Connected MX

Key Management Server

Software Version 4.10.1

Installation and Upgrade Guide

Document Release Date: February 2021
Software Release Date: February 2021

Legal notices

Copyright notice

Acknowledgements

This product includes software written by Eric Young (eay@cyrptsoft.com).

Documentation updates

The title page of this document contains the following identifying information:

- Software Version number, which indicates the software version.
- Document Release Date, which changes each time the document is updated.
- Software Release Date, which indicates the release date of this version of the software.

To check for updated documentation, visit https://www.microfocus.com/documentation/connected-mx/.

Support

Visit the MySupport portal to access contact information and details about the products, services, and support that Micro Focus offers.

This portal also provides customer self-solve capabilities. It gives you a fast and efficient way to access interactive technical support tools needed to manage your business. As a valued support customer, you can benefit by using the MySupport portal to:

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- Access product documentation
- View software vulnerability alerts
- Enter into discussions with other software customers
- Download software patches
- Manage software licenses, downloads, and support contracts
- Submit and track service requests
- Contact customer support
- View information about all services that Support offers

Many areas of the portal require you to sign in. If you need an account, you can create one when prompted to sign in. To learn about the different access levels the portal uses, see the Access Levels descriptions.

Contents

Chapter 1: Overview

To keep your data secure while in motion as well as at rest, Micro Focus Connected MX (CMX) uses escrowed encryption keys by default. Although these keys provide ample security for many customers, CMX also supports a customer-managed encryption key option for sites that require enhanced data security. When using this option, implemented by the CMX Key Management Server (CMX-KMS) component, you maintain full control over the encryption keys that protect your company's data. As a result, only those within your company ever have access to your valuable corporate data.

CAUTION: Ensure that you follow best practices for key management by rotating and backing up your site-specific encryption keys. If your site's keys are compromised or lost, you lose access to your company's CMX data and Support cannot recover it for you .

Components

Managing your own encryption keys for CMX requires installation and configuration of the following components in your local environment:

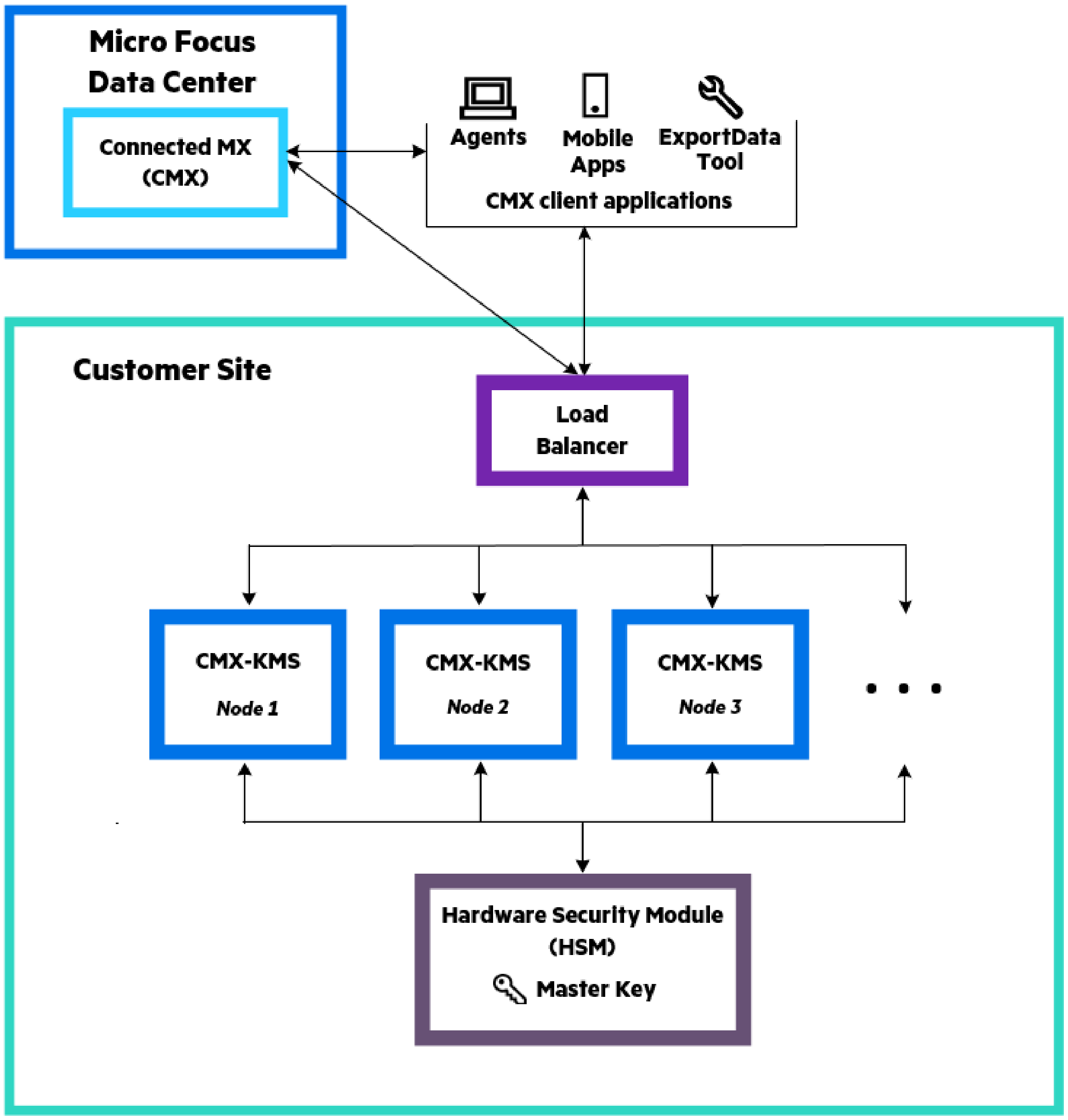
- **CMX Key Management Server (CMX-KMS)**. A CMX software server component that services CMX requests for encrypted and decrypted copies of your site's encryption keys. This component works in conjunction with your site's hardware security module (HSM) to fulfill these requests.
- **A physical or virtual hardware security module**. The HSM maintains your site's master encryption key. This device services encryption and decryption requests from CMX-KMS that require the use of your master encryption key. Neither CMX nor CMX-KMS ever have direct access to that key. One example of an HSM compatible with CMX-KMS is Micro Focus Enterprise Secure Key Manager (ESKM).
- **Load balancer (optional, but recommended)**. Micro Focus recommends that you deploy CMX-KMS in a distributed multi-node environment, serviced by a load balancer, such as HAProxy.

Deployment Model

CMX supports both single-node and multi-node deployments of the CMX-KMS component. However, Micro Focus recommends that you deploy CMX-KMS in a distributed multi-node environment, administered by a load balancer, such as HAProxy.

Using a multi-node environment improves the application's performance and reliability by distributing CMX requests across multiple nodes. Therefore, if a node goes offline or becomes inaccessible, other nodes remain available to service requests for your site's encryption keys. In contrast, if the node in a single-node deployment becomes inaccessible, CMX stops protecting user data and all data currently stored in it becomes inaccessible until access to the node is restored.

The following figure illustrates the major components in a multi-node CMX-KMS deployment and identifies the data flow between them.



This document provides the information necessary to install and configure CMX-KMS, including the configurations necessary for it to communicate with CMX, the user devices registered with it, and with the HSM. For HSM installation and configuration instructions, which are outside the scope of this document, see the HSM's documentation.

SSL Certificates

CMX-KMS uses several SSL certificates to establish secure connections with other components. There are two sets of CMX-KMS-related certificates: one for connecting with CMX applications and another for connecting with the HSM's KMIP-server. Use the information in this section as a reference when performing the tasks in this document to create and install these certificates.

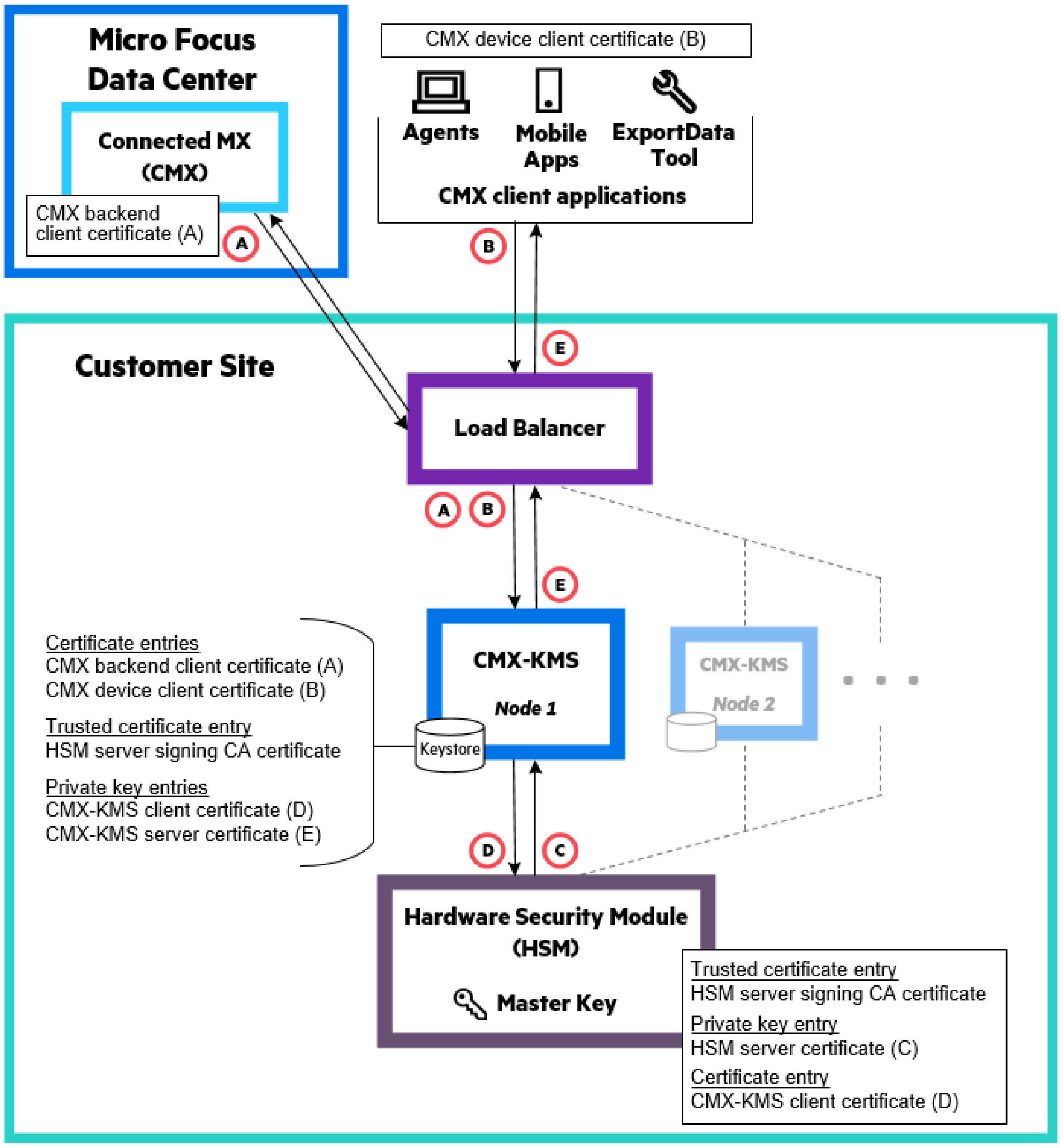
Certificates for connectivity with CMX applications:

- **CMX-KMS server certificate**. The certificate CMX-KMS uses to identify itself to clients, such as CMX applications.
- **CMX backend client certificate**. The certificate the CMX backend server uses to identify itself to CMX-KMS.
- **CMX device client certificate**. The certificate CMX client applications use to identify themselves to CMX-KMS. One certificate supports all CMX client applications in your environment.

Certificates for connectivity with the HSM's server:

- **CMX-KMS client certificate**. The certificate that CMX-KMS uses to identify itself to servers, such as the HSM's server.
- **HSM server certificate**. The certificate that the HSM's server uses to identify itself to clients. A valid KMIP server certificate is a prerequisite to installing CMX-KMS. For information about creating this certificate and installing it on your HSM, see your HSM's documentation.
- **HSM server signing CA certificate**. The certificate of the CA that signed the *HSM server certificate*. A valid KMIP server signing CA certificate is a prerequisite to installing CMX-KMS. For information about creating this certificate and installing it on your HSM, see your HSM's documentation.

The following figure shows the installed location of these certificates and the communication channels that use them.


Micro Focus Data Center
Connected MX (CMX)
CMX backend client certificate (A)
CMX device client certificate (B)
Agents
Mobile Apps
ExportData Tool
CMX client applications
A
B
E
Customer Site
Load Balancer
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D
C
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Master Key
Trusted certificate entry
HSM server signing CA certificate
Private key entry
HSM server certificate (C)
Certificate entry
CMX-KMS client certificate (D)

Chapter 2: Install CMX-KMS

This chapter provides information about how to install and configure the CMX-KMS software.

Installation process

Before you begin

Ensure that your environment meets all hardware, software, and third-party component requirements as described in the *CMX-KMS Support Matrix*. You can access this guide from the Connected MX documentation site.

To install CMX-KMS

1. Download the CMX-KMS software package, `cmx-kms-server-rpm.tar.gz`, from the CMX web application to a temporary location in your environment accessible by all computers that will run CMX-KMS:

   a. Log in to the CMX web application using a CMX administrator or data administrator account.

   b. In the upper-right corner of the CMX web application, click your name, and then click **Downloads**.

   c. Under **Tools & Utilities** on the Downloads page, click **Download Key Management Server (CMX-KMS)**.

   During the installation process, you will copy this software to each CMX-KMS node in your environment.

2. If you plan to deploy CMX-KMS on multiple nodes, create a list that contains each node's host name and TCP port number on which it listens for incoming requests.

   You must specify these values while configuring each node, so it is best to create the list now.

3. Create the SSL certificates and keystore.

4. On each node in your CMX-KMS environment:

   a. Install the CMX-KMS software.

   b. Configure the CMX-KMS software.

5. In a multi-node environment, install and configure a load balancer, such as HAProxy, to distribute requests across all CMX-KMS nodes.

   Configure each node in the load balancer with port 8443, which is the port that each node listens to for requests. For detailed information about how to configure your load balancer, see the documentation that accompanies it.

6. Provide the following to Micro Focus Software Fulfillment or the Micro Focus Partner who will create your CMX corporate account:
   - PKSC12 file and password of the CMX backend client certificate
   - Password of the CMX device client certificate
   - Public URL of either the load balancer in a multi-node deployment or the CMX-KMS server in a single-node deployment
7. Install the CMX device client certificate.

Create the SSL certificates and CMX-KMS keystore

CMX-KMS uses SSL certificates to secure the channels it uses to communicate with other components. When establishing a communication channel, CMX-KMS sends its own certificate to identify itself and verifies the certificate it receives against those in its keystore. This chapter describes how to create these certificates and the CMX-KMS keystore.

Table 1 identifies the set of certificates that CMX-KMS uses, regardless of how many nodes you deploy, and provides notes about required signing and creation of each. For detailed information about these certificates and how the software uses them, see Overview, on page 4.

Table 1: CMX-KMS required certificates

Certificate	Notes
CMX backend client certificate	Signed by an external certificate authority (CA), such as VeriSign or DigiCert.
CMX device client certificate	Signed by an external CA.
CMX-KMS server certificate	Signed by an external CA. If you have an existing PKCS12 certificate for your CMX-KMS computer that meets this requirement, you can use it.
CMX-KMS client certificate	(**Optional** when using a Vault with Azure Authentication enabled) Signed by a CA that you have imported into the HSM as a Trusted Certificate Entry, such as the *HSM server signing CA certificate*. After creating this certificate using the steps in this document, you must import it into the HSM as a Certificate Entry. However, the steps to do so are outside the scope of this document. See the HSM documentation for details. If you have an existing PKCS12 certificate for your CMX-KMS computer that meets this requirement, you can use it.
HSM server signing CA certificate	You must create this certificate and import it into the HSM as a Trusted Certificate Entry. To do so, see your HSM documentation for details. You must also import a copy of this certificate, in PEM

Certificate	Notes
	format, into the CMX-KMS keystore file, as described in this chapter.
HSM server certificate	Signed by the *HSM server signing CA certificate*. You must create this certificate and import it into the HSM as a Private Key Entry. To do so, see the HSM documentation for details.

Create the certificates

Prior to CMX-KMS configuration, you must create the CMX backend client certificate, the CMX device client certificate, and the CMX-KMS server and client certificates. This section provides step-by-step instruction for creating these certificates using the OpenSSL toolkit and verifying them with Java Keytool. If your company uses different tools to create and verify certificates, you can use them.

Before you begin

Ensure that the HSM server certificate and HSM server signing CA certificate are available and installed on the HSM in the manner described in Table 1: CMX-KMS required certificates. For information about how to create these certificates and import them into your HSM, see the HSM documentation.

To create the SSL certificates

1. On one of your planned CMX-KMS nodes, create a `keystore` directory to hold all certificate files, and then go to the new directory.

   ```
   mkdir ~/keystore
   ```

   ```
   cd ~/keystore
   ```

2. Generate an RSA key.

   ```
   openssl genrsa -out keyName.key 2048
   ```

   This command stores an RSA key in the file *`keyName`*`.key`.

   Based on which certificate you want to create, specify *`keyName`* throughout these steps as follows or choose your own unique name to identify it. Examples throughout this document use the names listed.

   - **CMX backend client certificate**. `cmxBackend`
   - **CMX device client certificate**. `cmxDevice`

     Agents require this certificate to have the name `cmxDevice.p12`; therefore, by specifying the key name as `cmxDevice`, you do not have to rename the resulting certificate.

- **CMX-KMS server certificate**. `kmsServer`
- **CMX-KMS client certificate**. `kmsClient` (**Optional** for Vault)

> **NOTE:** The *`keyName`*`.key` file contains the RSA key in an unencrypted format, so keep this file secure.

3. Create a certificate signing request (CSR) for the RSA key.

   ```
   openssl req -new -sha256 -key keyName.key -out keyName.csr
   ```

   This command prompts for the following information:

   - **Country Name**. Two-letter Organization for Standardization (ISO) country code that identifies where your organization is legally registered. For example, type `US` for United States.
   - **State or Province Name**. Name of the state where your organization is legally located. Do not abbreviate this value. For example, type `Massachusetts` not `MA`.
   - **Locality Name**. Name of the city or town where your organization is legally located. Do not abbreviate this value. For example, type `New York City` not `NYC`.
   - **Organization Name**. Full legal name of your organization. Do not abbreviate this value. For example, type `Micro Focus` not `MF`.

     If the name of the Organization or Organizational Unit contains a symbol or special character (one that requires you to press the Shift key to type), either spell out or omit the symbol. For example, for AB&C Company, type `AB and C Company`.
   - **Organizational Unit Name**. (Optional) Name of the department or unit within your organization making the request. To keep this field blank, type a period (`.`).
   - **Common Name**. One of the following, depending on certificate:
     - **CMX backend client certificate**. A unique, case-sensitive, company-specific string in FQDN format that identifies the CMX backend server. Typically, *`<certIdentifier>`*`.`*`<company>`*`.com`

       For example, for the fictitious AcmeXYZ company: `cmxBackend.AcmeXYZ.com`.
     - **CMX device client certificate**. A unique, case-sensitive, company-specific string in FQDN format that identifies the CMX device. Typically, *`<certIdentifier>`*`.`*`<company>`*`.com`

       For example: `cmxDevice.AcmeXYZ.com`.
     - **CMX-KMS client certificate**. A unique, case-sensitive, company-specific string in FQDN format that identifies the CMX-KMS server as a client to the HSM. Typically, *`<certIdentifier>`*`.`*`<company>`*`.com`

       For example: `kmsClient.AcmeXYZ.com`.
     - **CMX-KMS server certificate**. The case-sensitive hostname (host + domain) of the CMX-KMS server. Typically, *`<server>`*`.`*`<company>`*`.com`

       For example: `myServer.AcmeXYZ.com`.

> **NOTE:** If prompted for a challenge password, optional company name, or email address, do not provide values. To leave those fields empty, type a period (`.`).

4. Submit the CSR to the appropriate CA, as described in Table 1: CMX-KMS required certificates.

   To proceed to the next step, you need the CA-signed certificate and possibly intermediate CA certificates in the trust chain so that you have all certificates up to, but not including, the Root CA. Usually the certificate trust chain contains an intermediate CA certificate; however, the use of none or more than one is possible. All certificates must be in PEM format, which typically have a `.crt` file extension. If the CA did not return an intermediate CA certificate, you can download it from the CA's website.

5. Create a certificate chain from your CA-signed certificate (`*keyName*.crt`), as follows:

   - If your CA-signed certificate is signed by the Root CA, your CA-signed certificate is essentially a chain that contains one certificate. Therefore, the remaining steps in this task refer to your `*keyName*.crt` file as the certificate chain named `*keynameCertChain*.crt`.
   - If your CA-signed certificate is signed by an intermediate CA, do the following:

     a. Create a copy of your CA-signed certificate in which to build the certificate chain.

     ```
     cp keyName.crt keynameCertChain.crt
     ```

     b. Open `*keynameCertChain*.crt` in a text editor, and then paste the entire contents of the intermediate CA certificate at the end of the file, starting on a new line.

     The file should now contain the following:

     ```
     -----BEGIN CERTIFICATE-----
     <Your CA-signed certificate in encoded format.>
     -----END CERTIFICATE-----
     -----BEGIN CERTIFICATE-----
     <Encoded certificate of the Intermediate CA that signed your
     certificate.>
     -----END CERTIFICATE-----
     ```

     c. If the trust chain for your certificate includes multiple intermediate CA certificates, add any remaining ones to the end of the file.

     First, add the intermediate CA certificate whose owner is the issuer of the intermediate CA certificate that you added in step b. Next, add any intermediate CA whose owner is the issuer of the previous certificate. Continue adding intermediate CA certificates in this order, ending with the one issued by a Root CA.

     d. Save the file.

6. If you added intermediate CA certificates to the `*keynameCertChain*.crt` file, verify its contents. To do so:

   a. List the certificate's contents.

   ```
   keytool -printcert -v -file keynameCertChain.crt
   ```

   b. Verify that the certificates listed form a chain from your certificate, `Certificate[1]`, to one issued by a Root CA, `Certificate[*N*]`.

`Certificate[1]` should identify your organization as the owner and an intermediate certificate authority as the issuer. For example, for the CMX backend client certificate:

```
Certificate[1]:
Owner: CN=cmxBackend, OU=MyOU, O=MyCorp, ST=MyState, C=US
Issuer: CN=XYZ Intermediate CA, OU=www.xyzIntermediateCA.com, O=XYZOrg, C=US
```

`Certificate[2]` should list its owner as the issuer of `Certificate[1]`. Its issuer can be another intermediate CA, or as in this example, a Root CA:

```
Certificate[2]:
Owner: CN=XYZ Intermediate CA, OU=www.xyzIntermediateCA.com, O=SomeOrg, C=US
Issuer: CN=ABC Root CA, OU=www.abcRootCA.com, O=ABCOrg, C=US
```

If the issuer is another intermediate CA, continue to follow the pattern matching each certificate's issuer to the following certificate's owner and ensure that the issuer of the last certificate is a Root CA.

> **NOTE:** If the file does not contain the correct certificate chain, delete the file, and then repeat step 5 to create it again. To delete the file, type: `rm` ***`keynameCertChain`***`.crt`

7. Create a password-protected PKCS12 file using the key generated in step 1 (***`keyName`***`.key`) and the file that contains your certificate chain (***`keynameCertChain`***`.crt`).

   ```
   openssl pkcs12 -export -inkey keyName.key -in keynameCertChain.crt -name
   "keyName" -out keyName.p12
   ```

   This command prompts for a password to encrypt the resulting PKCS12 file. The command does not display the password as you type it.

   > **NOTE:** Store this password in a secure location. You will need it and the PKCS12 file to create the keystore and to configure Tomcat's SSL properties.

8. Verify the PKCS12 certificate by examining its contents and ensuring it contains a certificate chain that includes your CA-signed certificate and intermediate CA certificates. To do so:

   a. List the certificate's contents.

      ```
      keytool -list -v -keystore keyName.p12 -storetype PKCS12 -storepass
      certPassword
      ```

      Where *`certPassword`* is the password that you assigned the PKCS12 file in the previous step.

   b. Verify that the following line exists, which indicates the certificate contains a private key:

      ```
      Entry type: PrivateKeyEntry
      ```

   c. Verify that the certificates listed form a chain from your certificate, `Certificate[1]`, to one ultimately issued by the Root CA, `Certificate[`*`N`*`]`.

      Use the same logic as in step 6b to match each certificate's issuer to the following certificate's owner. The issuer of the last certificate must be a Root CA.

> **NOTE:** If the PKCS12 file does not contain the correct certificate chain, delete the file, and then repeat step 7 to create it again. To delete the file, type: `rm` *`keyName`*`.p12`

9. Repeat these steps until you have created all four certificates listed in step 1.

After you have created all certificates, you are ready to create the CMX-KMS keystore.

Create the CMX-KMS keystore

CMX-KMS uses a password-protected keystore to hold its copy of certificates that verify the identity of components requesting its services. This section provides step-by-step instruction for generating the CMX-KMS keystore using Java Keytool. If your company uses a different tool to create keystores, you can use it instead of Keytool in these steps.

Before you begin

Ensure that the CMX, CMX-KMS, and KMIP server signing CA certificates listed in Table 1: CMX-KMS required certificates, are available and that you know their passwords.

> **CAUTION:** The sample commands in this section include options for passwords. If you use the sample commands exactly as-is, the passwords that you assign will be stored in the computer's command history and therefore be viewable by others. If this poses a security issue in your environment, omit the password options from the commands. The Keytool command automatically prompts for any passwords not specified by the command.

To create the CMX-KMS keystore

1. (**Optional** when using the Vault) While still in the `keystore` directory, import the CMX-KMS client certificate into a new keystore file, *`kmsKeystore`*`.jks`.

   ```
   keytool -importkeystore -srckeystore kmsClient.p12 -srcstoretype PKCS12 \
   -srckeypass kmsClientPwd -srcstorepass kmsClientPwd -alias kmsClient \
   -deststorepass kmsKeystorePwd -destkeypass kmsClientKeyPwd \
   -destkeystore kmsKeystore.jks
   ```

   This command uses the following passwords:

   - ***`kmsClientPwd`***. Password that you gave the *`kmsClient`*`.p12` file when creating it.
   - ***`keystorePwd`***. Password to assign to the new keystore.
   - ***`kmsClientKeyPwd`***. Password to assign to private key of the keystore's *`kmsClient`* key pair. CMX-KMS requires that this password be the same as *`keystorePwd`*.

   > **TIP:** For more information about a specific option, type `keytool -`*`option`*` -help`.

2. Import the CMX-KMS server certificate into the keystore file.

   ```
   keytool -importkeystore -srckeystore kmsServer.p12 -srcstoretype PKCS12 \
   -srckeypass kmsServerPwd -srcstorepass kmsServerPwd -alias kmsServer \
   -deststorepass kmsKeystorePwd -destkeypass kmsServerKeyPwd \
   -destkeystore kmsKeystore.jks
   ```

   This command uses the following passwords:

   - ***kmsServerPwd***. Password that you gave the *kmsServer*`.p12` file when creating it.
   - ***keystorePwd***. Password that you assigned to the new keystore in the previous step.
   - ***kmsServerKeyPwd***. Password to assign to the private key of the keystore's *kmsServer* key pair. CMX-KMS requires that this password be the same as *keystorePwd*.

3. Import the HSM server signing CA certificate into the keystore file.

   ```
   keytool -import -trustcacerts -alias kmipSigningCA -file kmipSigningCA.crt
   -keystore kmsKeystore.jks -storepass keystorePwd
   ```

   The tool prompts you to verify that the certificate looks correct. If so, type `yes`. Otherwise, type `no`, and then run the command again with the correct certificate file.

4. Import the CMX backend client certificate into the keystore file.

   ```
   keytool -import -alias cmxBackend -file cmxBackend.crt -keystore
   kmsKeystore.jks -storepass kmsKeystorePwd
   ```

5. Import the CMX device client certificate into the keystore file.

   ```
   keytool -import -alias cmxDevice -file cmxDevice.crt -keystore kmsKeystore.jks
   -storepass kmsKeystorePwd
   ```

6. Verify the keystore contents.

   ```
   keytool -v -list -keystore kmsKeystore.jks -storepass kmsKeystorePwd
   ```

   The CMX-KMS keystore should contain these entries:

   - (**Optional** when using Vault) Private key entry for the CMX-KMS client certificate
   - Private key entry for the CMX-KMS server certificate
   - Trusted certificate entry for the KMIP server signing CA certificate
   - Certificate entry for the CMX backend client certificate
   - Certificate entry for the CMX device client certificate

   The information for each private key entry should show the full certificate chain. The first part of the chain should contain information that you provided about your environment while creating the certificate and the end of the chain should contain information about the signing CA.

7. In a multi-node environment, copy the keystore to each CMX-KMS node.

   Use the secure copy command (`scp`), or other method, to transfer the keystore to each node. For example:

   ```
   scp kmsKeystore.jks jdoe@kms1.myCorp.com:
   ```

This command copies the `kmsKeystore.jks` file from the local directory to the jdoe user's home directory on the computer named `kms1.myCorp.com`.

After copying the keystore to each node, complete the installation of certificates on the HSM by importing the CMX-KMS client certificate into it.

Import the CMX-KMS client certificate into the HSM

IMPORTANT: This section is **Optional** when using a Vault.

CMX-KMS presents its CMX-KMS client certificate to the HSM when trying to establish a secure connection. The HSM verifies the certificate against its local copy of the public key certificate before allowing the connection. You must install a copy of the CMX-KMS client certificate on the HSM for use in this verification process.

To import the CMX-KMS client certificate

- Import the CA-signed CMX-KMS client certificate (*`kmsClient`*`.crt`) into the HSM as a Certificate Entry (`CertEntry`).

  For information about how to import certificates into the HSM, see your HSM's documentation.

You are now ready to install the CMX-KMS software. To do so, see Install the CMX-KMS software, below.

Install the CMX-KMS software

You must install and configure the CMX-KMS software on each node in your CMX-KMS environment. The software, which you previously downloaded, comes packaged as a compressed TAR file that contains the following items:

- **CMX-KMS RPM (`cmx-kms-server-`*`version.build`*`.x86_64.rpm`)**. RPM package that installs the CMX-KMS software.
- **Installation script (`CMX-KMS-Installer.sh`)**. Installation script file that runs the CMX-KMS and Java SE RPMs.
- **Uninstallation script (`CMX-KMS-Uninstaller.sh`)**. Script that uninstalls the CMX-KMS software.

  NOTE: If Tomcat 7 is installed, it will be automatically uninstalled when installing CMX-KMS. It is recommended to copy the relevant data from /usr/share/tomcat.

  Tomcat 9 is automatically installed if not already installed.

To install the CMX-KMS software

1. On a computer you plan to install the CMX-KMS software, create a subdirectory under `/tmp` in which to copy and unzip the software package.

   ```
   mkdir /tmp/cmx-kms-installer
   ```

2. Go to the new directory.

   ```
   cd /tmp/cmx-kms-installer
   ```

3. Copy the software package, `cmx-kms-server-rpm.tar.gz`, from where you previously downloaded it to the current directory, and then extract its contents.

   ```
   tar -xvf cmx-kms-server-rpm.tar.gz
   ```

4. Run the `CMX-KMS-Installer.sh` script with root privileges.

   ```
   sudo sh CMX-KMS-Installer.sh
   ```

   The script identifies the packages it will install and prompts for confirmation. Review this information and, if acceptable, enter `Y`.

   As the script runs, it provides information about the installation process. If an error occurs, correct the problem listed, and then run the script again.

   The CMX-KMS installation creates a `/usr/share/kms` directory for application files and a `/var/log/kms` directory for log files.

The software is now installed, but not configured. To configure it, see Configure the CMX-KMS software, below.

Configure the CMX-KMS software

Configure the CMX-KMS software that you previously installed on the computer.

To configure the CMX-KMS software

1. Copy the CMX-KMS keystore file, which you previously copied to your home directory, to the local `/usr/share/kms/conf/` directory.

   ```
   sudo cp ~/kmsKeystore.jks /usr/share/kms/conf
   ```

2. Configure the `kms.properties` file with site-specific values.

   a. Open the file `/usr/share/kms/conf/kms.properties` in a text editor.

      For example, to open the file using the vi editor, type:

      ```
      sudo vi /usr/share/kms/conf/kms.properties
      ```

      TIP: vi is one of the most common editors available on Linux-based computers. You can find detailed information about how to use the vi editor on the Internet by searching for: `vi editor`.

b. Configure the following `kms.properties` parameters:

- **`kms.keystore.file=<`*`keystorePath`*`>`**. Path to the keystore file. For example: `/usr/share/kms/conf/`*`kmsKeystore`*`.jks`.
- **`kms.keystore.password=<`*`keystorePassword`*`>`**. Keystore password in plain text. The software also uses this password to access the CMX-KMS client certificate.
- (**Optional** when using a Vault) **`kms.keystore.alias=<`*`keystoreAlias`*`>`**. Case-insensitive alias that you provided when importing the CMX-KMS client certificate's PKCS12 file into the keystore. For example: `kmsClient`.
- **`kms.hsm.server.url=<`*`kmipURL`*`>`**. URL to the HSM's server. For example: `https://kmshsm.myCorp.com`

  > **NOTE:** The original property `kmip.server.url` is still supported but not preferred.

- **`kms.hsm.server.port=<`*`kmipPort`*`>`**. Port number on which the HSM's server listens for client requests, such as from CMX-KMS.

  > **NOTE:** The original property `kmip.server.port` is still supported but not preferred.

- The following additional properties to be configured **only** for the Vault:
  - **`kms.hsm.protocol=<`*`Protocol`*`>`**. The protocol used to communicate with the HSM. The default value is kmip1. For example, `kms.hsm.protocol=VAULT`
  - **`kms.hsm.vault.namespace=<`*`Namespace`*`>`**. The value to pass in the X-Vault-Namespace header. The default value is none. For example: `kms.hsm.vault.namespace=engineering`
  - **`kms.hsm.vault.auth=<`*`token`*`>`**. The authentication method to authenticate with the Vault. The default value is token. For example: `kms.hsm.vault.auth=azure`
  - **`kms.hsm.vault.auth.renew-before-expiry=<`*`seconds`*`>`**. Renew a token this number of seconds before the token expires. The default value is 30. For example: `kms.hsm.vault.auth.renew-before-expiry=35`
  - **`kms.hsm.vault.auth.azure.role=<`*`role`*`>`**. The role to pass during Azure Auth login. For example: `kms.hsm.vault.auth.azure.role=KMS_ADMIN`
  - **`kms.hsm.vault.auth.azure.path=<`*`path`*`>`**. The request path for the Azure Auth login request. The default value is `/v1/auth/azure/login`. For example: `kms.hsm.vault.auth.azure.path=/v1/auth/azure/login`
  - **`kms.hsm.vault.auth.azure.resource=<`*`resource passed`*`>`**. The resource passed in the Get Azure Token. The default value is `https://vault.hashicorp.com/`. For example: `kms.hsm.vault.auth.azure.resource=https://management.azure.com`

> **NOTE:** Keep the `kms.distributed.cache.config.file` parameter set to its default value.

c. In a mult-node environment, set `kms.cache.type=distributed`. Otherwise, keep the default value (none).

d. Save the file, and then exit the editor.

3. (**Only** for Vault) Configure the Vault so KMS can access it

   a. Configure a Vault policy so KMS can use the Vault Transit Secrets Engine.

   Create a Vault policy that will be associated with the logged in KMS so it has the necessary permissions on the Transit Secrets engine. For example,

```
#
# Write a policy to allow KMS to create keys, get keys, and encrypt/decrypt
(update). BTW,
# as written this grants permission to all keys.
#
echo "Write <kms-app-policy>"
vault policy write <kms-app-policy> - <<EOF
path "transit/encrypt/*" {
capabilities = [ "update"]
}
path "transit/decrypt/*" {
capabilities = [ "update"]
}
path "transit/keys/*" {
capabilities = [ "create",  "read", "update", "list" ]
}
EOF
```

   Where *kms-app-policy* is a name you give for the Vault policy.

   b. Create a Vault Azure Auth role that refers to the policy created above.

   You configure this when running the Vault in Azure. For example,

```
# Create a role. This role must also be specified in kms.properties.
vault write auth/azure/role/kms \
policies="kms-app" \
bound_subscription_ids=<AZURE_SUBSCRIPTION_ID> \
bound_resource_groups=<AZURE_RESOURCE_GROUP_NAME>
```

   For more information on Azure Authentication with HashiCorp Vault, refer the following resources:

   - https://www.hashicorp.com/resources/azure-authentication-hashicorp-vault
   - https://nedinthecloud.com/2019/01/23/using-azure-active-directory-authentication-with-hashicorp-vault-part-1/
   - https://github.com/straubt1/blogs.digitalinnovation/blob/master/blogs/vault-azure-and-terraform.md

4. Configure Tomcat with information about the keystore.

   a. Open the file `/usr/share/tomcat/conf/server.xml` in a text editor.

      For example, to open the file using the vi editor, type:

      ```
      sudo vi /usr/share/tomcat/conf/server.xml
      ```

   b. Update the keystoreFile, keystorePass and keyAlias appropriately in `server.xml`.

      When doing so, set the following:

      - **`keystoreFile`**. Path to the keystore file. For example: `/usr/share/kms/conf/`*`kmsKeystore`*`.jks`
      - **`keystorePass`**. Keystore password in plain text. Tomcat also uses this password to access the CMX-KMS server certificate.
      - (**Only** for KMIP) **`keyAlias`**. Case-insensitive alias that you provided when importing the CMX-KMS server certificate's PKCS12 file into the keystore. For example: `kmsServer`.

      NOTE: Ensure that port 8443 is publicly accessible so that CMX can establish communication with CMX-KMS through it.
      In a multi-node environment, port 8443 need not be publicly accessible, but the load balancer port needs to be publicly accessible.

   c. Save the file, and then exit the editor.

5. In a multi-node environment, define the node in Tomcat's configuration file.

   a. Open the file `/usr/share/tomcat/bin/setenv.sh` in a text editor.

      For example, to open the file using the vi editor, type:

      ```
      sudo vi /usr/share/tomcat/bin/setenv.sh
      ```

   b. Locate the following comment line:

      ```
      #JAVA_OPTS="${JAVA_OPTS} -Djgroups.tcp.address=<ipAddress>
      -Djgroups.tcp.port=<portNum>"
      ```

      Then, edit it as follows:

      - Remove the leading number sign (#) to uncomment the line.
      - Replace <*`ipAddress`*> with the host name of the node that you are installing. For example: `kms1.AcmeXYZ.com`
      - Replace <*`portNum`*> with the TCP port number that the node uses to communicate with other CMX-KMS nodes in the cluster. To use the default port of 7800, omit the `-Djgroups.tcp.port` option.

        NOTE: You can designate a unique port for each node; however, the port must be accessible through firewalls.

        The following example uses the default TCP port:

```
JAVA_OPTS="${JAVA_OPTS} -Djgroups.tcp.address=kms1.AcmeXYZ.com"
```

c. Save the file, and then exit the editor.

6. In a multi-node environment, define the set of all other CMX-KMS nodes in your distributed environment.

   a. Open the file `/usr/share/kms/conf/jgroups.xml` in a text editor.

      For example, to open the file using the vi editor, type:

      ```
      sudo vi /usr/share/kms/conf/jgroups.xml
      ```

   b. Locate the following section:

      ```
      <TCPPING
      initial_hosts=""
      />
      ```

      Then, specify the following:

      - **`initial_hosts`**. Comma-separated list of the hostname and TCP port number of each node in the cluster *except* the node that you are currently configuring. The syntax for this value is in the format: `kmsHostName1[tcpPort1],kmsHostName2[tcpPort2],kmsHostName3[tcpPort3]...`

      For example, the following line configures the first node of a four-node cluster in which all nodes listen for TCP requests on the default port 7800:

      ```
      <TCPPING
      initial_hosts="kms2.myCorp.com[7800],kms3.myCorp.com[7800],kms4.myCorp.com
      [7800]"
      />
      ```

   c. Save the file, and then exit the editor.

7. Restart the Tomcat server.

   ```
   sudo systemctl restart tomcat
   ```

   TIP: To configure the Tomcat server to start automatically each time the node restarts, use the following command:

   ```
   sudo systemctl enable tomcat
   ```

CMX-KMS software configuration on this node is complete. To install and configure the software on another node, see Install the CMX-KMS software, on page 16. Otherwise, complete the installation process by performing the remaining steps in Install CMX-KMS, on page 8.

Install the CMX device client certificate

CMX applications use the CMX device client certificate to establish a secure connection to CMX-KMS. Therefore, to ensure a successful connection, you must install this certificate on each device that has a CMX application installed.

> **NOTE:** CMX-KMS applications will not work correctly unless the CMX device client certificate is installed on the device.

Install the certificate for Agents

The Agent reads the CMX device client certificate from disk. You can install the certificate in either the user's or system's application data folder, depending on which location best meets your needs. For example, if multiple CMX users share the computer, install the certificate in the system's folder so that it applies to all users. You can use the instructions provided in this task to install the certificate manually or you can deploy it using a custom process that distributes and installs it on one or more clients at the same time.

> **NOTE:** Installation of the certificate file is outside of the Agent installation process. As a result, the file remains after you uninstall the Agent using the typical uninstall process. To remove the certificate after uninstalling the Agent, manually delete it.

Before you begin

Ensure that the name of the CMX device client certificate is `cmxDevice.p12`.

The Agent installation process creates the folder in which you will store the certificate. Therefore, install the Agent (but do not sign in) before installing the certificate. The Agent needs the certificate to encrypt and decrypt data, so sign in only after installing the certificate.

To install the certificate for Agents

- Distribute the `cmxDevice.p12` certificate to the computer, and then place it into one of the following locations:
  - On Windows-based computers, either:
    - **system-specific location.** `%ALLUSERSPROFILE%\Connected MX`
    - **user-specific location.** `%LOCALAPPDATA%\Connected MX`
  - On macOS-based computers, either:
    - **system-specific location.** `/Library/Application Support/Connected MX`
    - **user-specific location.** `$HOME/Library/Application Support/Connected MX`

Install the certificate for mobile apps

On mobile devices, the CMX mobile app installs the certificate into the device's secure key store. To do so, it requires direct access to the certificate so follow the steps in this section to install the certificate. You cannot deploy it through a third-party mobile management app.

Before you begin

The user must install the mobile app and perform initial setup before installing the certificate. Setup includes starting the app, configuring a server and email address, and then signing in to the app.

To install the certificate for mobile apps

1. Create a copy of the CMX device client certificate to a similarly named file having the extension `.cmx`.

   ```
   cp cmxDevice.p12 cmxDevice.cmx
   ```

2. Email the newly created certificate to the user.
3. On receipt of the message, open its certificate attachment using the CMX app.
4. When prompted, confirm that the app should import the certificate.

You have installed the certificate correctly if the app can download files.

Install the certificate for the ExportData tool

The ExportData tool reads the CMX device client certificate from disk and uses it to establish a secure connection with CMX-KMS. Although the certificate is password-protected, you can provide additional security by restricting access to the tool's root folder to only users who will run the tool.

Before you begin

Ensure that the name of the CMX device client certificate is `cmxDevice.p12`.

To install the certificate for the ExportData tool

- Copy the CMX client device certificate, `cmxDevice.p12`, to the ExportData tool's root folder.

NOTE: Each instance of the ExportData tool requires its own certificate. Therefore, if you install the tool in multiple locations, you must install a copy of the certificate in the tool's root folder of each location.

Chapter 3: Upgrade CMX-KMS

This chapter provides information about how to upgrade the CMX-KMS software from a previous version.

You must upgrade the CMX-KMS software on each node in your CMX-KMS environment. The software, which you will download, comes packaged as a compressed TAR file that contains the following items:

- **CMX-KMS RPM (`cmx-kms-server-`*`version.build`*`.x86_64.rpm`)**. RPM package that installs the CMX-KMS software.
- **Installation script (`CMX-KMS-Installer.sh`)**. Installation script file that runs the CMX-KMS and Java SE RPMs.
- **Uninstallation script (`CMX-KMS-Uninstaller.sh`)**. Script that uninstalls the CMX-KMS software.

  NOTE: If Tomcat 7 is installed, it will be automatically uninstalled when installing CMX-KMS. It is recommended to copy the relevant data from /usr/share/tomcat.

  Tomcat 9 is automatically installed if not already installed.

Before you begin

Ensure that your environment meets all hardware, software, and third-party component requirements as described in the *CMX-KMS Support Matrix*. You can access this guide from the Connected MX documentation site.

To upgrade the CMX-KMS software

1. Download the CMX-KMS software package, `cmx-kms-server-rpm.tar.gz`, from the CMX web application to a temporary location in your environment accessible by all computers that will run CMX-KMS:

   a. Log in to the CMX web application using a CMX administrator or data administrator account.

   b. In the upper-right corner of the CMX web application, click your name, and then click **Downloads**.

   c. Under **Tools & Utilities** on the Downloads page, click **Download Key Management Server (CMX-KMS)**.

   During the upgrade process, you will copy this software to each CMX-KMS node in your environment.

2. Create a subdirectory under `/tmp` in which to copy and unzip the software package.

   ```
   mkdir /tmp/cmx-kms-installer
   ```

3. Go to the new directory.

   ```
   cd /tmp/cmx-kms-installer
   ```

4. Copy the software package, `cmx-kms-server-rpm.tar.gz`, from where you previously downloaded it to the current directory, and then extract its contents.

   ```
   tar -xvf cmx-kms-server-rpm.tar.gz
   ```

5. Make a copy of the existing CMX-KMS software so you can revert to it, if necessary.

   ```
   cp -r /usr/share/kms/conf /usr/share/kms/conf-orig
   ```

6. Run the `CMX-KMS-Installer.sh` script with root privileges.

   ```
   sudo sh CMX-KMS-Installer.sh
   ```

   The script identifies the packages it will upgrade and prompts for confirmation. Review this information and, if acceptable, enter `Y`.

   As the script runs, it provides information about the upgrade process. If an error occurs, correct the problem listed, and then run the script again.

   The CMX-KMS installation creates a `/usr/share/kms` directory for application files and a `/var/log/kms` directory for log files.

7. If replacing Oracle Java with an OpenJDK distribution, do the following:

   a. Stop tomcat:

      ```
      sudo systemctl stop tomcat
      ```

   b. Open the file `/usr/share/tomcat/bin/setenv.sh` in a text editor.

      For example, to open the file using the vi editor, type:

      ```
      sudo vi /usr/share/tomcat/bin/setenv.sh
      ```

   c. Set `JAVA_HOME` to the location where OpenJDK is installed.

      For example:

      ```
      JAVA_HOME="/usr/lib/jvm/jre"
      ```

   d. Save the file, and then exit the editor.

   e. Start tomcat:

      ```
      sudo systemctl start tomcat
      ```

8. Repeat steps 2 through 7 for each remaining node in your CMX-KMS environment.

Chapter 4: Replace certificates

To replace the certificates in your CMX-KMS environment, such as if they are expiring, use the following tasks:

- Replace CMX device client certificate

  This certificates identifies CMX client applications to CMX-KMS. One certificate supports all CMX client applications in your environment.

- Replace CMX backend client certificate

  This certificate identifies the CMX backend server to CMX-KMS.

- Replace CMX-KMS server certificate

  This certificate identifies CMX-KMS to CMX client applications.

Replace CMX device client certificate

CMX applications use the CMX device client certificate to establish a secure connection with CMX-KMS. This task provides the steps to replace this certificate, such as if it is expiring.

Before you begin

Make a backup copy of the following:

- `/usr/share/kms/conf` folder
- `cmxDevice.p12` certificate

To replace the CMX device client certificate

1. Obtain a new or renewed CMX device client certificate that has the *same* password as the current certificate.

   For information about how to create a new certificate, see Create the certificates, on page 10. Although the task provides information for creating all certificates used with CMX-KMS, you need only create the type that you want to replace, such as the CMX device client certificate. You will use the resulting `.p12` and `.crt` files in the steps that follow.

2. Import the CMX device client certificate (`.crt` file) into the keystore as follows:

   a. On one of your CMX-KMS nodes, navigate to the `keystore` directory that holds the new certificate file, and run the following command:

      ```
      keytool -import -alias cmxDeviceAlias -file cmxDevice.crt -keystore
      kmsKeystore.jks -storepass kmsKeystorePwd
      ```

To support multiple device certificates in the keystore, specify a unique *cmxDeviceAlias*. For example, append the current date, such as `cmxDevice20190512`. Using a unique alias enables clients to access CMX with their current certificate until you replace it. For Agents, this ensures backups are not interrupted.

b. In a multi-node environment, copy the keystore to each CMX-KMS node.

   Use the secure copy command (`scp`), or other method, to transfer the keystore to each node. For example:

   ```
   scp kmsKeystore.jks jdoe@kms1.myCorp.com:
   ```

   This command copies the `kmsKeystore.jks` file from the local directory to the jdoe user's home directory on the computer named `kms1.myCorp.com`.

> **NOTE:** Do not remove the current device certificate from the `kmsKeystore.jks` keystore file until after you have installed the new CMX device client certificate on all devices. This ensures that each device can continue to establish a secure connection with CMX-KMS using its current certificate until you replace it.

3. Replace the CMX device client certificate (`.p12` file) on each computer and mobile device.

   For information, see Install the CMX device client certificate, on page 21.

> **NOTE:** Keep the following in mind when replacing the CMX device client certificate on a computer running an Agent:
>
> - You can install the certificate in one of two locations. To ensure that Agents function correctly, locate and replace the current CMX device client certificate so that only one resides on the device.
> - If, before you replace the certificate, the Agent icon in the notification tray indicates a certificate-related issue (such as if it expired), the error might not clear until the Agent attempts its next backup.

Replace CMX backend client certificate

This task provides the steps to replace the CMX backend client certificate, which the CMX backend server uses to identify itself to CMX-KMS.

Before you begin

Make a backup copy of the following:

- `/usr/share/kms/conf` folder
- *`cmxBackend`*`.p12` and *`cmxBackend`*`.crt` certificates

To replace the CMX backend client certificate

1. Obtain a new or renewed CMX backend client certificate.

   For information about how to create a new certificate, see Create the certificates, on page 10. Although the task provides information for creating all certificates used with CMX-KMS, you need only create the type that you want to replace, such as the CMX backend client certificate.

2. Import the CMX backend client certificate (`.crt` file) into the keystore.

   To do so, on one of your CMX-KMS nodes, navigate to the `keystore` directory that holds the new certificate file, run the following command, and then answer the password prompt:

   ```
   keytool -import -alias cmxBackendAlias -file cmxBackend.crt -keystore
   kmsKeystore.jks
   ```

   To avoid disruption of backups and restores, specify a unique *`cmxBackendAlias`*. For example, append the current date, such as `cmxBackend20190512`.

3. In a multi-node environment, copy the keystore to all other nodes as descried in Distribute updated keystore.

   TIP: After successfully distributing the keystore to all other nodes in your environment, you can delete the original CMX backend client certificate.

4. In the CMX Web application, update your customer-managed key information as follows:

   a. Click the **HIERARCHY** tab.

   b. Select your company, and then click **EDIT**.

   c. Under **Additional Customer Features**, locate the **Customer-managed keys** option.

   d. To update certificate-related items, click **CONFIGURE CERTIFICATES**, and then do the following:

      i. To replace the CMX backend client certificate, click **Choose File**, and then use the Open dialog box to select the new CMX backend server certificate (`.p12`).

         If you select a file, and then decide that you want only to change a password and not to upload a new certificate, click **Clear**.

      ii. To replace a certificate's password, click **Edit** in the appropriate section, and then enter the new password.

   e. Click **SAVE**.

Replace CMX-KMS server certificate

This task provides the steps to replace the CMX-KMS server certificate, which CMX-KMS uses to identify itself to CMX client applications.

Before you begin

Make a backup copy of the following:

- `kmsServer.p12` certificate

To replace the CMX-KMS server certificate

1. Obtain a new or renewed CMX-KMS server certificate.

   For information about how to create a new certificate, see Create the certificates, on page 10. Although the task provides information for creating all certificates used with CMX-KMS, you need only create the type that you want to replace, such as the CMX-KMS server certificate.

2. Import the CMX-KMS server certificate into the keystore.

   To do so, on one of your CMX-KMS nodes, navigate to the `keystore` directory, run the following command, answer the password prompts, and then confirm that the current certificate with `kmsserver` alias should be replaced:

   ```
   keytool -importkeystore -srckeystore kmsServer.p12 -srcstoretype PKCS12 \
   -srcAlias kmsServerALias -destkeystore kmsKeystore.jks -destAlias kmsserver
   ```

   When specifying the command:

   - For `srcAlias`, set *`kmsServerALias`* to the name you specified when converting the `.crt` file to a `.p12` file.
   - For `destAlias`, always specify `kmsserver` because that alias is the value of the `keyAlias` parameter in the Tomcat `server.xml` file.

   When run, this command prompts for the following passwords:

   - ***`kmsServerPwd`***. Password that you gave the *`kmsServer`*`.p12` file when creating it.
   - ***`keystorePwd`***. Password of the keystore.
   - ***`kmsServerKeyPwd`***. Password assigned to the private key of the keystore's *`kmsServer`* key pair. Specify the same password as for *`keystorePwd`*.

3. In a multi-node environment, copy the keystore to all other nodes as descried in Distribute updated keystore.

Distribute updated keystore

In a multi-node environment, after updating the keystore with a new certificate, copy the keystore to each CMX-KMS node.

To distribute the updated keystore

1. Copy the keystore to each CMX-KMS node.

   Use the secure copy command (`scp`), or other method, to transfer the keystore to each CMX-KMS node. For example:

   ```
   scp kmsKeystore.jks jdoe@kms1.myCorp.com:
   ```

   This command copies the `kmsKeystore.jks` file from the local directory to the jdoe user's home directory on the computer named `kms1.myCorp.com`.

2. On each CMX-KMS node, perform the following steps:

   a. Copy the keystore to the `/usr/share/kms/conf` directory.

   b. Restart tomcat using these commands:

   ```
   systemctl stop tomcat
   systemctl start tomcat
   ```

Chapter 5: Uninstall CMX-KMS

This chapter describes how to uninstall the CMX-KMS software from your environment. The uninstall process unlinks the `kms.war` file and removes the `/usr/share/kms` directory created during install. It does not delete the CMX-KMS software package or extracted install and uninstall scripts, if they still exist on the computer.

Before you begin

To uninstall CMX-KMS you need the `CMX-KMS-Uninstaller.sh` script that is part of the software package extracted onto each computer during CMX-KMS installation or upgrade. If this script is missing from a computer, you can copy it from another one. If it no longer exists on any computer in your environment, download the CMX-KMS software package and extract it again. To do so:

1. Download the CMX-KMS software package, `cmx-kms-server-rpm.tar.gz`, from the CMX web application to a temporary location in your environment accessible by all computers running CMX-KMS:

   a. Log in to the CMX web application using a CMX administrator or data administrator account.

   b. In the upper-right corner of the CMX web application, click your name, and then click **Downloads**.

   c. Under **Tools & Utilities** on the Downloads page, click **Download Key Management Server (CMX-KMS)**.

   The uninstall script is not version specific so you can use the one from the currently available version of CMX-KMS.

2. Go to the location where you downloaded the package and extract its contents.

   ```
   tar -xvf cmx-kms-server-rpm.tar.gz
   ```

To uninstall the CMX-KMS software

1. On a computer that contains CMX-KMS software you want to uninstall, go to the local directory that contains the `CMX-KMS-Uninstaller.sh` script.

   You might find the script in `/tmp/cmx-kms-installer`, which is the sample extraction directory the installation and upgrade documentation uses. However, if you cannot find it there or elsewhere on the computer, copy it from another computer to any temporary local directory.

2. Run the `CMX-KMS-Uninstaller.sh` script with root privileges.

   ```
   sudo sh CMX-KMS-Uninstaller.sh
   ```

   The script identifies the packages it will remove and prompts for confirmation. Review this information and, if acceptable, enter `Y`.

As it runs, the script provides information about the uninstall process. If an error occurs, correct the specified problem, and then run the script again.

> **NOTE:** The script might leave some files related to CMX-KMS in `/var/log/kms` and `/usr/share/kms`. If you no longer plan to use CMX-KMS, you may delete these directories.

3. Repeat these steps for each remaining node in your CMX-KMS environment.

Send documentation feedback

If you have comments about this document, you can contact the documentation team by email. If an email client is configured on this system, click the link above and an email window opens with the following information in the subject line:

Feedback on Micro Focus Connected MX Key Management Server 4.10.1 Installation and Upgrade Guide

Add your feedback to the email and click **Send**.

If no email client is available, copy the information above to a new message in a web mail client, and send your feedback to swpdl.ConnectedMx.DocFeedback@microfocus.com.

We appreciate your feedback!