto pki server ra12`	Defines a label for the certificate server and enters certificate-server configuration mode. • *label*—Name for the trustpoint and RA. The certificate-server label must have the same name as the trustpoint that was created in Step 3.
Step 10	**mode ra** **Example:** `Router(config-cs-server)# mode ra`	Places the PKI server into certificate-server mode for the RA.

	Command or Action	Purpose
Step 11	**lifetime certificate** *time* **Example:** `Router(config-cs-server)# lifetime certificate 1800`	(Optional) Specifies the lifetime, in days, of a certificate. • *time*—Number of days until the certificate expires. Range is 1 to 1825. Default is 1 year. The maximum certificate lifetime is 1 month less than the lifetime of the CA certificate. **Note** If this command is used, it must be used before the server is enabled with the **no shutdown** command.
Step 12	**grant auto** **Example:** `Router(config-cs-server)# grant auto`	Allows a certificate to be issued automatically to any requester. **Note** Use this command only during enrollment when testing and building simple networks. As a security best practice, disable this functionality after configuration using the **no grant auto** command so that certificates are not continually granted.
Step 13	**no shutdown** **Example:** `Router(config-cs-server)# no shutdown`	(Optional) Enables the certificate server. You are prompted to provide input regarding acceptance of the CA certificate, the router certificate, the challenge password, and a password for protecting the private key. **Note** Use this command only after you have completely configured your certificate server.

Step 14	**end**
	Example:
	`Router(config-cs-server)# end`
		Returns to privileged EXEC mode.

Verifying the Registration Authority

Step 1 Use the **show crypto pki server** command to display the status of the certificate server.

Step 2 Use the **show crypto pki certificates** command to display certificate information.

Step 3 Use the **show running-config** command to display the running configuration.

Authenticating Certificates for Server Functions

The Cisco Unified CME router needs certificates for the following server functions:

- Secure SCCP server (Cisco Unified CME)—Requires a certificate for TLS sessions with phones.
- TFTP server credentials—Requires a key pair and certificate for signing configuration files.
- CAPF server—Requires a certificate for TLS sessions with phones.
- Security tokens—Required for signing the CTL file. We recommend creating two certificates, one for primary use and the other for backup.

To obtain a certificate for each of these functions, perform the following steps for each server function.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **crypto pki trustpoint** *trustpoint-label*
4. **enrollment url** *url*
5. **revocation-check** *method1* [*method2* [*method3*]]
6. **rsakeypair** *key-label* [*key-size* [*encryption-key-size*]]
7. **exit**
8. **crypto pki authenticate** *trustpoint-label*
9. **crypto pki enroll** *trustpoint-label*
10. **exit**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**`enable`**
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		- Enter your password if prompted.

Step 2	**`configure terminal`**
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	**`crypto pki trustpoint`** *`trustpoint-label`*
	Example:
	`Router(config)# crypto pki trustpoint capf`
		Declares the trustpoint that the Cisco Unified CME certificate server should use and enters ca-trustpoint configuration mode.
		- *trustpoint-label*—Label for the trustpoint.

Step 4	**`enrollment url`** *`url`*
	Example:
	`Router(config-ca-trustpoint)# enrollment url http://ca-server.company.com`
		Specifies the enrollment URL of the issuing CA certificate server (root certificate server).
		- *url*—URL of the router on which the root CA is installed.

	Command or Action	Purpose
Step 5	**revocation-check** *method1* [*method2* [*method3*]] **Example:** `Router(config-ca-trustpoint)# revocation-check none`	(Optional) Checks the revocation status of a certificate. • *method*—Method used by the router to check the revocation status of the certificate. If a second and third method are specified, each method is used only if the previous method returns an error, such as a server being down. – **crl**—Certificate checking is performed by a certificate revocation list (CRL). This is the default behavior. – **none**—Certificate checking is not required. – **ocsp**—Certificate checking is performed by an Online Certificate Status Protocol (OCSP) server.
Step 6	**rsakeypair** *key-label* [*key-size* [*encryption-key-size*]] **Example:** `Router(config-ca-trustpoint)# rsakeypair capf 1024 1024`	(Optional) Specifies a key pair to use with a certificate. • *key-label*—Name of the key pair, which is generated during enrollment if it does not already exist or if the **auto-enroll regenerate** command is configured. • *key-size*—(Optional) Size of the desired RSA key. If not specified, the existing key size is used. • *encryption-key-size*—(Optional) Size of the second key, which is used to request separate encryption, signature keys, and certificates. **Note** Multiple trustpoints can share the same key.
Step 7	**exit** **Example:** `Router(config-ca-trustpoint)# exit`	Exits CA trustpoint configuration mode.
Step 8	**crypto pki authenticate** *trustpoint-label* **Example:** `Router(config)# crypto pki authenticate capf`	Retrieves the CA certificate and authenticates it. Checks the certificate fingerprint if prompted. • *trustpoint-label*—Trustpoint label. **Note** This command is optional if the CA certificate is already loaded into the configuration.
Step 9	**crypto pki enroll** trustpoint-label **Example:** `Router(config)# crypto pki enroll capf`	Enrolls with the CA and obtains the certificate for this trustpoint. • *trustpoint-label*—Trustpoint label.
Step 10	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.

Verifying Certificates for Server Functions

Step 1 Use the **show crypto pki certificates** command to display information about the certificates.

Step 2 Use the **show running-config** command to display the running configuration.

Manually Importing MIC Root Certificate

The MIC root certificate must be present in the Cisco Unified CME router to allow Cisco Unified CME to authenticate the MIC that is presented to it. To manually import the MIC root certificate on the Cisco Unified CME router, perform the following steps for each type of phone that requires a MIC for authentication.

Prerequisites

One of the following situations must be true before you perform this task:

- You choose to use MIC as the method for phone authentication during CAPF certificate operation
- You plan to establish the TLS session for SCCP signaling using the phone's MIC instead of an LSC

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **crypto pki trustpoint** *name*
4. **revocation-check** *method1*
5. **enrollment terminal**
6. **exit**
7. **crypto pki authenticate** *name*
8. Open the MIC root file and copy the certificate.
9. When prompted, paste the certificate, press Enter, and type **quit**.
10. Enter **y** to accept the certificate.
11. **exit**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**`enable`**
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		- Enter your password if prompted.

Step 2	**`configure terminal`**
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	**`crypto pki trustpoint`** *`name`*
	Example:
	`Router(config)# crypto pki trustpoint sanjose1`
		Declares the CA that your router should use and enters CA-trustpoint configuration mode.
		- *name*—CA trustpoint name.

Step 4	**`revocation-check`** *`method1`*
	Example:
	`Router(ca-trustpoint)# revocation-check none`
		Checks the revocation status of a certificate.
		- *method1*—The method used by the router to check the revocation status of the certificate. For this task, the only available method is **none**. The keyword **none** is required for this task and means that a revocation check is not performed and the certificate is always accepted.

Step 5	**`enrollment terminal`**
	Example:
	`Router(ca-trustpoint)# enrollment terminal`
		Specifies manual (copy-and-paste) certificate enrollment.

Step 6	**`exit`**
	Example:
	`Router(ca-trustpoint)# exit`
		Exits CA-trustpoint configuration mode.

Step 7	**`crypto pki authenticate`** *`name`*
	Example:
	`Router(config)# crypto pki authenticate sanjose1`
		Authenticates the CA (by getting the certificate from the CA).
		- *name*—Name of the CA.

Step 8	Open the MIC root file and copy the certificate.	The MIC root file is a file with name a*.0, located in the directory C:\Program Files\Cisco\Certificates Copy to a buffer or temporary location all of the contents that appear between "-----BEGIN CERTIFICATE-----" and "-----END CERTIFICATE-----".
Step 9	When prompted, paste the certificate, press Enter, and type **quit**.	Paste the text from the a*.0 file, press Enter after pasting the certificate, and type **quit** on a line by itself.

	Command or Action	Purpose
Step 10	Enter **y** to accept the certificate.	The system responds to the pasted certificate text by providing the MD5 and SHA1 fingerprints, and asks whether you accept the certificate. Enter **y** to accept the certificate or **n** to reject it.

Step 11	`exit`
	Example:
	`Router(config)# exit`
		Returns to privileged EXEC mode.

Configuring Telephony-Service Security Parameters

To enable telephony-service security parameters, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **telephony-service**
4. **secure-signaling trustpoint** *label*
5. **tftp-server-credentials trustpoint** *label*
6. **device-security-mode** {**authenticated** | **none** | **encrypted**}
7. **cnf-file perphone**
8. **load-cfg-file** *file-url* **alias** *file-alias* [**sign**] [**create**]
9. **server-security-mode** {**secure** | **non-secure**}
10. **exit**
11. **ephone** *phone-tag*
12. **device-security-mode** {**authenticated** | **none** | **encrypted**}
13. **codec** {**g711ulaw** | **g729r8** [**dspfarm-assist**]}
14. **capf-auth-str** *digit-string*
15. **cert-oper** {**delete** | **fetch** | **upgrade**} **auth-mode** {**auth-string** | **LSC** | **MIC** | **null-string**}
16. **reset**
17. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**telephony-service** **Example:** Router(config)# telephony-service	Enters telephony-service configuration mode.
Step 4	**secure-signaling trustpoint** *label* **Example:** Router(config-telephony)# secure-signaling trustpoint cme-sccp	Specifies the name of the PKI trustpoint that has the valid certificate to be used for TLS handshakes with IP phones on TCP port 2443. • *label*—Name of a configured PKI trustpoint with a valid certificate.
Step 5	**tftp-server-credentials trustpoint** *label* **Example:** Router(config-telephony)# tftp-server-credentials trustpoint cme-tftp	Specifies the name of the PKI trustpoint to be used to sign the phone configuration files. This can be the CAPF-server trustpoint that was used in the previous step or any trustpoint with a valid certificate. • *label*—Name of a configured PKI trustpoint with a valid certificate.
Step 6	**device-security-mode** {**authenticated** | **none** | **encrypted**} **Example:** Router(config-telephony)# device-security-mode authenticated	Enables security mode for all security-capable phones in the system. • **authenticated**—SCCP signaling between a device and Cisco Unified CME takes place through the secure TLS connection on TCP port 2443. • **none**—SCCP signaling is not secure. This is the default. • **encrypted**—SCCP signaling between a device and Cisco Unified CME takes place through the secure TLS connection on TCP port 2443, and the media uses Secure Real-Time Transport Protocol (SRTP). Use the **encrypted** keyword to enable Secure Cisco Unified CME functionality. **Note** You can override the setting you make in this command for individual ephones by using the **device-security-mode** command in ephone configuration mode.

	Command or Action	Purpose
Step 7	**cnf-file perphone** **Example:** `Router(config-telephony)# cnf-file perphone`	Specifies the generation of a separate configuration file for each individual phone. Separate configuration files for each endpoint are required for security.
Step 8	**load-cfg-file** *file-url* **alias** *file-alias* [**sign**] [**create**] **Example:** `Router(config-telephony)# load-cfg-file slot0:Ringlist.xml alias Ringlist.xml sign create`	(Optional) Signs configuration files that are not created by Cisco Unified CME. Also loads the signed and unsigned versions of a file on the TFTP server. To serve an already signed file on the TFTP server, use this command without the **sign** and **create** keywords. • *file-url*—Complete path of a configuration file in a local directory. • **alias** *file-alias*—Alias name of the file to be served on the TFTP server. • **sign**—(Optional) The file needs to be digitally signed and served on the TFTP server. • **create**—(Optional) Creates the signed file in the local directory. **Note** The first time that you use this command for each file, use the **create** keyword in addition to the **sign** keyword. The **create** keyword is not maintained in the running configuration to prevent signed files from being recreated during every reload.

Step 9	**server-security-mode** {**secure** | **non-secure**}
	Example:
	`Router(config-telephony)# server-security-mode secure`
		(Optional) Changes the security mode of the server.
		• **secure**—Secure mode.
		• **non-secure**—Nonsecure mode.
		Note This command has no impact until the CTL file is initially generated by the CTL client. When the CTL file is generated, the CTL client automatically sets server security mode to secure.
		Note This command must be followed by the **regenerate** command in CTL-client configuration mode.

Step 10	**exit** **Example:** `Router(config)# exit`	Exits telephony-service configuration mode.
Step 11	**ephone** *phone-tag* **Example:** `Router(config)# ephone 24`	Enters ephone configuration mode. • *phone-tag*—Identifier of the ephone to be configured.

	Command or Action	Purpose

Step 12	**device-security-mode** {**authenticated** | **none** | **encrypted**}
	Example:
	`Router(config-ephone)# device-security-mode authenticated`
		(Optional) Sets the security mode for SCCP signaling for an ephone communicating with the Cisco Unified CME router.
		• **authenticated**—SCCP signaling between a device and Cisco Unified CME takes place through the secure TLS connection on TCP port 2443.
		• **none**—SCCP signaling is not secure.
		• **encrypted**—SCCP signaling between a device and Cisco Unified CME takes place through the secure TLS connection on TCP port 2443, and the media uses Secure Real-Time Transport Protocol (SRTP). Use the **encrypted** keyword to enable Secure Cisco Unified CME functionality.
		Note You can set this value globally using the **device-security-mode** command in telephony-service configuration mode. A per-phone setting in ephone configuration mode overrides the global setting for that phone.

Step 13	**codec** {**g711ulaw** | **g729r8** [**dspfarm-assist**]}
	Example:
	`Router(config-ephone)# codec g711ulaw dspfarm-assist`
		(Optional) Sets the security mode for SCCP signaling for a phone communicating with the Cisco Unified CME router.
		• **dspfarm-assist**—Attempts to use DSP-farm resources for transcoding the segment between the phone and the Cisco Unified CME router if G.711 is negotiated for the call. The **dspfarm-assist** keyword is ignored if the SCCP endpoint type is ATA, VG224, or VG248.
		Note The **dspfarm-assist** keyword is required for secure transcoding with Cisco Unified CME to work.

Step 14	**capf-auth-str** *digit-string* **Example:** `Router(config-ephone)# capf-auth-str 2734`	(Optional) Defines a string to use as a personal identification number (PIN) for CAPF authentication. Use the show **capf-server auth-string** command to display configured strings. For instructions on how to enter the string from the phone, see the "Entering the Authentication String on the Phone" section on page 452. • *digit-string*—String of digits that the phone user must dial for CAPF authentication. The string can be from 4 to 10 digits in length. **Note** You can set this value globally using this command or per ephone using the **auth-string** command in CAPF-server configuration mode.

	Command or Action	Purpose

Step 15	**cert-oper** {**delete** | **fetch** | **upgrade**} **auth-mode** {**auth-string** | **LSC** | **MIC** | **null-string**}
	Example:
	`Router(config-ephone)# cert-oper upgrade auth-mode auth-string`
		(Optional) Initiates the indicated certificate operation on this ephone.
		• **delete**—Removes the phone certificate.
		• **fetch**—Retrieves the phone certificate for troubleshooting.
		• **upgrade**—Upgrades the phone certificate.
		• **auth-mode**—Type of authentication to use during CAPF sessions to verify endpoints that request certificates.
		• **auth-string**—Phone user enters a special authentication string at the phone. The string is set with the **capf-auth-str** command and is provided to the phone user by the system administrator. See the "Entering the Authentication String on the Phone" section on page 452.
		• **LSC**—Phone provides its phone certificate for authentication. Precedence is given to an LSC if one exists.
		• **MIC**—Phone provides its phone certificate for authentication. Precedence is given to an MIC if one exists. If this option is chosen, the MIC's issuer certificate must be imported into a PKI trustpoint. See the "Manually Importing MIC Root Certificate" section on page 434.
		• **null-string**—No authentication.
		Note You can initiate certificate operations globally using the **cert-oper** command in CAPF-server configuration mode. You can set authentication mode globally using the **auth-mode** command in CAPF-server configuration mode.

Step 16	**reset** **Example:** `Router(config-ephone)# reset`	Performs a complete reboot of the phone.

Step 17	**end**
	Example:
	`Router(config-ephone)# end`
		Returns to privileged EXEC mode.

Verifying Telephony-Service Security Parameters

Step 1 **show telephony-service security-info**

Use this command to display the security-related information that is configured in telephony-service configuration mode.

```
Router# show telephony-service security-info

Skinny Server Trustpoint for TLS: cme-sccp
TFTP Credentials Trustpoint: cme-tftp
Server Security Mode: Secure
Global Device Security Mode: Authenticated
```

Step 2 **show capf-server auth-string**

Use this command to display authentication strings for phones.

```
Router# show capf-server auth-string

Authentication Strings for configured Ephones
Mac-Addr        Auth-String
--------        -----------
000CCE3A817C    2734
001121116BDD    922
000D299D50DF    9182
000ED7B10DAC    3114
000F90485077    3328
0013C352E7F1    0678
```

Step 3 **show running-config**

Use this command to display the running configuration to verify telephony and per-phone security configuration.

```
Router# show running-config

telephony-service
 secure-signaling trustpoint cme-sccp
 server-security-mode secure
 device-security-mode authenticated
 tftp-server-credentials trustpoint cme-tftp
.
.
.
```

Configuring the CTL Client

The tasks to configure the CTL client differ slightly depending on whether the CTL client is running on the same router as Cisco Unified CME. Choose the appropriate procedure based on your network:

- Configuring the CTL Client on a Cisco Unified CME Router, page 442
- Configuring the CTL Client on a Router Other Than a Cisco Unified CME Router, page 444

Configuring the CTL Client on a Cisco Unified CME Router

The credentials of various functions are included in the CTL file, which is created and hosted on the TFTP server. To configure a CTL client on a Cisco Unified CME router, perform the following steps.

If you have primary and secondary Cisco Unified CME routers, you can configure the CTL client on either one of them.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ctl-client**
4. **sast1 trustpoint** *trustpoint-label*
5. **sast2 trustpoint** *trustpoint-label*
6. **server** {**capf** | **cme** | **cme-tftp** | **tftp**} *ip-address* **trustpoint** *trustpoint-label*
7. **server cme** *ip-address* **username** *string* **password 0** *string*
8. **regenerate**
9. **end**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**`enable`**
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		• Enter your password if prompted.

Step 2	**`configure terminal`**
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	**`ctl-client`**
	Example:
	`Router(config)# ctl-client`
		Enters CTL-client configuration mode.

Step 4	**`sast1 trustpoint`** *`label`*
	Example:
	`Router(config-ctl-client)# sast1 trustpoint sast1tp`
		Configures credentials for the primary SAST.
		• *label*—SAST1 trustpoint name.
		Note SAST1 and SAST2 certificates must be different from each other. The CTL file is always signed by SAST1. The SAST2 credentials are included in the CTL file, so that if the SAST1 certificate is compromised, the file can be signed by SAST2 to prevent phones from being reset to the factory default.

	Command or Action	Purpose
Step 5	**sast2 trustpoint** *label* **Example:** `Router(config-ctl-client)# sast2 trustpoint`	Configures credentials for the secondary SAST. • *label*—SAST2 trustpoint name. **Note** SAST1 and SAST2 certificates must be different from each other. The CTL file is always signed by SAST1. The SAST2 credentials are included in the CTL file, so that if the SAST1 certificate is compromised, the file can be signed by SAST2 to prevent phones from being reset to the factory default.
Step 6	**server** {**capf** | **cme** | **cme-tftp** | **tftp**} *ip-address* **trustpoint** *trustpoint-label* **Example:** `Router(config-ctl-client)# server capf 10.2.2.2 trustpoint capftp`	Configures a trustpoint for each server function that is running locally on the Cisco Unified CME router. **Note** Repeat this command with the appropriate keyword for each function that is running locally on the Cisco Unified CME router. • **capf**—CAPF server. • **cme**—Cisco Unified CME router. • **cme-tftp**—Combined Cisco Unified CME router and TFTP server. • **tftp**—TFTP server. • *ip-address*—IP address of the Cisco Unified CME router. If there are multiple network interfaces, use the interface address in the local LAN to which the phones are connected. • **trustpoint** *trustpoint-label*—Name of the PKI trustpoint for the entity.
Step 7	**server cme** *ip-address* **username** *name-string* **password** {**0** | **1**} *password-string* **Example:** `Router(config-ctl-client)# server cme 10.2.2.2 username user3 password 0 38h2KL`	(Optional) Provides information about another Cisco Unified CME router (primary or secondary) in the network, if one exists. • *ip-address*—IP address of the other Cisco Unified CME router. • **username** *name-string*—Username that is configured on the CTL provider. • **password**—Encryption status of the password string. – **0**—Not encrypted. – **1**—Encrypted using Message Digest 5 (MD5). **Note** This option refers to the way that you want the password to appear in **show** command output and not to the way that you enter the password. • *password-string*—Administrative password of the CTL provider running on the remote Cisco Unified CME router.

	Command or Action	Purpose
Step 8	**regenerate** **Example:** `Router(config-ctl-client)# regenerate`	Creates a new CTLFile.tlv after you make changes to the CTL client configuration.

Step 9	**end**
	Example:
	`Router(config-ctl-client)# end`
		Returns to privileged EXEC mode.

What to do Next

When you have more than one Cisco Unified CME router in your network, you must configure a CTL provider on each Cisco Unified CME router that is not running the CTL client. See the "Configuring the CTL Provider" section on page 446.

Configuring the CTL Client on a Router Other Than a Cisco Unified CME Router

To configure a CTL client on an external router that is not a Cisco Unified CME router, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ctl-client**
4. **sast1 trustpoint** *trustpoint-label*
5. **sast2 trustpoint** *trustpoint-label*
6. **server cme** *ip-address* **username** *name-string* **password** {**0** | **1**} *password-string*
7. **regenerate**
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose

Step 3	**`ctl-client`**
	Example:
	`Router(config)# ctl-client`
		Enters CTL-client configuration mode.

Step 4	**`sast1 trustpoint`** *`label`*
	Example:
	`Router(config-ctl-client)# sast1 trustpoint sast1tp`
		Configures credentials for the primary SAST.
		• *label*—SAST1 trustpoint name.
		Note SAST1 and SAST2 certificates must be different from each other, but either of them may use the same certificate as the Cisco Unified CME router to conserve memory. The CTL file is always signed by SAST1. The SAST2 credentials are included in the CTL file, so that if the SAST1 certificate is compromised, the file can be signed by SAST2 to prevent phones from being reset to the factory default.

Step 5	**`sast2 trustpoint`** *`label`*
	Example:
	`Router(config-ctl-client)# sast2 trustpoint`
		Configures credentials for the secondary SAST.
		• *label*—SAST2 trustpoint name.
		Note SAST1 and SAST2 certificates must be different from each other, but either of them may use the same certificate as the Cisco Unified CME router to conserve memory. The CTL file is always signed by SAST1. The SAST2 credentials are included in the CTL file, so that if the SAST1 certificate is compromised, the file can be signed by SAST2 to prevent phones from being reset to the factory default.

Step 6	**`server cme`** *`ip-address`* **`username`** *`name-string`* **`password {0 | 1}`** *`password-string`*
	Example:
	`Router(config-ctl-client)# server cme 10.2.2.2 username user3 password 0 38h2KL`
		(Optional) Provides information about another Cisco Unified CME router (primary or secondary) in the network, if one exists.
		• *ip-address*—IP address of the other Cisco Unified CME router.
		• **username** *name-string*—Username that is configured on the CTL provider.
		• **password**—Encryption status of the password string.
		– **0**—Not encrypted.
		– **1**—Encrypted using Message Digest 5 (MD5).
		Note This option refers to the way that you want the password to appear in show command output and not to the way that you enter the password in this command.
		• *password-string*—Administrative password of the CTL provider running on the remote Cisco Unified CME router.

	Command or Action	Purpose
Step 7	**regenerate** **Example:** `Router(config-ctl-client)# regenerate`	Creates a new CTLFile.tlv after you make changes to the CTL client configuration.

Step 8	**end**
	Example:
	`Router(config-ctl-client)# end`
		Returns to privileged EXEC mode.

What to do Next

You must configure a CTL provider on each Cisco Unified CME router. See the "Configuring the CTL Provider" section on page 446.

Verifying the CTL Client

Step 1 Use the **show ctl-client** command to display the CTL client configuration.

The following sample output from the **show ctl-client** command displays the trustpoints in the system.

```
Router# show ctl-client

CTL Client Information
-----------------------------
        SAST 1 Certificate Trustpoint: cmeserver
        SAST 1 Certificate Trustpoint: sast2
        List of Trusted Servers in the CTL
                CME     10.1.1.1        cmeserver
                TFTP    10.1.1.1        cmeserver
                CAPF    10.1.1.1        cmeserver
```

Configuring the CTL Provider

If you have more than one Cisco Unified CME router in your network, perform the following steps to configure a CTL provider on each Cisco Unified CME router on which the CTL client is not running.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **credentials**
4. **ip source-address** *ip-address* **port** *port-number*
5. **trustpoint** *trustpoint-label*
6. **ctl-service admin** *username* **secret** {**0** | **1**} *password-string*
7. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. - Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**credentials** **Example:** `Router(config)# credentials`	Enters credentials-interface mode to configure a CTL provider.
Step 4	**ip source-address** [*ip-address* [**port** [*port-number*]]] **Example:** `Router(config-credentials)# ip source-address 172.19.245.1 port 2444`	Identifies the local router on which this CTL provider is being configured. - *ip-address*—Router IP address, typically one of the addresses of the Ethernet port of the router. - **port** *port-number*—TCP port for credentials service communication. Default is 2444. You should use 2444.
Step 5	**trustpoint** *trustpoint-label* **Example:** `Router(config-credentials)# trustpoint ctlpv`	Configures the trustpoint to be used for TLS sessions with the CTL client. - *trustpoint-label*—CTL provider trustpoint label.
Step 6	**ctl-service admin** *username* **secret** {**0** | **1**} *password-string* **Example:** `Router(config-credentials)# ctl-service admin user4 secret 0 c89L8o`	Specifies a username and password to authenticate the CTL client when it connects to retrieve the credentials during the CTL protocol. You must use this command before you enable the CTL provider. - *username*—Name that will be used to authenticate the client. - **secret**—Character string for login authentication and whether the string should be encrypted when it is stored in the running configuration. – **0**—Not encrypted. – **1**—Encrypted using Message Digest 5 (MD5). - *password-string*—Character string for login authentication.

Step 7	**end**
	Example:
	`Router(config-credentials)# end`
		Returns to privileged EXEC mode.

Verifying the CTL Provider

Step 1 **show credentials**

Use this command to display credentials settings.

```
Router# show credentials

Credentials IP: 172.19.245.1
Credentials PORT: 2444
Trustpoint: ctlpv
```

Configuring the CAPF Server

A certificate must be obtained for the CAPF server so that it can establish a TLS session with the phone during certificate operation. The CAPF server can install, fetch, or delete locally significant certificates (LSCs) on security-enabled phones. To enable the CAPF server on the Cisco Unified CME router, perform the following steps.

Tip When you use the CAPF server to install phone certificates, arrange to do so during a scheduled period of maintenance. Generating many certificates at the same time may cause call-processing interruptions.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **capf-server**
4. **trustpoint-label** *label*
5. **cert-enroll-trustpoint** *label* **password** {**0** | **1**} *password-string*
6. **source-addr** *ip-address*
7. **port** *tcp-port*
8. **auth-mode** {**auth-string** | **LSC** | **MIC** | **none** | **null-string**}
9. **auth-string** {**delete** | **generate**} {**all** | *ephone-tag*} [*auth-string*]
10. **phone-key-size** {**512** | **1024** | **2048**}
11. **keygen-retry** *number*
12. **keygen-timeout** *minutes*
13. **cert-oper** {**delete all** | **fetch all** | **upgrade all**}
14. **end**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**`enable`**
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		- Enter your password if prompted.

Step 2	**`configure terminal`**
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	**`capf-server`**
	Example:
	`Router(config)# capf-server`
		Enters CAPF-server configuration mode.

Step 4	**`trustpoint-label`** *`label`*
	Example:
	`Router(config-capf-server)# trustpoint-label tp1`
		Specifies the label of the trustpoint whose certificate is to be used for TLS connection between the CAPF server and the phone.
		- *label*—Trustpoint name.

Step 5	**`cert-enroll-trustpoint`** *`trustpoint-label`* **`password`** `{`**`0`** `|` **`1`**`}` *`password-string`*
	Example:
	`Router(config-capf-server)# cert-enroll-trustpoint ra1 password 0 x8oWiet`
		Enrolls the CAPF with the CA (or RA if the CA is not local to the Cisco Unified CME router).
		- *trustpoint-label*—PKI trustpoint label for the CA or RA.
		- **password**—Encryption status of the password string.
		- *password-string*—Password to use for certificate enrollment. This password is the revocation password that is sent along with the certificate request to the CA.

Step 6	**`source-addr`** *`ip-address`*
	Example:
	`Router(config-capf-server)# source addr 10.10.10.1`
		Defines the IP address of the CAPF server on the Cisco Unified CME router.
		- *ip-address*—IP address of the CAPF server.

Step 7	**`port`** *`tcp-port`*
	Example:
	`Router(config-capf-server)# port 3804`
		(Optional) Defines the TCP port number on which the CAPF server listens for socket connections from the phones.
		- *tcp-port*—TCP port number. Range is 2000 to 9999. Default is 3804.

	Command or Action	Purpose

Step 8	**auth-mode** {**auth-string** | **LSC** | **MIC** | **none** | **null-string**}
	Example:
	`Router(config-capf-server)# auth-mode auth-string`
		Specifies the type of authentication to use during CAPF sessions to verify endpoints that request certificates.
		• **auth-string**—The phone user enters a special authentication string at the phone. The string is provided to the user by the system administrator and is configured using the **auth-string generate** command.
		• **LSC**—The phone provides its LSC for authentication, if one exists.
		• **MIC**—The phone provides its MIC for authentication, if one exists. If this option is chosen, the MIC's issuer certificate must be imported into a PKI trustpoint. See the "Manually Importing MIC Root Certificate" section on page 434.
		• **none**—No certificate upgrade is initiated. This is the default.
		• **null-string**—No authentication.

Step 9	**auth-string** {**delete** | **generate**} {**all** | *ephone-tag*} [*digit-string*] **Example:** `Router(config-capf-server)# auth-string generate all`	(Optional) Creates or removes authentication strings for all the secure ephones or for specified secure ephones. Use this command if the **auth-string** keyword is specified in the **auth-mode** command. Strings become part of the ephone configuration. Use the **show capf-server auth-string** command to view authentication strings. • **delete**—Remove authentication strings for the specified secure devices. • **generate**—Create authentication strings for the specified secure devices. • **all**—All phones. • *ephone-tag*—Identifier for the ephone to receive the authentication string. • *digit-string*—String of digits that the phone user must dial for CAPF authentication. The string can be 4 to 10 digits. If this value is not specified, a random string is generated for each phone. For instructions on how to enter the string from the phone, see the "Entering the Authentication String on the Phone" section on page 452. **Note** You can also define an authentication string for an individual ephone using the **capf-auth-str** command.

Step 10	**phone-key-size** {**512** | **1024** | **2048**}
	Example:
	`Router(config-capf-server)# phone-key-size 2048`
		(Optional) Specifies the size of the RSA key pair that is generated on the phone for the phone's certificate, in bits.
		• **512**—512.
		• **1024**—1024. This is the default.
		• **2048**—2048.

	Command or Action	Purpose
Step 11	**keygen-retry** *number* **Example:** `Router(config-capf-server)# keygen-retry 5`	(Optional) Specifies the number of times that the server sends a key generation request. • *number*—Number of retries. Range is 0 to 100. Default is 3.
Step 12	**keygen-timeout** *minutes* **Example:** `Router(config-capf-server)# keygen-timeout 45`	(Optional) Specifies the amount of time that the server waits for a key generation response from the phone, in minutes. • *minutes*—Number of minutes before the generation process times out. Range is 1 to 120. Default is 30.

Step 13	**cert-oper** {**delete all** | **fetch all** | **upgrade all**}
	Example:
	`Router(config-capf-server)# cert-oper upgrade all`
		Initiates the indicated certificate operation on all configured endpoints in the system.
		• **delete all**—Remove all phone certificates.
		• **fetch all**—Retrieve all phone certificates for troubleshooting.
		• **upgrade all**—Upgrade all phone certificates.
		Note You can use the **cert-oper** command in ephone configuration mode for certificate operations on individual ephones. See the "Configuring Telephony-Service Security Parameters" section on page 436.

Step 14	**end**
	Example:
	`Router(config-capf-server)# end`
		Returns to privileged EXEC mode.

What to Do Next

If you select the authentication-string method of authentication in the **auth-mode** command, you must also enter an authentication string on each phone that is receiving an updated LSC. For instructions on this task, see the "Entering the Authentication String on the Phone" section on page 452.

Verifying the CAPF Server

Step 1 **show capf-server summary**

Use this command to display CAPF-server configuration information.

```
Router# show capf-server summary

CAPF Server Configuration Details
        Trustpoint for TLS With Phone: tp1
        Trustpoint for CA operation: ra1
        Source Address: 10.10.10.1
        Listening Port: 3804
        Phone Key Size: 1024
        Phone KeyGen Retries: 3
        Phone KeyGen Timeout: 30 minutes
```

Step 2 **show capf-server auth-string**

Use this command to display configured strings (PINs) that users enter at the phone to establish CAPF authentication:

```
Router# show capf-server auth-string

Authentication Strings for configured Ephones
Mac-Addr        Auth-String
--------        -----------
000CCE3A817C    7012
001121116BDD    922
000D299D50DF    9182
000ED7B10DAC    3114
000F90485077    3328
0013C352E7F1    0678
```

Entering the Authentication String on the Phone

This procedure is required only for the one-time installation of an LSC on a phone and only if you specify the authentication string method of authentication.

If an authentication string is defined using the **auth-string** command in CAPF-server configuration mode or the **capf-auth-str** command in ephone configuration mode, the authentication string must be communicated to the phone user so that it can be entered on the phone before the LSC is installed.

The phone user can perform the following procedure to install the certificate. The authentication string applies for one-time use only.

Note You can list authentication strings for phones by using the **show capf-server auth-string** command.

Prerequisites

- The CAPF certificate exists in the CTL file.
- A signed image exists on the phone; see the Cisco Unified IP phone administration documentation that supports your phone model.
- The device has registered.
- The device security mode is nonsecure.

DETAILED STEPS

Step 1 Press the Settings button.

On the Cisco Unified IP Phone 7921, use the down arrow key to access the Settings menu.

Step 2 If the configuration is locked, press **# (asterisk, asterisk, pound sign) to unlock it.

Step 3 Scroll down the Settings menu. Highlight Security Configuration and press the Select soft key.

Step 4 Scroll down the Security Configuration menu. Highlight LSC and press the Update soft key.

On the Cisco Unified IP Phone 7921, press **# to unlock the Security Configuration menu.

Step 5 When prompted for the authentication string, enter the string provided by the system administrator and press the Submit soft key.

The phone installs, updates, deletes, or fetches the certificate, depending on the CAPF configuration.

You can monitor the progress of the certificate operation by viewing the messages that display on the phone. After you press Submit, the message "Pending" displays under the LSC option. The phone generates the public and private key pair and displays the information on the phone. When the phone successfully completes the process, the phone displays a successful message. If the phone displays a failure message, you entered the wrong authentication string or did not enable the phone for upgrade.

You can stop the process by choosing the Stop option at any time.

Verifying the Authentication String on the Phone

Step 1 Verify that the certificate was installed on the phone by choosing Settings > Model Information and viewing the LSC setting, which indicates Installed or Not Installed.

Configuring Secure Calls Between Cisco Unified CMEs Across an H.323 Trunk

To configure the network for secure calls between Cisco Unified CME systems across an H.323 trunk, perform the following steps on the Cisco Unified CME router.

Prerequisites

To make secure H.323 calls, telephony-service security parameters must be configured. See the "Configuring Telephony-Service Security Parameters" section on page 436.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **voice service voip**
4. **supplementary-service media-renegotiate**
5. **srtp fallback**
6. **h323**
7. **emptycapability**
8. **exit**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**`enable`**
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		• Enter your password if prompted.

Step 2	**`configure terminal`**
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	**`voice service voip`**
	Example:
	`Router(config)# voice service voip`
		Enters voice-service configuration mode.
		• The **voip** keyword specifies VoIP encapsulation.

Step 4	**`supplementary-service media-renegotiate`**
	Example:
	`Router(conf-voi-serv)# supplementary-service media-renegotiate`
		Enables midcall renegotiation of SRTP cryptographic keys.

Step 5	**`srtp fallback`**
	Example:
	`Router(conf-voi-serv)# srtp fallback`
		Enables security policies.
		• The **srtp** command enables secure calls using SRTP for media encryption and authentication and disables fallback.
		• The **fallback** keyword enables call fallback to nonsecure (RTP) mode, allowing the user to make calls that are not secure.
		• SRTP-to-RTP fallback must be configured for supplementary services such as ringback tone and MOH to function. Without SRTP-to-RTP fallback configured, MOH causes secure calls to be dropped.
		Note This security policy applies to all calls going through the gateway and is not configurable on a per-call basis.
		If fallback is not configured it will drop all calls that are not secure so only secure phones can call you.
		This step configures fallback globally. To configure fallback for individual dial peers, see the "Configuring Cisco Unified CME SRTP Fallback for H.323 Dial Peers" section on page 455. Skip this step if you are going to configure fallback on individual dial peers.

Step 6	**`h323`**
	Example:
	`Router(conf-voi-serv)# h323`
		Enters H.323 voice-service configuration mode.

	Command or Action	Purpose
Step 7	**emptycapability** **Example:** `Router(conf-serv-h323)# emptycapability`	Eliminates the need for identical codec capabilities for all dial peers in the rotary group.
Step 8	**exit** **Example:** `Router(conf-serv-h323)# exit`	Exits H.323 voice-service configuration mode.

Configuring Cisco Unified CME SRTP Fallback for H.323 Dial Peers

To configure SRTP fallback for an individual dial peer, perform the following steps on the Cisco Unified CME router.

Note SRTP-to-RTP fallback must be configured for supplementary services such as ringback tone and MOH to function. Without SRTP-to-RTP fallback configured, MOH causes secure calls to be dropped.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **voice class codec** *tag*
4. **codec preference** *value codec-type*
5. **exit**
6. **dial-peer voice** *tag* **voip**
7. **srtp fallback**
8. **voice-class codec** *tag*
9. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**voice class codec** *tag* **Example:** `Router(config)# voice class codec 1`	Enters voice-class configuration mode and assigns an identification tag number for a codec voice class.
Step 4	**codec preference** *value codec-type* **Example:** `Router(config-voice-class)# codec preference 1 g711alaw`	Specifies a list of preferred codecs to use on a dial peer. • Repeat this step to build a list of preferred codecs. • Use the same preference order for the codec list on both Cisco Unified CMEs on either side of the H.323 trunk.
Step 5	**exit** **Example:** `Router(config-voice-class)# exit`	Exits voice-class configuration mode.
Step 6	**dial-peer voice** *tag* **voip** **Example:** `Router(config)# dial-peer voice 101 voip`	Enters dial peer voice configuration mode.
Step 7	srtp **fallback** **Example:** `Router(config-dial-peer)# srtp fallback`	Enables secure calls that use SRTP for media encryption and authentication and specifies fallback capability. Using the **no srtp** command disables security and causes the dial peer to fall back to RTP mode. • The **srtp** command enables secure calls. • The **fallback** keyword enables fallback to nonsecure mode (RTP) on an individual dial peer. The **no** form of this command disables fallback and disables SRTP. **Note** This dial-peer configuration command takes precedence over the globally configured **srtp** command enabled in voice service voip configuration mode shown in the "Configuring Secure Calls Between Cisco Unified CMEs Across an H.323 Trunk" section on page 453.
Step 8	**voice-class codec** *tag* **Example:** `Router(config-dial-peer)# voice-class codec 1`	Assigns a previously configured codec selection preference list (codec voice class) to a Voice over IP (VoIP) dial peer. • The *tag* argument in this step is the same as the *tag* in Step 3.
Step 9	**exit** **Example:** `Router(config-dial-peer)# exit`	Exits dial-peer voice configuration mode.

Configuring Cisco Unity for Secure Cisco Unified CME Operation

This section contains the following tasks:

- Configuring Integration Between Cisco Unified CME and Cisco Unity, page 457
- Importing the Cisco Unity Root Certificate to Cisco Unified CME, page 458
- Configuring Cisco Unity Ports for Secure Registration, page 459
- Verifying that Cisco Unity are Registering Securely, page 459

Configuring Integration Between Cisco Unified CME and Cisco Unity

To change the settings for the integration between Cisco Unified CME and Cisco Unity, perform the following steps on the Cisco Unity server:

Step 1 If Cisco Unity Telephony Integration Manager (UTIM) is not already open, on the Cisco Unity server, on the Windows Start menu, click **Programs** > **Cisco Unity** > **Manage Integrations**. The UTIM window appears.

Step 2 In the left pane, double-click **Cisco Unity Server**. The existing integrations appear.

Step 3 Click the **Cisco Unified Communications Manager** integration.

Step 4 In the right pane, click the cluster for the integration.

Step 5 Click the **Servers** tab.

Step 6 In the Cisco Unified Communications Manager Cluster Security Mode field, click the applicable setting.

Step 7 If you clicked the Non-secure setting, click **Save** and skip the remaining steps in this procedure.

If you clicked the Authenticated or the Encrypted settings, the Security tab and the Add TFTP Server dialog box appear. In the Add TFTP Server dialog box, in the IP Address or Host Name field, enter the IP address (or DNS name) of the primary TFTP server for the Cisco Unified Communications Manager cluster, and click **OK**.

Step 8 If there are more TFTP servers that Cisco Unity will use to download the Cisco Unified Communications Manager certificates, click **Add**. The Add TFTP Server dialog box appears.

Step 9 In the IP Address or Host Name field, enter the IP address (or DNS name) of the secondary TFTP server for the Cisco Unified Communications Manager cluster, and click **OK**.

Step 10 Click **Save**.

Cisco Unity creates the voice messaging port device certificates, exports the Cisco Unity server root certificate, and displays the Export Cisco Unity Root Certificate dialog box.

Step 11 Note the file name of the exported Cisco Unity server root certificate and click **OK**.

Step 12 On the Cisco Unity server, navigate to the CommServer\SkinnyCerts directory.

Step 13 Locate the Cisco Unity server root certificate file that you exported in Step 11.

Step 14 Right-click the file and click **Rename**.

Step 15 Change the file extension from .0 to .pem. For example, change the filename “12345.0” to “12345.pem” for the exported Cisco Unity server root certificate file.

Step 16 Copy this file to a PC from which you can access the Cisco Unified CME router.

Importing the Cisco Unity Root Certificate to Cisco Unified CME

To import the Cisco Unity root certificate to Cisco Unified CME, perform the following steps on the Cisco Unified CME router:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **crypto pki trustpoint** *name*
4. **revocation-check none**
5. **enrollment terminal**
6. **exit**
7. **crypto pki authenticate** *trustpoint-label*
8. Open the root certificate file that you copied from the Cisco Unity Server in Step 16.
9. You will be prompted to enter the CA certificate. Cut and paste the entire contents of the base 64 encoded certificate between “BEGIN CERTIFICATE” and “END CERTIFICATE” at the command line. Press **Enter**, and type “quit.” The router prompts you to accept the certificate. Enter “yes” to accept the certificate.

DETAILED STEPS

	Command or Action	Purpose

Step 1	**`enable`**
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		• Enter your password if prompted.

Step 2	**`configure terminal`**
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	**`crypto pki trustpoint`** *`name`*
	Example:
	`Router(config)# crypto pki trustpoint PEM`
		Declares the trustpoint that your RA mode certificate server should use and enters CA-trustpoint configuration mode.
		• *label*—Name for the trustpoint and RA.

Step 4	**`revocation-check none`**
	Example:
	`Router(ca-trustpoint)# revocation-check none`
		(Optional) Checks the revocation status of a certificate and specifies one or more methods to check the status. If a second and third method are specified, each method is used only if the previous method returns an error, such as a server being down.
		• **none**—Certificate checking is not required.

Step 5	**`enrollment terminal`**
	Example:
	`Router(ca-trustpoint)# enrollment terminal`
		Specifies manual cut-and-paste certificate enrollment.

	Command or Action	Purpose

Step 6	**`exit`**
	Example:
	`Router(ca-trustpoint)# exit`
		Exits CA-trustpoint configuration mode.

Step 7	**`crypto pki authenticate`** *`trustpoint-label`*
	Example:
	`Router(config)# crypto pki authenticate pem`
		Retrieves the CA certificate and authenticates it. Checks the certificate fingerprint if prompted.
		• *trustpoint-label*—Trustpoint label.
		Note The *trustpoint-label* must be the same as the *name* in step 3.

Step 8	You will be prompted to enter the CA certificate. Cut and paste the entire contents of the base 64 encoded certificate between “BEGIN CERTIFICATE” and “END CERTIFICATE” at the command line. Press **Enter**, and type “quit.” The router prompts you to accept the certificate. Enter “yes” to accept the certificate.	Completes the copying of the Cisco Unity root certificate to the Cisco Unified CME router.

Configuring Cisco Unity Ports for Secure Registration

To configure Cisco Unity ports for registration in secure mode, perform the following steps:

Step 1 Choose the Cisco voice-mail port that you want to update.

Step 2 In the Device Security Mode field, choose **Encrypted** from the drop-down list box.

Step 3 Click **Update**.

Verifying that Cisco Unity are Registering Securely

Use the **show sccp connections** command to verify that Cisco Unity ports are registered securely with Cisco Unified CME.

show sccp connection: Example

In the following example, the secure value of the stype field shows that the connections are secure.

```
Router# show sccp connections

sess_id    conn_id    stype        mode     codec   ripaddr       rport sport

16777222   16777409   secure-xcode sendrecv g729b   10.3.56.120   16772 19534
16777222   16777393   secure-xcode sendrecv g711u   10.3.56.50    17030 18464

Total number of active session(s) 1, and connection(s) 2
```

Configuration Examples for Security

This section contains the following examples:

Phone Authentication

- Cisco IOS CA Server: Example, page 460
- Enabling a Registration Authority: Example, page 460
- Manually Importing MIC Root Certificate on the Cisco Unified CME Router: Example, page 461
- Obtaining a Certificate for Cisco Unified CME Server Functions: Example, page 464
- CTL Client Running on Cisco Unified CME Router: Example, page 464
- CTL Client Running on Another Router: Example, page 464
- Telephony-Service Security Parameters: Example, page 464
- CAPF Server: Example, page 465

Media Encryption

- Secure Cisco Unified CME: Example, page 467

Cisco IOS CA Server: Example

```
!
crypto pki server iosca
 grant auto
 database url flash:
!
crypto pki trustpoint iosca
 revocation-check none
 rsakeypair iosca
!
crypto pki certificate chain iosca
 certificate ca 01
  308201F9 30820162 ...
```

Enabling a Registration Authority: Example

The following example sets up an RA and trustpoint named ra12:

```
Router(config)# crypto pki trustpoint ra12
Router(config-ca-trustpoint)# enrollment url http://ca-server.company.com
Router(config-ca-trustpoint)# revocation-check none
Router(config-ca-trustpoint)# rsakeypair exampleCAkeys 1024 1024
Router(config-ca-trustpoint)# exit
Router(config)# crypto pki server ra12
Router(config-cs-server)# mode ra
Router(config-cs-server)# lifetime certificate 1800
Router(config-cs-server)# no grant auto
Router(config-cs-server)# no shutdown
Router(config-cs-server)# exit
```

The following example sets up a trustpoint named sast2 that periodically generates a CRL instead of having it generated manually. Third-party CAs may require this functionality.

```
Router(config)# crypto pki trustpoint sast2
Router(config-ca-trustpoint)# enrollment url http://NTP-ab11:80
Router(config-ca-trustpoint)# serial-number
Router(config-ca-trustpoint)# revocation-check crl
Router(config-ca-trustpoint)# rsakeypair sast2
```

Manually Importing MIC Root Certificate on the Cisco Unified CME Router: Example

The following example shows three certificates imported to the router (7970, 7960, PEM).

```
Router(config)# crypto pki trustpoint 7970
Router(ca-trustpoint)# revocation-check none
Router(ca-trustpoint)# enrollment terminal
Router(ca-trustpoint)# exit
Router(config)# crypto pki authenticate 7970

Enter the base 64 encoded CA certificate.
End with a blank line or the word "quit" on a line by itself
MIIDqDCCApCgAwIBAgIQNT+yS9cPFKNGwfOprHJWdTANBgkqhkiG9w0BAQUFADAu
MRYwFAYDVQQKEw1DaXNjbyBTeXN0ZW1zMRQwEgYDVQQDEwtDQVAtUlRQLTAwMjAe
Fw0wMzEwMTAyMDE4NDlaFw0yMzEwMTAyMDI3MzdaMC4xFjAUBgNVBAoTDUNpc2Nv
IFN5c3RlbXMxFDASBgNVBAMTC0NBUC1SVFAtMDAyMIIBIDANBgkqhkiG9w0BAQEF
AAOCAQ0AMIIBCAKCAQEAxCZlBK19w/2NZVVvpjCPrpW1cCY7V1q9lhzI85RZZdnQ
2M4CufgIzNa3zYxGJIAYeFfcRECnMB3f5A+x7xNiEuzE87UPvK+7S80uWCY0Uhtl
AVVf5NQgZ3YDNoNXg5MmONb8lT86F55EZyVac0XGne77TSIbIdejrTgYQXGP2MJx
Qhg+ZQlGFDRzbHfM84Duv2Msez+l+SqmqO80kIckqE9Nr3/XCSj1hXZNNVg8D+mv
Hth2P6KZqAKXAAStGRLSZX3jNbS8tveJ3Gi5+sj9+F6KKK2PD0iDwHcRKkcUHb7g
lI++U/5nswjUDIAph715Ds2rn9ehkMGipGLF8kpuCwIBA6OBwzCBwDALBgNVHQ8E
BAMCAYYwDwYDVR0TAQH/BAUwAwEB/zAdBgNVHQ4EFgQUUpIr4ojuLgmKTn5wLFal
mrTUm5YwbwYDVR0fBGgwZjBkoGKgYIYtaHR0cDovL2NhcC1ydHAtMDAyL0NlcnRF
bnJvbGwvQ0FQLVJUUC0wMDIuY3Jshi9maWxlOi8vXFxjYXAtcnRwLTAwMlxDZXJ0
RW5yb2xsXENBUC1SVFAtMDAyLmNybDAQBgkrBgEEAYI3FQEEAwIBADANBgkqhkiG
9w0BAQUFAAOCAQEAVoOM78TaOtHqj7sVL/5u5VChlyvU168f0piJLNWip2vDRihm
E+DlXdwMS5JaqUtuaSd/m/xzxpcRJm4ZRRwPq6VeaiiQGkjFuZEe5jSKiSAK7eHg
tup4HP/ZfKSwPA40DlsGSYsKNMm3OmVOCQUMH02lPkS/eEQ9sIw6QS7uuHN4y4CJ
NPnRbpFRLw06hnStCZHtGpKEHnY213QOy3h/EWhbnp0MZ+hdr20FujSI6G1+L39l
aRjeD708f2fYoz9wnEpZbtn2Kzse3uhU1Ygq1D1x9yuPq388C18HWdmCj4OVTXux
V6Y47H1yv/GJM8FvdgvKlExbGTFnlHpPiaG9tQ==
quit
Certificate has the following attributes:
Fingerprint MD5: F7E150EA 5E6E3AC5 615FC696 66415C9F
Fingerprint SHA1: 1BE2B503 DC72EE28 0C0F6B18 798236D8 D3B18BE6
% Do you accept this certificate? [yes/no]: y
Trustpoint CA certificate accepted.
% Certificate successfully imported
Router(config)# crypto pki trustpoint 7960
Router(ca-trustpoint)# revocation-check none
Router(ca-trustpoint)# enrollment terminal
Router(ca-trustpoint)# exit
Router(config)# crypto pki authenticate 7960

Enter the base 64 encoded CA certificate.

End with a blank line or the word "quit" on a line by itself
MIICKDCCAZGgAwIBAgIC8wEwDQYJKoZIhvcNAQEFBQAwQDELMAkGA1UEBhMCVVMx
GjAYBgNVBAoTEUNpc2NvIFN5c3RlbXMgSW5jMRUwEwYDVQQDEwxDQVBGLTdEN0Qw
QzAwHhcNMDQwNzE1MjIzODMyWhcNMTkwNzEyMjIzODMxWjBAMQswCQYDVQQGEwJV
```

```
UzEaMBgGA1UEChMRQ2lzY28gU3lzdGVtcyBJbmMxFTATBgNVBAMTDENBUEYtN0Q3
RDBDMDCBnzANBgkqhkiG9w0BAQEFAAOBjQAwgYkCgYEA0hvMOZZ9ENYWme11YGY1
it2rvE3Nk/eqhnv8P9eqB1iqt+fFBeAG0WZ5bO5FetdU+BCmPnddvAeSpsfr3Z+h
x+r58fOEIBRHQLgnDZ+nwYH39uwXcRWWqWwlW147YHjV7M5c/R8T6daCx4B5NBo6
kdQdQNOrV3IP7kQaCShdM/kCAwEAAaMxMC8wDgYDVR0PAQH/BAQDAgKEMB0GA1Ud
JQQWMBQGCCsGAQUFBwMBBggrBgEFBQcDBTANBgkqhkiG9w0BAQUFAAOBgQCaNi6x
sL6M5NlDezpSBO3QmUVyXMfrONV2ysrSwcXzHu0gJ9MSJ8TwiQmVaJ47hSTlF5a8
YVYJ0IdifXbXRo+/EEO7kkmFE8MZta5rM7UWj8bAeR42iqA3RzQaDwuJgNWT9Fhh
GgfuNAlo5h1AikxsvxivmDlLdZyCMoqJJd7B2Q==
quit
Certificate has the following attributes:
Fingerprint MD5: 4B9636DF 0F3BA6B7 5F54BE72 24762DBC
Fingerprint SHA1: A9917775 F86BB37A 5C130ED2 3E528BB8 286E8C2D
% Do you accept this certificate? [yes/no]: y
Trustpoint CA certificate accepted.
% Certificate successfully imported


Router(config)# crypto pki trustpoint PEM
Router(ca-trustpoint)# revocation-check none
Router(ca-trustpoint)# enrollment terminal
Router(ca-trustpoint)# exit
Router(config)# crypto pki authenticate PEM

Enter the base 64 encoded CA certificate.
End with a blank line or the word "quit" on a line by itself
MIIDqDCCApCgAwIBAgIQdhL5YBU9b59OQiAgMrcjVjANBgkqhkiG9w0BAQUFADAu
MRYwFAYDVQQKEw1DaXNjbyBTeXN0ZW1zMRQwEgYDVQQDEwtDQVAtUlRQLTAwMTAe
Fw0wMzAyMDYyMzI3MTNaFw0yMzAyMDYyMzM2MzRaMC4xFjAUBgNVBAoTDUNpc2Nv
IFN5c3RlbXMxFDASBgNVBAMTC0NBUC1SVFAtMDAxMIIBIDANBgkqhkiG9w0BAQEF
AAOCAQ0AMIIBCAKCAQEArFW77Rjem4cJ/7yPLVCauDohwZZ/3qf0sJaWlLeAzBlq
Rj2lFlSij0ddkDtfEEo9VKmBOJsvx6xJlWJiuBwUMDhTRbsuJz+npkaGBXPOXJmN
Vd54qlpc/hQDfWlbrIFkCcYhHws7vwnPsLuy1Kw2L2cP0UXxYghSsx8H4vGqdPFQ
NnYy7aKJ43SvDFt4zn37n8jrvlRuz0x3mdbcBEdHbA825Yo7a8sk12tshMJ/YdMm
vny0pmDNZXmeHjqEgVO3UFUn6GVCO+K1y1dUU1qpYJNYtqLkqj7wgccGjsHdHr3a
U+bw1uLgSGsQnxMWeMaWo8+6hMxwlANPweufgZMaywIBA6OBwzCBwDALBgNVHQ8E
BAMCAYYwDwYDVR0TAQH/BAUwAwEB/zAdBgNVHQ4EFgQU6Rexgscfz6ypG270qSac
cK4FoJowbwYDVR0fBGgwZjBkoGKgYIYtaHR0cDovL2NhcC1ydHAtMDAxL0NlcnRF
bnJvbGwvQ0FQLVJUUC0wMDEuY3Jshi9maWxlOi8vXFxjYXAtcnRwLTAwMVxDZXJ0
RW5yb2xsXENBUC1SVFAtMDAxLmNybDAQBgkrBgEEAYI3FQEEAwIBADANBgkqhkiG
9w0BAQUFAAOCAQEAq2T96/YMMtw2Dw4QX+F1+g1XSrUCrNyjx7vtFaRDHyB+kobw
dwkpohfkzfTyYpJELzV1r+kMRoyuZ7oIqqccEroMDnnmeApc+BRGbDJqS1Zzk4OA
c6Ea7fm53nQRlcSPmUVLjDBzKYDNbnEjizptaIC5fgB/S9S6C1q0YpTZFn5tjUjy
WXzeYSXPrcxb0UH7IQJ1ogpONAAUKLoPaZU7tVDSH3hD4+VjmLyysaLUhksGFrrN
phzZrsVVilK17qpqCPllKLGAS4fSbkruq3r/6S/SpXS6/gAoljBKixP7ZW2PxgCU
1aU9cURLPO95NDOFN3jBk3Sips7cVidcogowPQ==
quit

Certificate has the following attributes:
Fingerprint MD5: 233C8E33 8632EA4E 76D79FEB FFB061C6
Fingerprint SHA1: F7B40B94 5831D2AB 447AB8F2 25990732 227631BE
% Do you accept this certificate? [yes/no]: y
Trustpoint CA certificate accepted.
% Certificate successfully imported
```

Use the **show crypto pki trustpoint status** command to show that enrollment has succeeded and that five CA certificates were granted. The five certificates include the three certificates just entered and the CA server certificate and the router certificate.

```
Router# show crypto pki trustpoint status

Trustpoint 7970:
Issuing CA certificate configured:
Subject Name:
```

```
cn=CAP-RTP-002,o=Cisco Systems
Fingerprint MD5: F7E150EA 5E6E3AC5 615FC696 66415C9F
Fingerprint SHA1: 1BE2B503 DC72EE28 0C0F6B18 798236D8 D3B18BE6
State:
Keys generated ............. Yes (General Purpose)
Issuing CA authenticated ....... Yes
Certificate request(s) ..... None
Trustpoint 7960:
Issuing CA certificate configured:
Subject Name:
cn=CAPF-508A3754,o=Cisco Systems Inc,c=US
Fingerprint MD5: 6BAE18C2 0BCE391E DAE2FE4C 5810F576
Fingerprint SHA1: B7735A2E 3A5C274F C311D7F1 3BE89942 355102DE
State:
Keys generated ............. Yes (General Purpose)
Issuing CA authenticated ....... Yes
Certificate request(s) ..... None
Trustpoint PEM:
Issuing CA certificate configured:
Subject Name:
cn=CAP-RTP-001,o=Cisco Systems
Fingerprint MD5: 233C8E33 8632EA4E 76D79FEB FFB061C6
Fingerprint SHA1: F7B40B94 5831D2AB 447AB8F2 25990732 227631BE
State:
Keys generated ............. Yes (General Purpose)
Issuing CA authenticated ....... Yes
Certificate request(s) ..... None
Trustpoint srstcaserver:
Issuing CA certificate configured:
Subject Name:
cn=srstcaserver
Fingerprint MD5: 6AF5B084 79C93F2B 76CC8FE6 8781AF5E
Fingerprint SHA1: 47D30503 38FF1524 711448B4 9763FAF6 3A8E7DCF
State:
Keys generated ............. Yes (General Purpose)
Issuing CA authenticated ....... Yes
Certificate request(s) ..... None

Trustpoint srstca:
Issuing CA certificate configured:
Subject Name:
cn=srstcaserver
Fingerprint MD5: 6AF5B084 79C93F2B 76CC8FE6 8781AF5E
Fingerprint SHA1: 47D30503 38FF1524 711448B4 9763FAF6 3A8E7DCF
Router General Purpose certificate configured:
Subject Name:
serialNumber=F3246544+hostname=c2611XM-sSRST.cisco.com
Fingerprint: 35471295 1C907EC1 45B347BC 7A9C4B86
State:
Keys generated ............. Yes (General Purpose)
Issuing CA authenticated ....... Yes
Certificate request(s) ..... Yes
```

Obtaining a Certificate for Cisco Unified CME Server Functions: Example

The following example establishes a trustpoint for the CAPF server called capf.

```
Router(config)# crypto pki trustpoint capf
Router(config-ca-trustpoint)# enrollment url http://ca-server.company.com
Router(config-ca-trustpoint)# revocation-check none
Router(config-ca-trustpoint)# rsakeypair capf 1024 1024
Router(config-ca-trustpoint)# exit
Router(config)# crypto pki authenticate capf
Router(config)# crypto pki enroll capf
```

Telephony-Service Security Parameters: Example

The following example shows Cisco Unified CME security parameters.

```
telephony-service
 device-security-mode authenticated
 secure-signaling trustpoint cme-sccp
 tftp-server-credentials trustpoint cme-tftp
 load-cfg-file slot0:Ringlist.xml alias Ringlist.xml sign create

ephone 24
 device-security-mode authenticated
 capf-auth-str 2734
 cert-oper upgrade auth-mode auth-string
```

CTL Client Running on Cisco Unified CME Router: Example

```
ctl-client
 server capf 10.1.1.1 trustpoint cmeserver
 server cme 10.1.1.1 trustpoint cmeserver
 server tftp 10.1.1.1 trustpoint cmeserver
 sast1 trustpoint cmeserver
 sast2 trustpoint sast2
```

CTL Client Running on Another Router: Example

```
ctl-client
 server cme 10.1.1.100 trustpoint cmeserver
 server cme 10.1.1.1 username cisco password 1 0822455D0A16544541
 sast1 trustpoint cmeserver
 sast2 trustpoint sast1
```

CAPF Server: Example

```
!
ip dhcp pool cme-pool
   network 10.1.1.0 255.255.255.0
   option 150 ip 10.1.1.1
   default-router 10.1.1.1
!
capf-server
 port 3804
 auth-mode null-string
 cert-enroll-trustpoint iosra password 1 00071A1507545A545C
 trustpoint-label cmeserver
 source-addr 10.1.1.1
!
crypto pki server iosra
 grant auto
 mode ra
 database url slot0:
!
crypto pki trustpoint cmeserver
 enrollment url http://10.1.1.100:80
 serial-number
 revocation-check none
 rsakeypair cmeserver
!
crypto pki trustpoint sast2
 enrollment url http://10.1.1.100:80
 serial-number
 revocation-check none
 rsakeypair sast2
!
!
crypto pki trustpoint iosra
 enrollment url http://10.1.1.200:80
 revocation-check none
 rsakeypair iosra
!
!
crypto pki certificate chain cmeserver
 certificate 1B
  30820207 30820170 A0030201 0202011B 300D0609 2A864886 F70D0101 04050030
  ....
  quit
 certificate ca 01
  3082026B 308201D4 A0030201 02020101 300D0609 2A864886 F70D0101 04050030
  ...
  quit
crypto pki certificate chain sast2
 certificate 1C
  30820207 30820170 A0030201 0202011C 300D0609 2A864886 F70D0101 04050030
  ....
  quit
 certificate ca 01
  3082026B 308201D4 A0030201 02020101 300D0609 2A864886 F70D0101 04050030
  .....
  quit
crypto pki certificate chain capf-tp
crypto pki certificate chain iosra
 certificate 04
  30820201 3082016A A0030201 02020104 300D0609 2A864886 F70D0101 04050030
  ......
 certificate ca 01
```

```
  308201F9 30820162 A0030201 02020101 300D0609 2A864886 F70D0101 04050030
  ....
  quit
!
!
credentials
 ctl-service admin cisco secret 1 094F471A1A0A464058
 ip source-address 10.1.1.1 port 2444
 trustpoint cmeserver
!
!
telephony-service
 no auto-reg-ephone
 load 7960-7940 P00307010200
 load 7914 S00104000100
 load 7941GE TERM41.7-0-0-129DEV
 load 7970 TERM70.7-0-0-77DEV
 max-ephones 20
 max-dn 10
 ip source-address 10.1.1.1 port 2000 secondary 10.1.1.100
 secure-signaling trustpoint cmeserver
 cnf-file location flash:
 cnf-file perphone
 dialplan-pattern 1 2... extension-length 4
 max-conferences 8 gain -6
 transfer-pattern ....
 tftp-server-credentials trustpoint cmeserver
 server-security-mode secure
 device-security-mode encrypted
 load-cfg-file slot0:Ringlist.xml alias Ringlist.xml sign
 load-cfg-file slot0:P00307010200.bin alias P00307010200.bin
 load-cfg-file slot0:P00307010200.loads alias P00307010200.loads
 load-cfg-file slot0:P00307010200.sb2 alias P00307010200.sb2
 load-cfg-file slot0:P00307010200.sbn alias P00307010200.sbn
 load-cfg-file slot0:cnu41.2-7-4-116dev.sbn alias cnu41.2-7-4-116dev.sbn
 load-cfg-file slot0:Jar41.2-9-0-101dev.sbn alias Jar41.2-9-0-101dev.sbn
 load-cfg-file slot0:CVM41.2-0-0-96dev.sbn alias CVM41.2-0-0-96dev.sbn
 load-cfg-file slot0:TERM41.DEFAULT.loads alias TERM41.DEFAULT.loads
 load-cfg-file slot0:TERM70.DEFAULT.loads alias TERM70.DEFAULT.loads
 load-cfg-file slot0:Jar70.2-9-0-54dev.sbn alias Jar70.2-9-0-54dev.sbn
 load-cfg-file slot0:cnu70.2-7-4-58dev.sbn alias cnu70.2-7-4-58dev.sbn
 load-cfg-file slot0:CVM70.2-0-0-49dev.sbn alias CVM70.2-0-0-49dev.sbn
 load-cfg-file slot0:DistinctiveRingList.xml alias DistinctiveRingList.xml sign
 load-cfg-file slot0:Piano1.raw alias Piano1.raw sign
 load-cfg-file slot0:S00104000100.sbn alias S00104000100.sbn
 create cnf-files version-stamp 7960 Aug 13 2005 12:39:24
!
!
ephone  1
 device-security-mode encrypted
 cert-oper upgrade auth-mode null-string
 mac-address 000C.CE3A.817C
 type 7960 addon 1 7914
 button  1:2 8:8
!
!
ephone  2
 device-security-mode encrypted
 capf-auth-str 2476
 cert-oper upgrade auth-mode null-string
 mac-address 0011.2111.6BDD
 type 7970
 button  1:1
!
```

```
!
ephone  3
 device-security-mode encrypted
 capf-auth-str 5425
 cert-oper upgrade auth-mode null-string
 mac-address 000D.299D.50DF
 type 7970
 button  1:3
!
!
ephone  4
 device-security-mode encrypted
 capf-auth-str 7176
 cert-oper upgrade auth-mode null-string
 mac-address 000E.D7B1.0DAC
 type 7960
 button  1:4
!
!
ephone  5
 device-security-mode encrypted
 mac-address 000F.9048.5077
 type 7960
 button  1:5
!
!
ephone  6
 device-security-mode encrypted
 mac-address 0013.C352.E7F1
 type 7941GE
 button  1:6
!
```

Secure Cisco Unified CME: Example

```
Router# show running-config

Building configuration...

Current configuration : 12735 bytes
!
! No configuration change since last restart
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
service internal
!
hostname Router
!
boot-start-marker
boot-end-marker
!
card type e1 1 1
logging queue-limit 10000
logging buffered 9999999 debugging
logging rate-limit 10000
no logging console
!
aaa new-model
!
```

```
!
aaa accounting connection h323 start-stop group radius
!
aaa session-id common
!
resource policy
!
clock timezone IST 5
no network-clock-participate slot 1
!
!
ip cef
!
!
isdn switch-type primary-net5
!
voice-card 0
 no dspfarm
!
voice-card 1
 no dspfarm
!
!
ctl-client
 server capf 10.13.32.11 trustpoint mytrustpoint1
 server tftp 10.13.32.11 trustpoint mytrustpoint1
 server cme 10.13.32.11 trustpoint mytrustpoint1
 sast1 trustpoint mytrustpoint1
 sast2 trustpoint sast2
!
capf-server
 port 3084
 auth-mode null-string
 cert-enroll-trustpoint iosra password 1 mypassword
 trustpoint-label mytrustpoint1
 source-addr 10.13.32.11
 phone-key-size 512
!
voice call debug full-guid
!
voice service voip
 srtp fallback
 allow-connections h323 to h323
 no supplementary-service h450.2
 no supplementary-service h450.3
 no supplementary-service h450.7
 supplementary-service media-renegotiate
 h323
  emptycapability
  ras rrq ttl 4000
!
!
voice class codec 2
 codec preference 1 g711alaw
 codec preference 2 g711ulaw
!
voice class codec 3
 codec preference 1 g729r8
 codec preference 8 g711alaw
 codec preference 9 g711ulaw
!
voice class codec 1
 codec preference 1 g729r8
 codec preference 2 g728
 codec preference 3 g723ar63
 codec preference 4 g711ulaw
!
!
voice iec syslog
voice statistics type iec
voice statistics time-range since-reset
!
!
!
crypto pki server myra
 database level complete
 grant auto
 lifetime certificate 1800
!
crypto pki trustpoint myra
 enrollment url http://10.13.32.11:80
 revocation-check none
 rsakeypair iosra
!
crypto pki trustpoint mytrustpoint1
 enrollment url http://10.13.32.11:80
 revocation-check none
 rsakeypair mytrustpoint1
!
crypto pki trustpoint sast2
 enrollment url http://10.13.32.11:80
 revocation-check none
 rsakeypair sast2
!
!
crypto pki certificate chain myra
 certificate ca 01
  308201F9 30820162 A0030201 02020101 300D0609 2A864886 F70D0101 04050030
  10310E30 0C060355 04031305 696F7372 61301E17 0D303630 37303730 35343031
  375A170D 30393037 30363035 34303137 5A301031 0E300C06 03550403 1305696F
  73726130 819F300D 06092A86 4886F70D 01010105 0003818D 00308189 02818100
  D8CE29F9 C9FDB1DD 0E1517E3 6CB4AAF7 52B83DE2 1C017ACA DFC4AF42 F9D10D08
  E74BF95B 29378902 B49E32C4 85907384 84CAE4B2 7759BB84 8AB1F578 580793C4
  B11A2DBE B2ED02CC DA0C3824 A5FCC377 18CE87EA C0C297BA BE54530F E62247D8
  1483CD14 9FD89EFE 05DFBB37 E03FD3F8 B2B1C0B8 A1931BCC B1174A9E 6566F8F5
  02030100 01A36330 61300F06 03551D13 0101FF04 05300301 01FF300E 0603551D
  0F0101FF 04040302 0186301F 0603551D 23041830 168014B7 16F6FD67 29666C90
  D0C62515 E14265A9 EB256230 1D060355 1D0E0416 0414B716 F6FD6729 666C90D0
  C62515E1 4265A9EB 2562300D 06092A86 4886F70D 01010405 00038181 002B7F41
  64535A66 D20D888E 661B9584 5E3A28DF 4E5A95B9 97E57CAE B07A7C38 7F3B60EE
  75C7E5DE 6DF19B06 5F755FB5 190BABFC EF272CEF 865FE01B 1CE80F98 F320A569
  CAFFA5D9 3DB3E7D8 8A86C66C F227FF81 6C4449F2 AF8015D9 8129C909 81AFDC01
  180B61E8 85E19873 96DB3AE3 E6B70726 9BF93521 CA2FA906 99194ECA 8F
  quit
crypto pki certificate chain mytrustpoint1
 certificate 02
  308201AB 30820114 A0030201 02020102 300D0609 2A864886 F70D0101 04050030
  10310E30 0C060355 04031305 696F7372 61301E17 0D303630 37303730 35343233
  385A170D 30393037 30363035 34303137 5A301A31 18301606 092A8648 86F70D01
  09021609 32383531 2D434D45 32305C30 0D06092A 864886F7 0D010101 0500034B
  00304802 4100B3ED A902646C 3851B7F6 CF94887F 0EC437E3 3B6FEDB2 2B4B45A6
  3611C243 5A0759EA 1E8D96D1 60ABE028 ED6A3F2A E95DCE45 BE0921AF 82E53E57
  17CC12F0 C1270203 010001A3 4F304D30 0B060355 1D0F0404 030205A0 301F0603
  551D2304 18301680 14B716F6 FD672966 6C90D0C6 2515E142 65A9EB25 62301D06
  03551D0E 04160414 4EE1943C EA817A9E 7010D5B8 0467E9B0 6BA76746 300D0609
  2A864886 F70D0101 04050003 81810003 564A6DA1 868B2669 7C096F9A 41173CFC
  E49246EE C645E30B A0753E3B E1A265D1 6EA5A829 F10CD0E8 3F2E3AD4 39D8DFE8
  83525F2B D19F5E15 F27D6262 62852D1F 43629B68 86D91B5F 7B2E2C25 3BD2CCC3
  00EF4028 714339B2 6A7E0B2F 131D2D9E 0BE08853 5CCAE47C 4F74953C 19305A20
  B2C97808 D6E01351 48366421 A1D407
  quit
 certificate ca 01
  308201F9 30820162 A0030201 02020101 300D0609 2A864886 F70D0101 04050030
  10310E30 0C060355 04031305 696F7372 61301E17 0D303630 37303730 35343031
  375A170D 30393037 30363035 34303137 5A301031 0E300C06 03550403 1305696F
  73726130 819F300D 06092A86 4886F70D 01010105 0003818D 00308189 02818100
  D8CE29F9 C9FDB1DD 0E1517E3 6CB4AAF7 52B83DE2 1C017ACA DFC4AF42 F9D10D08
  E74BF95B 29378902 B49E32C4 85907384 84CAE4B2 7759BB84 8AB1F578 580793C4
  B11A2DBE B2ED02CC DA0C3824 A5FCC377 18CE87EA C0C297BA BE54530F E62247D8
  1483CD14 9FD89EFE 05DFBB37 E03FD3F8 B2B1C0B8 A1931BCC B1174A9E 6566F8F5
  02030100 01A36330 61300F06 03551D13 0101FF04 05300301 01FF300E 0603551D
  0F0101FF 04040302 0186301F 0603551D 23041830 168014B7 16F6FD67 29666C90
  D0C62515 E14265A9 EB256230 1D060355 1D0E0416 0414B716 F6FD6729 666C90D0
  C62515E1 4265A9EB 2562300D 06092A86 4886F70D 01010405 00038181 002B7F41
  64535A66 D20D888E 661B9584 5E3A28DF 4E5A95B9 97E57CAE B07A7C38 7F3B60EE
  75C7E5DE 6DF19B06 5F755FB5 190BABFC EF272CEF 865FE01B 1CE80F98 F320A569
  CAFFA5D9 3DB3E7D8 8A86C66C F227FF81 6C4449F2 AF8015D9 8129C909 81AFDC01
  180B61E8 85E19873 96DB3AE3 E6B70726 9BF93521 CA2FA906 99194ECA 8F
  quit
crypto pki certificate chain sast2
 certificate 03
  308201AB 30820114 A0030201 02020103 300D0609 2A864886 F70D0101 04050030
  10310E30 0C060355 04031305 696F7372 61301E17 0D303630 37303730 35343331
  375A170D 30393037 30363035 34303137 5A301A31 18301606 092A8648 86F70D01
  09021609 32383531 2D434D45 32305C30 0D06092A 864886F7 0D010101 0500034B
  00304802 4100C703 840B11A7 81FCE5AE A14FE593 5114D3C2 5473F488 B8FB4CC5
  41EAFA3A D99381D8 21AE6AA9 BA83A84E 9DF3E8C6 54978787 5EF6CC35 C334D55E
  A3051372 17D30203 010001A3 4F304D30 0B060355 1D0F0404 030205A0 301F0603
  551D2304 18301680 14B716F6 FD672966 6C90D0C6 2515E142 65A9EB25 62301D06
  03551D0E 04160414 EB2146B4 EE24AA61 8B5D2F8D 2AD3B786 CBADC8F2 300D0609
  2A864886 F70D0101 04050003 81810057 BA0053E9 8FD54B25 72D85A4C CAB47F26
  8316F494 E94DFFB9 8E9D065C 9748465C F54719CA C7724F50 67FBCAFF BC332109
  DC2FB93D 5AD86583 EDC3E648 39274CE8 D4A5F002 5F21ED3C 6D524AB7 7F5B1876
  51867027 9BD2FFED 06984558 C903064E 5552015F 289BA9BB 308D327A DFE0A3B9
  78CF2B02 2DD4C208 80CDC0A8 43A26A
  quit
 certificate ca 01
  308201F9 30820162 A0030201 02020101 300D0609 2A864886 F70D0101 04050030
  10310E30 0C060355 04031305 696F7372 61301E17 0D303630 37303730 35343031
  375A170D 30393037 30363035 34303137 5A301031 0E300C06 03550403 1305696F
  73726130 819F300D 06092A86 4886F70D 01010105 0003818D 00308189 02818100
  D8CE29F9 C9FDB1DD 0E1517E3 6CB4AAF7 52B83DE2 1C017ACA DFC4AF42 F9D10D08
  E74BF95B 29378902 B49E32C4 85907384 84CAE4B2 7759BB84 8AB1F578 580793C4
  B11A2DBE B2ED02CC DA0C3824 A5FCC377 18CE87EA C0C297BA BE54530F E62247D8
  1483CD14 9FD89EFE 05DFBB37 E03FD3F8 B2B1C0B8 A1931BCC B1174A9E 6566F8F5
  02030100 01A36330 61300F06 03551D13 0101FF04 05300301 01FF300E 0603551D
  0F0101FF 04040302 0186301F 0603551D 23041830 168014B7 16F6FD67 29666C90
  D0C62515 E14265A9 EB256230 1D060355 1D0E0416 0414B716 F6FD6729 666C90D0
  C62515E1 4265A9EB 2562300D 06092A86 4886F70D 01010405 00038181 002B7F41
  64535A66 D20D888E 661B9584 5E3A28DF 4E5A95B9 97E57CAE B07A7C38 7F3B60EE
  75C7E5DE 6DF19B06 5F755FB5 190BABFC EF272CEF 865FE01B 1CE80F98 F320A569
  CAFFA5D9 3DB3E7D8 8A86C66C F227FF81 6C4449F2 AF8015D9 8129C909 81AFDC01
  180B61E8 85E19873 96DB3AE3 E6B70726 9BF93521 CA2FA906 99194ECA 8F
  quit
!
!
username admin password 0 mypassword2
username cisco password 0 mypassword2
!
!
controller E1 1/0
 pri-group timeslots 1-31
```

```
!
controller E1 1/1
 pri-group timeslots 1-31
gw-accounting aaa
!
!
!
!
!
interface GigabitEthernet0/0
 ip address 10.13.32.11 255.255.255.0
 duplex auto
 speed auto
 fair-queue 64 256 32
 h323-gateway voip interface
 h323-gateway voip id GK1 ipaddr 10.13.32.13 1719
 h323-gateway voip id GK2 ipaddr 10.13.32.16 1719
 h323-gateway voip h323-id 2851-CiscoUnifiedCME
 h323-gateway voip tech-prefix 1#
 ip rsvp bandwidth 1000 100
!
interface GigabitEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface Serial1/0:15
 no ip address
 encapsulation hdlc
 isdn switch-type primary-net5
 isdn protocol-emulate network
 isdn incoming-voice voice
 no cdp enable
!
interface Serial1/1:15
 no ip address
 encapsulation hdlc
 isdn switch-type primary-net5
 isdn protocol-emulate network
 isdn incoming-voice voice
 no cdp enable
!
ip route 0.0.0.0 0.0.0.0 10.13.32.1
!
!
ip http server
ip http authentication local
no ip http secure-server
ip http path flash:
!
!
!
!
!
!
tftp-server flash:music-on-hold.au
tftp-server flash:TERM70.DEFAULT.loads
tftp-server flash:TERM71.DEFAULT.loads
tftp-server flash:P00308000300.bin
tftp-server flash:P00308000300.loads
tftp-server flash:P00308000300.sb2
tftp-server flash:P00308000300.sbn
tftp-server flash:SCCP70.8-0-3S.loads
```

```
tftp-server flash:cvm70sccp.8-0-2-25.sbn
tftp-server flash:apps70.1-1-2-26.sbn
tftp-server flash:dsp70.1-1-2-26.sbn
tftp-server flash:cnu70.3-1-2-26.sbn
tftp-server flash:jar70sccp.8-0-2-25.sbn
radius-server host 10.13.32.241 auth-port 1645 acct-port 1646
radius-server timeout 40
radius-server deadtime 2
radius-server key cisco
radius-server vsa send accounting
!
control-plane
!
no call rsvp-sync
!
!
voice-port 1/0/0
!
voice-port 1/0/1
!
voice-port 1/0:15
!
voice-port 1/1:15
!
!
!
!
!
dial-peer voice 1 voip
 destination-pattern ........
 voice-class codec 2
 session target ras
 incoming called-number 9362....
 dtmf-relay h245-alphanumeric
 req-qos controlled-load audio
!
dial-peer voice 2 pots
 destination-pattern 93621101
!
dial-peer voice 3 pots
 destination-pattern 93621102
!
dial-peer voice 10 voip
 destination-pattern 2668....
 voice-class codec 1
 session target ipv4:10.13.46.200
!
dial-peer voice 101 voip
 shutdown
 destination-pattern 5694....
 voice-class codec 1
 session target ipv4:10.13.32.10
 incoming called-number 9362....
!
dial-peer voice 102 voip
 shutdown
 destination-pattern 2558....
 voice-class codec 1
 session target ipv4:10.13.32.12
 incoming called-number 9362....
!
dial-peer voice 103 voip
 shutdown
 destination-pattern 9845....
 voice-class codec 1
 session target ipv4:10.13.32.14
 incoming called-number 9362....
!
dial-peer voice 104 voip
 shutdown
 destination-pattern 9844....
 voice-class codec 1
 session target ipv4:10.13.32.15
 incoming called-number 9362....
!
dial-peer voice 201 pots
 destination-pattern 93625...
 no digit-strip
 direct-inward-dial
 port 1/0:15
!
dial-peer voice 202 pots
 destination-pattern 93625...
 no digit-strip
 direct-inward-dial
 port 1/1:15
!
!
gateway
 timer receive-rtp 1200
!
!
!
telephony-service
 load 7960-7940 P00308000300
 max-ephones 4
 max-dn 4
 ip source-address 10.13.32.11 port 2000
 auto assign 1 to 4
 secure-signaling trustpoint mytrustpoint1
 cnf-file location flash:
 cnf-file perphone
 voicemail 25589000
 max-conferences 4 gain -6
 call-forward pattern .T
 moh flash:music-on-hold.au
 web admin system name admin password mypassword2
 dn-webedit
 time-webedit
 transfer-system full-consult
 transfer-pattern ........
 tftp-server-credentials trustpoint mytrustpoint1
 server-security-mode secure
 device-security-mode encrypted
 create cnf-files version-stamp 7960 Oct 25 2006 07:19:39
!
!
ephone-dn  1
 number 93621000
 name 2851-PH1
 call-forward noan 25581101 timeout 10
!
!
ephone-dn  2
 number 93621001
 name 2851-PH2
 call-forward noan 98441000 timeout 10
!
```

```
!
ephone-dn  3
 number 93621002
 name 2851-PH3
!
!
ephone-dn  4
 number 93621003
 name 2851-PH4
!
!
ephone  1
 no multicast-moh
 device-security-mode encrypted
 mac-address 0012.4302.A7CC
 type 7970
 button  1:1
!
!
!
ephone  2
 no multicast-moh
 device-security-mode encrypted
 mac-address 0017.94CA.9CCD
 type 7960
 button  1:2
!
!
!
ephone  3
 no multicast-moh
 device-security-mode encrypted
 mac-address 0017.94CA.9833
 type 7960
 button  1:3
!
!
!
ephone  4
 no multicast-moh
 device-security-mode none
 mac-address 0017.94CA.A141
 type 7960
 button  1:4
!
!
!
line con 0
 logging synchronous level all limit 20480000
line aux 0
line vty 0 4
!
scheduler allocate 20000 1000
ntp clock-period 17179791
ntp server 10.13.32.12
!
webvpn context Default_context
 ssl authenticate verify all
 !
 no inservice
!
!
end
```

Where to Go Next

PKI Management

Cisco IOS public key infrastructure (PKI) provides certificate management to support security protocols such as IP Security (IPsec), secure shell (SSH), and secure socket layer (SSL). For more information, see the following documents:

- "Part 5: Implementing and Managing a PKI" in the *Cisco IOS Security Configuration Guide* for your Cisco IOS release.
- *Cisco IOS Security Command Reference* for your Cisco IOS release.

Cisco VG224 Analog Phone Gateway

- To configure secure endpoints on the Cisco VG224 Analog Phone Gateway, see *SCCP Controlled Analog (FXS) Ports with Supplementary Features in Cisco IOS Gateways*.

Additional References

The following sections provide references related to Cisco Unified CME features.

Related Documents

Related Topic	Document Title
Cisco Unified CME configuration	• *Cisco Unified CME Command Reference* • *Cisco Unified CME Documentation Roadmap*
Cisco IOS commands	• *Cisco IOS Voice Command Reference* • *Cisco IOS Software Releases 12.4T Command References*
Cisco IOS configuration	• "Implementing and Managing a PKI" section in the *Cisco IOS Security Configuration Guide*. • *Cisco IOS Voice Configuration Library* • *Cisco IOS Software Releases 12.4T Configuration Guides*
Phone documentation for Cisco Unified CME	• Quick Reference Cards and User Guides
Cisco VG224 Analog Phone Gateway	• *SCCP Controlled Analog (FXS) Ports with Supplementary Features in Cisco IOS Gateways* • *Cisco VG224 Voice Gateway Software Configuration Guide*

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register on Cisco.com.	http://www.cisco.com/techsupport

Feature Information for Security

Table 25 lists the features in this module and enhancements to the features by version.

To determine the correct Cisco IOS release to support a specific Cisco Unified CME version, see the *Cisco Unified CME and Cisco IOS Software Version Compatibility Matrix* at http://www.cisco.com/en/US/products/sw/voicesw/ps4625/products_documentation_roadmap09186a0080189132.html.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note Table 25 lists the Cisco Unified CME version that introduced support for a given feature. Unless noted otherwise, subsequent versions of Cisco Unified CME software also support that feature.

Table 25 Feature Information for Security

Feature Name	Cisco Unified CME Version	Feature Information
Media Encryption (SRTP) on Cisco Unified CME	4.2	Media encryption on Cisco Unified CME was introduced.
Phone Authentication	4.0	Phone authentication for Cisco Unified CME phones was introduced.