



Red Hat Enterprise Linux 8

Managing certificates in IdM

Issuing certificates, configuring certificate-based authentication, and controlling certificate validity in Identity Management in Red Hat Enterprise Linux 8

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Abstract

This documentation covers managing certificates issued by the IdM Certificate Authority, configuring user accounts to use certificates for authentication, and certificate maintenance in Identity Management on Red Hat Enterprise Linux 8.

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MAKING OPEN SOURCE MORE INCLUSIVE

Red Hat is committed to replacing problematic language in our code, documentation, and web properties. We are beginning with these four terms: master, slave, blacklist, and whitelist. Because of the enormity of this endeavor, these changes will be implemented gradually over several upcoming releases. For more details, see [our CTO Chris Wright's message](#).

In Identity Management, planned terminology replacements include:

- ***block list*** replaces *blacklist*
- ***allow list*** replaces *whitelist*
- ***secondary*** replaces *slave*
- The word *master* is being replaced with more precise language, depending on the context:
 - ***IdM server*** replaces *IdM master*
 - ***CA renewal server*** replaces *CA renewal master*
 - ***CRL publisher server*** replaces *CRL master*
 - ***multi-supplier*** replaces *multi-master*

PROVIDING FEEDBACK ON RED HAT DOCUMENTATION

We appreciate your input on our documentation. Please let us know how we could make it better. To do so:

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 2. Use your mouse cursor to highlight the part of text that you want to comment on.
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 4. Follow the displayed instructions.
- For submitting more complex feedback, create a Bugzilla ticket:
 1. Go to the [Bugzilla](#) website.
 2. As the Component, use **Documentation**.
 3. Fill in the **Description** field with your suggestion for improvement. Include a link to the relevant part(s) of documentation.
 4. Click **Submit Bug**.

CHAPTER 1. PUBLIC KEY CERTIFICATES IN IDENTITY MANAGEMENT

This chapter describes X.509 public key certificates, which are used to authenticate users, hosts and services in Identity Management (IdM). In addition to authentication, X.509 certificates also enable digital signing and encryption to provide privacy, integrity and non-repudiation.

A certificate contains the following information:

- The subject that the certificate authenticates.
- The issuer, that is the CA that has signed the certificate.
- The start and end date of the validity of the certificate.
- The valid uses of the certificate.
- The public key of the subject.

A message encrypted by the public key can only be decrypted by a corresponding private key. While a certificate and the public key it includes can be made publicly available, the user, host or service must keep their private key secret.

1.1. CERTIFICATE AUTHORITIES IN IDM

Certificate authorities operate in a hierarchy of trust. In an IdM environment with an internal Certificate Authority (CA), all the IdM hosts, users and services trust certificates that have been signed by the CA. Apart from this root CA, IdM supports sub-CAs to which the root CA has granted the ability to sign certificates in their turn. Frequently, the certificates that such sub-CAs are able to sign are certificates of a specific kind, for example VPN certificates. Finally, IdM supports using external CAs. The table [below](#) presents the specifics of using the individual types of CA in IdM.

Table 1.1. Comparison of using integrated and external CAs in IdM

Name of CA	Description	Use	Useful links
The ipa CA	An integrated CA based on the Dogtag upstream project	Integrated CAs can create, revoke, and issue certificates for users, hosts, and services.	Using the ipa CA to request a new user certificate and exporting it to the client
IdM sub-CAs	An integrated CA that is subordinate to the ipa CA	IdM sub-CAs are CAs to which the ipa CA has granted the ability to sign certificates. Frequently, these certificates are of a specific kind, for example VPN certificates.	Restricting an application to trust only a subset of certificates
External CAs	An external CA is a CA other than the integrated IdM CA or its sub-CAs.	Using IdM tools, you add certificates issued by these CAs to users, services, or hosts as well as remove them.	Managing certificates issued by external CAs in RHEL 7 documentation

From the certificate point of view, there is no difference between being signed by a self-signed IdM CA and being signed externally.

The role of the CA includes the following purposes:

- It issues digital certificates.
- By signing a certificate, it certifies that the subject named in the certificate owns a public key. The subject can be a user, host or service.
- It can revoke certificates, and provides revocation status via Certificate Revocation Lists (CRLs) and Online Certificate Status Protocol (OCSP).

Additional resources

- For more details on the supported CA configurations of the IdM server, see [Planning your CA services](#).

1.2. COMPARISON OF CERTIFICATES AND KERBEROS

Certificates perform a similar function to that performed by Kerberos tickets. Kerberos is a computer network authentication protocol that works on the basis of tickets to allow nodes communicating over a non-secure network to prove their identity to one another in a secure manner. The following table shows a comparison of Kerberos and X.509 certificates:

Table 1.2. Comparison of certificates and Kerberos

Characteristic	Kerberos	X.509
Authentication	Yes	Yes
Privacy	Optional	Yes
Integrity	Optional	Yes
Type of cryptography involved	Symmetrical	Asymmetrical
Default validity	Short (1 day)	Long(2 years)

By default, Kerberos in Identity Management only ensures the identity of the communicating parties.

1.3. THE PROS AND CONS OF USING CERTIFICATES TO AUTHENTICATE USERS IN IDM

The advantages of using certificates to authenticate users in IdM include the following points:

- A PIN that protects the private key on a smart card is typically less complex and easier to remember than a regular password.
- Depending on the device, a private key stored on a smart card cannot be exported. This provides additional security.

- Smart cards can make logout automatic: IdM can be configured to log out users when they remove the smart card from the reader.
- Stealing the private key requires actual physical access to a smart card, making smart cards secure against hacking attacks.
- Smart card authentication is an example of two-factor authentication: it requires both something you have (the card) and something you know (the PIN).
- Smart cards are more flexible than passwords because they provide the keys that can be used for other purposes, such as encrypting email.
- Using smart cards use on shared machines that are IdM clients does not typically pose additional configuration problems for system administrators. In fact, smart card authentication is an ideal choice for shared machines.

The disadvantages of using certificates to authenticate users in IdM include the following points:

- Users might lose or forget to bring their smart card or certificate and be effectively locked out.
- Mistyping a PIN multiple times might result in a card becoming locked.
- There is generally an intermediate step between request and authorization by some sort of security officer or approver. In IdM, the security officer or administrator must run the **ipa cert-request** command.
- Smart cards and readers tend to be vendor and driver specific: although a lot of readers can be used for different cards, a smart card of a specific vendor might not work in the reader of another vendor or in the type of a reader for which it was not designed.
- Certificates and smart cards have a steep learning curve for administrators.

CHAPTER 2. MANAGING CERTIFICATES FOR USERS, HOSTS, AND SERVICES USING THE INTEGRATED IDM CA

This chapter describes how to manage certificates in Identity Management (IdM) using the integrated CA, the **ipa** CA, and its sub-CAs.

This chapter contains the following sections:

- [Requesting new certificates for a user, host, or service using the IdM Web UI](#) .
- Requesting new certificates for a user, host, or service from the IdM CA using the IdM CLI:
 - [Requesting new certificates for a user, host, or service from IdM CA using certutil](#)
 - For a specific example of requesting a new user certificate from the IdM CA using the **certutil** utility and exporting it to an IdM client, see [Requesting a new user certificate and exporting it to the client](#).
 - [Requesting new certificates for a user, host, or service from IdM CA using openssl](#)

You can also request new certificates for a service from the IdM CA using the **certmonger** utility. For more information, see [Requesting new certificates for a service from IdM CA using certmonger](#) .

Prerequisites

- Your IdM deployment contains an integrated CA:
 - For information on how to plan your CA services in IdM, see [Planning your CA services](#) .
 - For information on how to install an IdM server with integrated DNS and integrated CA as the root CA, see [Installing an IdM server: With integrated DNS, with an integrated CA as the root CA](#)
 - For information on how to install an IdM server with integrated DNS and an external CA as the root CA, see [Installing an IdM server: With integrated DNS, with an external CA as the root CA](#)
 - For information on how to install an IdM server without integrated DNS and with an integrated CA as the root CA, see [Installing an IdM server: Without integrated DNS, with an integrated CA as the root CA](#).
 - [Optional] Your IdM deployment supports users authenticating with a certificate:
 - For information on how to configure your IdM deployment to support user authentication with a certificate stored in the IdM client filesystem, see [Configuring authentication with a certificate stored on the desktop of an IdM client](#).
 - For information on how to configure your IdM deployment to support user authentication with a certificate stored on a smart card inserted into an IdM client, see [Configuring Identity Management for smart card authentication](#) .
 - For information on how to configure your IdM deployment to support user authentication with smart cards issued by an Active Directory certificate system, see [Configuring certificates issued by AD CS for smart card authentication in IdM](#) .

2.1. REQUESTING NEW CERTIFICATES FOR A USER, HOST, OR SERVICE USING IDM WEB UI

This section describes how to use the Identity Management (IdM) Web UI to request a new certificate for any IdM entity from the integrated IdM certificate authorities (CAs): the **ipa** CA or any of its sub-CAs.

IdM entities include:

- Users
- Hosts
- Services



IMPORTANT

Services typically run on dedicated service nodes on which the private keys are stored. Copying a service's private key to the IdM server is considered insecure. Therefore, when requesting a certificate for a service, create the certificate signing request (CSR) on the service node.

Prerequisites

- Your IdM deployment contains an integrated CA.
- You are logged into the IdM Web UI as the IdM administrator.

Procedure

1. Under the **Identity** tab, select the **Users**, **Hosts**, or **Services** subtab.
2. Click the name of the user, host, or service to open its configuration page.

Figure 2.1. List of Hosts

Hosts			
<input type="text" value="Search"/>		<input type="button" value="Refresh"/>	<input type="button" value="Delete"/>
<input type="button" value="+ Add"/>		<input type="button" value="Actions v"/>	
<input type="checkbox"/>	Host name	Description	Enrolled
<input type="checkbox"/>	server.example.com		True
Showing 1 to 1 of 1 entries.			

3. Click **Actions** → **New Certificate**.
4. Optional: Select the issuing CA and profile ID.
5. Follow the instructions for using the **certutil** command-line (CLI) utility on the screen.
6. Click **Issue**.

2.2. REQUESTING NEW CERTIFICATES FOR A USER, HOST, OR SERVICE FROM IDM CA USING CERTUTIL

You can use the **certutil** utility to request a certificate for an Identity Management (IdM) user, host or service in standard IdM situations. To ensure that a host or service Kerberos alias can use a certificate, [use the openssl utility to request a certificate](#) instead.

This section describes how to request a certificate for an IdM user, host, or service from **ipa**, the IdM certificate authority (CA), using **certutil**.



IMPORTANT

Services typically run on dedicated service nodes on which the private keys are stored. Copying a service's private key to the IdM server is considered insecure. Therefore, when requesting a certificate for a service, create the certificate signing request (CSR) on the service node.

Prerequisites

- Your IdM deployment contains an integrated CA.
- You are logged into the IdM command-line interface (CLI) as the IdM administrator.

Procedure

1. Create a temporary directory for the certificate database:

```
# mkdir ~/certdb/
```

2. Create a new temporary certificate database, for example:

```
# certutil -N -d ~/certdb/
```

3. Create the CSR and redirect the output to a file. For example, to create a CSR for a 4096 bit certificate and to set the subject to *CN=server.example.com,O=EXAMPLE.COM*:

```
# certutil -R -d ~/certdb/ -a -g 4096 -s "CN=server.example.com,O=EXAMPLE.COM" -8  
server.example.com > certificate_request.csr
```

4. Submit the certificate request file to the CA running on the IdM server. Specify the Kerberos principal to associate with the newly-issued certificate:

```
# ipa cert-request certificate_request.csr --principal=host/server.example.com
```

The **ipa cert-request** command in IdM uses the following defaults:

- The **calPAserviceCert** certificate profile
To select a custom profile, use the **--profile-id** option.
- The integrated IdM root CA, **ipa**
To select a sub-CA, use the **--ca** option.

Additional resources

- For more information about the **ipa cert-request** command, see the output of the **ipa cert-request --help** command.
- For more information about creating a custom certificate profile, see [Creating and managing certificate profiles in Identity Management](#).

2.3. REQUESTING NEW CERTIFICATES FOR A USER, HOST, OR SERVICE FROM IDM CA USING OPENSSL

You can use the **openssl** utility to request a certificate for an Identity Management (IdM) host or service if you want to ensure that the Kerberos alias of the host or service can use the certificate. In standard situations, consider [requesting a new certificate using the certutil utility](#) instead.

This section describes how to request a certificate for an IdM host, or service from **ipa**, the IdM certificate authority, using **openssl**.



IMPORTANT

Services typically run on dedicated service nodes on which the private keys are stored. Copying a service's private key to the IdM server is considered insecure. Therefore, when requesting a certificate for a service, create the certificate signing request (CSR) on the service node.

Prerequisites

- Your IdM deployment contains an integrated CA.
- You are logged into the IdM command-line interface (CLI) as the IdM administrator.

Procedure

1. Create one or more aliases for your Kerberos principal *test/server.example.com*. For example, *test1/server.example.com* and *test2/server.example.com*.
2. In the CSR, add a subjectAltName for dnsName (*server.example.com*) and otherName (*test2/server.example.com*). To do this, configure the **openssl.conf** file to include the following line specifying the UPN otherName and subjectAltName:

```
otherName=1.3.6.1.4.1.311.20.2.3;UTF8:test2/server.example.com@EXAMPLE.COM
DNS.1 = server.example.com
```

3. Create a certificate request using **openssl**:

```
openssl req -new -newkey rsa:2048 -keyout test2service.key -sha256 -nodes -out
certificate_request.csr -config openssl.conf
```

4. Submit the certificate request file to the CA running on the IdM server. Specify the Kerberos principal to associate with the newly-issued certificate:

```
# ipa cert-request certificate_request.csr --principal=host/server.example.com
```

The **ipa cert-request** command in IdM uses the following defaults:

- The **caIPAServiceCert** certificate profile

To select a custom profile, use the **--profile-id** option.

- The integrated IdM root CA, **ipa**
To select a sub-CA, use the **--ca** option.

Additional resources

- For more information about the **ipa cert-request** command, see the output of the **ipa cert-request --help** command.
- For more information about creating a custom certificate profile, see [Creating and managing certificate profiles in Identity Management](#).

2.4. ADDITIONAL RESOURCES

- For information on how to revoke certificates using the IdM CA, see [Revoking certificates with the integrated IdM CAs](#).
- For information on how to restore certificates using the IdM CA, see [Restoring certificates with the integrated IdM CAs](#).
- For information on how to restrict an application to trust only certificates that were issued by an IdM sub-CA, see [Restricting an application to trust only a subset of certificates](#) .

CHAPTER 3. CONVERTING CERTIFICATE FORMATS TO WORK WITH IDM

This user story describes how to make sure that you as an IdM system administrator are using the correct format of a certificate with specific IdM commands. This is useful, for example, in the following situations:

- You are loading an external certificate into a user profile. For details, see [Section 3.2, “Converting an external certificate to load into an IdM user account”](#).
- You are using an external CA certificate when [configuring the IdM server for smart card authentication](#) or [configuring the IdM client for smart card authentication](#) so that users can authenticate to IdM using smart cards with certificates on them that have been issued by the external certificate authority.
- You are exporting a certificate from an NSS database into a pkcs #12 format that includes both the certificate and the private key. For details, see [Section 3.3.1, “Exporting a certificate and private key from an NSS database into a PKCS #12 file”](#).

3.1. CERTIFICATE FORMATS AND ENCODINGS IN IDM

Certificate authentication including smart card authentication in IdM proceeds by comparing the certificate that the user presents with the certificate, or certificate data, that are stored in the user’s IdM profile.

System configuration

What is stored in the IdM profile is only the certificate, not the corresponding private key. During authentication, the user must also show that he is in possession of the corresponding private key. The user does that by either presenting a PKCS #12 file that contains both the certificate and the private key or by presenting two files: one that contains the certificate and the other containing the private key.

Therefore, processes such as loading a certificate into a user profile only accept certificate files that do not contain the private key.

Similarly, when a system administrator provides you with an external CA certificate, he will provide only the public data: the certificate without the private key. The **ipa-adviser** utility for configuring the IdM server or the IdM client for smart card authentication expects the input file to contain the certificate of the external CA but not the private key.

Certificate encodings

There are two common certificate encodings: Privacy-enhanced Electronic Mail (**PEM**) and Distinguished Encoding Rules (**DER**). The **base64** format is almost identical to the **PEM** format but it does not contain the **-----BEGIN CERTIFICATE-----/-----END CERTIFICATE-----** header and footer.

A certificate that has been encoded using **DER** is a binary X509 digital certificate file. As a binary file, the certificate is not human-readable. **DER** files sometimes use the **.der** filename extension, but files with the **.crt** and **.cer** filename extensions also sometimes contain **DER** certificates. **DER** files containing keys can be named **.key**.

A certificate that has been encoded using **PEM** Base64 is a human-readable file. The file contains ASCII (Base64) armored data prefixed with a **“-----BEGIN ...”** line. **PEM** files sometimes use the **.pem** filename extension, but files with the **.crt** and **.cer** filename extensions also sometimes contain **PEM** certificates. **PEM** files containing keys can be named **.key**.

Different **ipa** commands have different limitations regarding the types of certificates that they accept. For example, the **ipa user-add-cert** command only accepts certificates encoded in the **base64** format but **ipa-server-certinstall** accepts **PEM**, **DER**, **PKCS #7**, **PKCS #8** and **PKCS #12** certificates.

Table 3.1. Certificate encodings

Encoding format	Human-readable	Common filename extensions	Sample IdM commands accepting the encoding format
PEM/base64	Yes	.pem, .crt, .cer	ipa user-add-cert, ipa-server-certinstall, ...
DER	No	.der, .crt, .cer	ipa-server-certinstall, ...

[Section 3.4, “Certificate-related commands and formats in IdM”](#) lists further **ipa** commands with the certificate formats that the commands accept.

User authentication

When using the web UI to access IdM, the user proves that he is in possession of the private key corresponding to the certificate by having both stored in the browser’s database.

When using the CLI to access IdM, the user proves that he is in possession of the private key corresponding to the certificate by one of the following methods:

- The user adds, as the value of the **X509_user_identity** parameter of the **kinit -X** command, the path to the smart card module that is connected to the smart card that contains both the certificate and the key:

```
$ kinit -X X509_user_identity='PKCS11:opensc-pkcs11.so' idm_user
```

- The user adds two files as the values of the **X509_user_identity** parameter of the **kinit -X** command, one containing the certificate and the other the private key:

```
$ kinit -X X509_user_identity='FILE:/path/to/cert.pem,/path/to/cert.key' idm_user
```

Useful certificate commands

To view the certificate data, such as the subject and the issuer:

```
$ openssl x509 -noout -text -in ca.pem
```

To compare in which lines two certificates differ:

```
$ diff cert1.crt cert2.crt
```

To compare in which lines two certificates differ with the output displayed in two columns:

```
$ diff cert1.crt cert2.crt -y
```

3.2. CONVERTING AN EXTERNAL CERTIFICATE TO LOAD INTO AN IDM USER ACCOUNT

This section describes how to make sure that an external certificate is correctly encoded and formatted before adding it to a user entry.

Prerequisites

- If your certificate was issued by an Active Directory certificate authority and uses the **PEM** encoding, make sure that the **PEM** file has been converted into the **UNIX** format. To convert a file, use the **dos2unix** utility provided by the eponymous package.

3.2.1. Converting an external certificate in the IdM CLI and loading it into an IdM user account

The **IdM CLI** only accepts a **PEM** certificate from which the first and last lines (-----BEGIN CERTIFICATE----- and -----END CERTIFICATE-----) have been removed.

Procedure

1. Convert the certificate to the **PEM** format:

- If your certificate is in the **DER** format:

```
$ openssl x509 -in cert.crt -inform der -outform pem -out cert.pem
```

- If your file is in the **PKCS #12** format, whose common filename extensions are **.pfx** and **.p12**, and contains a certificate, a private key, and possibly other data, extract the certificate using the **openssl pkcs12** utility. When prompted, enter the password protecting the private key stored in the file:

```
$ openssl pkcs12 -in cert_and_key.p12 -clcerts -nokeys -out cert.pem
Enter Import Password:
```

2. Obtain the administrator's credentials:

```
$ kinit admin
```

3. Add the certificate to the user account using the **IdM CLI** following one of the following methods:

- Remove the first and last lines (-----BEGIN CERTIFICATE----- and -----END CERTIFICATE-----) of the **PEM** file using the **sed** utility before adding the string to the **ipa user-add-cert** command:

```
$ ipa user-add-cert some_user --certificate="$(sed -e '/BEGIN CERTIFICATE/d;/END CERTIFICATE/d' cert.pem)"
```

- Copy and paste the contents of the certificate file without the first and last lines (-----BEGIN CERTIFICATE----- and -----END CERTIFICATE-----) into the **ipa user-add-cert** command:

```
$ ipa user-add-cert some_user --
certificate=MIIDlzCCAn+gAwIBAgIBATANBgkqhki...
```

**NOTE**

You cannot pass a **PEM** file containing the certificate as input to the **ipa user-add-cert** command directly, without first removing the first and last lines (-----BEGIN CERTIFICATE----- and -----END CERTIFICATE-----):

```
$ ipa user-add-cert some_user --cert=some_user_cert.pem
```

This command results in the "ipa: ERROR: Base64 decoding failed: Incorrect padding" error message.

4. Optionally, to check if the certificate was accepted by the system:

```
[idm_user@r8server]$ ipa user-show some_user
```

3.2.2. Converting an external certificate in the IdM web UI for loading into an IdM user account:

Procedure

1. Using the **CLI**, convert the certificate to the **PEM** format:

- If your certificate is in the **DER** format:

```
$ openssl x509 -in cert.crt -inform der -outform pem -out cert.pem
```

- If your file is in the **PKCS #12** format, whose common filename extensions are **.pfx** and **.p12**, and contains a certificate, a private key, and possibly other data, extract the certificate using the **openssl pkcs12** utility. When prompted, enter the password protecting the private key stored in the file:

```
$ openssl pkcs12 -in cert_and_key.p12 -clcerts -nokeys -out cert.pem
Enter Import Password:
```

2. Open the certificate in an editor and copy the contents. You can include the "-----BEGIN CERTIFICATE-----" and "-----END CERTIFICATE-----" header and footer lines but you do not have to, as both the **PEM** and **base64** formats are accepted by the IdM web UI.
3. In the IdM web UI, log in as security officer.
4. Go to **Identity → Users → some_user**.
5. Click **Add** next to **Certificates**.
6. Paste the PEM-formatted contents of the certificate into the window that opens.
7. Click **Add**.

If the certificate was accepted by the system, you can see it listed among the **Certificates** in the user profile.

3.3. PREPARING TO LOAD A CERTIFICATE INTO THE BROWSER

Before importing a user certificate into the browser, make sure that the certificate and the corresponding private key are in a **PKCS #12** format. There are two common situations requiring extra preparatory work:

- The certificate is located in an NSS database. For details how to proceed in this situation, see [Section 3.3.1, “Exporting a certificate and private key from an NSS database into a PKCS #12 file”](#).
- The certificate and the private key are in two separate **PEM** files. For details how to proceed in this situation, see [Section 3.3.2, “Combining certificate and private key PEM files into a PKCS #12 file”](#).

Afterwards, to import both the CA certificate in the **PEM** format and the user certificate in the **PKCS #12** format into the browser, follow the procedures in [Configuring a browser to enable certificate authentication](#) and [Authenticating to the Identity Management Web UI with a Certificate as an Identity Management User](#).

3.3.1. Exporting a certificate and private key from an NSS database into a PKCS #12 file

Procedure

1. Use the **pk12util** command to export the certificate from the NSS database to the **PKCS12** format. For example, to export the certificate with the **some_user** nickname from the NSS database stored in the **~/certdb** directory into the **~/some_user.p12** file:

```
$ pk12util -d ~/certdb -o ~/some_user.p12 -n some_user
Enter Password or Pin for "NSS Certificate DB":
Enter password for PKCS12 file:
Re-enter password:
pk12util: PKCS12 EXPORT SUCCESSFUL
```

2. Set appropriate permissions for the **.p12** file:

```
# chmod 600 ~/some_user.p12
```

Because the **PKCS #12** file also contains the private key, it must be protected to prevent other users from using the file. Otherwise, they would be able to impersonate the user.

3.3.2. Combining certificate and private key PEM files into a PKCS #12 file

This section describes how to combine a certificate and the corresponding key stored in separate **PEM** files into a **PKCS #12** file.

Procedure

- To combine a certificate stored in **certfile.cer** and a key stored in **certfile.key** into a **certfile.p12** file that contains both the certificate and the key:

```
$ openssl pkcs12 -export -in certfile.cer -inkey certfile.key -out certfile.p12
```

3.4. CERTIFICATE-RELATED COMMANDS AND FORMATS IN IDM

Table [IdM certificate commands and formats](#) displays certificate-related commands in IdM with acceptable formats.

Table 3.2. IdM certificate commands and formats

Command	Acceptable formats	Notes
ipa user-add-cert some_user --certificate	base64 PEM certificate	
ipa-server-certinstall	PEM and DER certificate; PKCS#7 certificate chain; PKCS#8 and raw private key; PKCS#12 certificate and private key	
ipa-cacert-manage install	DER; PEM; PKCS#7	
ipa-cacert-manage renew --external-cert-file	PEM and DER certificate; PKCS#7 certificate chain	
ipa-ca-install --external-cert-file	PEM and DER certificate; PKCS#7 certificate chain	
ipa cert-show <cert serial> --certificate-out /path/to/file.pem	N/A	Creates the PEM-encoded file.pem file with the certificate having the <cert_serial> serial number.
ipa cert-show <cert serial> --certificate-out /path/to/file.pem	N/A	Creates the PEM-encoded file.pem file with the certificate having the <cert_serial> serial number. If the --chain option is used, the PEM file contains the certificate including the certificate chain.
ipa cert-request --certificate-out=FILE /path/to/req.csr	N/A	Creates the req.csr file in the PEM format with the new certificate.
ipa cert-request --certificate-out=FILE /path/to/req.csr	N/A	Creates the req.csr file in the PEM format with the new certificate. If the --chain option is used, the PEM file contains the certificate including the certificate chain.

CHAPTER 4. CREATING AND MANAGING CERTIFICATE PROFILES IN IDENTITY MANAGEMENT

Certificate profiles are used by the Certificate Authority (CA) when signing certificates to determine if a certificate signing request (CSR) is acceptable, and if so what features and extensions are present on the certificate. A certificate profile is associated with issuing a particular type of certificate. By combining certificate profiles and CA access control lists (ACLs), you can define and control access to custom certificate profiles.

In describing how to create certificate profiles, the procedures use S/MIME certificates as an example. Some email programs support digitally signed and encrypted email using the Secure Multipurpose Internet Mail Extension (S/MIME) protocol. Using S/MIME to sign or encrypt email messages requires the sender of the message to have an S/MIME certificate.

- [What is a certificate profile](#)
- [Creating a certificate profile](#)
- [What is a CA access control list](#)
- [Defining a CA ACL to control access to certificate profiles](#)
- [Using certificate profiles and CA ACLs to issue certificates](#)
- [Modifying a certificate profile](#)
- [Certificate profile configuration parameters](#)

4.1. WHAT IS A CERTIFICATE PROFILE?

You can use certificate profiles to determine the content of certificates, as well as constraints for issuing the certificates, such as the following:

- The signing algorithm to use to encipher the certificate signing request.
- The default validity of the certificate.
- The revocation reasons that can be used to revoke a certificate.
- If the common name of the principal is copied to the subject alternative name field.
- The features and extensions that should be present on the certificate.

A single certificate profile is associated with issuing a particular type of certificate. You can define different certificate profiles for users, services, and hosts in IdM. IdM includes the following certificate profiles by default:

- **calPAserviceCert**
- **IECUserRoles**
- **KDCs_PKINIT_Certs** (used internally)

In addition, you can create and import custom profiles, which allow you to issue certificates for specific purposes. For example, you can restrict the use of a particular profile to only one user or one group, preventing other users and groups from using that profile to issue a certificate for authentication. To

create custom certificate profiles, use the **ipa certprofile** command.

Additional resources

- For information on the **ipa certprofile** command, run the **ipa help certprofile** command.

4.2. CREATING A CERTIFICATE PROFILE

This procedure describes how to create a certificate profile through the command line by creating a profile configuration file for requesting S/MIME certificates.

Procedure

1. Create a custom profile by copying an existing default profile:

```
$ ipa certprofile-show --out smime.cfg calPAserviceCert
-----
Profile configuration stored in file 'smime.cfg'
-----
Profile ID: calPAserviceCert
Profile description: Standard profile for network services
Store issued certificates: TRUE
```

2. Open the newly created profile configuration file in a text editor.

```
$ vi smime.cfg
```

3. Change the **Profile ID** to a name that reflects the usage of the profile, for example **smime**.



NOTE

When you are importing a newly created profile, the **profileid** field, if present, must match the ID specified on the command line.

4. Update the Extended Key Usage configuration. The default Extended Key Usage extension configuration is for TLS server and client authentication. For example for S/MIME, the Extended Key Usage must be configured for email protection:

```
policyset.serverCertSet.7.default.params.exKeyUsageOIDs=1.3.6.1.5.5.7.3.4
```

5. Import the new profile:

```
$ ipa certprofile-import smime --file smime.cfg \
--desc "S/MIME certificates" --store TRUE
-----
Imported profile "smime"
-----
Profile ID: smime
Profile description: S/MIME certificates
Store issued certificates: TRUE
```

Verification steps

- Verify the new certificate profile has been imported:

```
$ ipa certprofile-find
-----
4 profiles matched
-----
Profile ID: caIPAServiceCert
Profile description: Standard profile for network services
Store issued certificates: TRUE

Profile ID: IECUserRoles
Profile description: User profile that includes IECUserRoles extension from request
Store issued certificates: TRUE

Profile ID: KDCs_PKINIT_Certs
Profile description: Profile for PKINIT support by KDCs
Store issued certificates: TRUE

Profile ID: smime
Profile description: S/MIME certificates
Store issued certificates: TRUE
-----
Number of entries returned 4
-----
```

Additional resources

- For details on the **certprofile** plug-in, run the **ipa help certprofile** command.
- For more information on the Extended Key Usage extension, see [RFC 5280, section 4.2.1.12](#).

4.3. WHAT IS A CA ACCESS CONTROL LIST?

Certificate Authority access control list (CA ACL) rules define which profiles can be used to issue certificates to which principals. You can use CA ACLs to do this, for example:

- Determine which user, host, or service can be issued a certificate with a particular profile
- Determine which IdM certificate authority or sub-CA is permitted to issue the certificate

For example, using CA ACLs, you can restrict use of a profile intended for employees working from an office located in London only to users that are members of the London office-related IdM user group.

The **ipa caacl** utility for management of CA ACL rules allows privileged users to add, display, modify, or delete a specified CA ACL.

Additional resources

- For information on the **ipa caacl** command, run the **ipa help caacl** command.

4.4. DEFINING A CA ACL TO CONTROL ACCESS TO CERTIFICATE PROFILES

This procedure describes how to use the **caacl** utility to define a CA Access Control List (ACL) rule to allow users in a group access to a custom certificate profile. In this case, the procedure describes how to create an S/MIME user's group and a CA ACL to allow users in that group access to the **smime** certificate profile.

Prerequisites

- Make sure that you have obtained IdM administrator's credentials.

Procedure

1. Create a new group for the users of the certificate profile:

```
$ ipa group-add smime_users_group
-----
Added group "smime users group"
-----
Group name: smime_users_group
GID: 75400001
```

2. Create a new user to add to the **smime_user_group** group:

```
$ ipa user-add smime_user
First name: smime
Last name: user
-----
Added user "smime_user"
-----
User login: smime_user
First name: smime
Last name: user
Full name: smime user
Display name: smime user
Initials: TU
Home directory: /home/smime_user
GECOS: smime user
Login shell: /bin/sh
Principal name: smime_user@IDM.EXAMPLE.COM
Principal alias: smime_user@IDM.EXAMPLE.COM
Email address: smime_user@idm.example.com
UID: 1505000004
GID: 1505000004
Password: False
Member of groups: ipausers
Kerberos keys available: False
```

3. Add the **smime_user** to the **smime_users_group** group:

```
$ ipa group-add-member smime_users_group --users=smime_user
Group name: smime_users_group
GID: 1505000003
```

```
Member users: smime_user
```

```
-----  
Number of members added 1  
-----
```

4. Create the CA ACL to allow users in the group to access the certificate profile:

```
$ ipa caacl-add smime_acl
```

```
-----  
Added CA ACL "smime_acl"
```

```
-----  
ACL name: smime_acl
```

```
Enabled: TRUE
```

5. Add the user group to the CA ACL:

```
$ ipa caacl-add-user smime_acl --group smime_users_group
```

```
ACL name: smime_acl
```

```
Enabled: TRUE
```

```
User Groups: smime_users_group
```

```
-----  
Number of members added 1  
-----
```

6. Add the certificate profile to the CA ACL:

```
$ ipa caacl-add-profile smime_acl --certprofile smime
```

```
ACL name: smime_acl
```

```
Enabled: TRUE
```

```
Profiles: smime
```

```
User Groups: smime_users_group
```

```
-----  
Number of members added 1  
-----
```

Verification steps

- View the details of the CA ACL you created:

```
$ ipa caacl-show smime_acl
```

```
ACL name: smime_acl
```

```
Enabled: TRUE
```

```
Profiles: smime
```

```
User Groups: smime_users_group
```

```
...
```

Additional resources

- See **ipa** man page.
- For further details about the **ipa caacl** command, refer to the **ipa help caacl** command.

4.5. USING CERTIFICATE PROFILES AND CA ACLS TO ISSUE CERTIFICATES

You can request certificates using a certificate profile when permitted by the Certificate Authority access control lists (CA ACLs). This procedure describes how to request an S/MIME certificate for a user using a custom certificate profile which has been granted access through a CA ACL.

Prerequisites

- Your certificate profile has been created.
- An CA ACL has been created which permits the user to use the required certificate profile to request a certificate.



NOTE

You can bypass the CA ACL check if the user performing the **cert-request** command:

- Is the **admin** user.
- Has the **Request Certificate ignoring CA ACLs** permission.

Procedure

1. Generate a certificate request for the user. For example, using OpenSSL:

```
$ openssl req -new -newkey rsa:2048 -days 365 -nodes -keyout private.key -out cert.csr -subj '/CN=smime_user'
```

2. Request a new certificate for the user from the IdM CA:

```
$ ipa cert-request cert.csr --principal=smime_user --profile-id=smime
```

Optionally pass the `--ca sub-CA_name` option to the command to request the certificate from a sub-CA instead of the root CA.

Verification steps

- Verify the newly-issued certificate is assigned to the user:

```
$ ipa user-show user
User login: user
...
Certificate: MIICfzCCAWcCAQA...
...
```

Additional resources

- See **ipa(a)** man page.
- For further details about the **ipa user-show** command, refer to the **ipa help user-show** command.

- For further details about the **ipa cert-request** command, refer to the **ipa help cert-request** command.
- See **openssl(1ssl)** man page.

4.6. MODIFYING A CERTIFICATE PROFILE

This procedure describes how to modify certificate profiles directly through the command line using the **ipa certprofile-mod** command.

Procedure

1. Determine the certificate profile ID for the certificate profile you are modifying. To display all certificate profiles currently stored in IdM:

```
# ipa certprofile-find
-----
4 profiles matched
-----
Profile ID: caIPAServiceCert
Profile description: Standard profile for network services
Store issued certificates: TRUE

Profile ID: IECUserRoles
...

Profile ID: smime
Profile description: S/MIME certificates
Store issued certificates: TRUE
-----
Number of entries returned
-----
```

2. Modify the certificate profile description. For example, if you created a custom certificate profile for S/MIME certificates using an existing profile, change the description in line with the new usage:

```
# ipa certprofile-mod smime --desc "New certificate profile description"
-----
Modified Certificate Profile "smime"
-----
Profile ID: smime
Profile description: New certificate profile description
Store issued certificates: TRUE
```

3. Open your customer certificate profile file in a text editor and modify to suit your requirements:

```
# vi smime.cfg
```

For details on the options which can be configured in the certificate profile configuration file, see [Certificate profile configuration parameters](#).

4. Update the existing certificate profile configuration file:

■


```
# ipa certprofile-mod _profile_ID_ --file=smime.cfg
```

Verification steps

- Verify the certificate profile has been updated:

```
$ ipa certprofile-show smime
Profile ID: smime
Profile description: New certificate profile description
Store issued certificates: TRUE
```

Additional resources

- See **ipa(a)** man page.
- For further details about the **ipa certprofile-mod** command, refer to the **ipa help certprofile-mod** command.

4.7. CERTIFICATE PROFILE CONFIGURATION PARAMETERS

Certificate profile configuration parameters are stored in a *profile_name.cfg* file in the CA profile directory, **/var/lib/pki/pki-tomcat/ca/profiles/ca**. All of the parameters for a profile – defaults, inputs, outputs, and constraints – are configured within a single policy set. A policy set for a certificate profile has the name **policyset.policyName.policyNumber**. For example, for policy set **serverCertSet**:

```
policyset.list=serverCertSet
policyset.serverCertSet.list=1,2,3,4,5,6,7,8
policyset.serverCertSet.1.constraint.class_id=subjectNameConstraintImpl
policyset.serverCertSet.1.constraint.name=Subject Name Constraint
policyset.serverCertSet.1.constraint.params.pattern=CN=[^,]+.+
policyset.serverCertSet.1.constraint.params.accept=true
policyset.serverCertSet.1.default.class_id=subjectNameDefaultImpl
policyset.serverCertSet.1.default.name=Subject Name Default
policyset.serverCertSet.1.default.params.name=CN=$request.req_subject_name.cn$, OU=pki-ipa, O=IPA
policyset.serverCertSet.2.constraint.class_id=validityConstraintImpl
policyset.serverCertSet.2.constraint.name=Validity Constraint
policyset.serverCertSet.2.constraint.params.range=740
policyset.serverCertSet.2.constraint.params.notBeforeCheck=false
policyset.serverCertSet.2.constraint.params.notAfterCheck=false
policyset.serverCertSet.2.default.class_id=validityDefaultImpl
policyset.serverCertSet.2.default.name=Validity Default
policyset.serverCertSet.2.default.params.range=731
policyset.serverCertSet.2.default.params.startTime=0
```

Each policy set contains a list of policies configured for the certificate profile by policy ID number in the order in which they should be evaluated. The server evaluates each policy set for each request it receives. When a single certificate request is received, one set is evaluated, and any other sets in the profile are ignored. When dual key pairs are issued, the first policy set is evaluated for the first certificate request, and the second set is evaluated for the second certificate request. You do not need more than one policy set when issuing single certificates or more than two sets when issuing dual key pairs.

Table 4.1. Certificate profile configuration file parameters

Parameter	Description
desc	A free text description of the certificate profile, which is shown on the end-entities page. For example, desc=This certificate profile is for enrolling server certificates with agent authentication.
enable	Enables the profile so it is accessible through the end-entities page. For example, enable=true.
auth.instance_id	Sets the authentication manager plug-in to use to authenticate the certificate request. For automatic enrollment, the CA issues a certificate immediately if the authentication is successful. If authentication fails or there is no authentication plug-in specified, the request is queued to be manually approved by an agent. For example, auth.instance_id=AgentCertAuth.
authz.acl	<p>Specifies the authorization constraint. This is predominantly used to set the group evaluation Access Control List (ACL). For example, the caCMCUserCert parameter requires that the signer of the CMC request belongs to the Certificate Manager Agents group:</p> <p>authz.acl=group="Certificate Manager Agents</p> <p>In directory-based user certificate renewal, this option is used to ensure that the original requester and the currently-authenticated user are the same. An entity must authenticate (bind or, essentially, log into the system) before authorization can be evaluated.</p>
name	The name of the certificate profile. For example, name=Agent-Authenticated Server Certificate Enrollment. This name is displayed on the end users enrollment or renewal page.
input.list	Lists the allowed inputs for the certificate profile by name. For example, input.list=i1,i2.
input.input_id.class_id	Indicates the java class name for the input by input ID (the name of the input listed in input.list). For example, input.i1.class_id=certReqInputImpl.
output.list	Lists the possible output formats for the certificate profile by name. For example, output.list=o1.

Parameter	Description
output.output_id.class_id	Specifies the java class name for the output format named in output.list. For example, output.o1.class_id=certOutputImpl .
policyset.list	Lists the configured certificate profile rules. For dual certificates, one set of rules applies to the signing key and the other to the encryption key. Single certificates use only one set of certificate profile rules. For example, policyset.list=serverCertSet .
policyset.policyset_id.list	Lists the policies within the policy set configured for the certificate profile by policy ID number in the order in which they should be evaluated. For example, policyset.serverCertSet.list=1,2,3,4,5,6,7,8 .
policyset.policyset_id.policy_number.constraint.class_id	Indicates the java class name of the constraint plugin set for the default configured in the profile rule. For example, policyset.serverCertSet.1.constraint.class_id=subjectNameConstraintImpl .
policyset.policyset_id.policy_number.constraint.name	Gives the user-defined name of the constraint. For example, policyset.serverCertSet.1.constraint.name=Subject Name Constraint .
policyset.policyset_id.policy_number.constraint.params.attribute	Specifies a value for an allowed attribute for the constraint. The possible attributes vary depending on the type of constraint. For example, policyset.serverCertSet.1.constraint.params.pattern=CN=.* .
policyset.policyset_id.policy_number.default.class_id	Gives the java class name for the default set in the profile rule. For example, policyset.serverCertSet.1.default.class_id=userSubjectNameDefaultImpl .
policyset.policyset_id.policy_number.default.name	Gives the user-defined name of the default. For example, policyset.serverCertSet.1.default.name=Subject Name Default .

Parameter	Description
<code>policyset.policyset_id.policy_number.default.params.attribute</code>	Specifies a value for an allowed attribute for the default. The possible attributes vary depending on the type of default. For example, <code>policyset.serverCertSet.1.default.params.name=CN=(Name)\$request.requestor_name\$</code> .

CHAPTER 5. MANAGING THE VALIDITY OF CERTIFICATES IN IDM

In Identity Management (IdM), you can manage the validity of both already existing certificates and certificates you want to issue in the future, but the methods are different.

Managing the validity of an existing certificate that was issued by IdM CA

In IdM, the following methods of viewing the expiry date of a certificate are available:

- [Viewing the expiry date in IdM WebUI](#) ;
- [Viewing the expiry date in the CLI](#) .

You can manage the validity of an already existing certificate that was issued by IdM CA in the following ways:

- Renew a certificate by requesting a new certificate using either the original certificate signing request (CSR) or a new CSR generated from the private key. You can request a new certificate using the following utilities:

certmonger

You can use **certmonger** to request a service certificate. Before the certificate is due to expire, **certmonger** will automatically renew the certificate, thereby ensuring a continuing validity of the service certificate. For details, see [Obtaining an IdM certificate for a service using certmonger](#);

certutil

You can use **certutil** to renew user, host, and service certificates. For details on requesting a user certificate, see [Requesting a new user certificate and exporting it to the client](#) ;

openssl

You can use **openssl** to renew user, host, and service certificates.

- Revoke a certificate. For details, see:
 - [Revoking certificates with the integrated IdM CAs using IdM WebUI](#) ;
 - [Revoking certificates with the integrated IdM CAs using IdM CLI](#) ;
- Restore a certificate if it has been temporarily revoked. For details, see:
 - [Restoring certificates with the integrated IdM CAs using IdM WebUI](#) ;
 - [Restoring certificates with the integrated IdM CAs using IdM CLI](#) .

Managing the validity of future certificates issued by IdM CA

To manage the validity of future certificates issued by IdM CA, modify, import, or create a certificate profile. For details, see [Creating and managing certificate profiles in Identity Management](#) .

5.1. VIEWING THE EXPIRY DATE OF A CERTIFICATE

5.1.1. Viewing the expiry date of a certificate in IdM WebUI

You can use IdM WebUI to view the expiry date of all the certificates that have been issued by IdM CA.

Prerequisites

- Ensure that you have obtained the administrator's credentials.

Procedure

1. In the **Authentication** menu, click **Certificates** > **Certificates**.
2. Click the serial number of the certificate to open the certificate information page.

Figure 5.1. List of Certificates

Certificates		
<div> <div>Subject ▼</div> <div>Search 🔍</div> <div>Refresh ↻</div> <div>+ Issue</div> </div>		
<input type="checkbox"/>	Serial Number	Subject
<input type="checkbox"/>	1	CN=Certificate Authority,O=EXAMPLE.COM
<input type="checkbox"/>	2	CN=OCSP Subsystem,O=EXAMPLE.COM
<input type="checkbox"/>	3	CN=server.example.com,O=EXAMPLE.COM
<input type="checkbox"/>	4	CN=CA Subsystem O=EXAMPLE.COM

3. In the certificate information page, locate the **Expires On** information.

5.1.2. Viewing the expiry date of a certificate in the CLI

You can use the command-line interface (CLI) to view the expiry date of a certificate.

Procedure

- Use the **openssl** utility to open the file in a human-readable format:

```
$ openssl x509 -noout -text -in ca.pem
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number: 1 (0x1)
        Signature Algorithm: sha256WithRSAEncryption
        Issuer: O = IDM.EXAMPLE.COM, CN = Certificate Authority
        Validity
            Not Before: Oct 30 19:39:14 2017 GMT
            Not After : Oct 30 19:39:14 2037 GMT
```

5.2. REVOKING CERTIFICATES WITH THE INTEGRATED IDM CAS

5.2.1. Certificate revocation reasons

A revoked certificate is invalid and cannot be used for authentication. All revocations are permanent, except for reason 6: **Certificate Hold**.

The default revocation reason is 0: **unspecified**.

Table 5.1. Revocation Reasons

ID	Reason	Explanation
0	Unspecified	
1	Key Compromised	The key that issued the certificate is no longer trusted. Possible causes: lost token, improperly accessed file.
2	CA Compromised	The CA that issued the certificate is no longer trusted.
3	Affiliation Changed	Possible causes: * A person has left the company or moved to another department. * A host or service is being retired.
4	Superseded	A newer certificate has replaced the current certificate.
5	Cessation of Operation	The host or service is being decommissioned.
6	Certificate Hold	The certificate is temporarily revoked. You can restore the certificate later.
8	Remove from CRL	The certificate is not included in the certificate revocation list (CRL).
9	Privilege Withdrawn	The user, host, or service is no longer permitted to use the certificate.
10	Attribute Authority (AA) Compromise	The AA certificate is no longer trusted.



5.2.2. Revoking certificates with the integrated IdM CAs using IdM WebUI

If you know you have lost the private key for your certificate, you must revoke the certificate to prevent its abuse. Complete this procedure to use the IdM WebUI to revoke a certificate issued by the IdM CA.

Procedure

1. Click **Authentication > Certificates > Certificates**.
2. Click the serial number of the certificate to open the certificate information page.

Figure 5.2. List of Certificates

Certificates		
<div> <div>Subject ▼</div> <div>Search </div> <div>Refresh </div> <div>+ Issue</div> </div>		
<input type="checkbox"/>	Serial Number	Subject
<input type="checkbox"/>	1	CN=Certificate Authority,O=EXAMPLE.COM
<input type="checkbox"/>	2	CN=OCSP Subsystem,O=EXAMPLE.COM
<input type="checkbox"/>	3	CN=server.example.com,O=EXAMPLE.COM
<input type="checkbox"/>	4	CN=CA Subsystem,O=EXAMPLE.COM

3. In the certificate information page, click **Actions** → **Revoke Certificate**.
4. Select the reason for revoking and click **Revoke**. See [Section 5.2.1, “Certificate revocation reasons”](#) for details.

5.2.3. Revoking certificates with the integrated IdM CAs using IdM CLI

If you know you have lost the private key for your certificate, you must revoke the certificate to prevent its abuse. Complete this procedure to use the IdM CLI to revoke a certificate issued by the IdM CA.

Procedure

- Use the **ipa cert-revoke** command, and specify:
 - the certificate serial number
 - the ID number for the revocation reason; see [Section 5.2.1, “Certificate revocation reasons”](#) for details

For example, to revoke the certificate with serial number **1032** because of reason 1: **Key Compromised**, enter:

```
$ ipa cert-revoke 1032 --revocation-reason=1
```

For details on requesting a new certificate, see the following documentation:

- [Requesting a new user certificate and exporting it to the client](#) ;
- [Obtaining an IdM certificate for a service using certmonger](#) .

5.3. RESTORING CERTIFICATES WITH THE INTEGRATED IDM CAS

If you have revoked a certificate because of reason 6: **Certificate Hold**, you can restore it again if the private key for the certificate has not been compromised. To restore a certificate, use one of the following procedures:

- [Restore certificates with the integrated IdM CAs using IdM WebUI](#) ;
- [Restore certificates with the integrated IdM CAs using IdM CLI](#) .

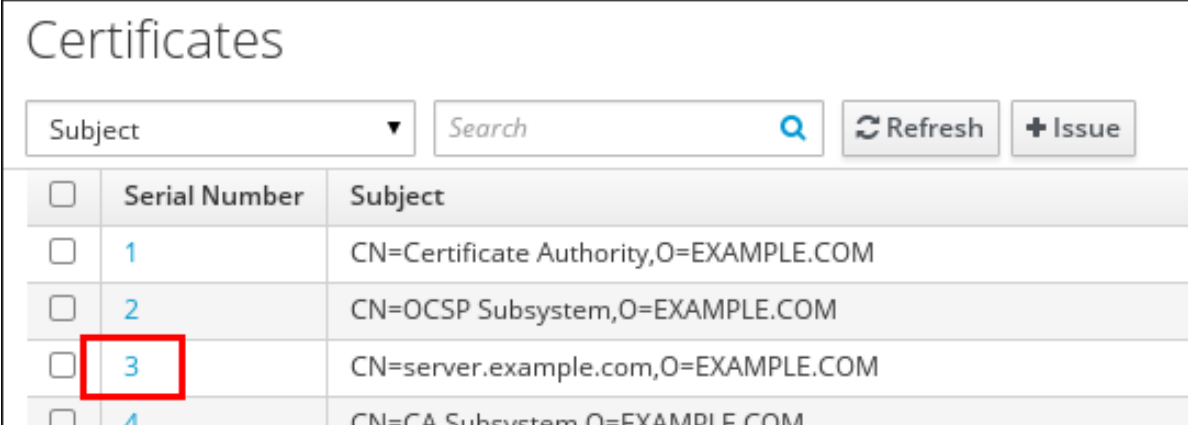
5.3.1. Restoring certificates with the integrated IdM CAs using IdM WebUI



Complete this procedure to use the IdM WebUI to restore an IdM certificate that has been revoked because of Reason 6: **Certificate Hold**.

Procedure

1. In the **Authentication** menu, click **Certificates** > **Certificates**.
2. Click the serial number of the certificate to open the certificate information page.

Figure 5.3. List of Certificates



Certificates		
<div> <div>Subject ▼</div> <div>Search </div> <div>Refresh </div> <div>+ Issue</div> </div>		
<input type="checkbox"/>	Serial Number	Subject
<input type="checkbox"/>	1	CN=Certificate Authority,O=EXAMPLE.COM
<input type="checkbox"/>	2	CN=OCSP Subsystem,O=EXAMPLE.COM
<input type="checkbox"/>	3	CN=server.example.com,O=EXAMPLE.COM
<input type="checkbox"/>	4	CN=CA Subsystem O=EXAMPLE.COM

3. In the certificate information page, click **Actions** → **Restore Certificate**.

5.3.2. Restoring certificates with the integrated IdM CAs using IdM CLI

Complete this procedure to use the IdM CLI to restore an IdM certificate that has been revoked because of Reason 6: **Certificate Hold**.

Procedure

- Use the **ipa cert-remove-hold** command and specify the certificate serial number. For example:

```
$ ipa cert-remove-hold 1032
```

CHAPTER 6. CONFIGURING IDENTITY MANAGEMENT FOR SMART CARD AUTHENTICATION

Authentication based on smart cards is an alternative to passwords. You can store user credentials on a smart card in the form of a private key and a certificate, and special software and hardware is used to access them. Place the smart card into a reader or a USB port and supply the PIN code for the smart card instead of providing your password.

Identity Management (IdM) supports smart card authentication with:

- User certificates issued by the IdM certificate authority
- User certificates issued by an external certificate authority

This user story shows how to set up smart card authentication in IdM for both types of certificates. In the user story, the **smartcard_ca.pem** CA certificate is the file containing the certificate of a trusted external certificate authority.

The user story contains the following modules:

- [Section 6.1, "Configuring the IdM server for smart card authentication"](#)
- [Section 6.2, "Configuring the IdM client for smart card authentication"](#)
- [Section 6.3, "Adding a certificate to a user entry in IdM"](#)
- [Section 6.4, "Installing tools for managing and using smart cards"](#)
- [Section 6.5, "Storing a certificate on a smart card"](#)
- [Section 6.6, "Logging in to IdM with smart cards"](#)
- [Section 6.7, "Configuring GDM access using smart card authentication"](#)
- [Section 6.8, "Configuring su access using smart card authentication"](#)

6.1. CONFIGURING THE IDM SERVER FOR SMART CARD AUTHENTICATION

If you want to enable smart card authentication for users whose certificates have been issued by the certificate authority of the **EXAMPLE.ORG** domain, whose LDAP distinguished name (DN) is **CN=Certificate Authority,DC=EXAMPLE,DC=ORG**, then you need to obtain the certificate of the authority so that you can run it with the script configuring the IdM server. You can, for example, download the certificate from a web page whose certificate has been issued by the authority. For details, see Steps 1 – 4a in [Configuring a browser to enable certificate authentication](#).

To enable smart card authentication for IdM users who have been issued a certificate by the IdM Certificate Authority, obtain the CA certificate from the **/etc/ipa/ca.crt** file on the IdM server on which the IdM CA is running.

This section describes how to configure an IdM server for smart card authentication. First, obtain files with the CA certificates in the PEM format, then run the in-built **ipa-adviser** script. Finally, reload the system configuration.

Prerequisites

- You have root access to the IdM server.
- You have the root CA certificate and any sub CA certificates.

Procedure

1. Create a directory in which you will do the configuration:

```
[root@server]# mkdir ~/SmartCard/
```

2. Navigate to the directory:

```
[root@server]# cd ~/SmartCard/
```

3. Obtain the relevant CA certificates stored in files in PEM format. If your CA certificate is stored in a file of a different format, such as DER, convert it to PEM format. The IdM Certificate Authority certificate is located in the `/etc/ipa/ca.crt` file.

Convert a DER file to a PEM file:

```
# openssl x509 -in <filename>.der -inform DER -out <filename>.pem -outform PEM
```

4. For convenience, copy the certificates to the directory in which you want to do the configuration:

```
[root@server SmartCard]# cp /etc/ipa/ca.crt ~/SmartCard/
[root@server SmartCard]# cp /tmp/smartcard_ca.pem ~/SmartCard/
```

5. Optionally, if you use certificates of external certificate authorities, use the **openssl x509** utility to view the contents of the files in the **PEM** format to check that the **Issuer** and **Subject** values are correct:

```
[root@server SmartCard]# openssl x509 -noout -text -in smartcard_ca.pem | more
```

6. Generate a configuration script with the in-built **ipa-adviser** utility, using the administrator's privileges:

```
[root@server SmartCard]# kinit admin
[root@server SmartCard]# sudo ipa-adviser config-server-for-smart-card-auth > config-
server-for-smart-card-auth.sh
```

The **config-server-for-smart-card-auth.sh** script performs the following actions:

- It configures the IdM Apache HTTP Server.
 - It enables Public Key Cryptography for Initial Authentication in Kerberos (PKINIT) on the Key Distribution Center (KDC).
 - It configures the IdM Web UI to accept smart card authorization requests.
7. Execute the script, adding the PEM files containing the root CA and sub CA certificates as arguments:

```
[root@server SmartCard]# chmod +x config-server-for-smart-card-auth.sh
```

```
[root@server SmartCard]# ./config-server-for-smart-card-auth.sh smartcard_ca.pem
ca.crt
Ticket cache:KEYRING:persistent:0:0
Default principal: admin@IDM.EXAMPLE.COM
[...]
Systemwide CA database updated.
The ipa-certupdate command was successful
```

**NOTE**

Ensure that you add the root CA's certificate as an argument before any sub CA certificates and that the CA or sub CA certificates have not expired.

8. Optionally, if the certificate authority that issued the user certificate does not provide any Online Certificate Status Protocol (OCSP) responder, you may need to disable OCSP check for authentication to the IdM Web UI:

- a. Set the **SSLOCSPEnable** parameter to **off** in the `/etc/httpd/conf.d/ssl.conf` file:

```
SSLOCSPEnable off
```

- b. Restart the Apache daemon (httpd) for the changes to take effect immediately:

```
[root@server SmartCard]# sudo systemctl restart httpd
```

**WARNING**

Do not disable the OCSP check if you only use user certificates issued by the IdM CA. OCSP responders are part of IdM.

For instructions on how to keep the OCSP check enabled, and yet prevent a user certificate from being rejected by the IdM server if it does not contain the information about the location at which the CA that issued the user certificate listens for OCSP service requests, see the **SSLOCSPDefaultResponder** directive in [Apache mod_ssl configuration options](#).

The server is now configured for smart card authentication.

**NOTE**

To enable smart card authentication in the whole topology, run the procedure on each IdM server.

6.2. CONFIGURING THE IDM CLIENT FOR SMART CARD AUTHENTICATION

This section describes how to configure IdM clients for smart card authentication. The procedure needs to be run on each IdM system, a client or a server, to which you want to connect while using a smart card for authentication. For example, to enable an **ssh** connection from host A to host B, the script needs to

be run on host B.

As an administrator, run this procedure to enable smart card authentication using

- the **ssh** protocol
For details see [Configuring SSH access using smart card authentication](#) .
- the console login
- the Gnome Display Manager (GDM)
- the **su** command

This procedure is not required for authenticating to the IdM Web UI. Authenticating to the IdM Web UI involves two hosts, neither of which needs to be an IdM client:

- the machine - possibly outside of the IdM domain - on which the browser is running
- the IdM server on which **httpd** is running

The following procedure assumes that you are configuring smart card authentication on an IdM client, not an IdM server. For this reason you need two computers: an IdM server to generate the configuration script, and the IdM client on which to run the script.

Prerequisites

- Your IdM server has been configured for smart card authentication, as described in [Section 6.1, “Configuring the IdM server for smart card authentication”](#).
- You have root access to the IdM server and the IdM client.
- You have the root CA certificate and any sub CA certificates.

Procedure

1. On an IdM server, generate a configuration script with **ipa-adviser** using the administrator’s privileges:

```
[root@server SmartCard]# kinit admin
[root@server SmartCard]# ipa-adviser config-client-for-smart-card-auth > config-client-
for-smart-card-auth.sh
```

The **config-client-for-smart-card-auth.sh** script performs the following actions:

- It configures the smart card daemon.
 - It sets the system-wide trust store.
 - It configures the System Security Services Daemon (SSSD) to allow smart card logins to the desktop.
2. From the IdM server, copy the script to a directory of your choice on the IdM client machine:

```
[root@server SmartCard]# scp config-client-for-smart-card-auth.sh
root@client.idm.example.com:/root/SmartCard/
Password:
```

```
config-client-for-smart-card-auth.sh    100% 2419    3.5MB/s  00:00
```

- From the IdM server, copy the CA certificate files in the PEM format for convenience to the same directory on the IdM client machine as used in the previous step:

```
[root@server SmartCard]# scp {smartcard_ca.pem,ca.crt}
root@client.idm.example.com:/root/SmartCard/
Password:
smartcard_ca.pem          100% 1237    9.6KB/s  00:00
ca.crt                    100% 2514   19.6KB/s  00:00
```

- On the client machine, execute the script, adding the PEM files containing the CA certificates as arguments:

```
[root@client SmartCard]# kinit admin
[root@client SmartCard]# chmod +x config-client-for-smart-card-auth.sh
[root@client SmartCard]# ./config-client-for-smart-card-auth.sh smartcard_ca.pem ca.crt
Ticket cache:KEYRING:persistent:0:0
Default principal: admin@IDM.EXAMPLE.COM
[...]
Systemwide CA database updated.
The ipa-certupdate command was successful
```



NOTE

Ensure that you add the root CA's certificate as an argument before any sub CA certificates and that the CA or sub CA certificates have not expired.

The client is now configured for smart card authentication.

6.3. ADDING A CERTIFICATE TO A USER ENTRY IN IDM

This procedure describes how to add an external certificate to a user entry in IdM.

Instead of uploading the whole certificate, it is also possible to upload certificate mapping data to a user entry in IdM. User entries containing either full certificates or certificate mapping data can be used in conjunction with corresponding certificate mapping rules to facilitate the configuration of smart card authentication for system administrators. For details, see [Certificate mapping rules for configuring authentication on smart cards](#)



NOTE

If the user's certificate has been issued by the IdM Certificate Authority, the certificate is already stored in the user entry, and you can skip this section.

6.3.1. Adding a certificate to a user entry in the IdM Web UI

Prerequisites

- You have the certificate that you want to add to the user entry at your disposal.

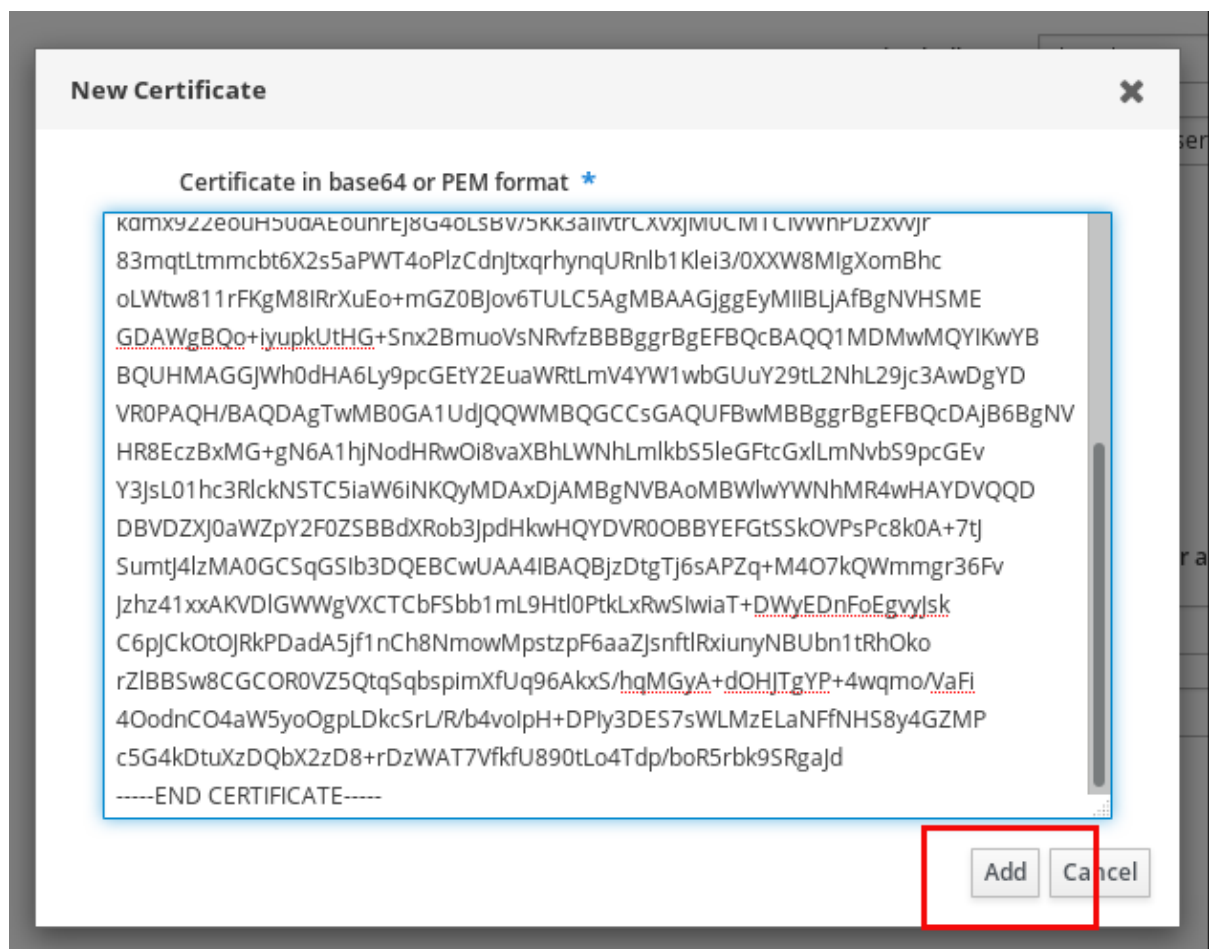
Procedure

1. Log into the IdM Web UI as an administrator if you want to add a certificate to another user. For adding a certificate to your own profile, you do not need the administrator's credentials.
2. Navigate to **Users** → **Active users** → **sc_user**.
3. Find the **Certificate** option and click **Add**.
4. In the **Command-Line Interface**, display the certificate in the **PEM** format using the **cat** utility or a text editor:

```
[user@client SmartCard]$ cat testuser.crt
```

5. Copy and paste the certificate from the CLI into the window that has opened in the Web UI.
6. Click **Add**.

Figure 6.1. Adding a new certificate in the IdM Web UI



The **sc_user** entry now contains an external certificate.

6.3.2. Adding a certificate to a user entry in the IdM CLI

Prerequisites

- You have the certificate that you want to add to the user entry at your disposal.

Procedure

1. Log into the IdM CLI as an administrator if you want to add a certificate to another user:

```
[user@client SmartCard]$ kinit admin
```

For adding a certificate to your own profile, you do not need the administrator's credentials:

```
[user@client SmartCard]$ kinit sc_user
```

2. Create an environment variable containing the certificate with the header and footer removed and concatenated into a single line, which is the format expected by the **ipa user-add-cert** command:

```
[user@client SmartCard]$ export CERT=`openssl x509 -outform der -in testuser.crt |  
base64 -w0 -`
```

Note that certificate in the **testuser.crt** file must be in the **PEM** format.

3. Add the certificate to the profile of **sc_user** using the **ipa user-add-cert** command:

```
[user@client SmartCard]$ ipa user-add-cert sc_user --certificate=$CERT
```

The **sc_user** entry now contains an external certificate.

6.4. INSTALLING TOOLS FOR MANAGING AND USING SMART CARDS

To configure your smart card, you need tools which can generate certificates and store them on a smart card.

You must:

- Install the **gnutls-utils** package which helps you to manage certificates.
- Install the **opensc** package which provides a set of libraries and utilities to work with smart cards.
- Start the **pcscd** service which communicates with the smart card reader.

Procedure

1. Install the **opensc** and **gnutls-utils** packages:

```
# dnf -y install opensc gnutls-utils
```

2. Start the **pcscd** service.

```
# systemctl start pcscd
```

Verify that the **pcscd** service is up and running.

6.5. STORING A CERTIFICATE ON A SMART CARD

This section describes smart card configuration with the **pkcs15-init** tool, which helps you to configure:

- Erasing your smart card
- Setting new PINs and optional PIN Unblocking Keys (PUKs)
- Creating a new slot on the smart card
- Storing the certificate, private key, and public key in the slot
- Locking the smart card settings (some smart cards require this type of finalization)

Prerequisites

- The **opensc** package, which includes the **pkcs15-init** tool is installed. For details, see [Installing tools for managing and using smart cards](#).
- The card is inserted in the reader and connected to the computer.
- You have the private key, public key, and certificate to store on the smart card. In this procedure, **testuser.key**, **testuserpublic.key**, and **testuser.crt** are the names used for the private key, public key, and the certificate.
- Your current smart card user PIN and Security Officer PIN (SO-PIN)

Procedure

1. Erase your smart card and authenticate yourself with your PIN:

```
$ pkcs15-init --erase-card --use-default-transport-keys
Using reader with a card: Reader name
PIN [Security Officer PIN] required.
Please enter PIN [Security Officer PIN]:
```

The card has been erased.

2. Initialize your smart card, set your user PIN and PUK, and your Security Officer PIN and PUK:

```
$ pkcs15-init --create-pkcs15 --use-default-transport-keys \
  --pin 963214 --puk 321478 --so-pin 65498714 --so-puk 784123
Using reader with a card: Reader name
```

The **pkcs15-init** tool creates a new slot on the smart card.

3. Set the label and the authentication ID for the slot:

```
$ pkcs15-init --store-pin --label testuser \
  --auth-id 01 --so-pin 65498714 --pin 963214 --puk 321478
Using reader with a card: Reader name
```

The label is set to a human-readable value, in this case, **testuser**. The **auth-id** must be two hexadecimal values, in this case it is set to **01**.

4. Store and label the private key in the new slot on the smart card:

```
$ pkcs15-init --store-private-key testuser.key --label testuser_key \
  --auth-id 01 --id 01 --pin 963214
Using reader with a card: Reader name
```

**NOTE**

The value you specify for **--id** must be the same when storing your private key, and certificate. If you do not specify a value for **--id**, a more complicated value is calculated by the tool and it is therefore easier to define your own value.

5. Store and label the certificate in the new slot on the smart card:

```
$ pkcs15-init --store-certificate testuser.crt --label testuser_cert \
  --auth-id 01 --id 01 --format pem --pin 963214
Using reader with a card: Reader name
```

6. (Optional) Store and label the public key in the new slot on the smart card:

```
$ pkcs15-init --store-public-key testuserpublic.key
  --label testuserpublic_key --auth-id 01 --id 01 --pin 963214
Using reader with a card: Reader name
```

**NOTE**

If the public key corresponds to a private key and/or certificate, you should specify the same ID as that private key and/or certificate.

7. (Optional) Some smart cards require you to finalize the card by locking the settings:

```
$ pkcs15-init -F
```

At this stage, your smart card includes the certificate, private key, and public key in the newly created slot. You have also created your user PIN and PUK and the Security Officer PIN and PUK.

6.6. LOGGING IN TO IDM WITH SMART CARDS

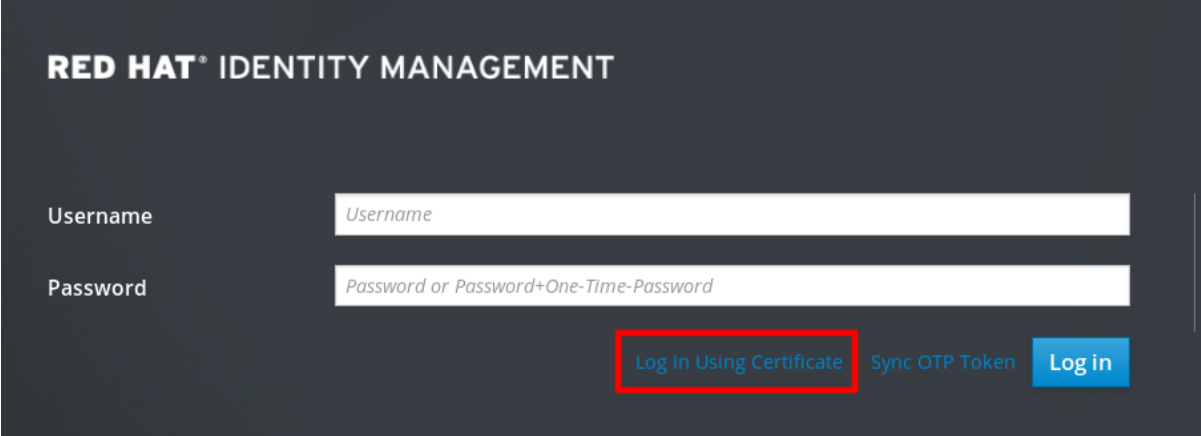
This section provides information about using smart cards for logging in to IdM Web UI.

Prerequisites

- The web browser is configured for using smart card authentication.
- The IdM server has been configured for smart card authentication.
- The certificate installed on your smart card is known to the IdM server.
- You need the PIN to unlock the smart card.
- The smart card has been plugged to the reader.

Procedure

1. Open the IdM Web UI in the browser.
2. Click on **Log In Using Certificate**



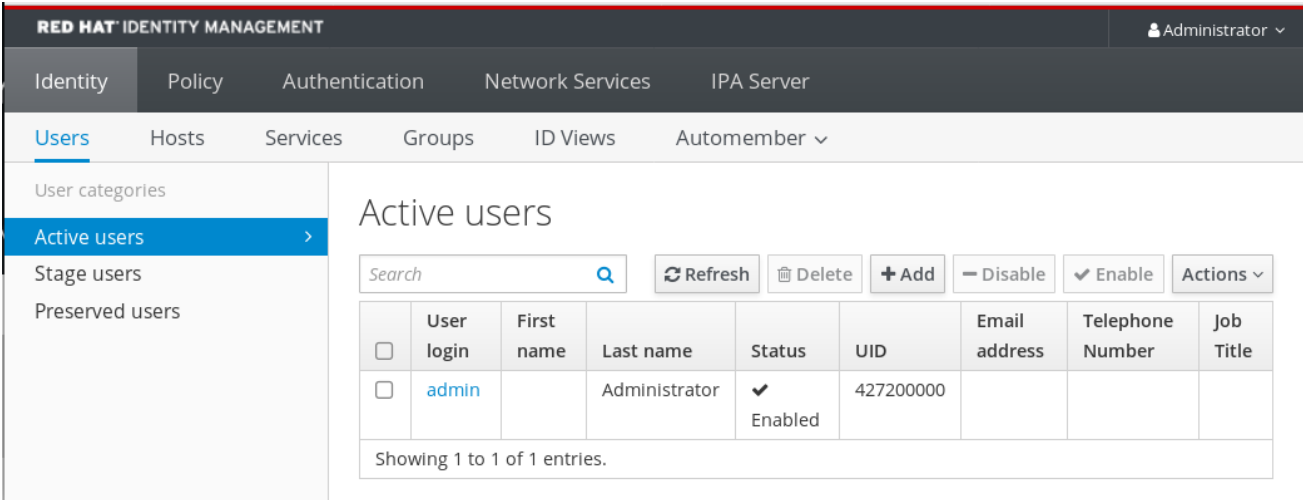
The screenshot shows the Red Hat Identity Management login interface. It has a dark background with the title 'RED HAT® IDENTITY MANAGEMENT' at the top. Below the title are two input fields: 'Username' with a placeholder 'Username' and 'Password' with a placeholder 'Password or Password+One-Time-Password'. At the bottom right, there are three buttons: 'Log In Using Certificate' (highlighted with a red rectangle), 'Sync OTP Token', and 'Log in'.

3. If the **Password Required** dialog box opens, add the PIN to unlock the smart card and click the **OK** button.
The **User Identification Request** dialog box opens.

If the smart card contains more than one certificate, select the certificate you want to use for authentication in the drop down list below **Choose a certificate to present as identification**

4. Click the **OK** button.

Now you are successfully logged in to the IdM Web UI.



The screenshot shows the Red Hat Identity Management web UI dashboard. The top navigation bar includes 'Identity', 'Policy', 'Authentication', 'Network Services', and 'IPA Server'. The 'Users' section is active, showing a list of 'Active users'. The left sidebar has 'User categories' with 'Active users' selected. The main content area shows a table of active users with columns: User login, First name, Last name, Status, UID, Email address, Telephone Number, and Job Title. There is one user listed: 'admin' with status 'Enabled' and UID '427200000'. Above the table are buttons for 'Search', 'Refresh', 'Delete', 'Add', 'Disable', 'Enable', and 'Actions'. Below the table, it says 'Showing 1 to 1 of 1 entries.'

6.7. CONFIGURING GDM ACCESS USING SMART CARD AUTHENTICATION

The Gnome Desktop Manager (GDM) requires authentication. You can use your password, however, you can also use a smart card for authentication.

This section describes smart card authentication to access GDM.

The advantage of using smart card authentication is that if the user account is part of the Identity Management domain, you also get a ticket-granting ticket (TGT).

Prerequisites

- The smart card contains your certificate and private key.
- The user account is a member of the IdM domain.
- The certificate on the smart card maps to the user entry through:
 - Assigning the certificate to a particular user entry. For details, see, [Section 6.3, “Adding a certificate to a user entry in IdM”](#)
 - The certificate mapping data being applied to the account. For details, see [Certificate mapping rules for configuring authentication on smart cards](#).

Procedure

1. Insert the smart card in the reader.
2. Enter the smart card PIN.
3. Click **Sign In**.

You are successfully logged in to the RHEL system and you have a TGT provided by the IdM server.

Verification steps

- In the **Terminal** window, enter **klist** and check the result:

```
$ klist
Ticket cache: KEYRING:persistent:1358900015:krb_cache_TObtNMd
Default principal: example.user@REDHAT.COM

Valid starting    Expires          Service principal
04/20/2020 13:58:24 04/20/2020 23:58:24 krbtgt/EXAMPLE.COM@EXAMPLE.COM
renew until 04/27/2020 08:58:15
```

6.8. CONFIGURING SU ACCESS USING SMART CARD AUTHENTICATION

Changing to a different user requires authentication. You can use a password or a certificate. This section describes using your smart card with the **su** command. It means that after entering the **su** command, you are prompted for the smart card PIN.

Prerequisites

- The smart card contains your certificate and private key.
- The card is inserted in the reader and connected to the computer.

Procedure

- In a terminal window, change to a different user with the **su** command:

```
$ su - example.user
PIN for smart_card
```

If the configuration is successful, you are prompted to enter the smart card PIN.

CHAPTER 7. CONFIGURING CERTIFICATES ISSUED BY ADCS FOR SMART CARD AUTHENTICATION IN IDM

This scenario describes the following situation:

- Your deployment is based on cross-forest trust between Identity Management (IdM) and Active Directory (AD).
- You want to allow smart card authentication for users whose accounts are stored in AD.
- Certificates are created and stored in Active Directory Certificate Services (ADCS).

Configuration will be accomplished in the following steps:

- [Copying CA and user certificates from Active Directory to the IdM server and client](#)
- [Configuring the IdM server and clients for smart card authentication using ADCS certificates](#)
- [Converting a PFX \(PKCS#12\) file to be able to store the certificate and private key into the smart card](#)
- [Configuring timeouts in the sssd.conf file](#)
- [Creating certificate mapping rules for smart card authentication](#)

Prerequisites

- Identity Management (IdM) and Active Directory (AD) trust is installed
For details, see [Installing trust between IdM and AD](#).
- Active Directory Certificate Services (ADCS) is installed and certificates for users are generated

7.1. SMART CARD AUTHENTICATION

A smart card is a physical device which can provide personal authentication using certificates stored on the card. Personal authentication means that you can use smart cards in the same way as user passwords.

You can store user credentials on the smart card in the form of a private key and a certificate, and special software and hardware is used to access them. You place the smart card into a reader or a USB socket and supply the PIN code for the smart card instead of providing your password.

You can configure how you want smart card authentication to work in a particular IdM client:

- Users can authenticate with the user name and password or with their smart cards
- Users can authenticate with their smart cards, and passwords are not allowed
- Users can use the smart card for logout with a function lock on removal, and passwords are not allowed

Identity Management (IdM) supports smart card authentication with:

- User certificates issued by the IdM certificate authority. For details, see [Configuring Identity Management for smart card authentication](#).

- User certificates issued by the ADCS certificate authority. For details, see [Configuring certificates issued by ADCS for smart card authentication in IdM](#).
- User certificates issued by local certification authority generated on a RHEL system. For details, see [Configuring and importing local certificates to a smart card](#).
- User certificates issued by an external certificate authority.



NOTE

If you want to start to use smart card authentication, see the hardware requirements: [Smart Card support in RHEL8](#).

7.2. WINDOWS SERVER SETTINGS REQUIRED FOR TRUST CONFIGURATION AND CERTIFICATE USAGE

This section summarizes what must be configured on Windows Server:

- Active Directory Certificate Services (ADCS) is installed
- Certificate Authority is created
- [Optional] If you are using Certificate Authority Web Enrollment, the Internet Information Services (IIS) must be configured

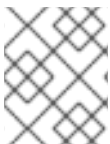
Export the certificate:

- Key must have **2048** bits or more
- Include a private key
- You will need a certificate in the following format: Personal Information Exchange – **PKCS #12(.PFX)**
 - Enable certificate privacy

7.3. COPYING CERTIFICATES FROM ACTIVE DIRECTORY USING SFTP

To be able to use smart card authentication, you need to copy the following certificate files:

- A root CA certificate in the **CER** format: **adcs-winservice-ca.cer** on your IdM server.
- A user certificate with a private key in the **PFX** format: **aduser1.pfx** on an IdM client.



NOTE

This procedure expects SSH access is allowed. If SSH is unavailable the user must copy the file from the AD Server to the IdM server and client.

Procedure

1. Connect from **the IdM server** and copy the **adcs-winservice-ca.cer** root certificate to the IdM server:

```
root@idmservice ~]# sftp Administrator@winservice.ad.example.com
```

```

Administrator@winserver.ad.example.com's password:
Connected to Administrator@winserver.ad.example.com.
sftp> cd <Path to certificates>
sftp> ls
adcs-winserver-ca.cer  aduser1.pfx
sftp>
sftp> get adcs-winserver-ca.cer
Fetching <Path to certificates>/adcs-winserver-ca.cer to adcs-winserver-ca.cer
<Path to certificates>/adcs-winserver-ca.cer      100% 1254  15KB/s 00:00
sftp quit

```

2. Connect from **the IdM client** and copy the **aduser1.pfx** user certificate to the client:

```

[root@client1 ~]# sftp Administrator@winserver.ad.example.com
Administrator@winserver.ad.example.com's password:
Connected to Administrator@winserver.ad.example.com.
sftp> cd /<Path to certificates>
sftp> get aduser1.pfx
Fetching <Path to certificates>/aduser1.pfx to aduser1.pfx
<Path to certificates>/aduser1.pfx      100% 1254  15KB/s 00:00
sftp quit

```

Now the CA certificate is stored in the IdM server and the user certificates is stored on the client machine.

7.4. CONFIGURING THE IDM SERVER AND CLIENTS FOR SMART CARD AUTHENTICATION USING ADCS CERTIFICATES

You must configure the IdM (Identity Management) server and clients to be able to use smart card authentication in the IdM environment. IdM includes the **ipa-adviser** scripts which makes all necessary changes:

- install necessary packages
- it configures IdM server and clients
- copy the CA certificates into expected locations

You can run **ipa-adviser** on your IdM server.

This procedure describes:

- On an IdM server: Preparing the **ipa-adviser** script to configure your IdM server for smart card authentication.
- On an IdM server: Preparing the **ipa-adviser** script to configure your IdM client for smart card authentication.
- On an IdM server: Applying the the **ipa-adviser** server script on the IdM server using the AD certificate.
- Moving the client script to the IdM client machine.
- On an IdM client: Applying the the **ipa-adviser** client script on the IdM client using the AD certificate.

Prerequisites

- The certificate has been copied to the IdM server.
- Obtain the Kerberos ticket.
- Log in as a user with administration rights.

Procedure

1. On the IdM server, use the **ipa-advise** script for configuring a client:

```
[root@idmserver ~]# ipa-advise config-client-for-smart-card-auth > sc_client.sh
```

2. On the IdM server, use the **ipa-advise** script for configuring a server:

```
[root@idmserver ~]# ipa-advise config-server-for-smart-card-auth > sc_server.sh
```

3. On the IdM server, execute the script:

```
[root@idmserver ~]# sh -x sc_server.sh adcs-winservice-ca.cer
```

- It configures the IdM Apache HTTP Server.
- It enables Public Key Cryptography for Initial Authentication in Kerberos (PKINIT) on the Key Distribution Center (KDC).
- It configures the IdM Web UI to accept smart card authorization requests.

4. Copy the **sc_client.sh** script to the client system:

```
[root@idmserver ~]# scp sc_client.sh root@client1.idm.example.com:/root
Password:
sc_client.sh          100% 2857  1.6MB/s  00:00
```

5. Copy the Windows certificate to the client system:

```
[root@idmserver ~]# scp adcs-winservice-ca.cer root@client1.idm.example.com:/root
Password:
adcs-winservice-ca.cer 100% 1254  952.0KB/s  00:00
```

6. On the client system, run the client script:

```
[root@idmclient1 ~]# sh -x sc_client.sh adcs-winservice-ca.cer
```

The CA certificate is installed in the correct format on the IdM server and client systems and next step is to copy the user certificates onto the smart card itself.

7.5. CONVERTING THE PFX FILE

Before you store the PFX (PKCS#12) file into the smart card, you must:

- convert the file to the PEM format

- extract the private key and the certificate to two different files

Prerequisites

- The PFX file is copied into the IdM client machine.

Procedure

1. On the IdM client, into the PEM format:

```
[root@idmclient1 ~]# openssl pkcs12 -in aduser1.pfx -out aduser1_cert_only.pem -clcerts -nodes
Enter Import Password:
```

2. Extract the key into the separate file:

```
[root@idmclient1 ~]# openssl pkcs12 -in adduser1.pfx -nocerts -out adduser1.pem > aduser1.key
```

3. Extract the public certificate into the separate file:

```
[root@idmclient1 ~]# openssl pkcs12 -in adduser1.pfx -clcerts -nokeys -out aduser1_cert_only.pem > aduser1.crt
```

At this point, you can store the **aduser1.key** and **aduser1.crt** into the smart card.

7.6. INSTALLING TOOLS FOR MANAGING AND USING SMART CARDS

To configure your smart card, you need tools which can generate certificates and store them on a smart card.

You must:

- Install the **gnutls-utils** package which helps you to manage certificates.
- Install the **opensc** package which provides a set of libraries and utilities to work with smart cards.
- Start the **pcscd** service which communicates with the smart card reader.

Procedure

1. Install the **opensc** and **gnutls-utils** packages:

```
# dnf -y install opensc gnutls-utils
```

2. Start the **pcscd** service.

```
# systemctl start pcscd
```

Verify that the **pcscd** service is up and running.

7.7. STORING A CERTIFICATE ON A SMART CARD

This section describes smart card configuration with the **pkcs15-init** tool, which helps you to configure:

- Erasing your smart card
- Setting new PINs and optional PIN Unblocking Keys (PUKs)
- Creating a new slot on the smart card
- Storing the certificate, private key, and public key in the slot
- Locking the smart card settings (some smart cards require this type of finalization)

Prerequisites

- The **opensc** package, which includes the **pkcs15-init** tool is installed.
For details, see [Installing tools for managing and using smart cards](#).
- The card is inserted in the reader and connected to the computer.
- You have the private key, public key, and certificate to store on the smart card. In this procedure, **testuser.key**, **testuserpublic.key**, and **testuser.crt** are the names used for the private key, public key, and the certificate.
- Your current smart card user PIN and Security Officer PIN (SO-PIN)

Procedure

1. Erase your smart card and authenticate yourself with your PIN:

```
$ pkcs15-init --erase-card --use-default-transport-keys
Using reader with a card: Reader name
PIN [Security Officer PIN] required.
Please enter PIN [Security Officer PIN]:
```

The card has been erased.

2. Initialize your smart card, set your user PIN and PUK, and your Security Officer PIN and PUK:

```
$ pkcs15-init --create-pkcs15 --use-default-transport-keys \
  --pin 963214 --puk 321478 --so-pin 65498714 --so-puk 784123
Using reader with a card: Reader name
```

The **pkcs15-init** tool creates a new slot on the smart card.

3. Set the label and the authentication ID for the slot:

```
$ pkcs15-init --store-pin --label testuser \
  --auth-id 01 --so-pin 65498714 --pin 963214 --puk 321478
Using reader with a card: Reader name
```

The label is set to a human-readable value, in this case, **testuser**. The **auth-id** must be two hexadecimal values, in this case it is set to **01**.

4. Store and label the private key in the new slot on the smart card:

```
$ pkcs15-init --store-private-key testuser.key --label testuser_key \
  --auth-id 01 --id 01 --pin 963214
```

Using reader with a card: *Reader name*



NOTE

The value you specify for **--id** must be the same when storing your private key, and certificate. If you do not specify a value for **--id**, a more complicated value is calculated by the tool and it is therefore easier to define your own value.

5. Store and label the certificate in the new slot on the smart card:

```
$ pkcs15-init --store-certificate testuser.crt --label testuser_cert \
  --auth-id 01 --id 01 --format pem --pin 963214
```

Using reader with a card: *Reader name*

6. (Optional) Store and label the public key in the new slot on the smart card:

```
$ pkcs15-init --store-public-key testuserpublic.key
  --label testuserpublic_key --auth-id 01 --id 01 --pin 963214
```

Using reader with a card: *Reader name*



NOTE

If the public key corresponds to a private key and/or certificate, you should specify the same ID as that private key and/or certificate.

7. (Optional) Some smart cards require you to finalize the card by locking the settings:

```
$ pkcs15-init -F
```

At this stage, your smart card includes the certificate, private key, and public key in the newly created slot. You have also created your user PIN and PUK and the Security Officer PIN and PUK.

7.8. CONFIGURING TIMEOUTS IN SSSD.CONF

Authentication with a smart card certificate might take longer than the default timeouts used by SSSD. Time out expiration can be caused by:

- slow reader
- a forwarding from a physical device into a virtual environment
- too many certificates stored on the smart card
- slow response from the OCSP (Online Certificate Status Protocol) responder if OCSP is used to verify the certificates

In this case you can prolong the following timeouts in the **sssd.conf** file, for example, to 60 seconds:

- **p11_child_timeout**
- **krb5_auth_timeout**

Prerequisites

- You must be logged in as root.

Procedure

1. Open the **sssd.conf** file:

```
[root@idmclient1 ~]# vim /etc/sss/sss.conf
```

2. Change the value of **p11_child_timeout**:

```
[pam]
p11_child_timeout = 60
```

3. Change the value of **krb5_auth_timeout**:

```
[domain/IDM.EXAMPLE.COM]
krb5_auth_timeout = 60
```

4. Save the settings.

Now, the interaction with the smart card is allowed to run for 1 minute (60 seconds) before authentication will fail with a timeout.

7.9. CREATING CERTIFICATE MAPPING RULES FOR SMART CARD AUTHENTICATION

If you want to use one certificate for a user who has accounts in AD (Active Directory) and in IdM (Identity Management), you can create a certificate mapping rule on the IdM server.

After creating such a rule, the user is able to authenticate with their smart card in both domains.

For details about certificate mapping rules, see [Certificate mapping rules for configuring authentication on smart cards](#).

CHAPTER 8. CONFIGURING CERTIFICATE MAPPING RULES IN IDENTITY MANAGEMENT

8.1. CERTIFICATE MAPPING RULES FOR CONFIGURING AUTHENTICATION ON SMART CARDS

Certificate mapping rules are a convenient way of allowing users to authenticate using certificates in scenarios when the Identity Management (IdM) administrator does not have access to certain users' certificates. This lack of access is typically caused by the fact that the certificates have been issued by an external certificate authority. A special use case is represented by certificates issued by the Certificate System of an Active Directory (AD) with which the IdM domain is in a trust relationship.

Certificate mapping rules are also convenient if the IdM environment is large with a lot of users using smart cards. In this situation, adding full certificates can be complicated. The subject and issuer are predictable in most scenarios and thus easier to add ahead of time than the full certificate. As a system administrator, you can create a certificate mapping rule and add certificate mapping data to a user entry even before a certificate is issued to a particular user. Once the certificate is issued, the user can log in using the certificate even though the full certificate has not yet been uploaded to the user entry.

In addition, as certificates have to be renewed at regular intervals, certificate mapping rules reduce administrative overhead. When a user's certificate gets renewed, the administrator does not have to update the user entry. For example, if the mapping is based on the **Subject** and **Issuer** values, and if the new certificate has the same subject and issuer as the old one, the mapping still applies. If, in contrast, the full certificate was used, then the administrator would have to upload the new certificate to the user entry to replace the old one.

To set up certificate mapping:

1. An administrator has to load the certificate mapping data (typically the issuer and subject) or the full certificate into a user account.
2. An administrator has to create a certificate mapping rule to allow successful logging into IdM for a user
 - a. whose account contains a certificate mapping data entry
 - b. whose certificate mapping data entry matches the information on the certificate

For details on the individual components that make up a mapping rule and how to obtain and use them, see [Components of an identity mapping rule in IdM](#) and [Obtaining the issuer from a certificate for use in a matching rule](#).

Afterwards, when the end-user presents the certificate, stored either in the [filesystem](#) or on a [smart card](#), authentication is successful.

8.1.1. Certificate mapping rules for trusts with Active Directory domains

This section outlines the different certificate mapping use cases that are possible if an IdM deployment is in a trust relationship with an Active Directory (AD) domain.

Certificate mapping rules are a convenient way to enable access to IdM resources for users who have smart card certificates that were issued by the trusted AD Certificate System. Depending on the AD configuration, the following scenarios are possible:

- If the certificate is issued by AD but the user and the certificate are stored in IdM, the mapping and the whole processing of the authentication request takes place on the IdM side. For details of configuring this scenario, see [Configuring certificate mapping for users stored in IdM](#)
- If the user is stored in AD, the processing of the authentication request takes place in AD. There are three different subcases:
 - The AD user entry contains the whole certificate. For details how to configure IdM in this scenario, see [Configuring certificate mapping for users whose AD user entry contains the whole certificate](#).
 - AD is configured to map user certificates to user accounts. In this case, the AD user entry does not contain the whole certificate but instead contains an attribute called **altSecurityIdentities**. For details how to configure IdM in this scenario, see [Configuring certificate mapping if AD is configured to map user certificates to user accounts](#).
 - The AD user entry contains neither the whole certificate nor the mapping data. In this case, the only solution is to use the **ipa idoverrideuser-add** command to add the whole certificate to the AD user's ID override in IdM. For details, see [Configuring certificate mapping if AD user entry contains no certificate or mapping data](#).

8.1.2. Components of an identity mapping rule in IdM

This section describes the components of an *identity mapping rule* in IdM and how to configure them. Each component has a default value that you can override. You can define the components in either the web UI or the CLI. In the CLI, the identity mapping rule is created using the **ipa certmaprule-add** command.

Mapping rule

The mapping rule component associates (or *maps*) a certificate with one or more user accounts. The rule defines an LDAP search filter that associates a certificate with the intended user account. Certificates issued by different certificate authorities (CAs) might have different properties and might be used in different domains. Therefore, IdM does not apply mapping rules unconditionally, but only to the appropriate certificates. The appropriate certificates are defined using *matching rules*.

Note that if you leave the mapping rule option empty, the certificates are searched in the **userCertificate** attribute as a DER encoded binary file.

Define the mapping rule in the CLI using the **--maprule** option.

Matching rule

The matching rule component selects a certificate to which you want to apply the mapping rule. The default matching rule matches certificates with the **digitalSignature key** usage and **clientAuth extended key** usage.

Define the matching rule in the CLI using the **--matchrule** option.

Domain list

The domain list specifies the identity domains in which you want IdM to search the users when processing identity mapping rules. If you leave the option unspecified, IdM searches the users only in the local domain to which the IdM client belongs.

Define the domain in the CLI using the **--domain** option.

Priority

When multiple rules are applicable to a certificate, the rule with the highest priority takes precedence. All other rules are ignored.

- The lower the numerical value, the higher the priority of the identity mapping rule. For example, a rule with a priority 1 has higher priority than a rule with a priority 2.
- If a rule has no priority value defined, it has the lowest priority.

Define the mapping rule priority in the CLI using the **--priority** option.

Certificate mapping rule example

To define, using the CLI, a certificate mapping rule called **simple_rule** that allows authentication for a certificate issued by the **Smart Card CA** of the **EXAMPLE.ORG** organisation as long as the **Subject** on that certificate matches a **certmapdata** entry in a user account in IdM:

```
# ipa certmaprule-add simple_rule --matchrule '<ISSUER>CN=Smart Card
CA,O=EXAMPLE.ORG' --maprule '(ipacertmapdata=X509:<I>{issuer_dn!nss_x500}<S>
{subject_dn!nss_x500})'
```

8.1.3. Obtaining the issuer from a certificate for use in a matching rule

This procedure describes how to obtain the issuer information from a certificate so that you can copy and paste it into the matching rule of a certificate mapping rule. To get the issuer format required by a matching rule, use the **openssl x509** utility.

Prerequisites

- You have the user certificate in a **.pem** or **.crt** format

Procedure

1. Obtain the user information from the certificate. Use the **openssl x509** certificate display and signing utility with:
 - the **-noout** option to prevent the output of an encoded version of the request
 - the **-issuer** option to output the issuer name
 - the **-in** option to specify the input file name to read the certificate from
 - the **-nameopt** option with the **RFC2253** value to display the output with the most specific relative distinguished name (RDN) first

If the input file contains an Identity Management certificate, the output of the command shows that the Issuer is defined using the **Organisation** information:

```
# openssl x509 -noout -issuer -in idm_user.crt -nameopt RFC2253
issuer=CN=Certificate Authority,O=REALM.EXAMPLE.COM
```

If the input file contains an Active Directory certificate, the output of the command shows that the Issuer is defined using the **Domain Component** information:

```
# openssl x509 -noout -issuer -in ad_user.crt -nameopt RFC2253
issuer=CN=AD-WIN2012R2-CA,DC=AD,DC=EXAMPLE,DC=COM
```


- Optionally, to create a new mapping rule in the CLI based on a matching rule which specifies that the certificate issuer must be the extracted **AD-WIN2012R2-CA** of the **ad.example.com** domain and the subject on the certificate must match the **certmapdata** entry in a user account in IdM:

```
# ipa certmaprule-add simple_rule --matchrule '<ISSUER>CN=AD-WIN2012R2-CA,DC=AD,DC=EXAMPLE,DC=COM' --maprule '(ipacertmapdata=X509:<I>{issuer_dn!nss_x500}<S>{subject_dn!nss_x500})'
```

Additional information

For details about the supported formats for the matching rule and the mapping rule, and an explanation of the priority and domain fields, see the **sss-certmap(5)** man page.

8.2. CONFIGURING CERTIFICATE MAPPING FOR USERS STORED IN IDM

This user story describes the steps a system administrator must take to enable certificate mapping in IdM if the user for whom certificate authentication is being configured is stored in IdM.

Prerequisites

- The user has an account in IdM.
- The administrator has either the whole certificate or the certificate mapping data to add to the user entry.

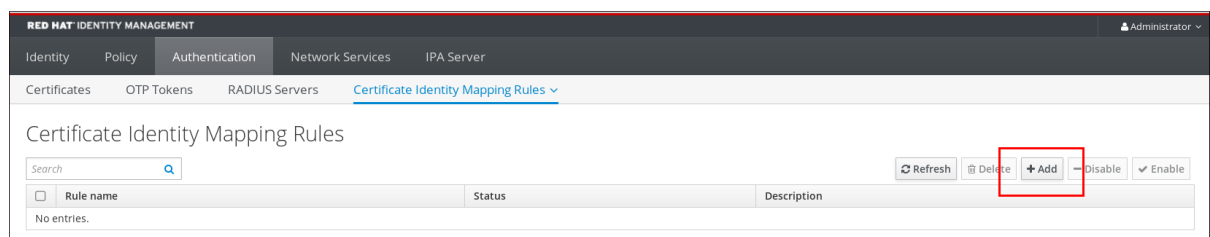
8.2.1. Adding a certificate mapping rule in IdM

This section describes how to set up a certificate mapping rule so that IdM users with certificates that match the conditions specified in the mapping rule and in their certificate mapping data entries can authenticate to IdM.

8.2.1.1. Adding a certificate mapping rule in the IdM web UI

- Log in to the IdM web UI as an administrator.
- Navigate to **Authentication** → **Certificate Identity Mapping Rules** → **Certificate Identity Mapping Rules**.
- Click **Add**.

Figure 8.1. Adding a new certificate mapping rule in the IdM web UI



- Enter the rule name.

5. Enter the mapping rule. For example, to make IdM search for the **Issuer** and **Subject** entries in any certificate presented to them, and base its decision to authenticate or not on the information found in these two entries of the presented certificate:

```
(ipacertmapdata=X509:<I>{issuer_dn!nss_x500}<S>{subject_dn!nss_x500})
```

6. Enter the matching rule. For example, to only allow certificates issued by the **Smart Card CA** of the **EXAMPLE.ORG** organization to authenticate users to IdM:

```
<ISSUER>CN=Smart Card CA,O=EXAMPLE.ORG
```

Figure 8.2. Entering the details for a certificate mapping rule in the IdM web UI

Add Certificate Identity Mapping Rule

Rule name *

Mapping rule ⓘ

Matching rule ⓘ

Domain name ⓘ

Priority ⓘ

7. Click **Add** at the bottom of the dialog box to add the rule and close the box.
8. The System Security Services Daemon (SSSD) periodically re-reads the certificate mapping rules. To force the newly-created rule to be loaded immediately, restart SSSD:

```
# systemctl restart sssd
```

Now you have a certificate mapping rule set up that compares the type of data specified in the mapping rule that it finds on a smart card certificate with the certificate mapping data in your IdM user entries. Once it finds a match, it authenticates the matching user.

8.2.1.2. Adding a certificate mapping rule in the IdM CLI

1. Obtain the administrator's credentials:

```
# kinit admin
```

2. Enter the mapping rule and the matching rule the mapping rule is based on. For example, to make IdM search for the **Issuer** and **Subject** entries in any certificate presented, and base its decision to authenticate or not on the information found in these two entries of the presented certificate, recognizing only certificates issued by the **Smart Card CA** of the **EXAMPLE.ORG** organization:

```
# ipa certmaprule-add rule_name --matchrule '<ISSUER>CN=Smart Card  
CA,O=EXAMPLE.ORG' --maprule '(ipacertmapdata=X509:<I>{issuer_dn!nss_x500}<S>
```

```
{subject_dn!nss_x500})'
```

```
-----
Added Certificate Identity Mapping Rule "rule_name"
-----
```

```
Rule name: rule_name
```

```
Mapping rule: (ipacertmapdata=X509:<I>{issuer_dn!nss_x500}<S>{subject_dn!nss_x500})
```

```
Matching rule: <ISSUER>CN=Smart Card CA,O=EXAMPLE.ORG
```

```
Enabled: TRUE
```

3. The System Security Services Daemon (SSSD) periodically re-reads the certificate mapping rules. To force the newly-created rule to be loaded immediately, restart SSSD:

```
# systemctl restart sssd
```

Now you have a certificate mapping rule set up that compares the type of data specified in the mapping rule that it finds on a smart card certificate with the certificate mapping data in your IdM user entries. Once it finds a match, it authenticates the matching user.

8.2.2. Adding certificate mapping data to a user entry in IdM

This section describes how to enter certificate mapping data to an IdM user entry so that the user can authenticate using multiple certificates as long as they all contain the values specified in the certificate mapping data entry.

8.2.2.1. Adding certificate mapping data to a user entry in the IdM web UI

1. Log into the IdM web UI as an administrator.
2. Navigate to **Users** → **Active users** → **idm_user**.
3. Find the **Certificate mapping data** option and click **Add**.
4. If you have the certificate of **idm_user** at your disposal:
 - a. In the Command-Line Interface, display the certificate using the **cat** utility or a text editor:

```
[root@server ~]# cat idm_user_certificate.pem
-----BEGIN CERTIFICATE-----
MIIFTCCA/2gAwIBAgIBejANBgkqhkiG9w0BAQsFADA6MRgwFgYDVQQKDA9JRE0u
RVhBTBVBMR5DT00xHjAcBgNVBAMMFUNlcnRpZmljYXRlIEF1dGhvcml0eTAeFw0x
ODA5MDIxODE1MzlaFw0yMDA5MDIxODE1MzlaMCwxGDAWBgNVBAoMD0lETS5FWWE
FN
[...output truncated...]
```

- b. Copy the certificate.
- c. In the IdM web UI, click **Add** next to **Certificate** and paste the certificate into the window that opens up.

Figure 8.3. Adding a user's certificate mapping data: certificate

User: demouser
demouser is a member of:

Settings | User Groups | Netgroups | Roles | HBAC Rules | Sudo Rules

Refresh Revert Save Actions

Identity Settings

Job Title:

First name *: Demo

Last name *: User

Full name *: Demo User

Display name: Demo User

Initials: DU

GECOS: Demo User

Class:

Account Settings

User login: demouser

Password: *****

Password expiration: 2016-07-14 10:14:41Z

UID: 373000005

GID: 373000005

Principal alias: demouser@IDM.EXAMPLE.COM Delete

Add

Kerberos principal expiration: YYYY-MM-DD hh : mn UTC

Login shell: /bin/sh

Home directory: /home/demouser

SSH public keys: Add

Certificates: Add

Alternatively, if you do not have the certificate of **idm_user** at your disposal but know the **Issuer** and the **Subject** of the certificate, check the radio button of **Issuer and subject** and enter the values in the two respective boxes.

Figure 8.4. Adding a user's certificate mapping data: issuer and subject

Add Certificate Mapping Data

☐ Certificate mapping data

Certificate mapping data

Certificate ⓘ

☒ Issuer and subject

Issuer ⓘ *: O=EXAMPLE.ORG,CN=Smart Card CA

Subject ⓘ *: CN=test,O=EXAMPLE.ORG

Add Cancel

Certificate mapping Add

5. Click **Add**.
6. Optionally, if you have access to the whole certificate in the **.pem** format, verify that the user and certificate are linked:
 - a. Use the **sss_cache** utility to invalidate the record of **idm_user** in the SSSD cache and force a reload of the **idm_user** information:

```
# sss_cache -u idm_user
```

- b. Run the **ipa certmap-match** command with the name of the file containing the certificate of the IdM user:

```
# ipa certmap-match idm_user_cert.pem
-----
1 user matched
-----
Domain: IDM.EXAMPLE.COM
User logins: idm_user
-----
Number of entries returned 1
-----
```

The output confirms that now you have certificate mapping data added to **idm_user** and that a corresponding mapping rule exists. This means that you can use any certificate that matches the defined certificate mapping data to authenticate as **idm_user**.

8.2.2.2. Adding certificate mapping data to a user entry in the IdM CLI

1. Obtain the administrator's credentials:

```
# kinit admin
```

2. If you have the certificate of **idm_user** at your disposal, add the certificate to the user account using the **ipa user-add-cert** command:

```
# CERT=`cat idm_user_cert.pem | tail -n +2 | head -n -1 | tr -d '\r\n\'`
# ipa user-add-certmapdata idm_user --certificate $CERT
```

Alternatively, if you do not have the certificate of **idm_user** at your disposal but know the **Issuer** and the **Subject** of **idm_user**'s certificate:

```
# ipa user-add-certmapdata idm_user --subject "O=EXAMPLE.ORG,CN=test" --issuer
"CN=Smart Card CA,O=EXAMPLE.ORG"
-----
Added certificate mappings to user "idm_user"
-----
User login: idm_user
Certificate mapping data: X509:<I>O=EXAMPLE.ORG,CN=Smart Card
CA<S>CN=test,O=EXAMPLE.ORG
```

3. Optionally, if you have access to the whole certificate in the **.pem** format, verify that the user and certificate are linked:
 - a. Use the **sss_cache** utility to invalidate the record of **idm_user** in the SSSD cache and force a reload of the **idm_user** information:

```
# sss_cache -u idm_user
```

- b. Run the **ipa certmap-match** command with the name of the file containing the certificate of the IdM user:

```
# ipa certmap-match idm_user_cert.pem
-----
```

```

1 user matched
-----
Domain: IDM.EXAMPLE.COM
User logins: idm_user
-----
Number of entries returned 1
-----

```

The output confirms that now you have certificate mapping data added to **idm_user** and that a corresponding mapping rule exists. This means that you can use any certificate that matches the defined certificate mapping data to authenticate as **idm_user**.

8.3. CONFIGURING CERTIFICATE MAPPING FOR USERS WHOSE AD USER ENTRY CONTAINS THE WHOLE CERTIFICATE

This user story describes the steps necessary for enabling certificate mapping in IdM if the IdM deployment is in trust with Active Directory (AD), the user is stored in AD and the user entry in AD contains the whole certificate.

Prerequisites

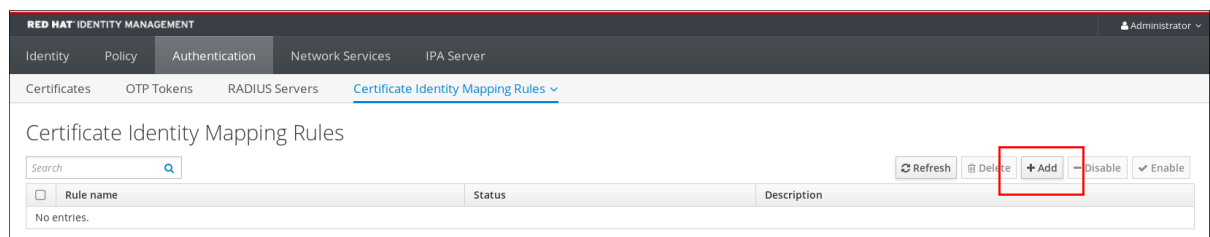
- The user does not have an account in IdM.
- The user has an account in AD which contains a certificate.
- The IdM administrator has access to data on which the IdM certificate mapping rule can be based.

8.3.1. Adding a certificate mapping rule for users whose AD entry contains whole certificates

8.3.1.1. Adding a certificate mapping rule in the IdM web UI

1. Log into the IdM web UI as an administrator.
2. Navigate to **Authentication** → **Certificate Identity Mapping Rules** → **Certificate Identity Mapping Rules**.
3. Click **Add**.

Figure 8.5. Adding a new certificate mapping rule in the IdM web UI



4. Enter the rule name.
5. Enter the mapping rule. To have the whole certificate that is presented to IdM for authentication compared to what is available in AD:

```
(userCertificate;binary={cert!bin})
```

- Enter the matching rule. For example, to only allow certificates issued by the **AD-ROOT-CA** of the **AD.EXAMPLE.COM** domain to authenticate:

```
<ISSUER>CN=AD-ROOT-CA,DC=ad,DC=example,DC=com
```

Figure 8.6. Certificate mapping rule for a user with a certificate stored in AD

- Click **Add**.
- The System Security Services Daemon (SSSD) periodically re-reads the certificate mapping rules. To force the newly-created rule to be loaded immediately, restart SSSD in the CLI::

```
# systemctl restart sssd
```

8.3.1.2. Adding a certificate mapping rule in the IdM CLI

- Obtain the administrator's credentials:

```
# kinit admin
```

- Enter the mapping rule and the matching rule the mapping rule is based on. To have the whole certificate that is presented for authentication compared to what is available in AD, only allowing certificates issued by the **AD-ROOT-CA** of the **AD.EXAMPLE.COM** domain to authenticate:

```
# ipa certmaprule-add simpleADrule --matchrule '<ISSUER>CN=AD-ROOT-CA,DC=ad,DC=example,DC=com' --maprule '(userCertificate;binary={cert!bin})' --domain ad.example.com
```

```
-----
Added Certificate Identity Mapping Rule "simpleADrule"
-----
```

```
Rule name: simpleADrule
Mapping rule: (userCertificate;binary={cert!bin})
Matching rule: <ISSUER>CN=AD-ROOT-CA,DC=ad,DC=example,DC=com
Domain name: ad.example.com
Enabled: TRUE
```

3. The System Security Services Daemon (SSSD) periodically re-reads the certificate mapping rules. To force the newly-created rule to be loaded immediately, restart SSSD:

```
# systemctl restart sssd
```

8.4. CONFIGURING CERTIFICATE MAPPING IF AD IS CONFIGURED TO MAP USER CERTIFICATES TO USER ACCOUNTS

This user story describes the steps necessary for enabling certificate mapping in IdM if the IdM deployment is in trust with Active Directory (AD), the user is stored in AD and the user entry in AD contains certificate mapping data.

Prerequisites

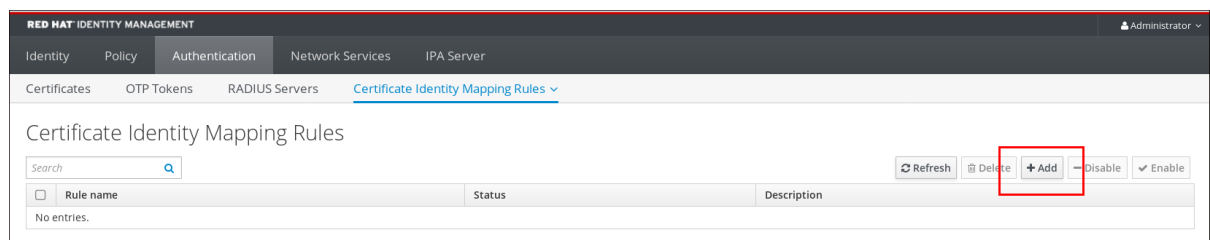
- The user does not have an account in IdM.
- The user has an account in AD which contains the **altSecurityIdentities** attribute, the AD equivalent of the IdM **certmapdata** attribute.
- The IdM administrator has access to data on which the IdM certificate mapping rule can be based.

8.4.1. Adding a certificate mapping rule if the trusted AD domain is configured to map user certificates

8.4.1.1. Adding a certificate mapping rule in the IdM web UI

1. Log into the IdM web UI as an administrator.
2. Navigate to **Authentication** → **Certificate Identity Mapping Rules** → **Certificate Identity Mapping Rules**.
3. Click **Add**.

Figure 8.7. Adding a new certificate mapping rule in the IdM web UI



4. Enter the rule name.
5. Enter the mapping rule. For example, to make AD DC search for the **Issuer** and **Subject** entries in any certificate presented, and base its decision to authenticate or not on the information found in these two entries of the presented certificate:

```
(altSecurityIdentities=X509:<I>{issuer_dn!ad_x500}<S>{subject_dn!ad_x500})
```

6. Enter the matching rule. For example, to only allow certificates issued by the **AD-ROOT-CA** of the **AD.EXAMPLE.COM** domain to authenticate users to IdM:


```
<ISSUER>CN=AD-ROOT-CA,DC=ad,DC=example,DC=com
```

7. Enter the domain:

```
ad.example.com
```

Figure 8.8. Certificate mapping rule if AD is configured for mapping

8. Click **Add**.
9. The System Security Services Daemon (SSSD) periodically re-reads the certificate mapping rules. To force the newly-created rule to be loaded immediately, restart SSSD in the CLI::

```
# systemctl restart sssd
```

8.4.1.2. Adding a certificate mapping rule in the IdM CLI

1. Obtain the administrator's credentials:

```
# kinit admin
```

2. Enter the mapping rule and the matching rule the mapping rule is based on. For example, to make AD search for the **Issuer** and **Subject** entries in any certificate presented, and only allow certificates issued by the **AD-ROOT-CA** of the **AD.EXAMPLE.COM** domain:

```
# ipa certmaprule-add ad_configured_for_mapping_rule --matchrule
'<ISSUER>CN=AD-ROOT-CA,DC=ad,DC=example,DC=com' --maprule
'(altSecurityIdentities=X509:<I>{issuer_dn!ad_x500}<S>{subject_dn!ad_x500})' --
domain=ad.example.com
```

```
-----
Added Certificate Identity Mapping Rule "ad_configured_for_mapping_rule"
-----
```

```
Rule name: ad_configured_for_mapping_rule
Mapping rule: (altSecurityIdentities=X509:<I>{issuer_dn!ad_x500}<S>
{subject_dn!ad_x500})
Matching rule: <ISSUER>CN=AD-ROOT-CA,DC=ad,DC=example,DC=com
Domain name: ad.example.com
Enabled: TRUE
```

3. The System Security Services Daemon (SSSD) periodically re-reads the certificate mapping rules. To force the newly-created rule to be loaded immediately, restart SSSD:

```
# systemctl restart sssd
```

8.4.2. Checking certificate mapping data on the AD side

The **altSecurityIdentities** attribute is the Active Directory (AD) equivalent of **certmapdata** user attribute in IdM. When configuring certificate mapping in IdM in the scenario when a trusted AD domain is configured to map user certificates to user accounts, the IdM system administrator needs to check that the **altSecurityIdentities** attribute is set correctly in the user entries in AD.

To check that AD contains the right information for the user stored in AD, use the **ldapsearch** command.

- For example, enter the command below to check with the **adserver.ad.example.com** server that the following conditions apply:
 - The **altSecurityIdentities** attribute is set in the user entry of **ad_user**.
 - The matchrule stipulates that the following conditions apply:
 - The certificate that **ad_user** uses to authenticate to AD was issued by **AD-ROOT-CA** of the **ad.example.com** domain.
 - The subject is **<S>DC=com,DC=example,DC=ad,CN=Users,CN=ad_user**:

```
$ ldapsearch -o ldif-wrap=no -LLL -h adserver.ad.example.com \
-p 389 -D cn=Administrator,cn=users,dc=ad,dc=example,dc=com \
-W -b cn=users,dc=ad,dc=example,dc=com "(cn=ad_user)" \
altSecurityIdentities
Enter LDAP Password:
dn: CN=ad_user,CN=Users,DC=ad,DC=example,DC=com
altSecurityIdentities: X509:<I>DC=com,DC=example,DC=ad,CN=AD-ROOT-
CA<S>DC=com,DC=example,DC=ad,CN=Users,CN=ad_user
```

8.5. CONFIGURING CERTIFICATE MAPPING IF AD USER ENTRY CONTAINS NO CERTIFICATE OR MAPPING DATA

This user story describes the steps necessary for enabling certificate mapping in IdM if the IdM deployment is in trust with Active Directory (AD), the user is stored in AD and the user entry in AD contains neither the whole certificate nor certificate mapping data.

Prerequisites

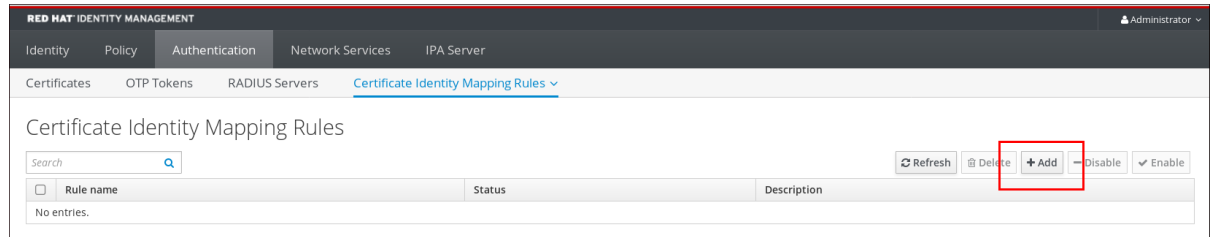
- The user does not have an account in IdM.
- The user has an account in AD which contains neither the whole certificate nor the **altSecurityIdentities** attribute, the AD equivalent of the IdM **certmapdata** attribute.
- The IdM administrator has the whole AD user certificate to add to the AD user's **user ID override** in IdM.

8.5.1. Adding a certificate mapping rule if the AD user entry contains no certificate or mapping data

8.5.1.1. Adding a certificate mapping rule in the IdM web UI

1. Log into the IdM web UI as an administrator.
2. Navigate to **Authentication** → **Certificate Identity Mapping Rules** → **Certificate Identity Mapping Rules**.
3. Click **Add**.

Figure 8.9. Adding a new certificate mapping rule in the IdM web UI



4. Enter the rule name.
5. Enter the mapping rule. To have the whole certificate that is presented to IdM for authentication compared to the certificate stored in the user ID override entry of the AD user entry in IdM:

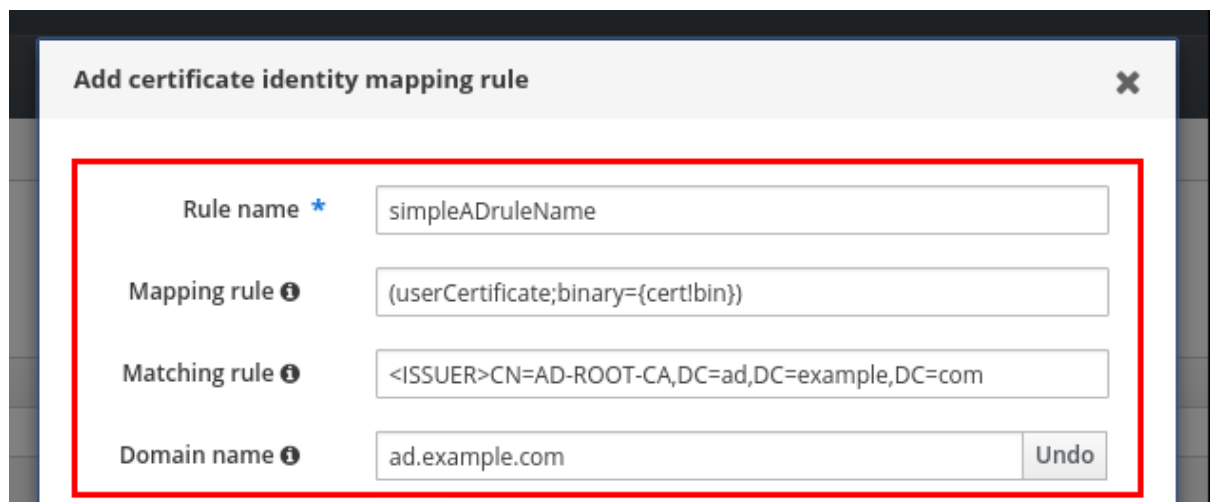
(userCertificate;binary={cert!bin})

6. Enter the matching rule. For example, to only allow certificates issued by the **AD-ROOT-CA** of the **AD.EXAMPLE.COM** domain to authenticate:

<ISSUER>CN=AD-ROOT-CA,DC=ad,DC=example,DC=com

7. Enter the domain name. For example, to search for users in the **ad.example.com** domain:

Figure 8.10. Certificate mapping rule for a user with no certificate or mapping data stored in AD



8. Click **Add**.

- The System Security Services Daemon (SSSD) periodically re-reads the certificate mapping rules. To force the newly-created rule to be loaded immediately, restart SSSD in the CLI:

```
# systemctl restart sssd
```

8.5.1.2. Adding a certificate mapping rule in the IdM CLI

- Obtain the administrator's credentials:

```
# kinit admin
```

- Enter the mapping rule and the matching rule the mapping rule is based on. To have the whole certificate that is presented for authentication compared to the certificate stored in the user ID override entry of the AD user entry in IdM, only allowing certificates issued by the **AD-ROOT-CA** of the **AD.EXAMPLE.COM** domain to authenticate:

```
# ipa certmaprule-add simpleADrule --matchrule '<ISSUER>CN=AD-ROOT-CA,DC=ad,DC=example,DC=com' --maprule '(userCertificate;binary={cert!bin})' --domain ad.example.com
```

```
-----
Added Certificate Identity Mapping Rule "simpleADrule"
-----
```

```
Rule name: simpleADrule
Mapping rule: (userCertificate;binary={cert!bin})
Matching rule: <ISSUER>CN=AD-ROOT-CA,DC=ad,DC=example,DC=com
Domain name: ad.example.com
Enabled: TRUE
```

- The System Security Services Daemon (SSSD) periodically re-reads the certificate mapping rules. To force the newly-created rule to be loaded immediately, restart SSSD:

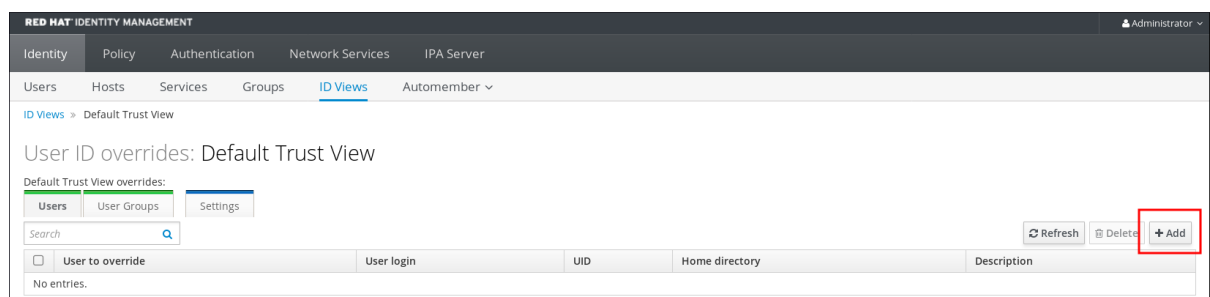
```
# systemctl restart sssd
```

8.5.2. Adding a certificate to an AD user's ID override if the user entry in AD contains no certificate or mapping data

8.5.2.1. Adding a certificate to an AD user's ID override in the IdM web UI

- Navigate to **Identity** → **ID Views** → **Default Trust View**.
- Click **Add**.

Figure 8.11. Adding a new user ID override in the IdM web UI



3. In the **User to override** field, enter **ad_user@ad.example.com**.
4. Copy and paste the certificate of **ad_user** into the **Certificate** field.

Figure 8.12. Configuring the User ID override for an AD user

Add User ID override

User to override *

ad_user@ad.example.com

Certificate

MIIFFTCCA/2gAwIBAgIBHDANBgkqhkiG9w0BAQsFADA6MRgwFgYDVQQKDA9JRE0uRVhBTvBMR55DT00xHjAcBgNVBAMMFUNcnRpZmljYXRlIEF1dGhvcml0eTAeFw0xOTAyMDYxMDQ0MjFaFw0yMTAyMDYxMDQ0MjFaMCwxGDAWBgNVBAoMD0lET55FWEFNUExFLkNPTEEQMA4GA1UEAwwHbWFTb25pYTCCAlwDQYJKoZIhvcNAQEBBQADBgIBADCCAggCggIBADBYeYdaYmQ0eYF7BB

5. Click **Add**.
6. Optionally, verify that the user and certificate are linked:
 - a. Use the **sss_cache** utility to invalidate the record of **ad_user@ad.example.com** in the SSSD cache and force a reload of the **ad_user@ad.example.com** information:

```
# sss_cache -u ad_user@ad.example.com
```

- b. Run the **ipa certmap-match** command with the name of the file containing the certificate of the AD user:

```
# ipa certmap-match ad_user_cert.pem
```

```
1 user matched
-----
Domain: AD.EXAMPLE.COM
User logins: ad_user@ad.example.com
-----
Number of entries returned 1
```

The output confirms that you have certificate mapping data added to **ad_user@ad.example.com** and that a corresponding mapping rule defined in [Adding a certificate mapping rule if the AD user entry contains no certificate or mapping data](#) exists.

This means that you can use any certificate that matches the defined certificate mapping data to authenticate as **ad_user@ad.example.com**.

8.5.2.2. Adding a certificate to an AD user's ID override in the IdM CLI

1. Obtain the administrator's credentials:

```
# kinit admin
```

2. Add the certificate of **ad_user@ad.example.com** to the user account using the **ipa idoverrideuser-add-cert** command:

```
# CERT=`cat ad_user_cert.pem | tail -n +2 | head -n -1 | tr -d '\r\n\'`
# ipa idoverrideuser-add-cert ad_user@ad.example.com --certificate $CERT
```

3. Optionally, verify that the user and certificate are linked:
 - a. Use the **sss_cache** utility to invalidate the record of **ad_user@ad.example.com** in the SSSD cache and force a reload of the **ad_user@ad.example.com** information:

```
# sss_cache -u ad_user@ad.example.com
```

- b. Run the **ipa certmap-match** command with the name of the file containing the certificate of the AD user:

```
# ipa certmap-match ad_user_cert.pem
-----
1 user matched
-----
Domain: AD.EXAMPLE.COM
User logins: ad_user@ad.example.com
-----
Number of entries returned 1
-----
```

The output confirms that you have certificate mapping data added to **ad_user@ad.example.com** and that a corresponding mapping rule defined in [Adding a certificate mapping rule if the AD user entry contains no certificate or mapping data](#) exists. This means that you can use any certificate that matches the defined certificate mapping data to authenticate as **ad_user@ad.example.com**.

8.6. COMBINING SEVERAL IDENTITY MAPPING RULES INTO ONE

To combine several identity mapping rules into one combined rule, use the **|** (or) character to precede the individual mapping rules, and separate them using **()** brackets, for example:

Certificate mapping filter example 1

```
$ ipa certmaprule-add ad_cert_for_ipa_and_ad_users \
--maprule='(|(ipacertmapdata=X509:<|>
{issuer_dn!nss_x500}<S>{subject_dn!nss_x500})(altSecurityIdentities=X509:<|>
{issuer_dn!ad_x500}<S>{subject_dn!ad_x500}))' \
--matchrule='<ISSUER>CN=AD-ROOT-CA,DC=ad,DC=example,DC=com' \
--domain=ad.example.com
```

In the above example, the filter definition in the **--maprule** option includes these criteria:

- **ipacertmapdata=X509:<I>{issuer_dn!nss_x500}<S>{subject_dn!nss_x500}** is a filter that links the subject and issuer from a smart card certificate to the value of the **ipacertmapdata** attribute in an IdM user account, as described in [Adding a certificate mapping rule in IdM](#)
- **altSecurityIdentities=X509:<I>{issuer_dn!ad_x500}<S>{subject_dn!ad_x500}** is a filter that links the subject and issuer from a smart card certificate to the value of the **altSecurityIdentities** attribute in an AD user account, as described in [Adding a certificate mapping rule if the trusted AD domain is configured to map user certificates](#)
- The addition of the **--domain=ad.example.com** option means that users mapped to a given certificate are not only searched in the local **idm.example.com** domain but also in the **ad.example.com** domain

The filter definition in the **--maprule** option accepts the logical operator **|** (or), so that you can specify multiple criteria. In this case, the rule maps all user accounts that meet at least one of the criteria.

Certificate mapping filter example 2

```
$ ipa certmaprule-add ipa_cert_for_ad_users \
--maprule='((userCertificate;binary={cert!bin})(ipacertmapdata=X509:<I>
{issuer_dn!nss_x500}<S>{subject_dn!nss_x500})(altSecurityIdentities=X509:<I>
{issuer_dn!ad_x500}<S>{subject_dn!ad_x500}))' \
--matchrule='<ISSUER>CN=Certificate Authority,O=REALM.EXAMPLE.COM' \
--domain=idm.example.com --domain=ad.example.com
```

In the above example, the filter definition in the **--maprule** option includes these criteria:

- **userCertificate;binary={cert!bin}** is a filter that returns user entries that include the whole certificate. For AD users, creating this type of filter is described in detail in [Adding a certificate mapping rule if the AD user entry contains no certificate or mapping data](#).
- **ipacertmapdata=X509:<I>{issuer_dn!nss_x500}<S>{subject_dn!nss_x500}** is a filter that links the subject and issuer from a smart card certificate to the value of the **ipacertmapdata** attribute in an IdM user account, as described in [Adding a certificate mapping rule in IdM](#).
- **altSecurityIdentities=X509:<I>{issuer_dn!ad_x500}<S>{subject_dn!ad_x500}** is a filter that links the subject and issuer from a smart card certificate to the value of the **altSecurityIdentities** attribute in an AD user account, as described in [Adding a certificate mapping rule if the trusted AD domain is configured to map user certificates](#).

The filter definition in the **--maprule** option accepts the logical operator **|** (or), so that you can specify multiple criteria. In this case, the rule maps all user accounts that meet at least one of the criteria.

CHAPTER 9. CONFIGURING AUTHENTICATION WITH A CERTIFICATE STORED ON THE DESKTOP OF AN IDM CLIENT

By configuring Identity Management (IdM), IdM system administrators can enable users to authenticate to the IdM web UI and command-line interface (CLI) using a certificate that a Certificate Authority (CA) has issued to the users.

The web browser can run on a system that is not part of the IdM domain.

This user story provides instructions on how to effectively configure and test logging into Identity Management web UI and CLI with a certificate stored on the desktop of an IdM client. In following this user story,

- you can skip [Section 9.2, “Requesting a new user certificate and exporting it to the client”](#) if the user you want to authenticate using a certificate already has a certificate;
- you can skip [Section 9.3, “Making sure the certificate and user are linked together”](#) if the user’s certificate has been issued by the IdM CA.



NOTE

Only Identity Management users can log into the web UI using a certificate. Active Directory users can log in with their user name and password.

9.1. CONFIGURING THE IDENTITY MANAGEMENT SERVER FOR CERTIFICATE AUTHENTICATION IN THE WEB UI

As an Identity Management (IdM) administrator, you can allow users to use certificates to authenticate to your IdM environment.

Procedure

As the Identity Management administrator:

1. On an Identity Management server, obtain administrator privileges and create a shell script to configure the server.
 - a. Run the **ipa-adviser config-server-for-smart-card-auth** command, and save its output to a file, for example **server_certificate_script.sh**:

```
# kinit admin
# ipa-adviser config-server-for-smart-card-auth > server_certificate_script.sh
```

- b. Add execute permissions to the file using the **chmod** utility:

```
# chmod +x server_certificate_script.sh
```

2. On all the servers in the Identity Management domain, run the **server_certificate_script.sh** script
 - a. with the path of the IdM Certificate Authority certificate, **/etc/ipa/ca.crt**, as input if the IdM CA is the only certificate authority that has issued the certificates of the users you want to enable certificate authentication for:


```
# ./server_certificate_script.sh /etc/ipa/ca.crt
```

- b. with the paths leading to the relevant CA certificates as input if different external CAs signed the certificates of the users who you want to enable certificate authentication for:

```
# ./server_certificate_script.sh /tmp/ca1.pem /tmp/ca2.pem
```



NOTE

Do not forget to run the script on each new replica that you add to the system in the future if you want to have certificate authentication for users enabled in the whole topology.

9.2. REQUESTING A NEW USER CERTIFICATE AND EXPORTING IT TO THE CLIENT

As an Identity Management (IdM) administrator, you can create certificates for users in your IdM environment and export them to the IdM clients on which you want to enable certificate authentication for users.



NOTE

You can skip this section if the user you want to authenticate using a certificate already has a certificate.

Procedure

1. Optionally, create a new directory, for example `~/certdb/`, and make it a temporary certificate database. When asked, create an NSS Certificate DB password to encrypt the keys to the certificate to be generated in a subsequent step:

```
# mkdir ~/certdb/
# certutil -N -d ~/certdb/
Enter a password which will be used to encrypt your keys.
The password should be at least 8 characters long,
and should contain at least one non-alphabetic character.
```

```
Enter new password:
Re-enter password:
```

2. Create the certificate signing request (CSR) and redirect the output to a file. For example, to create a CSR with the name **certificate_request.csr** for a **4096** bit certificate for the **idm_user** user in the **IDM.EXAMPLE.COM** realm, setting the nickname of the certificate private keys to **idm_user** for easy findability, and setting the subject to **CN=idm_user,O=IDM.EXAMPLE.COM**:

```
# certutil -R -d ~/certdb/ -a -g 4096 -n idm_user -s "CN=idm_user,O=IDM.EXAMPLE.COM"
> certificate_request.csr
```

3. When prompted, enter the same password that you entered when using **certutil** to create the temporary database. Then continue typing randomly until told to stop:

Enter Password or Pin for "NSS Certificate DB":

A random seed must be generated that will be used in the creation of your key. One of the easiest ways to create a random seed is to use the timing of keystrokes on a keyboard.

To begin, type keys on the keyboard until this progress meter is full. DO NOT USE THE AUTOREPEAT FUNCTION ON YOUR KEYBOARD!

Continue typing until the progress meter is full:

4. Submit the certificate request file to the server. Specify the Kerberos principal to associate with the newly-issued certificate, the output file to store the certificate, and optionally the certificate profile. For example, to obtain a certificate of the **IECUserRoles** profile, a profile with added user roles extension, for the **idm_user@IDM.EXAMPLE.COM** principal, and save it in the **~/idm_user.pem** file:

```
# ipa cert-request certificate_request.csr --principal=idm_user@IDM.EXAMPLE.COM --
profile-id=IECUserRoles --certificate-out=~/idm_user.pem
```

5. Add the certificate to the NSS database. Use the **-n** option to set the same nickname that you used when creating the CSR previously so that the certificate matches the private key in the NSS database. The **-t** option sets the trust level. For details, see the `certutil(1)` man page. The **-i** option specifies the input certificate file. For example, to add to the NSS database a certificate with the **idm_user** nickname that is stored in the **~/idm_user.pem** file in the **~/certdb/** database:

```
# certutil -A -d ~/certdb/ -n idm_user -t "P,," -i ~/idm_user.pem
```

6. Verify that the key in the NSS database does not show (**orphan**) as its nickname. For example, to verify that the certificate stored in the **~/certdb/** database is not orphaned:

```
# certutil -K -d ~/certdb/
< 0> rsa      5ad14d41463b87a095b1896cf0068ccc467df395  NSS Certificate
DB:idm_user
```

7. Use the **pk12util** command to export the certificate from the NSS database to the PKCS12 format. For example, to export the certificate with the **idm_user** nickname from the **/root/certdb** NSS database into the **~/idm_user.p12** file:

```
# pk12util -d ~/certdb -o ~/idm_user.p12 -n idm_user
Enter Password or Pin for "NSS Certificate DB":
Enter password for PKCS12 file:
Re-enter password:
pk12util: PKCS12 EXPORT SUCCESSFUL
```

8. Transfer the certificate to the host on which you want the certificate authentication for **idm_user** to be enabled:

```
# scp ~/idm_user.p12 idm_user@client.idm.example.com:/home/idm_user/
```

9. On the host to which the certificate has been transferred, make the directory in which the .pkcs12 file is stored inaccessible to the 'other' group for security reasons:

```
# chmod o-rwx /home/idm_user/
```

10. For security reasons, remove the temporary NSS database and the .pkcs12 file from the server:

```
# rm ~/certdb/
# rm ~/idm_user.p12
```

9.3. MAKING SURE THE CERTIFICATE AND USER ARE LINKED TOGETHER



NOTE

You can skip this section if the user's certificate has been issued by the IdM CA.

For certificate authentication to work, you need to make sure that the certificate is linked to the user that will use it to authenticate to Identity Management (IdM).

- If the certificate is provided by a Certificate Authority that is not part of your Identity Management environment, link the user and the certificate following the procedure described in [Linking User Accounts to Certificates](#).
- If the certificate is provided by Identity Management CA, the certificate is already automatically added in the user entry and you do not have to link the certificate to the user account. For details on creating a new certificate in IdM, see [Section 9.2, "Requesting a new user certificate and exporting it to the client"](#).

9.4. CONFIGURING A BROWSER TO ENABLE CERTIFICATE AUTHENTICATION

To be able to authenticate with a certificate when using the WebUI to log into Identity Management (IdM), you need to import the user and the relevant certificate authority (CA) certificates into the Mozilla Firefox or Google Chrome browser. The host itself on which the browser is running does not have to be part of the IdM domain.

IdM supports the following browsers for connecting to the WebUI:

- Mozilla Firefox 38 and later
- Google Chrome 46 and later

The following procedure shows how to configure the Mozilla Firefox 57.0.1 browser.

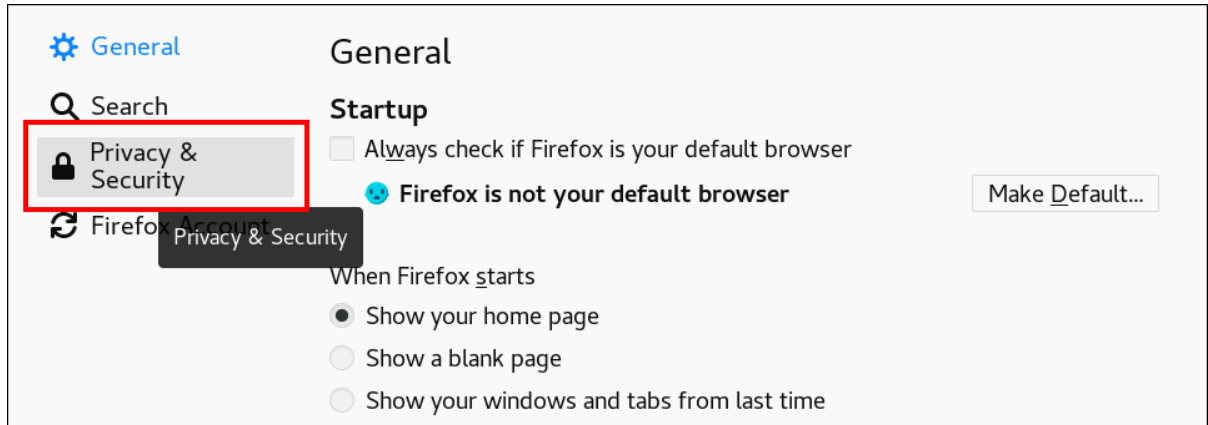
Prerequisites

- You have the [user certificate](#) that you want to import to the browser at your disposal in the PKCS#12 format.

Procedure

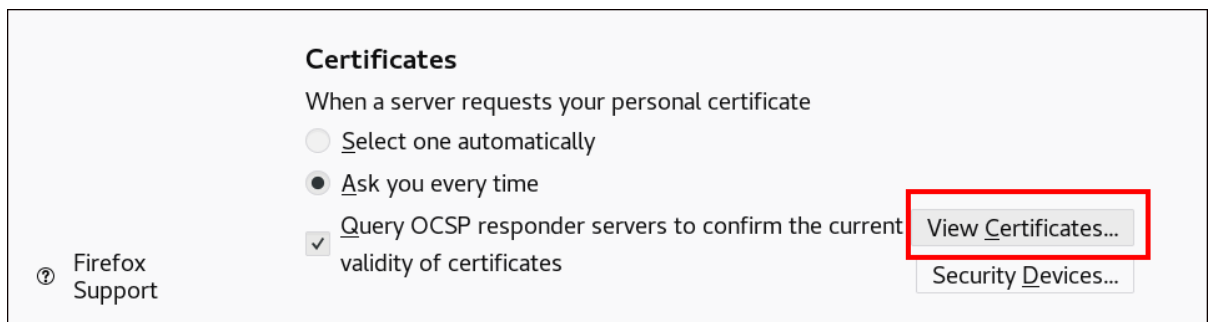
1. Open Firefox, then navigate to **Preferences → Privacy & Security**.

Figure 9.1. Privacy and Security section in Preferences



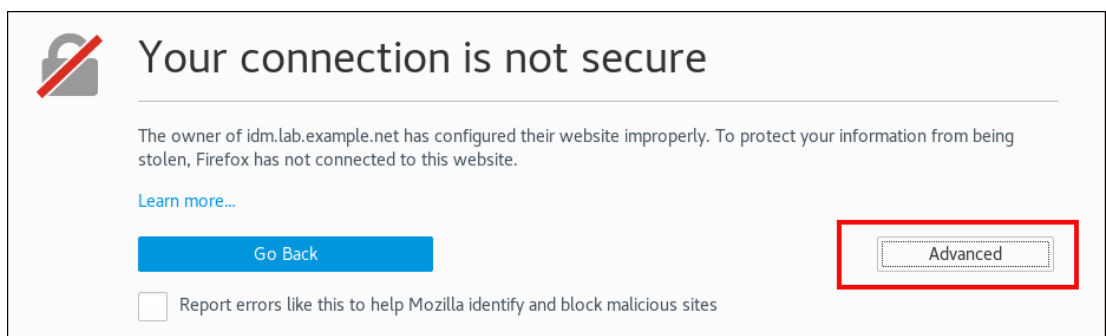
2. Click **View Certificates**.

Figure 9.2. View Certificates in Privacy and Security



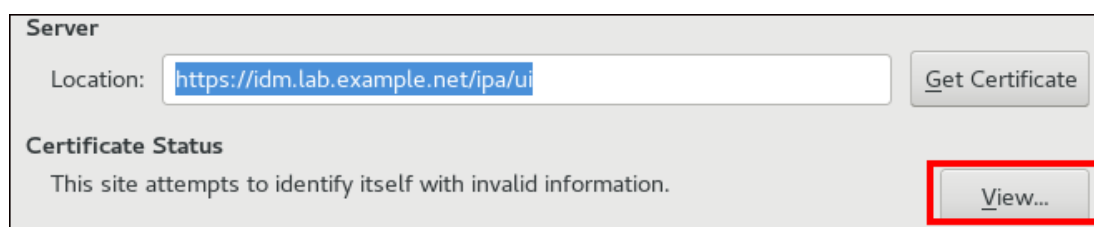
3. In the **Your Certificates** tab, click **Import**. Locate and open the certificate of the user in the PKCS12 format, then click **OK** and **OK**.
4. Make sure that the Identity Management Certificate Authority is recognized by Firefox as a trusted authority:
 - a. Save the IdM CA certificate locally:
 - Navigate to the IdM web UI by writing the name of your IdM server in the Firefox address bar. Click **Advanced** on the Insecure Connection warning page.

Figure 9.3. Insecure Connection



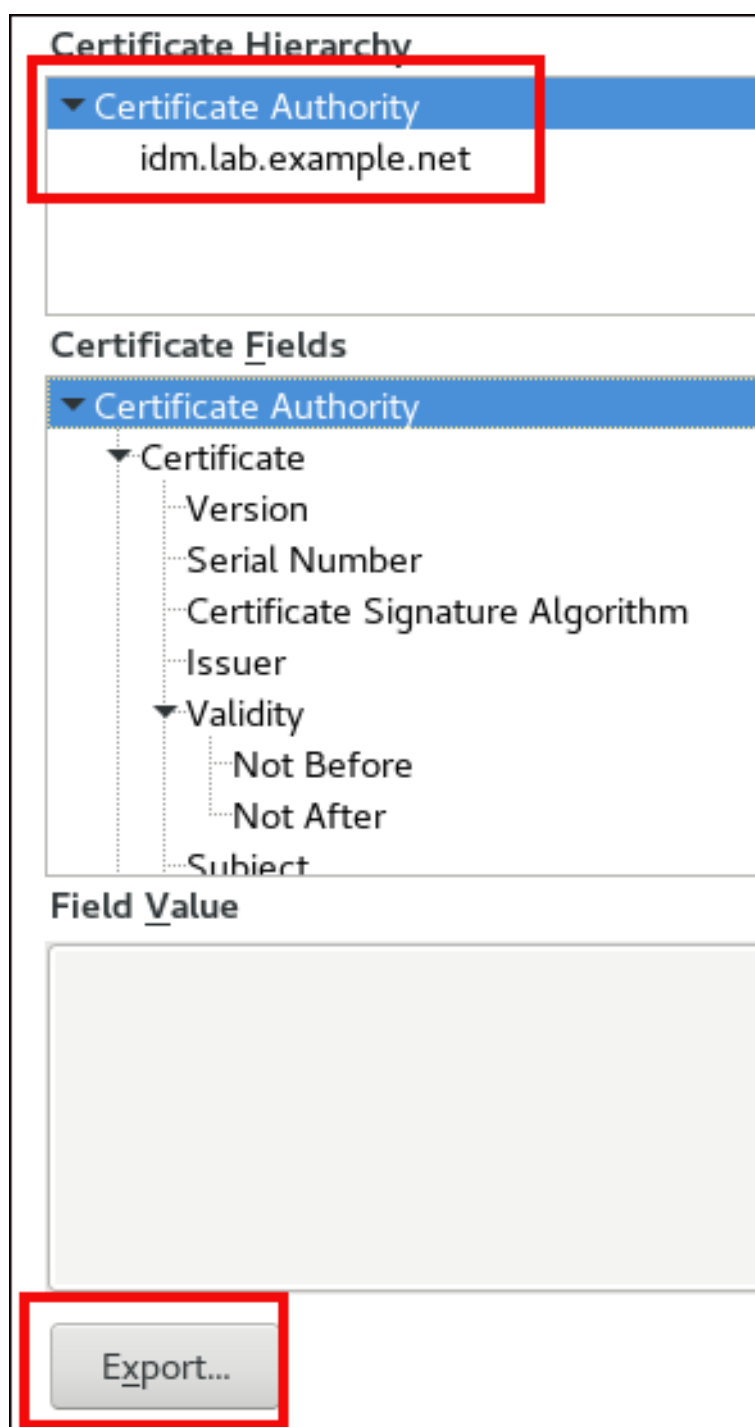
- **Add Exception.** Click **View**.

Figure 9.4. View the Details of a Certificate



- In the **Details** tab, highlight the **Certificate Authority** fields.

Figure 9.5. Exporting the CA Certificate

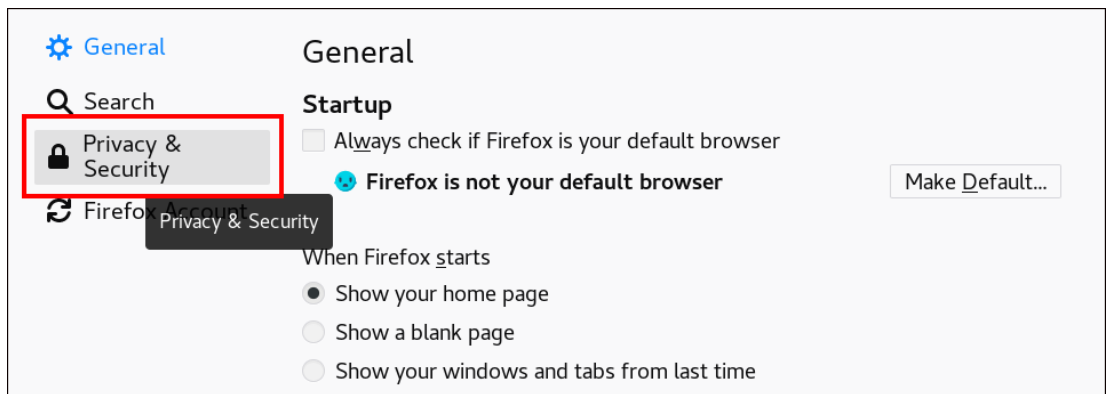


- Click **Export**. Save the CA certificate, for example as the **CertificateAuthority.crt** file, then click **Close**, and **Cancel**.

b. Import the IdM CA certificate to Firefox as a trusted certificate authority certificate:

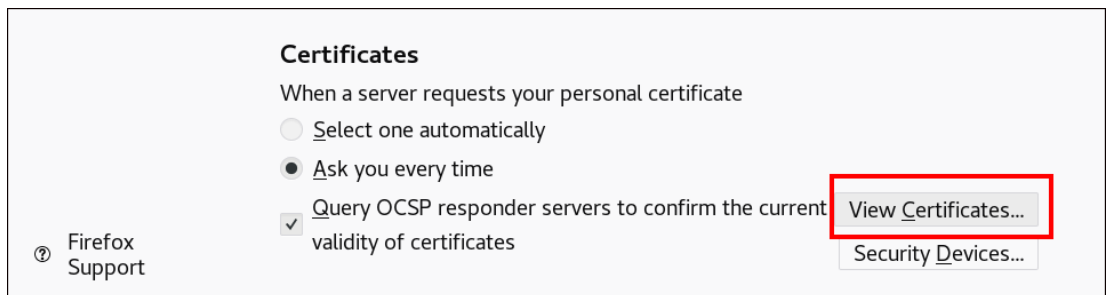
- Open Firefox, navigate to Preferences and click **Privacy & Security**.

Figure 9.6. Privacy and Security section in Preferences



- Click **View Certificates**.

Figure 9.7. View Certificates in Privacy and Security



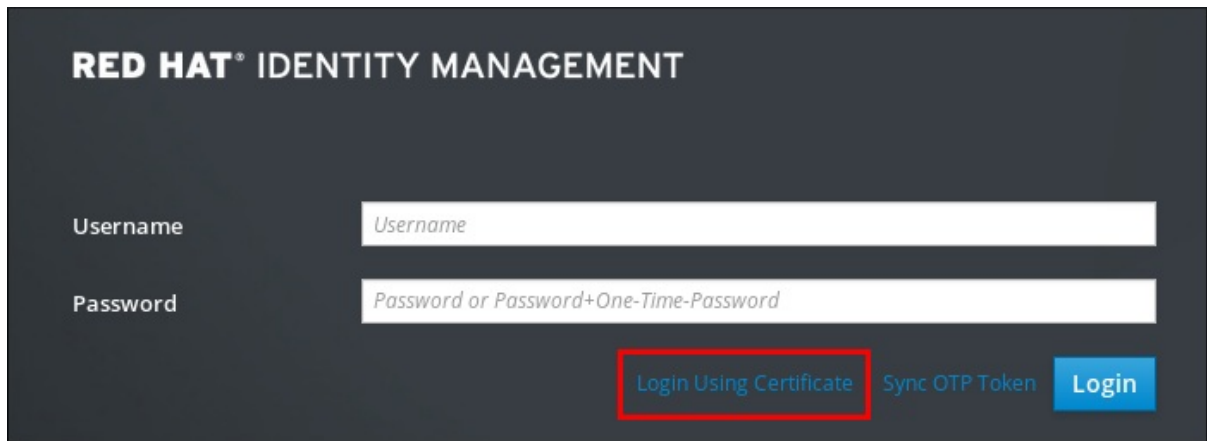
- In the **Authorities** tab, click **Import**. Locate and open the CA certificate that you saved in the previous step in the **CertificateAuthority.crt** file. Trust the certificate to identify websites, then click **OK** and **OK**.
5. Continue to [Authenticating to the Identity Management Web UI with a Certificate as an Identity Management User](#).

9.5. AUTHENTICATING TO THE IDENTITY MANAGEMENT WEB UI WITH A CERTIFICATE AS AN IDENTITY MANAGEMENT USER

This procedure describes authenticating as a user to the Identity Management (IdM) web UI using a certificate stored on the desktop of an Identity Management client.

Procedure

1. In the browser, navigate to the Identity Management web UI at, for example, **https://server.idm.example.com/ipa/ui**.
2. Click **Login Using Certificate**.
Login Using Certificate in the Identity Management web UI



The image shows the Red Hat Identity Management login page. It has a dark background with the title 'RED HAT® IDENTITY MANAGEMENT' at the top. Below the title, there are two input fields: 'Username' with a placeholder 'Username' and 'Password' with a placeholder 'Password or Password+One-Time-Password'. At the bottom right, there are three buttons: 'Login Using Certificate' (highlighted with a red rectangle), 'Sync OTP Token', and 'Login'.

3. The user's certificate should already be selected. Uncheck **Remember this decision**, then click **OK**.

You are now authenticated as the user who corresponds to the certificate.

Additional resources

- For information about authenticating to the IdM web UI using a certificate stored on a smart card, see [Configuring Identity Management for smart card authentication](#).

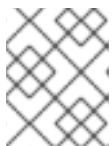
9.6. CONFIGURING AN IDM CLIENT TO ENABLE AUTHENTICATING TO THE CLI USING A CERTIFICATE

To make certificate authentication work for an IdM user in the Command Line Interface (CLI) of your IdM client, import the IdM user's certificate and the private key to the IdM client. For details on creating and transferring the user certificate, see [Section 9.2, "Requesting a new user certificate and exporting it to the client"](#).

Procedure

- Log into the IdM client and have the .p12 file containing the user's certificate and the private key ready. To obtain and cache the Kerberos ticket granting ticket (TGT), run the **kinit** command with the user's principal, using the **-X** option with the **X509_username:/path/to/file.p12** attribute to specify where to find the user's X509 identity information. For example, to obtain the TGT for **idm_user** using the user's identity information stored in the **~/idm_user.p12** file:

```
$ kinit -X X509_idm_user='PKCS12:~/idm_user.p12' idm_user
```



NOTE

The command also supports the .pem file format: **kinit -X X509_username='FILE:/path/to/cert.pem,/path/to/key' user_principal**

CHAPTER 10. USING IDM CA RENEWAL SERVER

10.1. EXPLANATION OF IDM CA RENEWAL SERVER

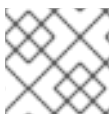
In an Identity Management (IdM) deployment that uses an embedded certificate authority (CA), the CA renewal server maintains and renews IdM system certificates. It ensures robust IdM deployments.

IdM system certificates include:

- **IdM CA** certificate
- **OCSF** signing certificate
- **IdM CA subsystem** certificates
- **IdM CA audit signing** certificate
- **IdM renewal agent** (RA) certificate
- **KRA** transport and storage certificates

What characterizes system certificates is that their keys are shared by all CA replicas. In contrast, the IdM service certificates (for example, **LDAP**, **HTTP** and **PKINIT** certificates), have different keypairs and subject names on different IdM CA servers.

In IdM topology, by default, the first IdM CA server is the CA renewal server.



NOTE

In upstream documentation, the IdM CA is called **Dogtag**.

The role of the CA renewal server

The **IdM CA**, **IdM CA subsystem**, and **IdM RA** certificates are crucial for IdM deployment. Each certificate is stored in an NSS database in the `/etc/pki/pki-tomcat/` directory and also as an LDAP database entry. The certificate stored in LDAP must match the certificate stored in the NSS database. If they do not match, authentication failures occur between the IdM framework and IdM CA, and between IdM CA and LDAP.

All IdM CA replicas have tracking requests for every system certificate. If an IdM deployment with integrated CA does not contain a CA renewal server, each IdM CA server requests the renewal of system certificates independently. This results in different CA replicas having various system certificates and authentication failures occurring.

Appointing one CA replica as the renewal server allows the system certificates to be renewed exactly once, when required, and thus prevents authentication failures.

The role of the **certmonger** service on CA replicas

The **certmonger** service running on all IdM CA replicas uses the **dogtag-ipa-ca-renew-agent** renewal helper to keep track of IdM system certificates. The renewal helper program reads the CA renewal server configuration. On each CA replica that is not the CA renewal server, the renewal helper retrieves the latest system certificates from the **ca_renewal** LDAP entries. Due to non-determinism in when exactly **certmonger** renewal attempts occur, the **dogtag-ipa-ca-renew-agent** helper sometimes attempts to update a system certificate before the CA renewal server has actually renewed the certificate. If this happens, the old, soon-to-expire certificate is returned to the **certmonger** service on

the CA replica. The **certmonger** service, realizing it is the same certificate that is already stored in its database, keeps attempting to renew the certificate with some delay between individual attempts until it can retrieve the updated certificate from the CA renewal server.

The correct functioning of IdM CA renewal server

An IdM deployment with an embedded CA is an IdM deployment that was installed with an IdM CA – or whose IdM CA server was installed later. An IdM deployment with an embedded CA must at all times have exactly one CA replica configured as the renewal server. The renewal server must be online and fully functional, and must replicate properly with the other servers.

If the current CA renewal server is being deleted using the **ipa server-del**, **ipa-replica-manage del**, **ipa-csreplica-manage del** or **ipa-server-install --uninstall** commands, another CA replica is automatically assigned as the CA renewal server. This policy ensures that the renewal server configuration remains valid.

This policy does not cover the following situations:

- **Offline renewal server**

If the renewal server is offline for an extended duration, it may miss a renewal window. In this situation, all nonrenewal CA servers keep reinstalling the current system certificates until the certificates expire. When this occurs, the IdM deployment is disrupted because even one expired certificate can cause renewal failures for other certificates.

To prevent this situation: if your current renewal server is offline and unavailable for an extended period of time, consider [assigning a new CA renewal server manually](#).

- **Replication problems**

If replication problems exist between the renewal server and other CA replicas, renewal might succeed, but the other CA replicas might not be able to retrieve the updated certificates before they expire.

To prevent this situation, make sure that your replication agreements are working correctly. For details, see [general](#) or [specific](#) replication troubleshooting guidelines in the RHEL 7 *Linux Domain Identity, Authentication, and Policy Guide*.

10.2. CHANGING AND RESETTING IDM CA RENEWAL SERVER

When a certificate authority (CA) renewal server is being decommissioned, Identity Management (IdM) automatically selects a new CA renewal server from the list of IdM CA servers. The system administrator cannot influence the selection.

To be able to select the new IdM CA renewal server, the system administrator must perform the replacement manually. Choose the new CA renewal server before starting the process of decommissioning the current renewal server.

If the current CA renewal server configuration is invalid, reset the IdM CA renewal server.

Complete this procedure to change or reset the CA renewal server.

Prerequisites

- You have the IdM administrator credentials.

Procedure

1. Obtain the IdM administrator credentials:

```
~]$ kinit admin
Password for admin@IDM.EXAMPLE.COM:
```

2. Optionally, to find out which IdM servers in the deployment have the CA role necessary to be eligible to become the new CA renewal server:

```
~]$ ipa server-role-find --role 'CA server'
-----
2 server roles matched
-----
Server name: server.idm.example.com
Role name: CA server
Role status: enabled

Server name: replica.idm.example.com
Role name: CA server
Role status: enabled
-----
Number of entries returned 2
-----
```

There are two CA servers in the deployment.

3. Optionally, to find out which CA server is the current CA renewal server, enter:

```
~]$ ipa config-show | grep 'CA renewal'
IPA CA renewal master: server.idm.example.com
```

The current renewal server is **server.idm.example.com**.

4. To change the renewal server configuration, use the **ipa config-mod** utility with the **--ca-renewal-master-server** option:

```
~]$ ipa config-mod --ca-renewal-master-server replica.idm.example.com | grep 'CA renewal'
IPA CA renewal master: replica.idm.example.com
```

IMPORTANT

You can also switch to a new CA renewal server using:

- the **ipa-cacert-manage --renew** command. This command both renews the CA certificate *and* makes the CA server on which you execute the command the new CA renewal server.
 - the **ipa-cert-fix** command. This command recovers the deployment when expired certificates are causing failures. It also makes the CA server on which you execute the command the new CA renewal server.
- For details, see [Renewing expired system certificates when IdM is offline](#) .

10.3. SWITCHING FROM AN EXTERNALLY TO SELF-SIGNED CA IN IDM

Complete this procedure to switch from an externally-signed to a self-signed certificate of the Identity Management (IdM) certificate authority (CA). With a self-signed CA, the renewal of the CA certificate is

managed automatically: a system administrator does not need to submit a certificate signing request (CSR) to an external authority.

Switching from an externally-signed to a self-signed CA replaces only the CA certificate. The certificates signed by the previous CA are still valid and still in use. For example, the certificate chain for the **LDAP** certificate remains unchanged even after you have moved to a self-signed CA:

external_CA certificate > **IdM CA** certificate > **LDAP** certificate

Prerequisites

- You have root access to the IdM CA renewal server.
- You have the IdM administrator credentials.

Procedure

1. On the IdM CA renewal server, renew the CA certificate as self-signed:

```
~]# ipa-cacert-manage renew --self-signed
Renewing CA certificate, please wait
CA certificate successfully renewed
The ipa-cacert-manage command was successful
```

2. On all the IdM servers and clients, update the local IdM certificate databases with the certificates from the server:

```
[client ~]$ kinit admin
[client ~]$ ipa-certupdate
Systemwide CA database updated.
Systemwide CA database updated.
The ipa-certupdate command was successful
```

3. Optionally, to check if your update has been successful and the new CA certificate has been added to the **/etc/ipa/ca.crt** file:

```
[client ~]$ openssl crl2pkcs7 -nocrl -certfile /etc/ipa/ca.crt | openssl pkcs7 -print_certs -
text -noout
[...]
Certificate:
  Data:
    Version: 3 (0x2)
    Serial Number: 39 (0x27)
    Signature Algorithm: sha256WithRSAEncryption
    Issuer: O=IDM.EXAMPLE.COM, CN=Certificate Authority
    Validity
      Not Before: Jul  1 16:32:45 2019 GMT
      Not After : Jul  1 16:32:45 2039 GMT
    Subject: O=IDM.EXAMPLE.COM, CN=Certificate Authority
  [...]

```

The output shows that the update has been successful as the new CA certificate is listed with the older CA certificates.

10.4. RENEWING THE IDM CA RENEWAL SERVER WITH AN EXTERNALLY-SIGNED CERTIFICATE

This section describes how to renew the Identity Management (IdM) certificate authority (CA) certificate using an external CA to sign the certificate signing request (CSR). In this configuration, your IdM CA server is a subCA of the external CA. The external CA can, but does not have to, be an Active Directory Certificate Server (AD CS).

If the external certificate authority is AD CS, you can specify the template you want for the IdM CA certificate in the CSR. A certificate template defines the policies and rules that a CA uses when a certificate request is received. Certificate templates in AD correspond to certificate profiles in IdM.

You can define a specific AD CS template by its Object Identifier (OID). OIDs are unique numeric values issued by various issuing authorities to uniquely identify data elements, syntaxes, and other parts of distributed applications.

Alternatively, you can define a specific AD CS template by its name. For example, the name of the default profile used in a CSR submitted by an IdM CA to an AD CS is **subCA**.

To define a profile by specifying its OID or name in the CSR, use the **external-ca-profile** option. For details, see the **ipa-cacert-manage** man page.

Apart from using a ready-made certificate template, you can also create a custom certificate template in the AD CS, and use it in the CSR.

Prerequisites

- You have root access to the IdM CA renewal server.
- You have the IdM administrator credentials.

Procedure

Complete this procedure to renew the certificate of the IdM CA with external signing, regardless of whether current CA certificate is self-signed or externally-signed.

1. Create a CSR to be submitted to the external CA:

- If the external CA is an AD CS, use the **--external-ca-type=ms-cs** option. If you want a different template than the default **subCA** template, specify it using the **--external-ca-profile** option:

```
~]# ipa-cacert-manage renew --external-ca --external-ca-type=ms-cs [--external-ca-profile=PROFILE]
Exporting CA certificate signing request, please wait
The next step is to get /var/lib/ipa/ca.csr signed by your CA and re-run ipa-cacert-manage
as:
ipa-cacert-manage renew --external-cert-file=/path/to/signed_certificate --external-cert-
file=/path/to/external_ca_certificate
The ipa-cacert-manage command was successful
```

- If the external CA is not an AD CS:

```
~]# ipa-cacert-manage renew --external-ca
Exporting CA certificate signing request, please wait
The next step is to get /var/lib/ipa/ca.csr signed by your CA and re-run ipa-cacert-manage
```

```
as:
ipa-cacert-manage renew --external-cert-file=/path/to/signed_certificate --external-cert-
file=/path/to/external_ca_certificate
The ipa-cacert-manage command was successful
```

The output shows that a CSR has been created and is stored in the **/var/lib/ipa/ca.csr** file.

2. Submit the CSR located in **/var/lib/ipa/ca.csr** to the external CA. The process differs depending on the service to be used as the external CA.
3. Retrieve the issued certificate and the CA certificate chain for the issuing CA in a base 64-encoded blob, which is:

- a PEM file if the external CA is not an AD CS.
- a Base_64 certificate if the external CA is an AD CS.

The process differs for every certificate service. Usually, a download link on a web page or in the notification email allows the administrator to download all the required certificates.

If the external CA is an AD CS and you have submitted the CSR with a known template through the Microsoft Windows Certification Authority management window, the AD CS issues the certificate immediately and the Save Certificate dialog appears in the AD CS web interface, asking where to save the issued certificate.

4. Run the **ipa-cacert-manage renew** command again, adding all the CA certificate files required to supply a full certificate chain. Specify as many files as you need, using the **--external-cert-file** option multiple times:

```
~]# ipa-cacert-manage renew --external-cert-file=/path/to/signed_certificate --external-
cert-file=/path/to/external_ca_certificate_1 --external-cert-
file=/path/to/external_ca_certificate_2
```

5. On all the IdM servers and clients, update the local IdM certificate databases with the certificates from the server:

```
[client ~]$ kinit admin
[client ~]$ ipa-certupdate
Systemwide CA database updated.
Systemwide CA database updated.
The ipa-certupdate command was successful
```

6. Optionally, to check if your update has been successful and the new CA certificate has been added to the **/etc/ipa/ca.crt** file:

```
[client ~]$ openssl crl2pkcs7 -nocrl -certfile /etc/ipa/ca.crt | openssl pkcs7 -print_certs -
text -noout
[...]
Certificate:
  Data:
    Version: 3 (0x2)
    Serial Number: 39 (0x27)
    Signature Algorithm: sha256WithRSAEncryption
    Issuer: O=IDM.EXAMPLE.COM, CN=Certificate Authority
    Validity
      Not Before: Jul  1 16:32:45 2019 GMT
```

```
Not After : Jul  1 16:32:45 2039 GMT
Subject: O=IDM.EXAMPLE.COM, CN=Certificate Authority
[...]
```

The output shows that the update has been successful as the new CA certificate is listed with the older CA certificates.

CHAPTER 11. RENEWING EXPIRED SYSTEM CERTIFICATES WHEN IDM IS OFFLINE

When a system certificate has expired, Identity Management (IdM) fails to start. IdM supports renewing system certificates when IdM is offline using the **ipa-cert-fix** tool.

Prerequisites

- IdM is installed only on Red Hat Enterprise Linux 8.1 or later

11.1. RENEWING EXPIRED SYSTEM CERTIFICATES ON A CA RENEWAL SERVER

This section describes how to apply the **ipa-cert-fix** tool on expired IdM certificates.



IMPORTANT

If you run the **ipa-cert-fix** tool on a CA (Certificate Authority) host that is not the CA renewal server, and the utility renews shared certificates, that host automatically becomes the new CA renewal server in the domain. There must always be only one CA renewal server in the domain to avoid inconsistencies.

Prerequisites

- Log in to the server with administration rights

Procedure

1. Start the **ipa-cert-fix** tool to analyze the system and list expired certificates that require renewal:

```
# ipa-cert-fix
...
The following certificates will be renewed:

Dogtag sslserver certificate:
  Subject: CN=ca1.example.com,O=EXAMPLE.COM 201905222205
  Serial: 13
  Expires: 2019-05-12 05:55:47
...
Enter "yes" to proceed:
```

2. Enter **yes** to start the renewal process:

```
Enter "yes" to proceed: yes
Proceeding.
Renewed Dogtag sslserver certificate:
  Subject: CN=ca1.example.com,O=EXAMPLE.COM 201905222205
  Serial: 268369925
  Expires: 2021-08-14 02:19:33
...
```

```
Becoming renewal master.
The ipa-cert-fix command was successful
```

It can take up to one minute before **ipa-cert-fix** renews all expired certificates.

3. Optionally, verify that all services are now running:

```
# ipactl status
Directory Service: RUNNING
krb5kdc Service: RUNNING
kadmin Service: RUNNING
httpd Service: RUNNING
ipa-custodia Service: RUNNING
pki-tomcatd Service: RUNNING
ipa-otpd Service: RUNNING
ipa: INFO: The ipactl command was successful
```

At this point, certificates have been renewed and services are running. The next step is to check other servers in the IdM domain.

11.2. VERIFYING OTHER IDM SERVERS IN THE IDM DOMAIN AFTER RENEWAL

After the renewing the CA renewal server's certificates with the **ipa-cert-fix** tool, you must:

- Restart all other Identity Management (IdM) servers in the domain.
- Check if certmonger renewed certificates.
- If there are other Certificate Authority (CA) replicas with expired system certificates, renew those certificates with the **ipa-cert-fix** tool as well.

Prerequisites

- Log in to the server with administration rights.

Procedure

1. Restart IdM with the **--force** parameter:

```
# ipactl restart --force
```

With the **--force** parameter, the **ipactl** utility ignores individual service startup failures. For example, if the server is also a CA with expired certificates, the **pki-tomcat** service fails to start. This is expected and ignored because of using the **--force** parameter.

2. After the restart, verify that the **certmonger** service renewed the certificates (certificate status says MONITORING):

```
# getcert list | egrep '^Request|status:|subject:'
Request ID '20190522120745':
  status: MONITORING
  subject: CN=IPA RA,O=EXAMPLE.COM 201905222205
```



```
Request ID '20190522120834':
  status: MONITORING
  subject: CN=Certificate Authority,O=EXAMPLE.COM 201905222205
...
```

It can take some time before **certmonger** renews the shared certificates on the replica.

3. If the server is also a CA, the previous command reports **CA_UNREACHABLE** for the certificate the **pki-tomcat** service uses:

```
Request ID '20190522120835':
  status: CA_UNREACHABLE
  subject: CN=ca2.example.com,O=EXAMPLE.COM 201905222205
...
```

4. To renew this certificate, use the **ipa-cert-fix** utility:

```
# ipa-cert-fix
Dogtag sslserver certificate:
  Subject: CN=ca2.example.com,O=EXAMPLE.COM
  Serial: 3
  Expires: 2019-05-11 12:07:11

Enter "yes" to proceed: yes
Proceeding.
Renewed Dogtag sslserver certificate:
  Subject: CN=ca2.example.com,O=EXAMPLE.COM 201905222205
  Serial: 15
  Expires: 2019-08-14 04:25:05

The ipa-cert-fix command was successful
```

Now, all IdM certificates have been renewed and work correctly.

CHAPTER 12. GENERATING CRL ON THE IDM CA SERVER

If your IdM deployment uses an embedded certificate authority (CA), you may need to move generating the Certificate Revocation List (CRL) from one Identity Management (IdM) server to another. It can be necessary, for example, when you want to migrate the server to another system.

Only configure one server to generate the CRL. The IdM server that performs the CRL publisher role is usually the same server that performs the CA renewal server role, but this is not mandatory. Before you decommission the CRL publisher server, select and configure another server to perform the CRL publisher server role.

This chapter describes:

- Stopping CRL generation on the IdM server.
- Starting to generate CRL on the IdM replica.

12.1. STOPPING CRL GENERATION ON AN IDM SERVER

To stop generating the Certificate Revocation List (CRL) on the IdM CRL publisher server, use the **ipa-crlgen-manage** command. Before you disable the generation, verify that the server really generates CRL. You can then disable it.

Prerequisites

- Identity Management (IdM) server is installed on the RHEL 8.1 system or newer.
- You must be logged in as root.

Procedure

1. Check if your server is generating the CRL:

```
[root@server ~]# ipa-crlgen-manage status
CRL generation: enabled
Last CRL update: 2019-10-31 12:00:00
Last CRL Number: 6
The ipa-crlgen-manage command was successful
```

2. Stop generating the CRL on the server:

```
[root@server ~]# ipa-crlgen-manage disable
Stopping pki-tomcatd
Editing /var/lib/pki/pki-tomcat/conf/ca/CS.cfg
Starting pki-tomcatd
Editing /etc/httpd/conf.d/ipa-pki-proxy.conf
Restarting httpd
CRL generation disabled on the local host. Please make sure to configure CRL generation on
another master with ipa-crlgen-manage enable.
The ipa-crlgen-manage command was successful
```

3. Check if the server stopped generating CRL:

```
[root@server ~]# ipa-crlgen-manage status
```

The server stopped generating the CRL. The next step is to enable CRL generation on the new RHEL 8 server.

12.2. STARTING CRL GENERATION ON AN IDM REPLICA SERVER

You can start generating the Certificate Revocation List (CRL) on an IdM CA server with the **ipa-crlgen-manage** command.

Prerequisites

- Identity Management (IdM) server is installed on the RHEL 8.1 system or newer.
- The RHEL system must be an IdM Certificate Authority server.
- You must be logged in as root.

Procedure

1. Start generating the CRL:

```
[root@replica1 ~]# ipa-crlgen-manage enable
Stopping pki-tomcatd
Editing /var/lib/pki/pki-tomcat/conf/ca/CS.cfg
Starting pki-tomcatd
Editing /etc/httpd/conf.d/ipa-pki-proxy.conf
Restarting httpd
Forcing CRL update
CRL generation enabled on the local host. Please make sure to have only a single CRL
generation master.
The ipa-crlgen-manage command was successful
```

2. Check if the CRL is generated:

```
[root@replica1 ~]# ipa-crlgen-manage status
CRL generation: enabled
Last CRL update: 2019-10-31 12:10:00
Last CRL Number: 7
The ipa-crlgen-manage command was successful
```

CHAPTER 13. OBTAINING AN IDM CERTIFICATE FOR A SERVICE USING CERTMONGER

13.1. CERTMONGER OVERVIEW

What **certmonger** does

When Identity Management (IdM) is installed with an integrated IdM Certificate Authority (CA), it uses the **certmonger** service to track and renew system and service certificates. When the certificate is reaching its expiration date, **certmonger** manages the renewal process by:

- regenerating a certificate-signing request (CSR) using the options provided in the original request.
- submitting the CSR to the IdM CA using the IdM API **cert-request** command.
- receiving the certificate from the IdM CA.
- executing a pre-save command if specified by the original request.
- installing the new certificate in the location specified in the renewal request: either in an **NSS** database or in a file.
- executing a post-save command if specified by the original request. For example, the post-save command can instruct **certmonger** to restart a relevant service, so that the service picks up the new certificate.

Types of certificates **certmonger** tracks

Certificates can be divided into system and service certificates.

Unlike service certificates (for example, for **HTTP**, **LDAP** and **PKINIT**), which have different keypairs and subject names on different servers, IdM system certificates and their keys are shared by all CA replicas. The IdM system certificates include:

- **IdM CA** certificate
- **OCSP** signing certificate
- **IdM CA subsystem** certificates
- **IdM CA audit signing** certificate
- **IdM renewal agent** (RA) certificate
- **KRA** transport and storage certificates

The **certmonger** service tracks the IdM system and service certificates that were requested during the installation of IdM environment with an integrated CA. **Certmonger** also tracks certificates that have been requested manually by the system administrator for other services running on the IdM host. **Certmonger** does not track external CA certificates or user certificates.

Certmonger components

The **certmonger** service consists of two main components:

- The **certmonger daemon**, which is the engine tracking the list of certificates and launching renewal commands

- The **getcert** utility for the **command-line interface** (CLI), which allows the system administrator to actively send commands to the **certmonger** daemon.

More specifically, the system administrator can use the **getcert** utility to:

- [Request a new certificate](#)
- [View the list of certificates that **certmonger** tracks](#)
- [Start or stop tracking a certificate](#)
- [Renew a certificate](#)

13.2. OBTAINING AN IDM CERTIFICATE FOR A SERVICE USING CERTMONGER

To ensure that communication between browsers and the web service running on your Identity Management (IdM) client is secure and encrypted, use a TLS certificate. Obtain the TLS certificate for your web service from the IdM Certificate Authority (CA).

This section describes how to use **certmonger** to obtain an IdM certificate for a service (**HTTP/my_company.idm.example.com@IDM.EXAMPLE.COM**) running on an IdM client.

Using **certmonger** to request the certificate automatically means that **certmonger** manages and renews the certificate when it is due for a renewal.

For a visual representation of what happens when **certmonger** requests a service certificate, see [Section 13.3, “Communication flow for certmonger requesting a service certificate”](#).

Prerequisites

- The web server is enrolled as an IdM client.
- You have root access to the IdM client on which you are running the procedure.
- The service for which you are requesting a certificate does not have to pre-exist in IdM.

Procedure

1. On the **my_company.idm.example.com** IdM client on which the **HTTP** service is running, request a certificate for the service corresponding to the **HTTP/my_company.idm.example.com@IDM.EXAMPLE.COM** principal, and specify that
 - The certificate is to be stored in the local **/etc/pki/tls/certs/httpd.pem** file
 - The private key is to be stored in the local **/etc/pki/tls/private/httpd.key** file
 - That an extensionRequest for a **SubjectAltName** be added to the signing request with the DNS name of **my_company.idm.example.com**:

```
# ipa-getcert request -K HTTP/my_company.idm.example.com -k
/etc/pki/tls/private/httpd.key -f /etc/pki/tls/certs/httpd.pem -g 2048 -D
my_company.idm.example.com -C "systemctl restart httpd"
New signing request "20190604065735" added.
```

In the command above:

- The **ipa-getcert request** command specifies that the certificate is to be obtained from the IdM CA. The **ipa-getcert request** command is a shortcut for **getcert request -c IPA**.
- The **-g** option specifies the size of key to be generated if one is not already in place.
- The **-D** option specifies the **SubjectAltName** DNS value to be added to the request.
- The **-C** option instructs **certmonger** to restart the **httpd** service after obtaining the certificate.
- To specify that the certificate be issued with a particular profile, use the **-T** option.
- To request a certificate using the named issuer from the specified CA, use the **-X ISSUER** option.

**NOTE**

RHEL 8 uses a different SSL module in Apache than the one used in RHEL 7. The SSL module relies on OpenSSL rather than NSS. For this reason, in RHEL 8 you cannot use an NSS database to store the **HTTPS** certificate and the private key.

2. Optionally, to check the status of your request:

```
# ipa-getcert list -f /etc/pki/tls/certs/httpd.pem
Number of certificates and requests being tracked: 3.
Request ID '20190604065735':
  status: MONITORING
  stuck: no
  key pair storage: type=FILE,location='/etc/pki/tls/private/httpd.key'
  certificate: type=FILE,location='/etc/pki/tls/certs/httpd.crt'
  CA: IPA
[...]
```

The output shows that the request is in the **MONITORING** status, which means that a certificate has been obtained. The locations of the key pair and the certificate are those requested.

13.3. COMMUNICATION FLOW FOR CERTMONGER REQUESTING A SERVICE CERTIFICATE

The diagrams in this section show the stages of what happens when **certmonger** requests a service certificate from Identity Management (IdM) certificate authority (CA) server. The sequence consists of these diagrams:

- [Figure 13.1, “Unencrypted communication”](#)
- [Figure 13.2, “Certmonger requesting a service certificate”](#)
- [Figure 13.3, “IdM CA issuing the service certificate”](#)
- [Figure 13.4, “Certmonger applying the service certificate”](#)
- [Figure 13.5, “Certmonger requesting a new certificate when the old one is nearing expiration”](#)

Figure 13.1, “Unencrypted communication” shows the initial situation: without an HTTPS certificate, the communication between the web server and the browser is unencrypted.

Figure 13.1. Unencrypted communication

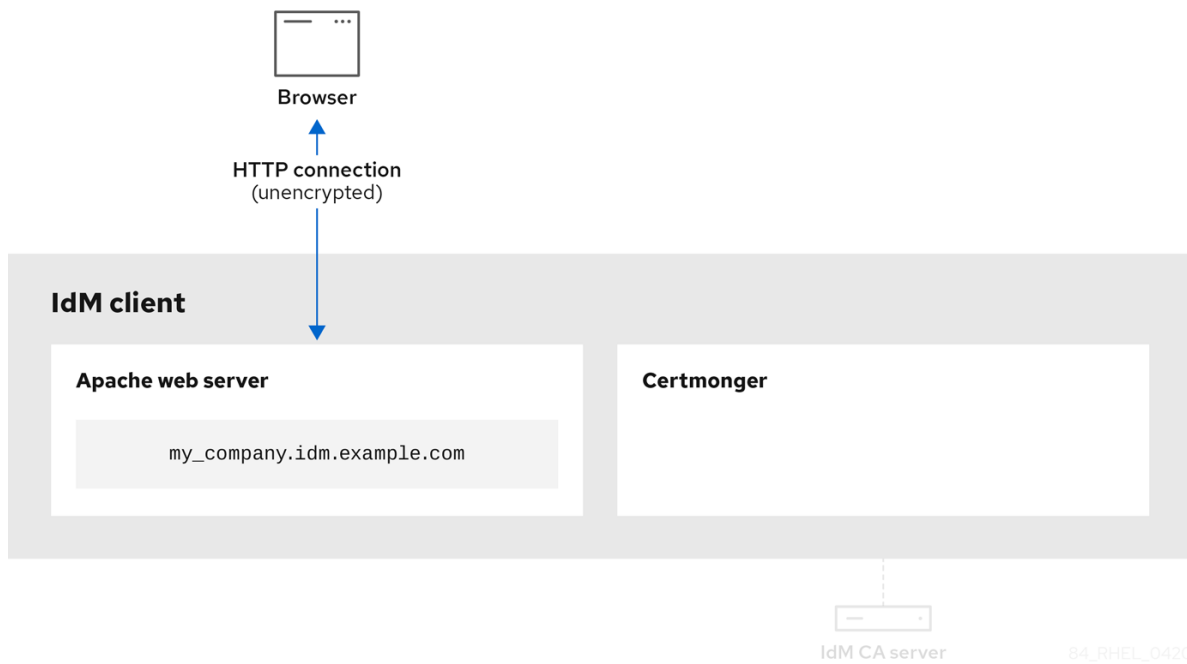


Figure 13.2, “Certmonger requesting a service certificate” shows the system administrator using **certmonger** to manually request an HTTPS certificate for the Apache web server. Note that when requesting a web server certificate, certmonger does not communicate directly with the CA. It proxies through IdM.

Figure 13.2. Certmonger requesting a service certificate

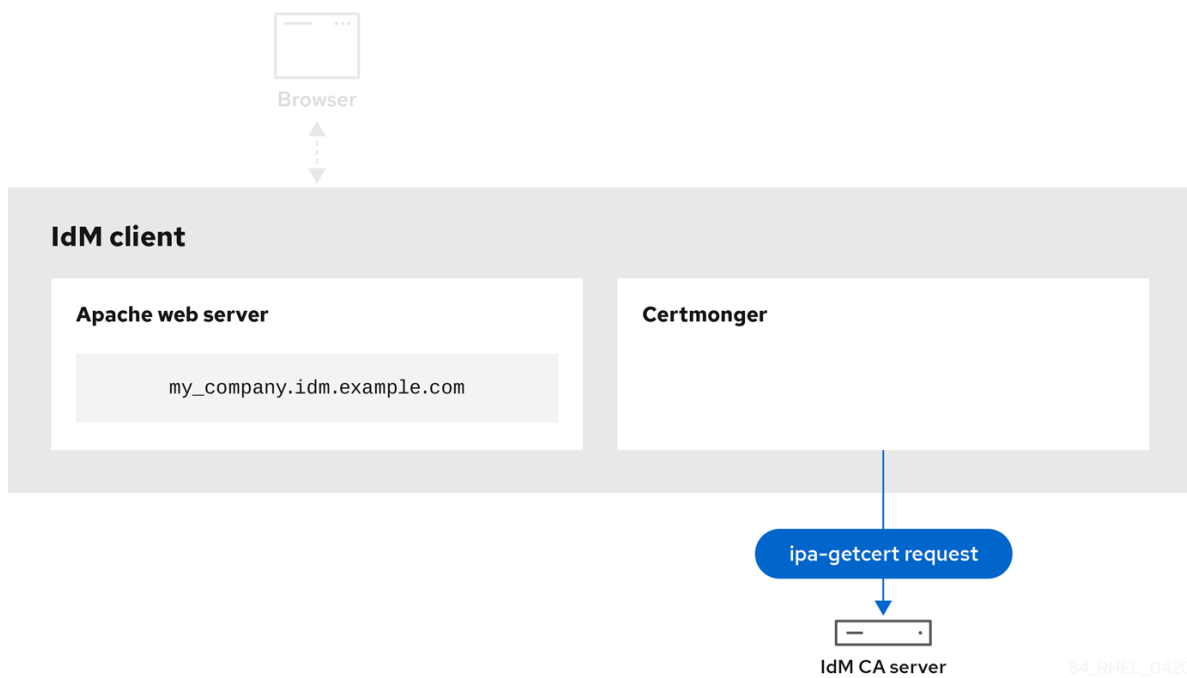


Figure 13.3, “IdM CA issuing the service certificate” shows an IdM CA issuing an HTTPS certificate for the web server.

Figure 13.3. IdM CA issuing the service certificate

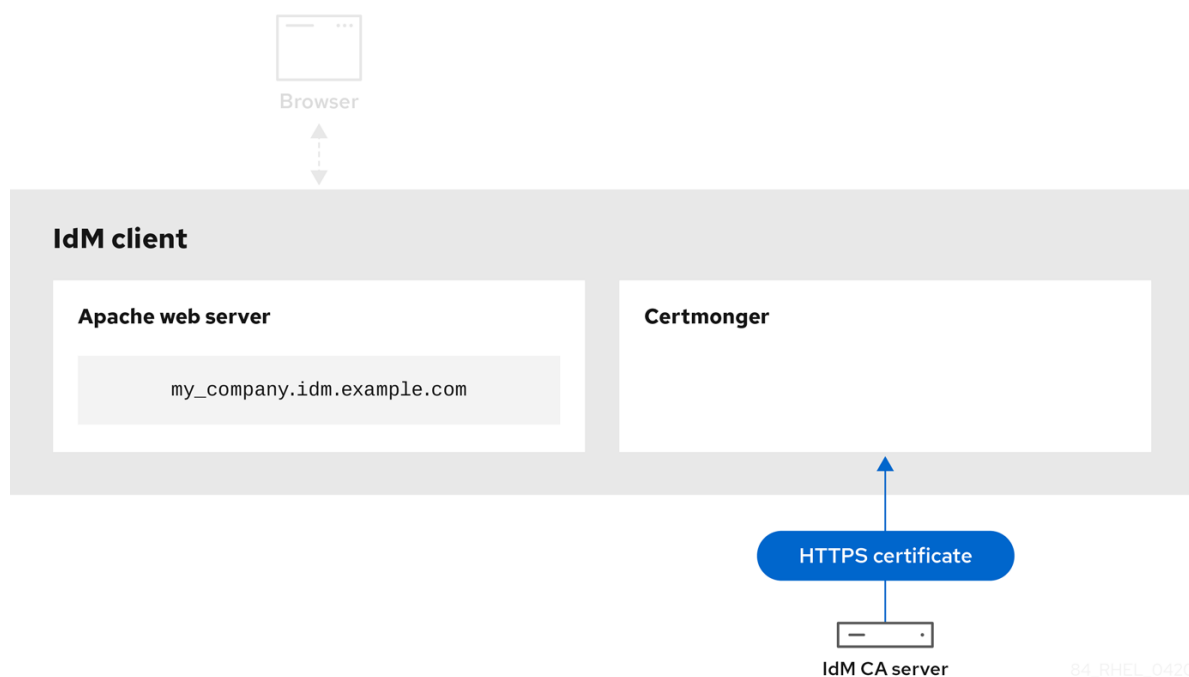


Figure 13.4, “Certmonger applying the service certificate” shows **certmonger** placing the HTTPS certificate in appropriate locations on the IdM client and, if instructed to do so, restarting the **httpd** service. The Apache server subsequently uses the HTTPS certificate to encrypt the traffic between itself and the browser.

Figure 13.4. Certmonger applying the service certificate

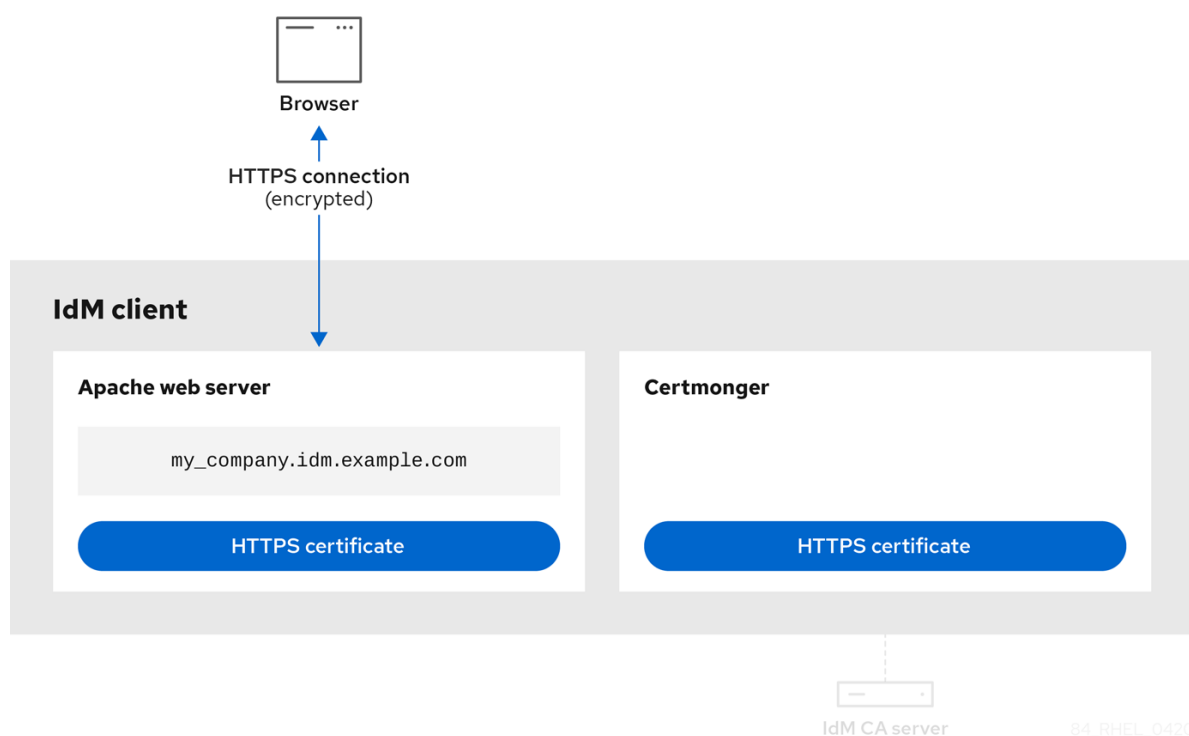
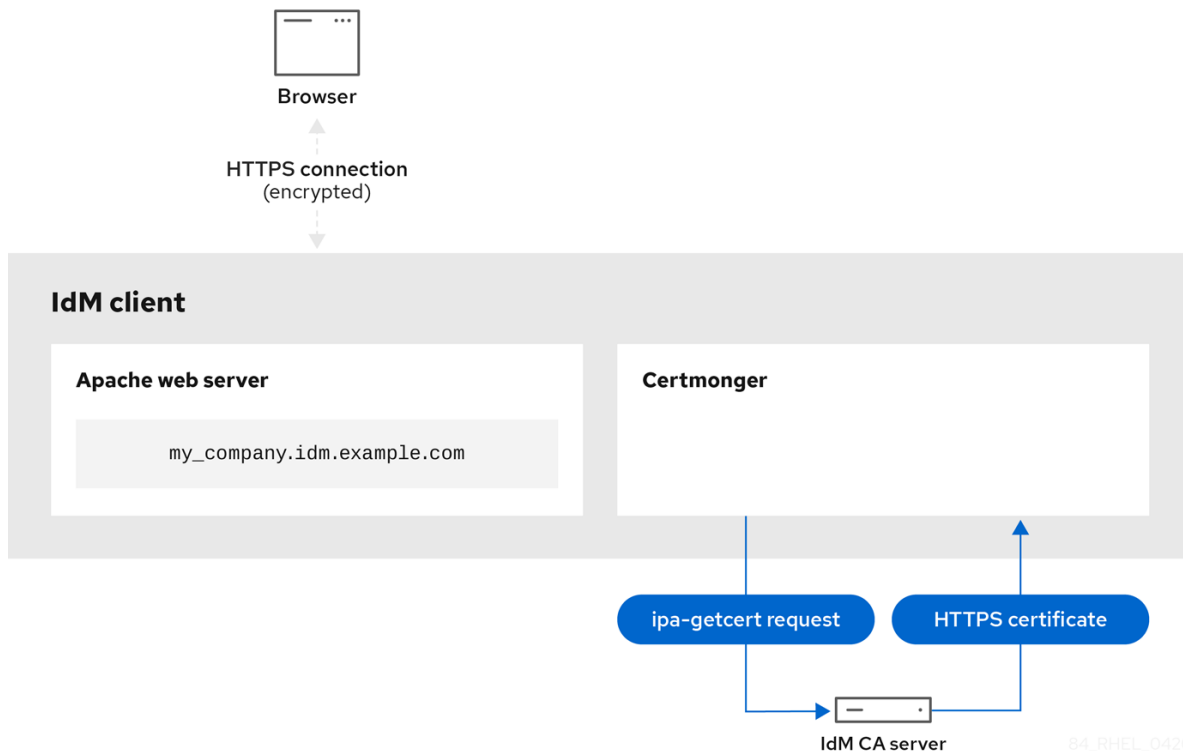


Figure 13.5, “Certmonger requesting a new certificate when the old one is nearing expiration” shows **certmonger** automatically requesting a renewal of the service certificate from the IdM CA before the expiration of the certificate. The IdM CA issues a new certificate.

Figure 13.5. Certmonger requesting a new certificate when the old one is nearing expiration



13.4. VIEWING THE DETAILS OF A CERTIFICATE REQUEST TRACKED BY CERTMONGER

The **certmonger** service monitors certificate requests. When a request for a certificate is successfully signed, it results in a certificate. **Certmonger** manages certificate requests including the resulting certificates. This section describes how to view the details of a particular certificate request managed by **certmonger**.

Procedure

- If you know how to specify the certificate request, list the details of only that particular certificate request. You can, for example, specify:
 - The request ID
 - The location of the certificate
 - The certificate nickname

For example, to view the details of the certificate whose request ID is 20190408143846, using the **-v** option to view all the details of errors in case your request for a certificate was unsuccessful:

getcert list -i 20190408143846 -v

Number of certificates and requests being tracked: 16.

Request ID '20190408143846':

status: MONITORING

stuck: no

key pair storage: type=NSSDB,location='/etc/dirsrv/slapd-IDM-EXAMPLE-COM',nickname='Server-Cert',token='NSS Certificate DB',pinfile='/etc/dirsrv/slapd-IDM-EXAMPLE-COM/pwdfile.txt'

certificate: type=NSSDB,location='/etc/dirsrv/slapd-IDM-EXAMPLE-COM',nickname='Server-Cert',token='NSS Certificate DB'

CA: IPA

issuer: CN=Certificate Authority,O=IDM.EXAMPLE.COM

subject: CN=r8server.idm.example.com,O=IDM.EXAMPLE.COM

expires: 2021-04-08 16:38:47 CEST

dns: r8server.idm.example.com

principal name: ldap/server.idm.example.com@IDM.EXAMPLE.COM

key usage: digitalSignature,nonRepudiation,keyEncipherment,dataEncipherment

eku: id-kp-serverAuth,id-kp-clientAuth

pre-save command:

post-save command: /usr/libexec/ipa/certmonger/restart_dirsrv IDM-EXAMPLE-COM

track: yes

auto-renew: yes

The output displays several pieces of information about the certificate, for example:

- the certificate location; in the example above, it is the NSS database in the **/etc/dirsrv/slapd-IDM-EXAMPLE-COM** directory
- the certificate nickname; in the example above, it is **Server-Cert**
- the file storing the pin; in the example above, it is **/etc/dirsrv/slapd-IDM-EXAMPLE-COM/pwdfile.txt**
- the Certificate Authority (CA) that will be used to renew the certificate; in the example above, it is the **IPA** CA
- the expiration date; in the example above, it is **2021-04-08 16:38:47 CEST**
- the status of the certificate; in the example above, the **MONITORING** status means that the certificate is valid and it is being tracked
- the post-save command; in the example above, it is the restart of the **LDAP** service
- If you do not know how to specify the certificate request, list the details of all the certificates that **certmonger** is monitoring or attempting to obtain:

getcert list**Additional information**

- To view the different options how to specify the certificate request displayed, see the **getcert list** man page.

13.5. STARTING AND STOPPING CERTIFICATE TRACKING

This section describes how you can use the **getcert stop-tracking** and **getcert start-tracking** commands to monitor certificates. The two commands are provided by the **certmonger** service. Enabling certificate tracking is especially useful if you have imported a certificate issued by the Identity Management (IdM) certificate authority (CA) onto the machine from a different IdM client. Enabling certificate tracking can also be the final step of the following provisioning scenario:

1. On the IdM server, you create a certificate for a system that does not exist yet.
2. You create the new system.
3. You enroll the new system as an IdM client.
4. You import the certificate and the key from the IdM server on to the IdM client.
5. You start tracking the certificate using **certmonger** to ensure that it gets renewed when it is due to expire.

Procedure

- To disable the monitoring of a certificate with the Request ID of 20190408143846:

```
# getcert stop-tracking -i 20190408143846
```

For more options, see the **getcert stop-tracking** man page.

- To enable the monitoring of a certificate stored in the **/tmp/some_cert.crt** file, whose private key is stored in the **/tmp/some_key.key** file:

```
# getcert start-tracking -c IPA -f /tmp/some_cert.crt -k /tmp/some_key.key
```

Certmonger cannot automatically identify the CA type that issued the certificate. For this reason, add the **-c** option with the **IPA** value to the **getcert start-tracking** command if the certificate was issued by the IdM CA. Omitting to add the **-c** option results in **certmonger** entering the **NEED_CA** state.

For more options, see the **getcert start-tracking** man page.



NOTE

The two commands do not manipulate the certificate. For example, **getcert stop-tracking** does not delete the certificate or remove it from the NSS database or from the filesystem but simply removes the certificate from the list of monitored certificates. Similarly, **getcert start-tracking** only adds a certificate to the list of monitored certificates.

13.6. RENEWING A CERTIFICATE MANUALLY

When a certificate is near its expiration date, the **certmonger** daemon automatically issues a renewal command using the certificate authority (CA) helper, obtains a renewed certificate and replaces the previous certificate with the new one.

It is also possible to manually renew a certificate in advance by using the **getcert resubmit** command. This way, you can update the information the certificate contains, e.g. by adding a Subject Alternative Name (SAN).

This section describes how to renew a certificate manually.

Procedure

- To renew a certificate with the Request ID of 20190408143846:

```
# getcert resubmit -i 20190408143846
```

To obtain the Request ID for a specific certificate, use the **getcert list** command. For details, see the **getcert list** man page.

13.7. MAKING CERTMONGER RESUME TRACKING OF IDM CERTIFICATES ON A CA REPLICA

This procedure shows how to make **certmonger** resume the tracking of Identity Management (IdM) system certificates that are crucial for an IdM deployment with an integrated certificate authority after the tracking of certificates was interrupted. The interruption may have been caused by the IdM host being unenrolled from IdM during the renewal of the system certificates or by replication topology not working properly. The procedure also shows how to make **certmonger** resume the tracking of the IdM service certificates, namely the **HTTP**, **LDAP** and **PKINIT** certificates.

Prerequisites

- The host on which you want to resume tracking system certificates is an IdM server that is also an IdM certificate authority (CA) but not the IdM CA renewal server.

Procedure

- Get the PIN for the subsystem CA certificates:

```
# grep 'internal=' /var/lib/pki/pki-tomcat/conf/password.conf
```

- Add tracking to the subsystem CA certificates, replacing **[internal PIN]** in the commands below with the PIN obtained in the previous step:

```
# getcert start-tracking -d /etc/pki/pki-tomcat/alias -n "caSigningCert cert-pki-ca" -c
'dogtag-ipa-ca-renew-agent' -P [internal PIN] -B
/usr/libexec/ipa/certmonger/stop_pkicad -C '/usr/libexec/ipa/certmonger/renew_ca_cert
"caSigningCert cert-pki-ca"
```

```
# getcert start-tracking -d /etc/pki/pki-tomcat/alias -n "auditSigningCert cert-pki-ca" -c
'dogtag-ipa-ca-renew-agent' -P [internal PIN] -B
/usr/libexec/ipa/certmonger/stop_pkicad -C '/usr/libexec/ipa/certmonger/renew_ca_cert
"auditSigningCert cert-pki-ca"
```

```
# getcert start-tracking -d /etc/pki/pki-tomcat/alias -n "ocspSigningCert cert-pki-ca" -c
'dogtag-ipa-ca-renew-agent' -P [internal PIN] -B
/usr/libexec/ipa/certmonger/stop_pkicad -C '/usr/libexec/ipa/certmonger/renew_ca_cert
"ocspSigningCert cert-pki-ca"
```

```
# getcert start-tracking -d /etc/pki/pki-tomcat/alias -n "subsystemCert cert-pki-ca" -c
'dogtag-ipa-ca-renew-agent' -P [internal PIN] -B
/usr/libexec/ipa/certmonger/stop_pkicad -C '/usr/libexec/ipa/certmonger/renew_ca_cert
"subsystemCert cert-pki-ca"
```

```
# getcert start-tracking -d /etc/pki/pki-tomcat/alias -n "Server-Cert cert-pki-ca" -c
'dogtag-ipa-ca-renew-agent' -P [internal PIN] -B
/usr/libexec/ipa/certmonger/stop_pkicad -C '/usr/libexec/ipa/certmonger/renew_ca_cert
"Server-Cert cert-pki-ca"'
```

3. Add tracking for the remaining IdM certificates, the **HTTP**, **LDAP**, **IPA renewal agent** and **PKINIT** certificates:

```
# getcert start-tracking -f /var/lib/ipa/certs/httpd.crt -k /var/lib/ipa/private/httpd.key -p
/var/lib/ipa/passwds/idm.example.com-443-RSA -c IPA -C
/usr/libexec/ipa/certmonger/restart_httpd

# getcert start-tracking -d /etc/dirsrv/slapd-IDM-EXAMPLE-COM -n "Server-Cert" -c IPA
-p /etc/dirsrv/slapd-IDM-EXAMPLE-COM/pwdfile.txt -C
'/usr/libexec/ipa/certmonger/restart_dirsrv "IDM-EXAMPLE-COM"'

# getcert start-tracking -f /var/lib/ipa/ra-agent.pem -k /var/lib/ipa/ra-agent.key -c
dogtag-ipa-ca-renew-agent -B /usr/libexec/ipa/certmonger/renew_ra_cert_pre -C
/usr/libexec/ipa/certmonger/renew_ra_cert

# getcert start-tracking -f /var/kerberos/krb5kdc/kdc.crt -k
/var/kerberos/krb5kdc/kdc.key -c dogtag-ipa-ca-renew-agent -B
/usr/libexec/ipa/certmonger/renew_ra_cert_pre -C
/usr/libexec/ipa/certmonger/renew_kdc_cert
```

4. Restart **certmonger**:

```
# systemctl restart certmonger
```

5. Wait for one minute after **certmonger** has started and then check the statuses of the new certificates:

```
# getcert list
```

Additional resources

- If your IdM system certificates have all expired, follow the procedure described in [this Knowledge Centered Support \(KCS\) solution](#) to manually renew IdM system certificates on the IdM CA server that is also the CA renewal server and the CRL publisher server. Then follow the procedure described in [this KCS solution](#) to manually renew IdM system certificates on all the other CA servers in the topology.

CHAPTER 14. REQUESTING CERTIFICATES USING RHEL SYSTEM ROLES

With the Certificate System Role, you can use Red Hat Ansible Engine to issue and manage certificates.

This chapter covers the following topics:

- [The Certificate System Role](#)
- [Requesting a new self-signed certificate using the Certificate System Role](#)
- [Requesting a new certificate from IdM CA using the Certificate System Role](#)

14.1. THE CERTIFICATE SYSTEM ROLE

Using the Certificate System Role, you can manage issuing and renewing TLS and SSL certificates using Red Hat Ansible Engine.

The role uses **certmonger** as the certificate provider, and currently supports issuing and renewing self-signed certificates and using the IdM integrated certificate authority (CA).

You can use the following variables in your Ansible playbook with the Certificate System Role:

- **certificate_wait** to specify if the task should wait for the certificate to be issued.
- **certificate_requests** to represent each certificate to be issued and its parameters.

Additional resources

- For details about the parameters used in the **certificate_requests** variable and additional information about the **certificate** System Role, see the **/usr/share/ansible/roles/rhel-system-roles.certificate/README.md** file.
- For details about RHEL System Roles and how to apply them, see [Getting started with RHEL System Roles](#).

14.2. REQUESTING A NEW SELF-SIGNED CERTIFICATE USING THE CERTIFICATE SYSTEM ROLE

With the Certificate System Role, you can use Red Hat Ansible Engine to issue self-signed certificates.

This process uses the **certmonger** provider and requests the certificate through the **getcert** command.



NOTE

By default, **certmonger** automatically tries to renew the certificate before it expires. You can disable this by setting the **auto_renew** parameter in the Ansible playbook to **no**.

Prerequisites

- You have Red Hat Ansible Engine installed on the system from which you want to run the playbook.



NOTE

You do not have to have Ansible installed on the systems on which you want to deploy the **certificate** solution.

- You have the **rhel-system-roles** package installed on the system from which you want to run the playbook.

For details about RHEL System Roles and how to apply them, see [Getting started with RHEL System Roles](#).

Procedure

1. *Optional:* Create an inventory file, for example **inventory.file**:

```
$ touch inventory.file
```

2. Open your inventory file and define the hosts on which you want to request the certificate, for example:

```
[webserver]
server.idm.example.com
```

3. Create a playbook file, for example **request-certificate.yml**:

- Set **hosts** to include the hosts on which you want to request the certificate, such as **webserver**.
- Set the **certificate_requests** variable to include the following:
 - Set the **name** parameter to the desired name of the certificate, such as **mycert**.
 - Set the **dns** parameter to the domain to be included in the certificate, such as ***.example.com**.
 - Set the **ca** parameter to **self-sign**.
- Set the **rhel-system-roles.certificate** role under **roles**.
This is the playbook file for this example:

```
---
- hosts: webserver

vars:
  certificate_requests:
    - name: mycert
      dns: *.example.com
      ca: self-sign

roles:
  - rhel-system-roles.certificate
```

4. Save the file.
5. Run the playbook:

```
$ ansible-playbook -i inventory.file request-certificate.yml
```

Additional resources

- For details about the parameters used in the **certificate_requests** variable and additional information about the **certificate** System Role, see the `/usr/share/ansible/roles/rhel-system-roles.certificate/README.md` file.
- For details about the **ansible-playbook** command, see the **ansible-playbook(1)** man page.

14.3. REQUESTING A NEW CERTIFICATE FROM IDM CA USING THE CERTIFICATE SYSTEM ROLE

With the Certificate System Role, you can use Red Hat Ansible Engine to issue certificates while using an IdM server with an integrated certificate authority (CA). Therefore, you can efficiently and consistently manage the certificate trust chain for multiple systems when using IdM as the CA.

This process uses the **certmonger** provider and requests the certificate through the **getcert** command.



NOTE

By default, **certmonger** automatically tries to renew the certificate before it expires. You can disable this by setting the **auto_renew** parameter in the Ansible playbook to **no**.

Prerequisites

- You have Red Hat Ansible Engine installed on the system from which you want to run the playbook.



NOTE

You do not have to have Ansible installed on the systems on which you want to deploy the **certificate** solution.

- You have the **rhel-system-roles** package installed on the system from which you want to run the playbook.
For details about RHEL System Roles and how to apply them, see [Getting started with RHEL System Roles](#).

Procedure

1. *Optional:* Create an inventory file, for example **inventory.file**:

```
$ touch inventory.file
```

2. Open your inventory file and define the hosts on which you want to request the certificate, for example:

```
[webserver]
server.idm.example.com
```

3. Create a playbook file, for example **request-certificate.yml**:

- Set **hosts** to include the hosts on which you want to request the certificate, such as **webserver**.
- Set the **certificate_requests** variable to include the following:
 - Set the **name** parameter to the desired name of the certificate, such as **mycert**.
 - Set the **dns** parameter to the domain to be included in the certificate, such as **www.example.com**.
 - Set the **principal** parameter to specify the Kerberos principal, such as **HTTP/www.example.com@EXAMPLE.COM**.
 - Set the **ca** parameter to **ipa**.
- Set the **rhel-system-roles.certificate** role under **roles**.
This is the playbook file for this example:

```
---
- hosts: webserver
  vars:
    certificate_requests:
      - name: mycert
        dns: www.example.com
        principal: HTTP/www.example.com@EXAMPLE.COM
        ca: ipa

  roles:
    - rhel-system-roles.certificate
```

4. Save the file.

5. Run the playbook:

```
$ ansible-playbook -i inventory.file request-certificate.yml
```

Additional resources

- For details about the parameters used in the **certificate_requests** variable and additional information about the **certificate** System Role, see the **/usr/share/ansible/roles/rhel-system-roles.certificate/README.md** file.
- For details about the **ansible-playbook** command, see the **ansible-playbook(1)** man page.

14.4. SPECIFYING COMMANDS TO RUN BEFORE OR AFTER CERTIFICATE ISSUANCE USING THE CERTIFICATE SYSTEM ROLE

With the Certificate System Role, you can use Red Hat Ansible Engine to execute a command before and after a certificate is issued or renewed.

In the following example, the administrator ensures stopping the **httpd** service before a self-signed certificate for **www.example.com** is issued or renewed, and restarting it afterwards.

**NOTE**

By default, **certmonger** automatically tries to renew the certificate before it expires. You can disable this by setting the **auto_renew** parameter in the Ansible playbook to **no**.

Prerequisites

- You have Red Hat Ansible Engine installed on the system from which you want to run the playbook.

**NOTE**

You do not have to have Ansible installed on the systems on which you want to deploy the **certificate** solution.

- You have the **rhel-system-roles** package installed on the system from which you want to run the playbook.
For details about RHEL System Roles and how to apply them, see [Getting started with RHEL System Roles](#).

Procedure

1. *Optional:* Create an inventory file, for example **inventory.file**:

```
$ touch inventory.file
```

2. Open your inventory file and define the hosts on which you want to request the certificate, for example:

```
[webserver]
server.idm.example.com
```

3. Create a playbook file, for example **request-certificate.yml**:

- Set **hosts** to include the hosts on which you want to request the certificate, such as **webserver**.
- Set the **certificate_requests** variable to include the following:
 - Set the **name** parameter to the desired name of the certificate, such as **mycert**.
 - Set the **dns** parameter to the domain to be included in the certificate, such as **www.example.com**.
 - Set the **ca** parameter to the CA you want to use to issue the certificate, such as **self-sign**.
 - Set the **run_before** parameter to the command you want to execute before this certificate is issued or renewed, such as **systemctl stop httpd.service**.
 - Set the **run_after** parameter to the command you want to execute after this certificate is issued or renewed, such as **systemctl start httpd.service**.
- Set the **rhel-system-roles.certificate** role under **roles**.
This is the playbook file for this example:

```
---
- hosts: webserver
  vars:
    certificate_requests:
      - name: mycert
        dns: www.example.com
        ca: self-sign
        run_before: systemctl stop httpd.service
        run_after: systemctl start httpd.service

  roles:
    - linux-system-roles.certificate
```

4. Save the file.

5. Run the playbook:

```
$ ansible-playbook -i inventory.file request-certificate.yml
```

Additional resources

- For details about the parameters used in the **certificate_requests** variable and additional information about the **certificate** System Role, see the **/usr/share/ansible/roles/rhel-system-roles.certificate/README.md** file.
- For details about the **ansible-playbook** command, see the **ansible-playbook(1)** man page.

CHAPTER 15. RESTRICTING AN APPLICATION TO TRUST ONLY A SUBSET OF CERTIFICATES

If your Identity Management (IdM) installation is configured with the integrated Certificate System (CS) certificate authority (CA), you are able to create lightweight sub-CAs. All sub-CAs you create are subordinated to the primary CA of the certificate system, the **ipa** CA.

A *lightweight sub-CA* in this context means *a sub-CA issuing certificates for a specific purpose*. For example, a lightweight sub-CA enables you to configure a service, such as a virtual private network (VPN) gateway and a web browser, to accept only certificates issued by *sub-CA A*. By configuring other services to accept certificates only issued by *sub-CA B*, you prevent them from accepting certificates issued by *sub-CA A*, the primary CA, that is the **ipa** CA, and any intermediate sub-CA between the two.

If you revoke the intermediate certificate of a sub-CA, [all certificates issued by this sub-CA are automatically considered invalid](#) by correctly configured clients. All the other certificates issued directly by the root CA, **ipa**, or another sub-CA, remain valid.

This section uses the example of the Apache web server to illustrate how to restrict an application to trust only a subset of certificates. Complete this section to restrict the web server running on your IdM client to use a certificate issued by the **webserver-ca** IdM sub-CA, and to require the users to authenticate to the web server using user certificates issued by the **webclient-ca** IdM sub-CA.

The steps you need to take are:

1. [Create an IdM sub-CA](#)
2. [Download the sub-CA certificate from IdM WebUI](#)
3. [Create a CA ACL specifying the correct combination of users, services and CAs, and the certificate profile used](#)
4. [Request a certificate for the web service running on an IdM client from the IdM sub-CA](#)
5. [Set up a single-instance Apache HTTP Server](#)
6. [Add TLS encryption to the Apache HTTP Server](#)
7. [Set the supported TLS protocol versions on an Apache HTTP Server](#)
8. [Set the supported ciphers on the Apache HTTP Server](#)
9. [Configure TLS client certificate authentication on the web server](#)
10. [Request a certificate for the user from the IdM sub-CA and export it to the client](#)
11. [Import the user certificate into the browser and configure the browser to trust the sub-CA certificate](#)

15.1. CREATING A LIGHTWEIGHT SUB-CA

For details on creating a sub-CA, see:

- [Section 15.1.1, “Creating a sub-CA from IdM WebUI”](#)
- [Section 15.1.2, “Creating a sub-CA from IdM CLI”](#)

15.1.1. Creating a sub-CA from IdM WebUI

This procedure describes how to use IdM WebUI to create new sub-CAs named **webserver-ca** and **webclient-ca**.

Prerequisites

- Make sure you have obtained the administrator's credentials.

Procedure

1. In the **Authentication** menu, click **Certificates**.
2. Select **Certificate Authorities** and click **Add**.
3. Enter the name of the **webserver-ca** sub-CA. Enter the Subject DN, for example **CN=WEBSERVER,O=IDM.EXAMPLE.COM**, in the Subject DN field. Note that the Subject DN must be unique in the IdM CA infrastructure.
4. Enter the name of the **webclient-ca** sub-CA. Enter the Subject DN **CN=WEBCLIENT,O=IDM.EXAMPLE.COM** in the Subject DN field.
5. In the command-line interface, run the **ipa-certupdate** command to create a **certmonger** tracking request for the **webserver-ca** and **webclient-ca** sub-CAs certificates:

```
[root@ipaserver ~]# ipa-certupdate
```



IMPORTANT

Forgetting to run the **ipa-certupdate** command after creating a sub-CA means that if the sub-CA certificate expires, end-entity certificates issued by the sub-CA are considered invalid even if the end-entity certificate has not expired.

6. Optionally, to verify that the signing certificate of the new sub-CA has been added to the IdM database, enter:

```
[root@ipaserver ~]# certutil -d /etc/pki/pki-tomcat/alias/ -L
```

Certificate Nickname	Trust Attributes
	SSL,S/MIME,JAR/XPI
caSigningCert cert-pki-ca	CTu,Cu,Cu
Server-Cert cert-pki-ca	u,u,u
auditSigningCert cert-pki-ca	u,u,Pu
caSigningCert cert-pki-ca ba83f324-5e50-4114-b109-acca05d6f1dc	u,u,u
ocspSigningCert cert-pki-ca	u,u,u
systemCert cert-pki-ca	u,u,u



NOTE

The new sub-CA certificate is automatically transferred to all the replicas that have a certificate system instance installed.

15.1.2. Creating a sub-CA from IdM CLI

This procedure describes how to use IdM CLI to create new sub-CAs named **webserver-ca** and **webclient-ca**.

Prerequisites

- Make sure that you have obtained the administrator's credentials.
- Make sure you are logged in to an IdM server that is a CA server.

Procedure

1. Enter the **ipa ca-add** command, and specify the name of the **webserver-ca** sub-CA and its Subject Distinguished Name (DN):

```
[root@ipaserver ~]# ipa ca-add webserver-ca --
subject="CN=WEBSERVER,O=IDM.EXAMPLE.COM"
-----
Created CA "webserver-ca"
-----
Name: webserver-ca
Authority ID: ba83f324-5e50-4114-b109-acca05d6f1dc
Subject DN: CN=WEBSERVER,O=IDM.EXAMPLE.COM
Issuer DN: CN=Certificate Authority,O=IDM.EXAMPLE.COM
```

Name

Name of the CA.

Authority ID

Automatically created, individual ID for the CA.

Subject DN

Subject Distinguished Name (DN). The Subject DN must be unique in the IdM CA infrastructure.

Issuer DN

Parent CA that issued the sub-CA certificate. All sub-CAs are created as a child of the IdM root CA.

2. Create the **webclient-ca** sub-CA for issuing certificates to web clients:

```
[root@ipaserver ~]# ipa ca-add webclient-ca --
subject="CN=WEBCLIENT,O=IDM.EXAMPLE.COM"
-----
Created CA "webclient-ca"
-----
Name: webclient-ca
Authority ID: 8a479f3a-0454-4a4d-8ade-fd3b5a54ab2e
Subject DN: CN=WEBCLIENT,O=IDM.EXAMPLE.COM
Issuer DN: CN=Certificate Authority,O=IDM.EXAMPLE.COM
```

3. In the command-line interface, run the **ipa-certupdate** command to create a **certmonger** tracking request for the **webserver-ca** and **webclient-ca** sub-CAs certificates:

```
[root@ipaserver ~]# ipa-certupdate
```



IMPORTANT

Forgetting to run the **ipa-certupdate** command after creating a sub-CA means that if the sub-CA certificate expires, end-entity certificates issued by the sub-CA are considered invalid even if the end-entity certificate has not expired.

- Optionally, to verify that the signing certificate of the new sub-CA has been added to the IdM database, enter:

```
[root@ipaserver ~]# certutil -d /etc/pki/pki-tomcat/alias/ -L
```

Certificate Nickname	Trust Attributes
	SSL,S/MIME,JAR/XPI
caSigningCert cert-pki-ca	CTu,Cu,Cu
Server-Cert cert-pki-ca	u,u,u
auditSigningCert cert-pki-ca	u,u,Pu
caSigningCert cert-pki-ca ba83f324-5e50-4114-b109-acca05d6f1dc	u,u,u
ocspSigningCert cert-pki-ca	u,u,u
subsystemCert cert-pki-ca	u,u,u



NOTE

The new sub-CA certificate is automatically transferred to all the replicas that have a certificate system instance installed.

15.2. DOWNLOADING THE SUB-CA CERTIFICATE FROM IDM WEBUI

Prerequisites

- Make sure that you have obtained the IdM administrator's credentials.

Procedure

- In the **Authentication** menu, click **Certificates > Certificates**.

Figure 15.1. sub-CA certificate in the list of certificates

<input type="checkbox"/>	268173326	CN=WEBSERVER,O=IDM.EXAMPLE.COM	ipa	VALID
<input type="checkbox"/>	268238849	CN=idm_user,O=IDM.EXAMPLE.COM	ipa	VALID

- Click the serial number of the sub-CA certificate to open the certificate information page.
- In the certificate information page, click **Actions > Download**.
- In the CLI, move the sub-CA certificate to the **/etc/pki/tls/private/** directory:

```
# mv path/to/the/downloaded/certificate /etc/pki/tls/private/sub-ca.crt
```

15.3. CREATING CA ACLS FOR WEB SERVER AND CLIENT AUTHENTICATION

Certificate authority access control list (CA ACL) rules define which profiles can be used to issue certificates to which users, services, or hosts. By associating profiles, principals, and groups, CA ACLs permit principals or groups to request certificates using particular profiles.

For example, using CA ACLs, the administrator can restrict the use of a profile intended for employees working from an office located in London only to users that are members of the London office-related group.

15.3.1. Viewing CA ACLs in IdM CLI

Complete this section to view the list of certificate authority access control lists (CA ACLs) available in your IdM deployment and the details of a specific CA ACL.

Procedure

1. To view all the CA ACLs in your IdM environment, enter the **ipa caacl-find** command:

```
$ ipa caacl-find
-----
1 CA ACL matched
-----
ACL name: hosts_services_calPAserviceCert
Enabled: TRUE
```

2. To view the details of a CA ACL, enter the **ipa caacl-show** command, and specify the CA ACL name. For example, to view the details of the **hosts_services_calPAserviceCert** CA ACL, enter:

```
$ ipa caacl-show hosts_services_calPAserviceCert
ACL name: hosts_services_calPAserviceCert
Enabled: TRUE
Host category: all
Service category: all
CAs: ipa
Profiles: calPAserviceCert
Users: admin
```

15.3.2. Creating a CA ACL for web servers authenticating to web clients using certificates issued by webserver-ca

This section describes how to create a CA ACL that requires the system administrator to use the **webserver-ca** sub-CA and the **calPAserviceCert** profile when requesting a certificate for the **HTTP/my_company.idm.example.com@IDM.EXAMPLE.COM** service. If the user requests a certificate from a different sub-CA or of a different profile, the request fails. The only exception is when there is another matching CA ACL that is enabled. To view the available CA ACLs, see [Viewing CA ACLs in IdM CLI](#).

Prerequisites

- Make sure that the **HTTP/my_company.idm.example.com@IDM.EXAMPLE.COM** service is part of IdM.
- Make sure you have obtained IdM administrator's credentials.

Procedure

1. Create a CA ACL using the **ipa caacl** command, and specify its name:

```
$ ipa caacl-add TLS_web_server_authentication
-----
Added CA ACL "TLS_web_server_authentication"
-----
ACL name: TLS_web_server_authentication
Enabled: TRUE
```

2. Modify the CA ACL using the **ipa caacl-mod** command to specify the description of the CA ACL:

```
$ ipa caacl-mod TLS_web_server_authentication --desc="CAACL for web servers
authenticating to web clients using certificates issued by webserver-ca"
-----
Modified CA ACL "TLS_web_server_authentication"
-----
ACL name: TLS_web_server_authentication
Description: CAACL for web servers authenticating to web clients using certificates issued
by webserver-ca
Enabled: TRUE
```

3. Add the **webserver-ca** sub-CA to the CA ACL:

```
$ ipa caacl-add-ca TLS_web_server_authentication --ca=webserver-ca
ACL name: TLS_web_server_authentication
Description: CAACL for web servers authenticating to web clients using certificates issued
by webserver-ca
Enabled: TRUE
CAs: webserver-ca
-----
Number of members added 1
-----
```

4. Use the **ipa caacl-add-service** to specify the service whose principal will be able to request a certificate:

```
$ ipa caacl-add-service TLS_web_server_authentication --
service=HTTP/my_company.idm.example.com@IDM.EXAMPLE.COM
ACL name: TLS_web_server_authentication
Description: CAACL for web servers authenticating to web clients using certificates issued
by webserver-ca
Enabled: TRUE
CAs: webserver-ca
Services: HTTP/my_company.idm.example.com@IDM.EXAMPLE.COM
-----
Number of members added 1
-----
```

5. Use the **ipa caacl-add-profile** command to specify the certificate profile for the requested certificate:

```
$ ipa caacl-add-profile TLS_web_server_authentication --
certprofiles=calPAserviceCert
```

```

ACL name: TLS_web_server_authentication
Description: CAACL for web servers authenticating to web clients using certificates issued
by webserver-ca
Enabled: TRUE
CAs: webserver-ca
Profiles: calPAserviceCert
Services: HTTP/my_company.idm.example.com@IDM.EXAMPLE.COM
-----

```

```

Number of members added 1
-----

```

You can use the newly-created CA ACL straight away. It is enabled after its creation by default.



NOTE

The point of CA ACLs is to specify which CA and profile combinations are allowed for requests coming from particular principals or groups. CA ACLs do not affect certificate validation or trust. They do not affect how the issued certificates will be used.

15.3.3. Creating a CA ACL for user web browsers authenticating to web servers using certificates issued by webclient-ca

This section describes how to create a CA ACL that requires the system administrator to use the **webclient-ca** sub-CA and the **IECUserRoles** profile when requesting a certificate. If the user requests a certificate from a different sub-CA or of a different profile, the request fails. The only exception is when there is another matching CA ACL that is enabled. To view the available CA ACLs, see [Viewing CA ACLs in IdM CLI](#).

Prerequisites

- Make sure that you have obtained IdM administrator's credentials.

Procedure

1. Create a CA ACL using the **ipa caacl** command and specify its name:

```

$ ipa caacl-add TLS_web_client_authentication
-----
Added CA ACL "TLS_web_client_authentication"
-----
ACL name: TLS_web_client_authentication
Enabled: TRUE

```

2. Modify the CA ACL using the **ipa caacl-mod** command to specify the description of the CA ACL:

```

$ ipa caacl-mod TLS_web_client_authentication --desc="CAACL for user web
browsers authenticating to web servers using certificates issued by webclient-ca"
-----
Modified CA ACL "TLS_web_client_authentication"
-----
ACL name: TLS_web_client_authentication

```

Description: CAACL for user web browsers authenticating to web servers using certificates issued by webclient-ca
Enabled: TRUE

3. Add the **webclient-ca** sub-CA to the CA ACL:

```
$ ipa caacl-add-ca TLS_web_client_authentication --ca=webclient-ca
ACL name: TLS_web_client_authentication
Description: CAACL for user web browsers authenticating to web servers using certificates
issued by webclient-ca
Enabled: TRUE
CAs: webclient-ca
-----
Number of members added 1
-----
```

4. Use the **ipa caacl-add-profile** command to specify the certificate profile for the requested certificate:

```
$ ipa caacl-add-profile TLS_web_client_authentication --certprofiles=IECUserRoles
ACL name: TLS_web_client_authentication
Description: CAACL for user web browsers authenticating to web servers using certificates
issued by webclient-ca
Enabled: TRUE
CAs: webclient-ca
Profiles: IECUserRoles
-----
Number of members added 1
-----
```

5. Modify the CA ACL using the **ipa caacl-mod** command to specify that the CA ACL applies to all IdM users:

```
$ ipa caacl-mod TLS_web_client_authentication --usercat=all
-----
Modified CA ACL "TLS_web_client_authentication"
-----
ACL name: TLS_web_client_authentication
Description: CAACL for user web browsers authenticating to web servers using certificates
issued by webclient-ca
Enabled: TRUE
User category: all
CAs: webclient-ca
Profiles: IECUserRoles
```

You can use the newly-created CA ACL straight away. It is enabled after its creation by default.



NOTE

The point of CA ACLs is to specify which CA and profile combinations are allowed for requests coming from particular principals or groups. CA ACLs do not affect certificate validation or trust. They do not affect how the issued certificates will be used.

15.4. OBTAINING AN IDM CERTIFICATE FOR A SERVICE USING CERTMONGER

To ensure that communication between browsers and the web service running on your IdM client is secure and encrypted, use a TLS certificate. If you want to restrict web browsers to trust certificates issued by the **webserver-ca** sub-CA but no other IdM sub-CA, obtain the TLS certificate for your web service from the **webserver-ca** sub-CA.

This section describes how to use **certmonger** to obtain an IdM certificate for a service (**HTTP/my_company.idm.example.com@IDM.EXAMPLE.COM**) running on an IdM client.

Using **certmonger** to request the certificate automatically means that **certmonger** manages and renews the certificate when it is due for a renewal.

For a visual representation of what happens when **certmonger** requests a service certificate, see [Section 15.5, “Communication flow for certmonger requesting a service certificate”](#).

Prerequisites

- The web server is enrolled as an IdM client.
- You have root access to the IdM client on which you are running the procedure.
- The service for which you are requesting a certificate does not have to pre-exist in IdM.

Procedure

1. On the **my_company.idm.example.com** IdM client on which the **HTTP** service is running, request a certificate for the service corresponding to the **HTTP/my_company.idm.example.com@IDM.EXAMPLE.COM** principal, and specify that
 - The certificate is to be stored in the local **/etc/pki/tls/certs/httpd.pem** file
 - The private key is to be stored in the local **/etc/pki/tls/private/httpd.key** file
 - The **webserver-ca** sub-CA is to be the issuing certificate authority
 - That an extensionRequest for a **SubjectAltName** be added to the signing request with the DNS name of **my_company.idm.example.com**:

```
# ipa-getcert request -K HTTP/my_company.idm.example.com -k
/etc/pki/tls/private/httpd.key -f /etc/pki/tls/certs/httpd.pem -g 2048 -D
my_company.idm.example.com -X webserver-ca -C "systemctl restart httpd"
New signing request "20190604065735" added.
```

In the command above:

- The **ipa-getcert request** command specifies that the certificate is to be obtained from the IdM CA. The **ipa-getcert request** command is a shortcut for **getcert request -c IPA**.
- The **-g** option specifies the size of key to be generated if one is not already in place.
- The **-D** option specifies the **SubjectAltName** DNS value to be added to the request.
- The **-X** option specifies that the issuer of the certificate must be **webserver-ca**, not **ipa**.

- The **-C** option instructs **certmonger** to restart the **httpd** service after obtaining the certificate.
- To specify that the certificate be issued with a particular profile, use the **-T** option.



NOTE

RHEL 8 uses a different SSL module in Apache than the one used in RHEL 7. The SSL module relies on OpenSSL rather than NSS. For this reason, in RHEL 8 you cannot use an NSS database to store the **HTTPS** certificate and the private key.

2. Optionally, to check the status of your request:

```
# ipa-getcert list -f /etc/pki/tls/certs/httpd.pem
Number of certificates and requests being tracked: 3.
Request ID '20190604065735':
  status: MONITORING
  stuck: no
  key pair storage: type=FILE,location='/etc/pki/tls/private/httpd.key'
  certificate: type=FILE,location='/etc/pki/tls/certs/httpd.crt'
  CA: IPA
  issuer: CN=WEBSERVER,O=IDM.EXAMPLE.COM

[...]
```

The output shows that the request is in the **MONITORING** status, which means that a certificate has been obtained. The locations of the key pair and the certificate are those requested.

15.5. COMMUNICATION FLOW FOR CERTMONGER REQUESTING A SERVICE CERTIFICATE

The diagrams in this section show the stages of what happens when **certmonger** requests a service certificate from Identity Management (IdM) certificate authority (CA) server. The sequence consists of these diagrams:

- [Figure 15.2, “Unencrypted communication”](#)
- [Figure 15.3, “Certmonger requesting a service certificate”](#)
- [Figure 15.4, “IdM CA issuing the service certificate”](#)
- [Figure 15.5, “Certmonger applying the service certificate”](#)
- [Figure 15.6, “Certmonger requesting a new certificate when the old one is nearing expiration”](#)

In the diagrams, the **webservers-ca** sub-CA is represented by the generic **IdM CA server**.

[Figure 15.2, “Unencrypted communication”](#) shows the initial situation: without an HTTPS certificate, the communication between the web server and the browser is unencrypted.

Figure 15.2. Unencrypted communication

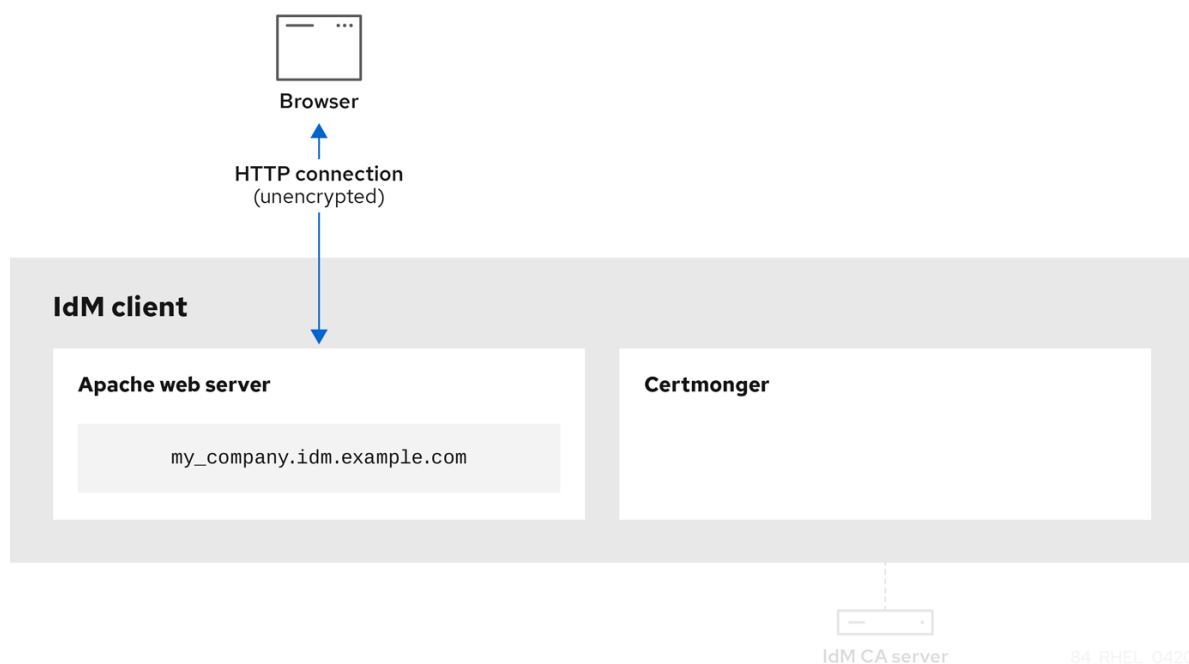


Figure 15.3, “[Certmonger requesting a service certificate](#)” shows the system administrator using **certmonger** to manually request an HTTPS certificate for the Apache web server. Note that when requesting a web server certificate, certmonger does not communicate directly with the CA. It proxies through IdM.

Figure 15.3. Certmonger requesting a service certificate

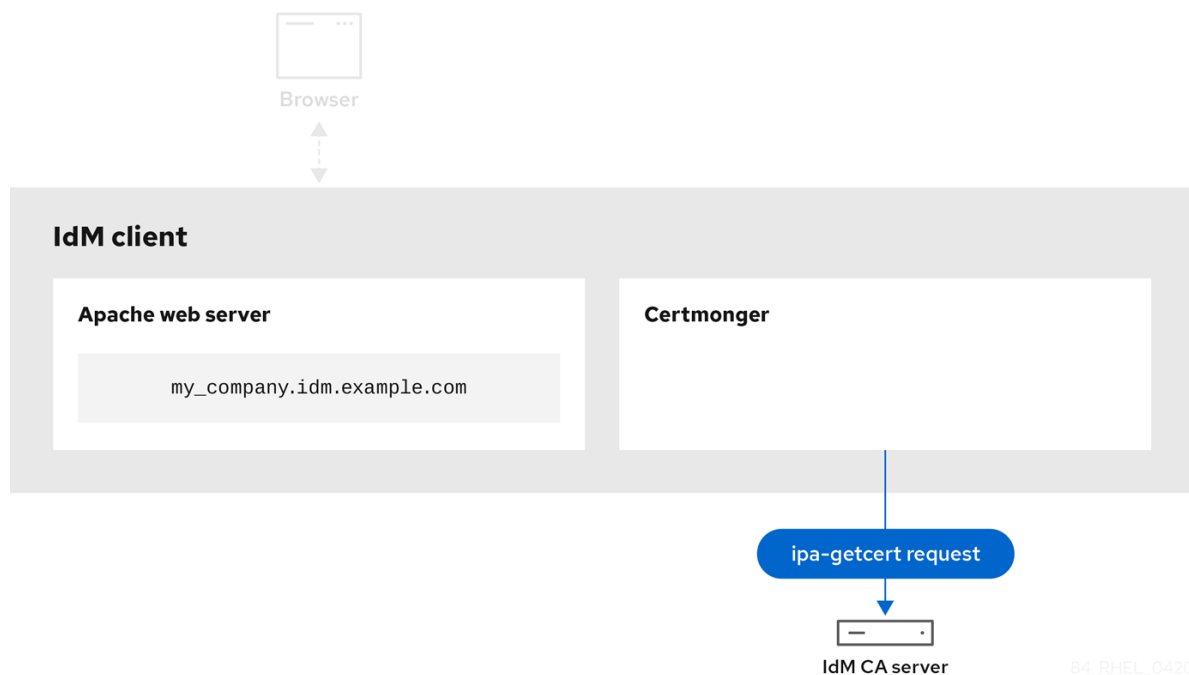


Figure 15.4, “[IdM CA issuing the service certificate](#)” shows an IdM CA issuing an HTTPS certificate for the web server.

Figure 15.4. IdM CA issuing the service certificate

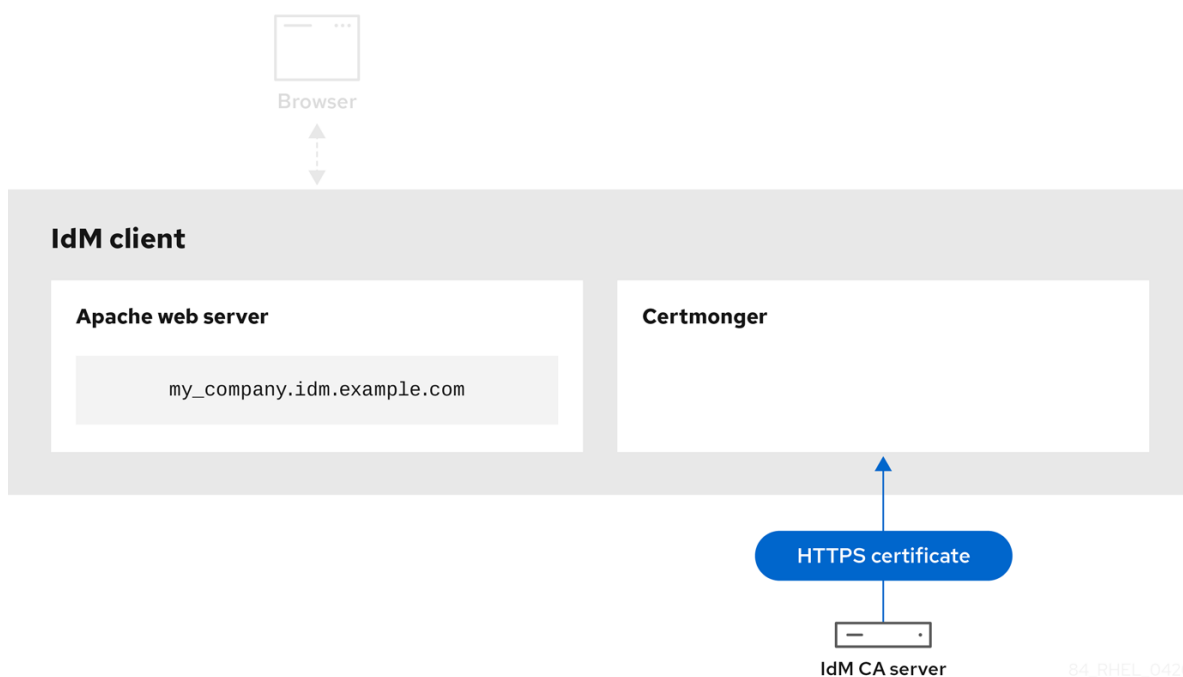


Figure 15.5, “[Certmonger applying the service certificate](#)” shows **certmonger** placing the HTTPS certificate in appropriate locations on the IdM client and, if instructed to do so, restarting the **httpd** service. The Apache server subsequently uses the HTTPS certificate to encrypt the traffic between itself and the browser.

Figure 15.5. Certmonger applying the service certificate

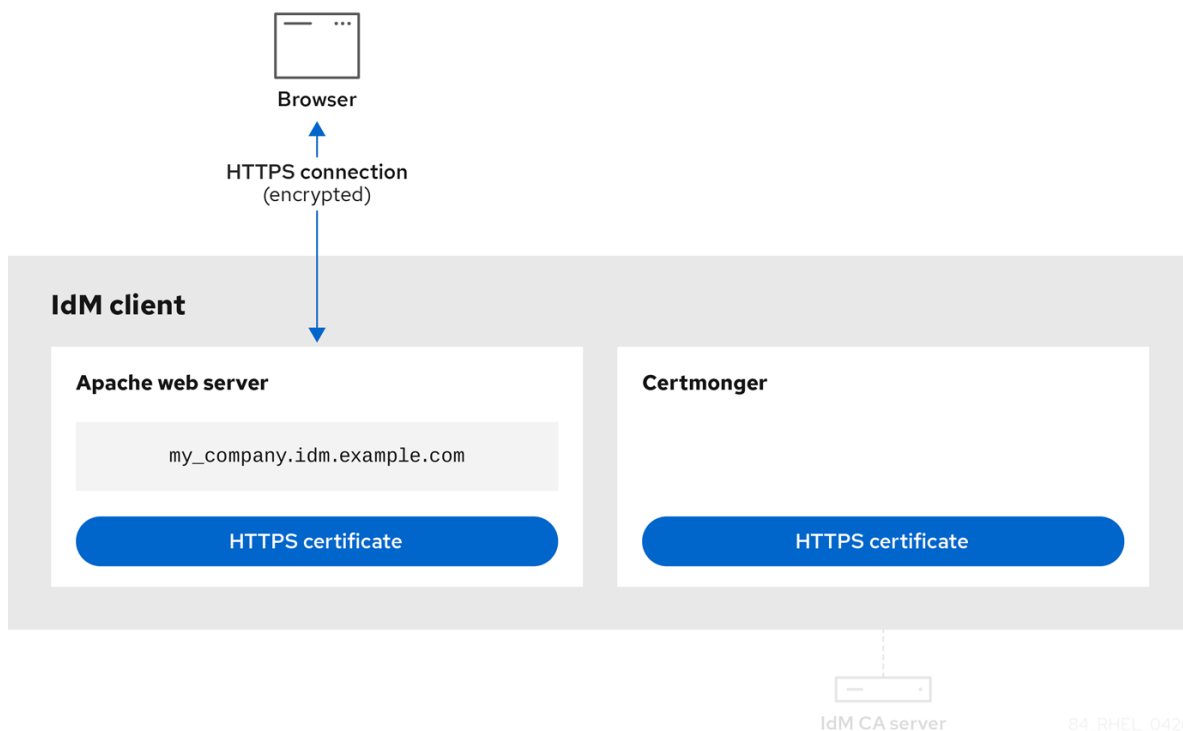
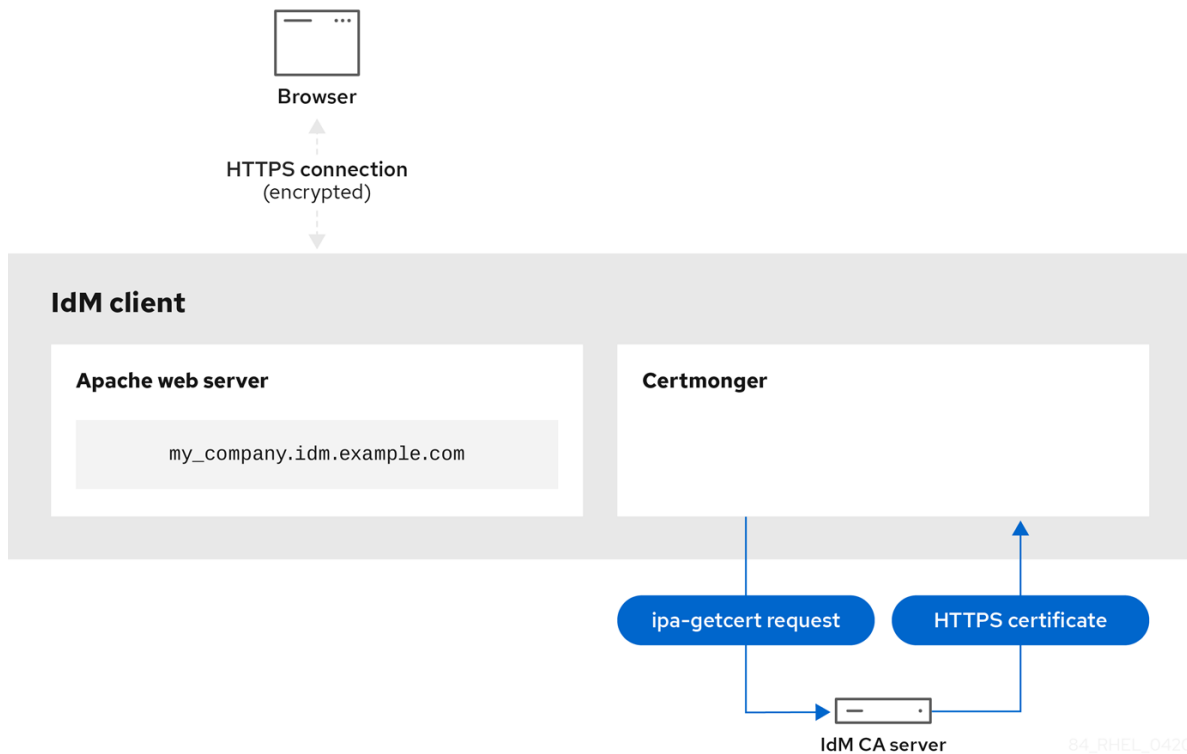


Figure 15.6, “Certmonger requesting a new certificate when the old one is nearing expiration” shows **certmonger** automatically requesting a renewal of the service certificate from the IdM CA before the expiration of the certificate. The IdM CA issues a new certificate.

Figure 15.6. Certmonger requesting a new certificate when the old one is nearing expiration



15.6. SETTING UP A SINGLE-INSTANCE APACHE HTTP SERVER

This section describes how to set up a single-instance Apache HTTP Server to serve static HTML content.

Follow the procedure in this section if the web server should provide the same content for all domains associated with the server. If you want to provide different content for different domains, set up name-based virtual hosts. For details, see [Configuring Apache name-based virtual hosts](#).

Procedure

1. Install the **httpd** package:

```
# yum install httpd
```

2. Open the TCP port **80** in the local firewall:

```
# firewall-cmd --permanent --add-port=80/tcp
# firewall-cmd --reload
```

3. Enable and start the **httpd** service:

```
# systemctl enable --now httpd
```


- Optional: Add HTML files to the **/var/www/html/** directory.



NOTE

When adding content to **/var/www/html/**, files and directories must be readable by the user under which **httpd** runs by default. The content owner can be the either the **root** user and **root** user group, or another user or group of the administrator's choice. If the content owner is the **root** user and **root** user group, the files must be readable by other users. The SELinux context for all the files and directories must be **httpd_sys_content_t**, which is applied by default to all content within the **/var/www** directory.

Verification steps

- Connect with a web browser to **http://my_company.idm.example.com/** or **http://server_IP/**. If the **/var/www/html/** directory is empty or does not contain an **index.html** or **index.htm** file, Apache displays the **Red Hat Enterprise Linux Test Page**. If **/var/www/html/** contains HTML files with a different name, you can load them by entering the URL to that file, such as **http://server_IP/example.html** or **http://my_company.idm.example.com/example.html**.

Additional resources

- For further details about configuring Apache and adapting the service to your environment, refer to the Apache manual. For details about installing the manual, see [Installing the Apache HTTP Server manual](#).
- For details about using or adjusting the **httpd systemd** service, see the **httpd.service(8)** man page.

15.7. ADDING TLS ENCRYPTION TO AN APACHE HTTP SERVER

This section describes how to enable TLS encryption on the **my_company.idm.example.com** Apache HTTP Server for the **idm.example.com** domain.

Prerequisites

- The **my_company.idm.example.com** Apache HTTP Server is installed and running.
- You have obtained the TLS certificate from the **webserver-ca** sub-CA, and stored it in the **/etc/pki/tls/certs/httpd.pem** file as described in [Section 15.4, "Obtaining an IdM certificate for a service using certmonger"](#). If you use a different path, adapt the corresponding steps of the procedure.
- The corresponding private key is stored in the **/etc/pki/tls/private/httpd.key** file. If you use a different path, adapt the corresponding steps of the procedure.
- The **webserver-ca** CA certificate is stored in the **/etc/pki/tls/private/sub-ca.crt** file. If you use a different path, adapt the corresponding steps of the procedure.
- Clients and the **my_company.idm.example.com** web server resolve the host name of the server to the IP address of the web server.

Procedure

- Install the **mod_ssl** package:

```
# dnf install mod_ssl
```

2. Edit the `/etc/httpd/conf.d/ssl.conf` file and add the following settings to the `<VirtualHost _default_:443>` directive:

- a. Set the server name:

```
ServerName my_company.idm.example.com
```



IMPORTANT

The server name must match the entry set in the **Common Name** field of the certificate.

- b. Optional: If the certificate contains additional host names in the **Subject Alt Names** (SAN) field, you can configure **mod_ssl** to provide TLS encryption also for these host names. To configure this, add the **ServerAliases** parameter with corresponding names:

```
ServerAlias www.my_company.idm.example.com server.my_company.idm.example.com
```

- c. Set the paths to the private key, the server certificate, and the CA certificate:

```
SSLCertificateKeyFile "/etc/pki/tls/private/httpd.key"
SSLCertificateFile "/etc/pki/tls/certs/httpd.pem"
SSLCACertificateFile "/etc/pki/tls/certs/ca.crt"
```

3. For security reasons, configure that only the **root** user can access the private key file:

```
# chown root:root /etc/pki/tls/private/httpd.key
# chmod 600 //etc/pki/tls/private/httpd.key
```



WARNING

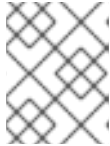
If the private key was accessed by unauthorized users, revoke the certificate, create a new private key, and request a new certificate. Otherwise, the TLS connection is no longer secure.

4. Open port **443** in the local firewall:

```
# firewall-cmd --permanent --add-port=443/tcp
# firewall-cmd --reload
```

5. Restart the **httpd** service:

```
# systemctl restart httpd
```

**NOTE**

If you protected the private key file with a password, you must enter this password each time when the **httpd** service starts.

- Use a browser and connect to **https://my_company.idm.example.com**.

Additional resources

- For further details about configuring TLS, refer to the **SSL/TLS Encryption** documentation in the Apache manual. For details about installing the manual, see [Installing the Apache HTTP Server manual](#).

15.8. SETTING THE SUPPORTED TLS PROTOCOL VERSIONS ON AN APACHE HTTP SERVER

By default, the Apache HTTP Server on RHEL 8 uses the system-wide crypto policy that defines safe default values, which are also compatible with recent browsers. For example, the **DEFAULT** policy defines that only the **TLSv1.2** and **TLSv1.3** protocol versions are enabled in apache.

This section describes how to manually configure which TLS protocol versions your **my_company.idm.example.com** Apache HTTP Server supports. Follow the procedure if your environment requires to enable only specific TLS protocol versions, for example:

- If your environment requires that clients can also use the weak **TLS1** (TLSv1.0) or **TLS1.1** protocol.
- If you want to configure that Apache only supports the **TLSv1.2** or **TLSv1.3** protocol.

Prerequisites

- TLS encryption is enabled on the **my_company.idm.example.com** server as described in [Section 15.7, “Adding TLS encryption to an Apache HTTP Server”](#).

Procedure

1. Edit the **/etc/httpd/conf/httpd.conf** file, and add the following setting to the **<VirtualHost>** directive for which you want to set the TLS protocol version. For example, to enable only the **TLSv1.3** protocol:

```
SSLProtocol -All TLSv1.3
```

2. Restart the **httpd** service:

```
# systemctl restart httpd
```

Verification steps

1. Use the following command to verify that the server supports **TLSv1.3**:

```
# openssl s_client -connect example.com:443 -tls1_3
```

2. Use the following command to verify that the server does not support **TLSv1.2**:

```
# openssl s_client -connect example.com:443 -tls1_2
```

If the server does not support the protocol, the command returns an error:

```
140111600609088:error:1409442E:SSL routines:ssl3_read_bytes:tlsv1 alert protocol
version:ssl/record/rec_layer_s3.c:1543:SSL alert number 70
```

- Optional: Repeat the command for other TLS protocol versions.

Additional resources

- For further details about the system-wide crypto policy, see the **update-crypto-policies(8)** man page and [Using system-wide cryptographic policies](#).
- For further details about the **SSLProtocol** parameter, refer to the **mod_ssl** documentation in the Apache manual. For details about installing the manual, see [Installing the Apache HTTP Server manual](#).

15.9. SETTING THE SUPPORTED CIPHERS ON AN APACHE HTTP SERVER

By default, the Apache HTTP Server on RHEL 8 uses the system-wide crypto policy that defines safe default values, which are also compatible with recent browsers. For the list of ciphers the system-wide crypto allows, see the **/etc/crypto-policies/back-ends/openssl.config** file.

This section describes how to manually configure which ciphers the **my_company.idm.example.com** Apache HTTP server supports. Follow the procedure if your environment requires specific ciphers.

Prerequisites

- TLS encryption is enabled on the **my_company.idm.example.com** server as described in [Section 15.7, "Adding TLS encryption to an Apache HTTP Server"](#).

Procedure

- Edit the **/etc/httpd/conf/httpd.conf** file, and add the **SSLCipherSuite** parameter to the **<VirtualHost>** directive for which you want to set the TLS ciphers:

```
SSLCipherSuite
"EECDH+AESGCM:EDH+AESGCM:AES256+EECDH:AES256+EDH:!SHA1:!SHA256"
```

This example enables only the **EECDH+AESGCM**, **EDH+AESGCM**, **AES256+EECDH**, and **AES256+EDH** ciphers and disables all ciphers which use the **SHA1** and **SHA256** message authentication code (MAC).

- Restart the **httpd** service:

```
# systemctl restart httpd
```

Verification steps

- To display the list of ciphers the Apache HTTP Server supports:

- a. Install the **nmap** package:

```
# yum install nmap
```

- b. Use the **nmap** utility to display the supported ciphers:

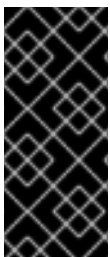
```
# nmap --script ssl-enum-ciphers -p 443 example.com
...
PORT      STATE SERVICE
443/tcp    open  https
| ssl-enum-ciphers:
|   TLSv1.2:
|     ciphers:
|       TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384 (ecdh_x25519) - A
|       TLS_DHE_RSA_WITH_AES_256_GCM_SHA384 (dh 2048) - A
|       TLS_ECDHE_RSA_WITH_CHACHA20_POLY1305_SHA256 (ecdh_x25519) - A
|
|_ ...
```

Additional resources

- For further details about the system-wide crypto policy, see the **update-crypto-policies(8)** man page and [Using system-wide cryptographic policies](#).
- For further details about the **SSLCipherSuite** parameter, refer to the **mod_ssl** documentation in the Apache manual. For details about installing the manual, see [Installing the Apache HTTP Server manual](#).

15.10. CONFIGURING TLS CLIENT CERTIFICATE AUTHENTICATION

Client certificate authentication enables administrators to allow only users who authenticate using a certificate to access resources on the **my_company.idm.example.com** web server. This section describes how to configure client certificate authentication for the **/var/www/html/Example/** directory.



IMPORTANT

If the **my_company.idm.example.com** Apache server uses the TLS 1.3 protocol, certain clients require additional configuration. For example, in Firefox, set the **security.tls.enable_post_handshake_auth** parameter in the **about:config** menu to **true**. For further details, see [Transport Layer Security version 1.3 in Red Hat Enterprise Linux 8](#).

Prerequisites

- TLS encryption is enabled on the **my_company.idm.example.com** server as described in [Section 15.7, “Adding TLS encryption to an Apache HTTP Server”](#).

Procedure

- Edit the **/etc/httpd/conf/httpd.conf** file and add the following settings to the **<VirtualHost>** directive for which you want to configure client authentication:

```
<Directory "/var/www/html/Example/">
    SSLVerifyClient require
</Directory>
```

■

The **SSLVerifyClient require** setting defines that the server must successfully validate the client certificate before the client can access the content in the **/var/www/html/Example/** directory.

2. Restart the **httpd** service:

```
# systemctl restart httpd
```

Verification steps

1. Use the **curl** utility to access the **https://my_company.idm.example.com/Example/** URL without client authentication:

```
$ curl https://my_company.idm.example.com/Example/
curl: (56) OpenSSL SSL_read: error:1409445C:SSL routines:ssl3_read_bytes:tlsv13 alert
certificate required, errno 0
```

The error indicates that the **my_company.idm.example.com** web server requires a client certificate authentication.

2. Pass the client private key and certificate, as well as the CA certificate to **curl** to access the same URL with client authentication:

```
$ curl --cacert ca.crt --key client.key --cert client.crt
https://my_company.idm.example.com/Example/
```

If the request succeeds, **curl** displays the **index.html** file stored in the **/var/www/html/Example/** directory.

Additional resources

- For further details about client authentication, see the **mod_ssl Configuration How-To** documentation in the Apache manual. For details about installing the manual, see [Installing the Apache HTTP Server manual](#).

15.11. REQUESTING A NEW USER CERTIFICATE AND EXPORTING IT TO THE CLIENT

As an Identity Management (IdM) administrator, you can configure a web server running on an IdM client to request users that use web browsers to access the server to authenticate with certificates issued by a specific IdM sub-CA. Complete this section to request a user certificate from a specific IdM sub-CA and to export the certificate and the corresponding private key on to the host from which the user wants to access the web server using a web browser. Afterwards, [import the certificate and the private key into the browser](#).

Procedure

1. Optionally, create a new directory, for example **~/certdb/**, and make it a temporary certificate database. When asked, create an NSS Certificate DB password to encrypt the keys to the certificate to be generated in a subsequent step:

```
# mkdir ~/certdb/
```

```
# certutil -N -d ~/certdb/
Enter a password which will be used to encrypt your keys.
The password should be at least 8 characters long,
and should contain at least one non-alphabetic character.
```

```
Enter new password:
Re-enter password:
```

2. Create the certificate signing request (CSR) and redirect the output to a file. For example, to create a CSR with the name **certificate_request.csr** for a **4096** bit certificate for the **idm_user** user in the **IDM.EXAMPLE.COM** realm, setting the nickname of the certificate private keys to **idm_user** for easy findability, and setting the subject to **CN=idm_user,O=IDM.EXAMPLE.COM**:

```
# certutil -R -d ~/certdb/ -a -g 4096 -n idm_user -s "CN=idm_user,O=IDM.EXAMPLE.COM"
> certificate_request.csr
```

3. When prompted, enter the same password that you entered when using **certutil** to create the temporary database. Then continue typing randomly until told to stop:

Enter Password or Pin for "NSS Certificate DB":

A random seed must be generated that will be used in the creation of your key. One of the easiest ways to create a random seed is to use the timing of keystrokes on a keyboard.

To begin, type keys on the keyboard until this progress meter is full. DO NOT USE THE AUTOREPEAT FUNCTION ON YOUR KEYBOARD!

Continue typing until the progress meter is full:

4. Submit the certificate request file to the server. Specify the Kerberos principal to associate with the newly-issued certificate, the output file to store the certificate, and optionally the certificate profile. Specify the IdM sub-CA that you want to issue the certificate. For example, to obtain a certificate of the **IECUserRoles** profile, a profile with added user roles extension, for the **idm_user@IDM.EXAMPLE.COM** principal from **webclient-ca**, and save the certificate in the **~/idm_user.pem** file:

```
# ipa cert-request certificate_request.csr --principal=idm_user@IDM.EXAMPLE.COM --
profile-id=IECUserRoles --ca=webclient-ca --certificate-out=~/idm_user.pem
```

5. Add the certificate to the NSS database. Use the **-n** option to set the same nickname that you used when creating the CSR previously so that the certificate matches the private key in the NSS database. The **-t** option sets the trust level. For details, see the **certutil(1)** man page. The **-i** option specifies the input certificate file. For example, to add to the NSS database a certificate with the **idm_user** nickname that is stored in the **~/idm_user.pem** file in the **~/certdb/** database:

```
# certutil -A -d ~/certdb/ -n idm_user -t "P,," -i ~/idm_user.pem
```

6. Verify that the key in the NSS database does not show (**orphan**) as its nickname. For example, to verify that the certificate stored in the **~/certdb/** database is not orphaned:

```
# certutil -K -d ~/certdb/
< O> rsa      5ad14d41463b87a095b1896cf0068ccc467df395  NSS Certificate
DB:ldm_user
```

- Use the **pk12util** command to export the certificate from the NSS database to the PKCS12 format. For example, to export the certificate with the **ldm_user** nickname from the **/root/certdb** NSS database into the **~/ldm_user.p12** file:

```
# pk12util -d ~/certdb -o ~/ldm_user.p12 -n ldm_user
Enter Password or Pin for "NSS Certificate DB":
Enter password for PKCS12 file:
Re-enter password:
pk12util: PKCS12 EXPORT SUCCESSFUL
```

- Transfer the certificate to the host on which you want the certificate authentication for **ldm_user** to be enabled:

```
# scp ~/ldm_user.p12 ldm_user@client.idm.example.com:/home/ldm_user/
```

- On the host to which the certificate has been transferred, make the directory in which the **.pkcs12** file is stored inaccessible to the 'other' group for security reasons:

```
# chmod o-rwx /home/ldm_user/
```

- For security reasons, remove the temporary NSS database and the **.pkcs12** file from the server:

```
# rm ~/certdb/
# rm ~/ldm_user.p12
```

15.12. CONFIGURING A BROWSER TO ENABLE CERTIFICATE AUTHENTICATION

To be able to authenticate with a certificate when using the WebUI to log into Identity Management (IdM), you need to import the user and the relevant certificate authority (CA) certificates into the Mozilla Firefox or Google Chrome browser. The host itself on which the browser is running does not have to be part of the IdM domain.

IdM supports the following browsers for connecting to the WebUI:

- Mozilla Firefox 38 and later
- Google Chrome 46 and later

The following procedure shows how to configure the Mozilla Firefox 57.0.1 browser.

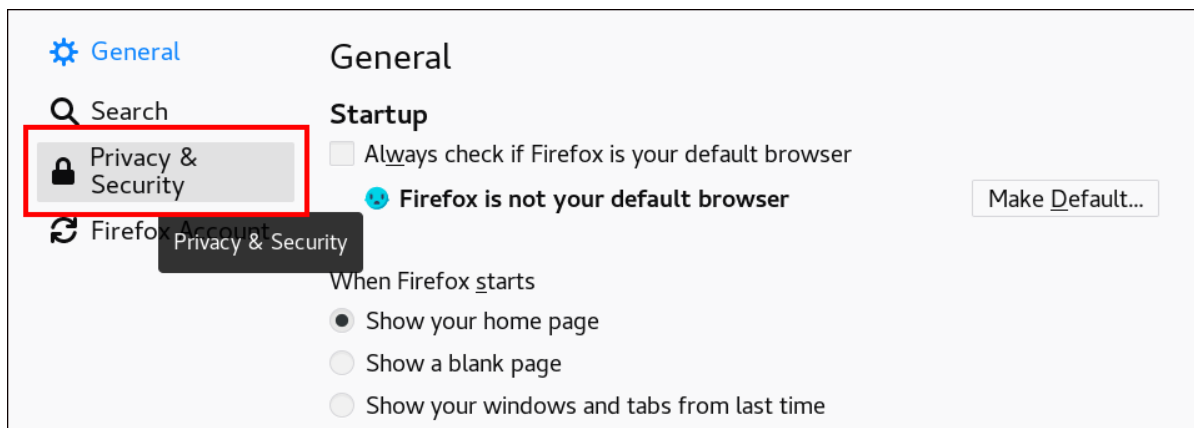
Prerequisites

- You have the [user certificate](#) that you want to import to the browser at your disposal in the PKCS#12 format.
- You have [downloaded the sub-CA certificate](#) and have it at your disposal in the PEM format.

Procedure

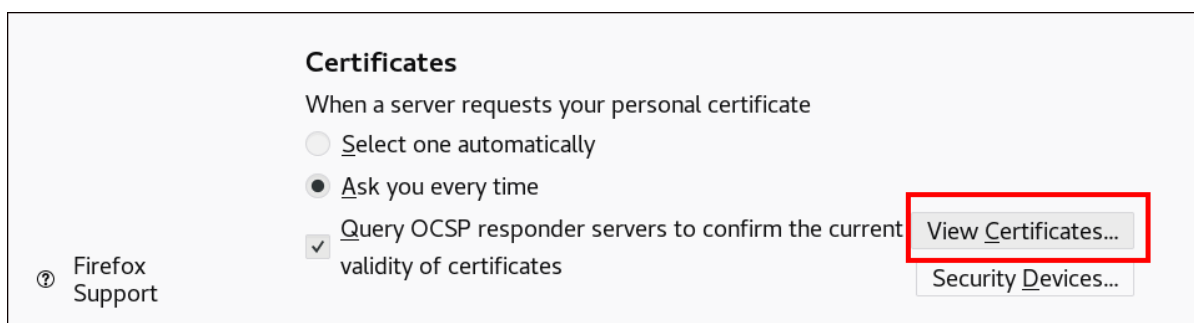
1. Open Firefox, then navigate to **Preferences → Privacy & Security**.

Figure 15.7. Privacy and Security section in Preferences



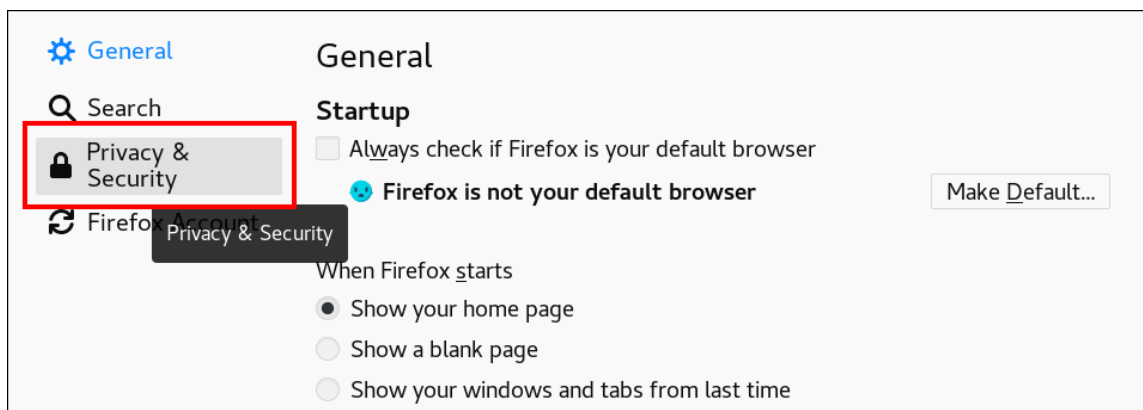
2. Click **View Certificates**.

Figure 15.8. View Certificates in Privacy and Security



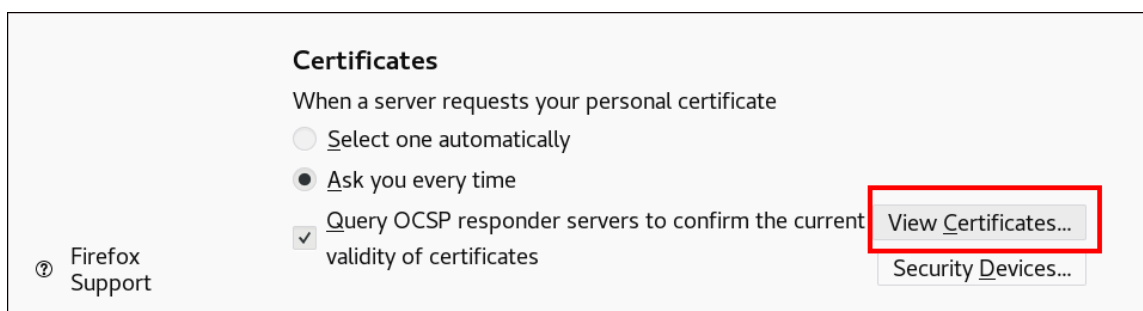
3. In the **Your Certificates** tab, click **Import**. Locate and open the certificate of the user in the PKCS12 format, then click **OK** and **OK**.
4. To make sure that your IdM sub-CA is recognized by Firefox as a trusted authority, import the IdM sub-CA certificate that you saved in [Section 15.2, "Downloading the sub-CA certificate from IdM WebUI"](#) as a trusted certificate authority certificate:
 - a. Open Firefox, navigate to Preferences and click **Privacy & Security**.

Figure 15.9. Privacy and Security section in Preferences



- b. Click **View Certificates**.

Figure 15.10. View Certificates in Privacy and Security



- c. In the **Authorities** tab, click **Import**. Locate and open the sub-CA certificate. Trust the certificate to identify websites, then click **OK** and **OK**.

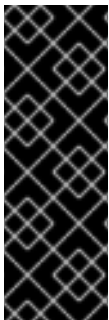
CHAPTER 16. INVALIDATING A SPECIFIC GROUP OF RELATED CERTIFICATES QUICKLY

As a system administrator, if you want to be able to invalidate a specific group of related certificates quickly:

- Design your applications so that they only trust certificates that were issued by a specific lightweight Identity Management (IdM) sub-CA. Afterwards, you will be able to invalidate all these certificates by only revoking the certificate of the Identity Management (IdM) sub-CA that issued these certificates. For details on how to create and use a lightweight sub-CA in IdM, see [Invalidating a specific group of related certificates quickly](#).
- To ensure that all the certificates that have been issued by the to-be-revoked IdM sub-CA are immediately invalid, configure applications that rely on such certificates to use the IdM OCSP responders. For example, to configure the Firefox browser to use OCSP responders, make sure that the **Query OCSP responder servers to confirm the current validity of certificates** checkbox is checked in Firefox Preferences.

In IdM, the certificate revocation list (CRL) is updated every four hours.

To invalidate all the certificates issued by an IdM sub-CA, [revoke the IdM sub-CA certificate](#). In addition, [disable the relevant CA ACLs](#), and consider [disabling the IdM sub-CA](#). Disabling the sub-CA prevents the sub-CA from issuing new certificates, but allows Online Certificate Status Protocol (OCSP) responses to be produced for previously issued certificates because the sub-CA's signing keys are retained.



IMPORTANT

Do not delete the sub-CA if you use OCSP in your environment. Deleting the sub-CA deletes the signing keys of the sub-CA, preventing production of OCSP responses for certificates issued by that sub-CA.

The only scenario when deleting a sub-CA is preferable to disabling it is when you want to create a new sub-CA with the same Subject distinguished name (DN) but a new signing key.

16.1. DISABLING CA ACLS IN IDM CLI

When you want to retire an IdM service or a group of IdM services, consider disabling any existing corresponding CA ACLs.

Complete this section to disable the [TLS_web_server_authentication](#) CA ACL that restricts the web server running on your IdM client to request a certificate to be issued by the **webserver-ca** IdM sub-CA, and to disable the [TLS_web_client_authentication](#) CA ACL that restricts IdM users to request a user certificate to be issued by the **webclient-ca** IdM sub-CA.

Procedure

1. Optionally, to view all the CA ACLs in your IdM environment, enter the **ipa caacl-find** command:

```
$ ipa caacl-find
-----
3 CA ACLs matched
-----
ACL name: hosts_services_calIPAserviceCert
```

```
Enabled: TRUE
```

```
ACL name: TLS_web_server_authentication
Enabled: TRUE
```

```
ACL name: TLS_web_client_authentication
Enabled: TRUE
```

- Optionally, to view the details of a CA ACL, enter the **ipa caacl-show** command, and specify the CA ACL name:

```
$ ipa caacl-show TLS_web_server_authentication
ACL name: TLS_web_server_authentication
Description: CAACL for web servers authenticating to web clients using certificates issued
by webserver-ca
Enabled: TRUE
CAs: webserver-ca
Profiles: calPAserviceCert
Services: HTTP/rhel8server.idm.example.com@IDM.EXAMPLE.COM
```

- To disable a CA ACL, enter the **ipa caacl-disable** command, and specify the CA ACL name.

- To disable the **TLS_web_server_authentication** CA ACL, enter:

```
$ ipa caacl-disable TLS_web_server_authentication
```

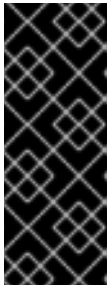
```
-----
Disabled CA ACL "TLS_web_server_authentication"
-----
```

- To disable the **TLS_web_client_authentication** CA ACL, enter:

```
$ ipa caacl-disable TLS_web_client_authentication
```

```
-----
Disabled CA ACL "TLS_web_client_authentication"
-----
```

The only enabled CA ACL now is the **hosts_services_calPAserviceCert** CA ACL.



IMPORTANT

Be extremely careful about disabling the **hosts_services_calPAserviceCert** CA ACL. Disabling **hosts_services_calPAserviceCert**, without another CA ACL granting IdM servers use of the **ipa** CA with the **calPAserviceCert** profile means that certificate renewal of the IdM **HTTP** and **LDAP** certificates will fail. The expired IdM **HTTP** and **LDAP** certificates will eventually cause IdM system failure.

16.2. DISABLING AN IDM SUB-CA

After revoking the CA certificate of an IdM sub-CA in order to invalidate all the certificates issued by that sub-CA, consider disabling the IdM sub-CA if you no longer need it. You can re-enable the sub-CA at a later time.

Disabling the sub-CA prevents the sub-CA from issuing new certificates, but allows Online Certificate Status Protocol (OCSP) responses to be produced for previously issued certificates because the sub-CA's signing keys are retained.

Prerequisites

- You are logged in as IdM administrator.

Procedure

- Enter the **ipa ca-disable** command and specify the name of the sub-CA:

```
$ ipa ca-disable webserver-CA
```

```
-----  
Disabled CA "webserver-CA"  
-----
```

CHAPTER 17. VERIFYING CERTIFICATES USING IDM HEALTHCHECK

This section helps in understanding and using the Healthcheck tool in Identity management (IdM) to identify issues with IPA certificates maintained by certmonger.

For details, see [Healthcheck in IdM](#).

Prerequisites

- The Healthcheck tool is only available in RHEL 8.1 and newer.

17.1. IDM CERTIFICATES HEALTHCHECK TESTS

The Healthcheck tool includes several tests for verifying the status of certificates maintained by certmonger in Identity Management (IdM). For details about certmonger, see [Obtaining an IdM certificate for a service using certmonger](#).

This suite of tests checks expiration, validation, trust and other issues. Multiple errors may be thrown for the same underlying issue.

To see all certificate tests, run the **ipa-healthcheck** with the **--list-sources** option:

```
# ipa-healthcheck --list-sources
```

You can find all tests under the **ipahealthcheck.ipa.certs** source:

IPACertmongerExpirationCheck

This test checks expirations in **certmonger**.
If an error is reported, the certificate has expired.

If a warning appears, the certificate will expire soon. By default, this test applies within 28 days or fewer days before certificate expiration.

You can configure the number of days in the **/etc/ipahealthcheck/ipahealthcheck.conf** file. After opening the file, change the **cert_expiration_days** option located in the default section.

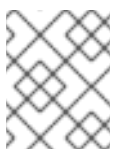


NOTE

Certmonger loads and maintains its own view of the certificate expiration. This check does not validate the on-disk certificate.

IPACertfileExpirationCheck

This test checks if the certificate file or NSS database cannot be opened. This test also checks expiration. Therefore, carefully read the **msg** attribute in the error or warning output. The message specifies the problem.



NOTE

This test checks the on-disk certificate. If a certificate is missing, unreadable, etc a separate error can also be raised.

IPACertNSSTrust

This test compares the trust for certificates stored in NSS databases. For the expected tracked certificates in NSS databases the trust is compared to an expected value and an error raised on a non-match.

IPANSSChainValidation

This test validates the certificate chain of the NSS certificates. The test executes: **certutil -V -u V -e -d [dbdir] -n [nickname]**

IPAOpenSSLChainValidation

This test validates the certificate chain of the OpenSSL certificates. To be comparable to the **NSSChain** validation here is the OpenSSL command we execute:

```
openssl verify -verbose -show_chain -CAfile /etc/ipa/ca.crt [cert file]
```

IPARAAgent

This test compares the certificate on disk with the equivalent record in LDAP in **uid=ipara,ou=People,o=ipaca**.

IPACertRevocation

This test uses certmonger to verify that certificates have not been revoked. Therefore, the test can find issues connected with certificates maintained by certmonger only.

IPACertmongerCA

This test verifies the certmonger Certificate Authority (CA) configuration. IdM cannot issue certificates without CA.

Certmonger maintains a set of CA helpers. In IdM, there is a CA named IPA which issues certificates through IdM, authenticating as a host or user principal, for host or service certs.

There are also **dogtag-ipa-ca-renew-agent** and **dogtag-ipa-ca-renew-agent-reuse** which renew the CA subsystem certificates.



NOTE

Run these tests on all IdM servers when trying to check for issues.

17.2. SCREENING CERTIFICATES USING THE HEALTHCHECK TOOL

This section describes a standalone manual test of an Identity Management (IdM) certificate health check using the Healthcheck tool.

The Healthcheck tool includes many tests, therefore, you can shorten the results with:

- excluding all successful test: **--failures-only**
- including only certificate tests: **--source=ipahealthcheck.ipa.certs**

Prerequisites

- Healthcheck tests must be performed as the root user.

Procedure

- To run Healthcheck with warnings, errors and critical issues regarding certificates, enter:

```
# ipa-healthcheck --source=ipahealthcheck.ipa.certs --failures-only
```

Successful test displays empty brackets:

```
[]
```

Failed test shows you the following output:

```
{
  "source": "ipahealthcheck.ipa.certs",
  "check": "IPACertfileExpirationCheck",
  "result": "ERROR",
  "kw": {
    "key": 1234,
    "dbdir": "/path/to/nssdb",
    "error": [error],
    "msg": "Unable to open NSS database '/path/to/nssdb': [error]"
  }
}
```

This **IPACertfileExpirationCheck** test failed on opening the NSS database.

Additional resources

- For reviewing detailed reference, enter **man ipa-healthcheck** in the command line.

CHAPTER 18. VERIFYING SYSTEM CERTIFICATES USING IDM HEALTHCHECK

This section describes a Healthcheck tool in Identity Management (IdM) to identify issues with system certificates.

For details, see [Healthcheck in IdM](#).

Prerequisites

- The Healthcheck tool is only available on RHEL 8.1 or newer.

18.1. SYSTEM CERTIFICATES HEALTHCHECK TESTS

The Healthcheck tool includes several tests for verifying system (DogTag) certificates.

To see all tests, run the **ipa-healthcheck** with the **--list-sources** option:

```
# ipa-healthcheck --list-sources
```

You can find all tests under the **ipahealthcheck.dogtag.ca** source:

DogtagCertsConfigCheck

This test compares the CA (Certificate Authority) certificates in its NSS database to the same values stored in **CS.cfg**. If they don't match, CA fails to start.

Specifically, it checks:

- **auditSigningCert cert-pki-ca** against **ca.audit_signing.cert**
- **ocspSigningCert cert-pki-ca** against **ca.ocsp_signing.cert**
- **caSigningCert cert-pki-ca** against **ca.signing.cert**
- **subsystemCert cert-pki-ca** against **ca.subsystem.cert**
- **Server-Cert cert-pki-ca** against **ca.sslserver.cert**

If Key Recovery Authority (KRA) is installed:

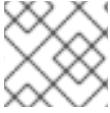
- **transportCert cert-pki-kra** against **ca.connector.KRA.transportCert**

DogtagCertsConnectivityCheck

This test verifies connectivity. This test is equivalent to the **ipa cert-show 1** command which checks:

- The PKI proxy configuration in Apache
- IdM being able to find a CA
- The RA agent client certificate
- Correctness of CA replies to requests

Note that the test checks a certificate with serial #1 because you want to verify that a **cert-show** can be executed and get back an expected result from CA (either the certificate or a not found).

**NOTE**

Run these tests on all IdM servers when trying to find an issue.

18.2. SCREENING SYSTEM CERTIFICATES USING HEALTHCHECK

This section describes a standalone manual test of Identity Management (IdM) certificates using the Healthcheck tool.

Since, the Healthcheck tool includes many tests, you can narrow the results by including only DogTag tests: **--source=ipahealthcheck.dogtag.ca**

Procedure

- To run Healthcheck restricted to DogTag certificates, enter:

```
# ipa-healthcheck --source=ipahealthcheck.dogtag.ca
```

An example of a successful test:

```
{
  "source: ipahealthcheck.dogtag.ca",
  "check: DogtagCertsConfigCheck",
  "result: SUCCESS",
  "uuid: 9b366200-9ec8-4bd9-bb5e-9a280c803a9c",
  "when: 20191008135826Z",
  "duration: 0.252280",
  "kw:" {
    "key": "Server-Cert cert-pki-ca",
    "configfile": "/var/lib/pki/pki-tomcat/conf/ca/CS.cfg"
  }
}
```

An example of a failed test:

```
{
  "source: ipahealthcheck.dogtag.ca",
  "check: DogtagCertsConfigCheck",
  "result: CRITICAL",
  "uuid: 59d66200-1447-4b3b-be01-89810c803a98",
  "when: 20191008135912Z",
  "duration: 0.002022",
  "kw:" {
    "exception": "NSDB /etc/pki/pki-tomcat/alias not initialized",
  }
}
```

Additional resources

- For reviewing detailed reference, enter **man ipa-healthcheck** in the command line.

