Red Hat Enterprise Linux 8

Managing smart card authentication

Configuring and using smart card authentication

Last Updated: 2025-05-30

Red Hat Enterprise Linux 8 Managing smart card authentication

Configuring and using smart card authentication

Legal Notice

Copyright © 2025 Red Hat, Inc.

The text of and illustrations in this document are licensed by Red Hat under a Creative Commons Attribution–Share Alike 3.0 Unported license ("CC-BY-SA"). An explanation of CC-BY-SA is available at
http://creativecommons.org/licenses/by-sa/3.0/
. In accordance with CC-BY-SA, if you distribute this document or an adaptation of it, you must provide the URL for the original version.

Red Hat, as the licensor of this document, waives the right to enforce, and agrees not to assert, Section 4d of CC-BY-SA to the fullest extent permitted by applicable law.

Red Hat, Red Hat Enterprise Linux, the Shadowman logo, the Red Hat logo, JBoss, OpenShift, Fedora, the Infinity logo, and RHCE are trademarks of Red Hat, Inc., registered in the United States and other countries.

Linux ® is the registered trademark of Linus Torvalds in the United States and other countries.

Java ® is a registered trademark of Oracle and/or its affiliates.

XFS ® is a trademark of Silicon Graphics International Corp. or its subsidiaries in the United States and/or other countries.

MySQL ® is a registered trademark of MySQL AB in the United States, the European Union and other countries.

Node.js ® is an official trademark of Joyent. Red Hat is not formally related to or endorsed by the official Joyent Node.js open source or commercial project.

The OpenStack ® Word Mark and OpenStack logo are either registered trademarks/service marks or trademarks/service marks of the OpenStack Foundation, in the United States and other countries and are used with the OpenStack Foundation's permission. We are not affiliated with, endorsed or sponsored by the OpenStack Foundation, or the OpenStack community.

All other trademarks are the property of their respective owners.

Abstract

With Red Hat Identity Management (IdM), you can store credentials in the form of a private key and a certificate on a smart card. You can then use this smart card instead of passwords to authenticate to services. Administrators can configure mapping rules to reduce the administrative overhead.

Table of Contents

PROVIDING FEEDBACK ON RED HAT DOCUMENTATION

We appreciate your feedback on our documentation. Let us know how we can improve it.

Submitting feedback through Jira (account required)

1. Log in to the Jira website.
2. Click **Create** in the top navigation bar.
3. Enter a descriptive title in the **Summary** field.
4. Enter your suggestion for improvement in the **Description** field. Include links to the relevant parts of the documentation.
5. Click **Create** at the bottom of the dialogue.

CHAPTER 1. UNDERSTANDING 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.

This section describes what a smart card is and how smart card authentication works. It describes the tools that you can use to read and manipulate smart card content. It also provides sample use cases and describes the setup of both the IdM server and IdM client for smart card authentication.

NOTE

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

1.1. WHAT IS A SMART CARD

A smart card is a physical device, usually a plastic card with a microprocessor, that 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.

1.2. SUPPORTED SMART CARDS

There are four types of cards that are supported by Red Hat Enterprise Linux: coolkey cards, CAC, PIV, and PKCS #15. For more details about the differences between the types of the cards, read the corresponding documentation.

In Red Hat Enterprise Linux, the following types of smart cards are supported:

- Cards with Coolkey applet:
  - Gemalto TOP IM FIPS CY2 64K token (SCP01)
  - Giesecke & Devrient (G&D) SmartCafe Expert 7.0 (SCP03)
  - SafeNet Assured Technologies SC-650 (SCP01)
- CAC and PIV smart cards. For more information, see Personal Identity Verification of Federal Employees and Contractors (PIV)
- Selected PKCS #15 cards are also supported. While several cards in this family are supported, there are many different configurations and options for these cards. For fully details on what cards are compatible with RHEL, contact your customer representative.
- Additionally, other cards may be supported at Red Hat's discretion. For details on other cards supported, contact your customer representative.

For more information on hardware requirements, see Smart Card support in RHEL 8 and later .

1.2.1. Supported smart card readers

In Red Hat Enterprise Linux, the smart card readers supported follow the **pcsc-lite** upstream project. Most CCID compatible readers should work without any issue. Red Hat periodically updates the USB identifiers from the upstream project into our **pcsc-lite-ccid** driver. Furthermore, additional readers may be supported at Red Hat's discretion. The following list of smart card readers are tested and verified by Red Hat:

- SCR331/SCR3310
- Omnikey 3121 (must be part number R31210399 for the SC650 card)

For a list of supported hardware in the upstream project, see Supported CCID readers/ICCD tokens .

1.3. SUPPORTED HARDWARE SECURITY MODULES

The following table lists Hardware Security Modules (HSM) supported by Red Hat Identity Management (IdM):

HSM	Firmware	Appliance Software	Client Software
nCipher nShield Connect XC (High)	nShield_HSM_Firmware-12.72.1	12.71.0	SecWorld_Lin64-12.71.0
Thales TCT Luna Network HSM Luna-T7	lunafw_update-7.11.1-4	7.11.0-25	610-500244-001_LunaClient-7.11.1-5

1.4. WHAT IS SMART CARD AUTHENTICATION

Public-key based authentication and certificate based authentication are two widely used alternatives to password based authentication. Your identity is confirmed by using public and private keys instead of your password. A certificate is an electronic document used to identify an individual, a server, a company, or other entity and to associate that identity with a public key. Like a driver's license or passport, a certificate provides generally recognized proof of a person's identity. Public-key cryptography uses certificates to address the problem of impersonation.

In the case of smart card authentication, your user credentials, that is your public and private keys and certificate, are stored on a smart card and can only be used after the smart card is inserted into the reader and a PIN is provided. As you need to possess a physical device, the smart card, and know its PIN, smart card authentication is considered as a type of two factor authentication.

1.4.1. Examples of smart card authentication in IdM

The following examples describe two simple scenarios on how you can use smart cards in IdM.

1.4.1.1. Logging in to your system with a smart card

You can use a smart card to authenticate to a RHEL system as a local user. If your system is configured to enforce smart card login, you are prompted to insert your smart card and enter its PIN and, if that fails, you cannot log in to your system. Alternatively, you can configure your system to authenticate using either smart card authentication or your user name and password. In this case, if you do not have your smart card inserted, you are prompted for your user name and password.

1.4.1.2. Logging in to GDM with lock on removal

You can activate the lock on removal function if you have configured smart card authentication on your RHEL system. If you are logged in to the GNOME Display Manager (GDM) and you remove your smart card, screen lock is enabled and you must reinsert your smart card and authenticate with the PIN to unlock the screen. You cannot use your user name and password to authenticate.

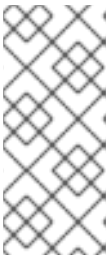
NOTE

If you are logged in to GDM and you remove your smart card, screen lock is enabled and you must reinsert your smart card and authenticate with the PIN to unlock the screen.

1.5. SMART CARD AUTHENTICATION OPTIONS IN RHEL

You can configure how you want smart card authentication to work in a particular Identity Management (IdM) client by using the **authselect** command, **authselect enable-feature <smartcard_option>**. The following smart card options are available:

- **with-smartcard**: Users can authenticate with the user name and password or with their smart card.
- **with-smartcard-required**: Users can authenticate with their smart cards, and password authentication is disabled. You cannot access the system without your smart card. Once you have authenticated with your smart card, you can stay logged in even if your smart card is removed from its reader.



NOTE

The **with-smartcard-required** option only enforces exclusive smart card authentication for login services, such as **login**, **gdm**, **xdm**, **xscreensaver**, and **gnome-screensaver**. For other services, such as **su** or **sudo** for switching users, smart card authentication is not enforced and if your smart card is not inserted, you are prompted for a password.

- **with-smartcard-lock-on-removal**: Users can authenticate with their smart card. However, if you remove your smart card from its reader, you are automatically locked out of the system. You cannot use password authentication.

NOTE

The **with-smartcard-lock-on-removal** option only works on systems with the GNOME desktop environment. If you are using a system that is **tty** or console based and you remove your smart card from its reader, you are not automatically locked out of the system.

For more information, see Configuring smart cards using authselect.

1.6. TOOLS FOR MANAGING SMART CARDS AND THEIR CONTENTS

You can use many different tools to manage the keys and certificates stored on your smart cards. You can use these tools to do the following:

- List available smart card readers connected to a system.

- List available smart cards and view their contents.
- Manipulate the smart card content, that is the keys and certificates.

There are many tools that provide similar functionality but some work at different layers of your system. Smart cards are managed on multiple layers by multiple components. On the lower level, the operating system communicates with the smart card reader using the PC/SC protocol, and this communication is handled by the **pcsc-lite** daemon. The daemon forwards the commands received to the smart card reader typically over USB, which is handled by low-level CCID driver. The PC/SC low level communication is rarely seen on the application level. The main method in RHEL for applications to access smart cards is via a higher level application programming interface (API), the OASIS PKCS#11 API, which abstracts the card communication to specific commands that operate on cryptographic objects, for example, private keys. Smart card vendors provide a shared module, such as an **.so** file, which follows the PKCS#11 API and serves as a driver for the smart card.

You can use the following tools to manage your smart cards and their contents:

- OpenSC tools: work with the drivers implemented in **opensc**.
  - **opensc-tool**: perform smart card operations.
  - **pkcs15-tool**: manage the PKCS#15 data structures on smart cards, such as listing and reading PINs, keys, and certificates stored on the token.
  - **pkcs11-tool**: manage the PKCS#11 data objects on smart cards, such as listing and reading PINs, keys, and certificates stored on the token.
- GnuTLS utils: an API for applications to enable secure communication over the network transport layer, as well as interfaces to access X.509, PKCS#12, OpenPGP, and other structures.
  - **p11tool**: perform operations on PKCS#11 smart cards and security modules.
  - **certtool**: parse and generate X.509 certificates, requests, and private keys.
- Network Security Services (NSS) Tools: a set of libraries designed to support the cross-platform development of security-enabled client and server applications. Applications built with NSS can support SSL v3, TLS, PKCS #5, PKCS #7, PKCS #11, PKCS #12, S/MIME, X.509 v3 certificates, and other security standards.
  - **modutil**: manage PKCS#11 module information with the security module database.
  - **certutil**: manage keys and certificates in both NSS databases and other NSS tokens.

For more information about using these tools to troubleshoot issues with authenticating using a smart card, see Troubleshooting authentication with smart cards.

Additional resources

- **opensc-tool**, **pkcs15-tool**, and **pkcs11-tool** man pages on your system
- **p11tool** and **certtool** man pages on your system
- **modutil** and **certutil** man pages on your system

1.7. CERTIFICATES AND SMART CARD AUTHENTICATION

If you use Identity Management (IdM) or Active Directory (AD) to manage identity stores, authentication, policies, and authorization policies in your domain, the certificates used for authentication are generated by IdM or AD, respectively. You can also use certificates provided by an external certificate authority and in this case you must configure Active Directory or IdM to accept certificates from the external provider. If the user is not part of a domain, you can use a certificate generated by a local certificate authority. For details, refer to the following sections:

- Configuring Identity Management for smart card authentication
- Configuring certificates issued by ADCS for smart card authentication in IdM
- Managing externally signed certificates for IdM users, hosts, and services
- Configuring and importing local certificates to a smart card

For a full list of certificates eligible for smart card authentication, see Certificates eligible for smart cards.

1.8. REQUIRED STEPS FOR SMART CARD AUTHENTICATION IN IDM

You must ensure the following steps have been followed before you can authenticate with a smart card in Identity Management (IdM):

- Configure your IdM server for smart card authentication. See Configuring the IdM server for smart card authentication
- Configure your IdM client for smart card authentication. See Configuring the IdM client for smart card authentication
- Add the certificate to the user entry in IdM. See Adding a certificate to a user entry in the IdM Web UI
- Store your keys and certificates on the smart card. See Storing a certificate on a smart card

1.9. REQUIRED STEPS FOR SMART CARD AUTHENTICATION WITH CERTIFICATES ISSUED BY ACTIVE DIRECTORY

You must ensure the following steps have been followed before you can authenticate with a smart card with certificates issued by Active Directory (AD):

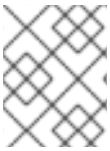
- Copy the CA and user certificates from Active Directory to the IdM server and client .
- Configure the IdM server and clients for smart card authentication using ADCS certificates .
- Convert the PFX (PKCS#12) file to be able to store the certificate and private key on the smart card.
- Configure timeouts in the sssd.conf file .
- Create certificate mapping rules for smart card authentication .

CHAPTER 2. CONFIGURING IDENTITY MANAGEMENT FOR SMART CARD AUTHENTICATION

Identity Management (IdM) supports smart card authentication with:

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

You can configure smart card authentication in IdM for both types of certificates. In this scenario, the **rootca.pem** CA certificate is the file containing the certificate of a trusted external certificate authority.



NOTE

Currently, IdM does not support importing multiple CAs that share the same Subject Distinguished Name (DN) but are cryptographically different.

2.1. CONFIGURING THE IDM SERVER FOR SMART CARD AUTHENTICATION

This procedure covers how to enable smart card authentication for users whose certificates have been issued by the certificate authority (CA) of the <EXAMPLE.ORG> domain that your Identity Management (IdM) CA trusts.

Prerequisites

- You have root access to the IdM server.
- You have the root CA certificate and all the intermediate CA certificates:
  - The certificate of the root CA that has either issued the certificate for the <EXAMPLE.ORG> CA directly, or through one or more of its sub-CAs. You can download the certificate chain 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 .
  - The IdM CA certificate. You can obtain the CA certificate from the **/etc/ipa/ca.crt** file on the IdM server on which an IdM CA instance is running.
  - The certificates of all of the intermediate CAs; that is, intermediate between the <EXAMPLE.ORG> CA and the IdM CA.

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 in PEM format and 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 /tmp/rootca.pem ~/SmartCard/
[root@server SmartCard]# cp /tmp/subca.pem ~/SmartCard/
[root@server SmartCard]# cp /tmp/issuingca.pem ~/SmartCard/
```

5. Optional: 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 rootca.pem | more
```

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

```
[root@server SmartCard]# kinit admin
[root@server SmartCard]# ipa-advise 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 rootca.pem subca.pem issuingca.pem
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. Optional: 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]# 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.

2.2. USING ANSIBLE TO CONFIGURE THE IDM SERVER FOR SMART CARD AUTHENTICATION

In this procedure, you use Ansible to enable smart card authentication for users whose certificates have been issued by the certificate authority (CA) of the <EXAMPLE.ORG> domain that your Identity Management (IdM) CA trusts.

Prerequisites

- You have **root** access to the IdM server.
- You know the IdM **admin** password.
- You have the root CA certificate, the IdM CA certificate, and all the intermediate CA certificates:
  - The certificate of the root CA that has either issued the certificate for the <EXAMPLE.ORG> CA directly, or through one or more of its sub-CAs. You can download the certificate chain from a web page whose certificate has been issued by the authority. For details, see Step 4 in Configuring a browser to enable certificate authentication .

  - The IdM CA certificate. You can obtain the CA certificate from the **/etc/ipa/ca.crt** file on any IdM CA server.
  - The certificates of all of the CAs that are intermediate between the <EXAMPLE.ORG> CA and the IdM CA.

- You have configured your Ansible control node to meet the following requirements:
  - You are using Ansible version 2.13 or later.
  - You have installed the **ansible-freeipa** package.
  - The example assumes that in the ***~/MyPlaybooks/*** directory, you have created an Ansible inventory file with the fully-qualified domain name (FQDN) of the IdM server.
  - The example assumes that the **secret.yml** Ansible vault stores your **ipaadmin_password**.
- The target node, that is the node on which the **ansible-freeipa** module is executed, is part of the IdM domain as an IdM client, server or replica.

Procedure

1. If your CA certificates are stored in files of a different format, such as **DER**, convert them to **PEM** format:

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

   The IdM Certificate Authority certificate is in **PEM** format and is located in the **/etc/ipa/ca.crt** file.

2. Optional: 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:

```
# openssl x509 -noout -text -in root-ca.pem | more
```

3. Navigate to your ***~/MyPlaybooks/*** directory:

```
$ cd ~/MyPlaybooks/
```

4. Create a subdirectory dedicated to the CA certificates:

```
$ mkdir SmartCard/
```

5. For convenience, copy all the required certificates to the **~/MyPlaybooks/SmartCard/** directory:

```
# cp /tmp/root-ca.pem ~/MyPlaybooks/SmartCard/
# cp /tmp/intermediate-ca.pem ~/MyPlaybooks/SmartCard/
# cp /etc/ipa/ca.crt ~/MyPlaybooks/SmartCard/ipa-ca.crt
```

6. In your Ansible inventory file, specify the following:
   - The IdM servers that you want to configure for smart card authentication.
   - The IdM administrator password.

- The paths to the certificates of the CAs in the following order:
  - The root CA certificate file
  - The intermediate CA certificates files
  - The IdM CA certificate file

The file can look as follows:

```
[ipaserver]
ipaserver.idm.example.com

[ipareplicas]
ipareplica1.idm.example.com
ipareplica2.idm.example.com

[ipacluster:children]
ipaserver
ipareplicas

[ipacluster:vars]
ipaadmin_password= "{{ ipaadmin_password }}"
ipasmartcard_server_ca_certs=/home/<user_name>/MyPlaybooks/SmartCard/root-ca.pem,/home/<user_name>/MyPlaybooks/SmartCard/intermediate-ca.pem,/home/<user_name>/MyPlaybooks/SmartCard/ipa-ca.crt
```

7. Create an **install-smartcard-server.yml** playbook with the following content:

```
---
- name: Playbook to set up smart card authentication for an IdM server
  hosts: ipaserver
  become: true

  roles:
  - role: ipasmartcard_server
    state: present
```

8. Save the file.

9. Run the Ansible playbook. Specify the playbook file, the file storing the password protecting the **secret.yml** file, and the inventory file:

```
$ ansible-playbook --vault-password-file=password_file -v -i inventory install-smartcard-server.yml
```

The **ipasmartcard_server** Ansible role 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.

10. Optional: 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. Connect to the IdM server as **root**:

    ```
    ssh root@ipaserver.idm.example.com
    ```

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

    ```
    SSLOCSPEnable off
    ```

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

    ```
    # 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 listed in the inventory file is now configured for smart card authentication.

NOTE

To enable smart card authentication in the whole topology, set the **hosts** variable in the Ansible playbook to **ipacluster**:

```
---
- name: Playbook to setup smartcard for IPA server and replicas
  hosts: ipacluster
[...]
```

Additional resources

- Sample playbooks using the **ipasmartcard_server** role in the **/usr/share/doc/ansible-freeipa/playbooks/** directory

2.3. CONFIGURING THE IDM CLIENT FOR SMART CARD AUTHENTICATION

You can 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 on which the browser is running. The machine can be outside of the IdM domain.
- 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 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 all the intermediate CA certificates.
- You installed the IdM client with the **--mkhomedir** option to ensure remote users can log in successfully. If you do not create a home directory, the default login location is the root of the directory structure, /.

Procedure

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

   ```
   [root@server SmartCard]# kinit admin
   [root@server SmartCard]# ipa-advise 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 truststore.
   - It configures the System Security Services Daemon (SSSD) to allow users to authenticate with either their user name and password or with their smart card. For more details on SSSD profile options for smart card authentication, see Smart card authentication options in

RHEL.

2. From the IdM server, copy the script to a directory of your choice on the IdM client machine:

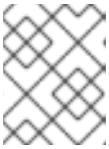
```
[root@server SmartCard]# scp config-client-for-smart-card-auth.sh
root@client.idm.example.com:/root/SmartCard/
Password:
config-client-for-smart-card-auth.sh        100%   2419       3.5MB/s   00:00
```

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

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

4. 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 rootca.pem subca.pem
issuingca.pem
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.

2.4. USING ANSIBLE TO CONFIGURE IDM CLIENTS FOR SMART CARD AUTHENTICATION

Follow this procedure to use the **ansible-freeipa ipasmartcard_client** module to configure specific Identity Management (IdM) clients to permit IdM users to authenticate with a smart card. Run this procedure to enable smart card authentication for IdM users that use any of the following to access IdM:

- The **ssh** protocol
  For details see Configuring SSH access using smart card authentication .
- The console login
- The GNOME Display Manager (GDM)

- The **su** command

NOTE

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 on which the browser is running. The machine can be outside of the IdM domain.
- The IdM server on which **httpd** is running.

Prerequisites

- Your IdM server has been configured for smart card authentication, as described in Using Ansible to configure 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, the IdM CA certificate, and all the intermediate CA certificates.
- You have configured your Ansible control node to meet the following requirements:
  - You are using Ansible version 2.13 or later.
  - You have installed the **ansible-freeipa** package.
  - The example assumes that in the ***~/MyPlaybooks/*** directory, you have created an Ansible inventory file with the fully-qualified domain name (FQDN) of the IdM server.
  - The example assumes that the **secret.yml** Ansible vault stores your **ipaadmin_password**.
- The target node, that is the node on which the **ansible-freeipa** module is executed, is part of the IdM domain as an IdM client, server or replica.

Procedure

1. If your CA certificates are stored in files of a different format, such as **DER**, convert them to **PEM** format:

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

   The IdM CA certificate is in **PEM** format and is located in the **/etc/ipa/ca.crt** file.

2. Optional: 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:

```
# openssl x509 -noout -text -in root-ca.pem | more
```

3. On your Ansible control node, navigate to your ***~/MyPlaybooks/*** directory:

```
$ cd ~/MyPlaybooks/
```

4. Create a subdirectory dedicated to the CA certificates:

```
$ mkdir SmartCard/
```

5. For convenience, copy all the required certificates to the **~/MyPlaybooks/SmartCard/** directory, for example:

```
# cp /tmp/root-ca.pem ~/MyPlaybooks/SmartCard/
# cp /tmp/intermediate-ca.pem ~/MyPlaybooks/SmartCard/
# cp /etc/ipa/ca.crt ~/MyPlaybooks/SmartCard/ipa-ca.crt
```

6. In your Ansible inventory file, specify the following:
   - The IdM clients that you want to configure for smart card authentication.
   - The IdM administrator password.
   - The paths to the certificates of the CAs in the following order:
     - The root CA certificate file
     - The intermediate CA certificates files
     - The IdM CA certificate file

   The file can look as follows:

```
[ipaclients]
ipaclient1.example.com
ipaclient2.example.com

[ipaclients:vars]
ipaadmin_password=SomeADMINpassword
ipasmartcard_client_ca_certs=/home/<user_name>/MyPlaybooks/SmartCard/root-ca.pem,/home/<user_name>/MyPlaybooks/SmartCard/intermediate-ca.pem,/home/<user_name>/MyPlaybooks/SmartCard/ipa-ca.crt
```

7. Create an **install-smartcard-clients.yml** playbook with the following content:

```
---
- name: Playbook to set up smart card authentication for an IdM client
  hosts: ipaclients
  become: true

  roles:
  - role: ipasmartcard_client
    state: present
```

8. Save the file.

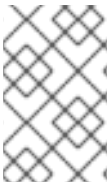
9. Run the Ansible playbook. Specify the playbook and inventory files:

```
$ ansible-playbook --vault-password-file=password_file -v -i inventory install-smartcard-clients.yml
```

   The **ipasmartcard_client** Ansible role performs the following actions:

- It configures the smart card daemon.
- It sets the system-wide truststore.
- It configures the System Security Services Daemon (SSSD) to allow users to authenticate with either their user name and password or their smart card. For more details on SSSD profile options for smart card authentication, see Smart card authentication options in RHEL.

The clients listed in the **ipaclients** section of the inventory file are now configured for smart card authentication.



NOTE

If you have installed the IdM clients with the **--mkhomedir** option, remote users will be able to log in to their home directories. Otherwise, the default login location is the root of the directory structure, /.

Additional resources

- Sample playbooks using the **ipasmartcard_server** role in the **/usr/share/doc/ansible-freeipa/playbooks/** directory

2.5. ADDING A CERTIFICATE TO A USER ENTRY IN THE IDM WEB UI

You can add an external certificate to a user entry in IdM Web UI.

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.

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 do not need to follow this procedure.

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. On the command line, 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**.

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

2.6. ADDING A CERTIFICATE TO A USER ENTRY IN THE IDM CLI

You can add an external certificate to a user entry in IdM CLI.

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.

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 do not need to follow this procedure.

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 <smartcard_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 *<smartcard_user>* using the **ipa user-add-cert** command:

```
[user@client SmartCard]$ ipa user-add-cert <smartcard_user> --certificate=$CERT
```

The ***<smartcard_user>*** entry now contains an external certificate.

2.7. INSTALLING TOOLS FOR MANAGING AND USING SMART CARDS

Before you can configure your smart card, you must install the corresponding tools that can generate certificates and start the **pscd** service.

Prerequisites

- You have **root** permissions.

Procedure

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

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

2. Start the **pcscd** service.

```
# systemctl start pcscd
```

Verification

- Verify that the **pcscd** service is up and running:

```
# systemctl status pcscd
```

2.8. PREPARING YOUR SMART CARD AND UPLOADING YOUR CERTIFICATES AND KEYS TO YOUR SMART CARD

Follow this procedure to configure your smart card 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
- If required, locking the smart card settings as certain smart cards require this type of finalization

The **pkcs15-init** tool may not work with all smart cards. You must use the tools that work with the smart card you are using.

Prerequisites

- The **opensc** package, which includes the **pkcs15-init** tool, is installed.
  For more details, see Installing tools for managing and using smart cards .
- The card is inserted in the reader and connected to the computer.
- You have a private key, a public key, and a 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.

- You have 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 **pcks15-init** tool creates a new slot on the smart card.

3. Set a 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

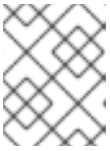
The value you specify for **--id** must be the same when storing your private key and storing your certificate in the next step. Specifying your own value for **--id** is recommended as otherwise a more complicated value is calculated by the tool.

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

```
$ pkcs15-init --store-certificate testuser.crt --label testuser_crt \
    --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 or certificate, specify the same ID as the ID of the private key or certificate.

7. Optional: Certain smart cards require you to finalize the card by locking the settings:

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

At this stage, your smart card contains 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.

2.9. LOGGING IN TO IDM WITH SMART CARDS

You can use smart cards for logging in to the IdM Web UI.

Prerequisites

- The web browser is configured for using smart card authentication.
- The IdM server is configured for smart card authentication.
- The certificate installed on your smart card is either issued by the IdM server or has been added to the user entry in IdM.
- You know the PIN required to unlock the smart card.
- The smart card has been inserted into the reader.

Procedure

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

2.10. LOGGING IN TO GDM USING SMART CARD AUTHENTICATION ON AN IDM CLIENT

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

Follow this procedure to use smart card authentication to access GDM.

Prerequisites

- The system has been configured for smart card authentication. For details, see Configuring the IdM client for smart card authentication.
- 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, Adding a certificate to a user entry in the IdM Web UI or Adding a certificate to a user entry in the IdM CLI .
  - 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

- 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
```

2.11. USING SMART CARD AUTHENTICATION WITH THE SU COMMAND

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

Prerequisites

- Your IdM server and client have been configured for smart card authentication.
  - See Configuring the IdM server for smart card authentication
  - See Configuring the IdM client for smart card authentication
- The smart card contains your certificate and private key. See Storing a certificate on a smart card

- 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 - <user_name>
PIN for smart_card
```

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

CHAPTER 3. CONFIGURING CERTIFICATES ISSUED BY ADCS FOR SMART CARD AUTHENTICATION IN IDM

To configure smart card authentication in IdM for users whose certificates are issued by Active Directory (AD) certificate services:

- 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).

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

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

You must configure the following on the 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

The exported certificate must fulfill the following criteria:

- 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

3.2. 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-winserver-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-winserver-ca.cer** root certificate to the IdM server:

```
root@idmserver ~]# 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> 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.

3.3. 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-advise** scripts which makes all necessary changes:

- Install necessary packages
- Configure IdM server and clients
- Copy the CA certificates into the expected locations

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

Follow this procedure to configure your server and clients for smart card authentication:

- On an IdM server: Preparing the **ipa-advise** script to configure your IdM server for smart card authentication.

- On an IdM server: Preparing the **ipa-advise** script to configure your IdM client for smart card authentication.
- On an IdM server: Applying the the **ipa-advise** 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-advise** 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-winserver-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-winserver-ca.cer root@client1.idm.example.com:/root
Password:
adcs-winserver-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-winserver-ca.cer
```

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

3.4. 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, convert the file 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.

3.5. INSTALLING TOOLS FOR MANAGING AND USING SMART CARDS

Before you can configure your smart card, you must install the corresponding tools that can generate certificates and start the **pscd** service.

Prerequisites

- You have **root** permissions.

Procedure

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

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

2. Start the **pcscd** service.

```
# systemctl start pcscd
```

Verification

- Verify that the **pcscd** service is up and running:

```
# systemctl status pcscd
```

3.6. PREPARING YOUR SMART CARD AND UPLOADING YOUR CERTIFICATES AND KEYS TO YOUR SMART CARD

Follow this procedure to configure your smart card 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
- If required, locking the smart card settings as certain smart cards require this type of finalization

The **pkcs15-init** tool may not work with all smart cards. You must use the tools that work with the smart card you are using.

Prerequisites

- The **opensc** package, which includes the **pkcs15-init** tool, is installed.
  For more details, see Installing tools for managing and using smart cards .
- The card is inserted in the reader and connected to the computer.
- You have a private key, a public key, and a 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.
- You have 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 **pcks15-init** tool creates a new slot on the smart card.

3. Set a 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 storing your certificate in the next step. Specifying your own value for **--id** is recommended as otherwise a more complicated value is calculated by the tool.

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

```
$ pkcs15-init --store-certificate testuser.crt --label testuser_crt \
   --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 or certificate, specify the same ID as the ID of the private key or certificate.

7. Optional: Certain smart cards require you to finalize the card by locking the settings:

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

At this stage, your smart card contains 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.

3.7. 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:

- A slow reader
- 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/sssd/sssd.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 fails with a timeout.

3.8. 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 .

CHAPTER 4. CERTIFICATE MAPPING RULES FOR CONFIGURING AUTHENTICATION

You might need to configure certificate mapping rules in the following scenarios:

- Certificates have been issued by the Certificate System of the Active Directory (AD) with which the IdM domain is in a trust relationship.
- Certificates have been issued by an external certificate authority.
- The IdM environment is large with many users using smart cards. In this case, adding full certificates can be complicated. The subject and issuer are predictable in most scenarios and therefore easier to add ahead of time than the full certificate.

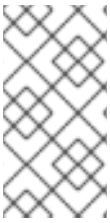
As a system administrator, you can create a certificate mapping rule and add certificate mapping data to a user entry even before a certificate is issued to a particular user. Once the certificate is issued, the user can log in using the certificate even though the full certificate has not yet been uploaded to the user entry.

In addition, as certificates are renewed at regular intervals, certificate mapping rules reduce administrative overhead. When a user's certificate is 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 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 whose account contains a certificate mapping data entry that matches the information on the certificate.

Once the certificate mapping rules have been created, when the end-user presents the certificate, stored either on a filesystem or a smart card, authentication is successful.



NOTE

The Key Distribution Center (KDC) has a cache for certificate mapping rules. The cache is populated on the first **certauth** request and it has a hard-coded timeout of 300 seconds. KDC will not see any changes to certificate mapping rules unless it is restarted or the cache expires.

Your certificate mapping rules can depend on the use case for which you are using the certificate. For example, if you are using SSH with certificates, you must have the full certificate to extract the public key from the certificate.

CHAPTER 5. CONFIGURING SMART CARD AUTHENTICATION WITH THE WEB CONSOLE FOR CENTRALLY MANAGED USERS

You can configure smart card authentication in the RHEL web console for users who are centrally managed by:

- Identity Management
- Active Directory which is connected in the cross-forest trust with Identity Management

IMPORTANT

Smart card authentication does not elevate administrative privileges yet and the web console opens in the web browser in the read-only mode.

You can run administrative commands in the built-in terminal with **sudo**.

Prerequisites

- The system for which you want to use the smart card authentication must be a member of an Active Directory or Identity Management domain.
  For details about joining the RHEL 8 system into a domain using the web console, see Joining a RHEL system to an IdM domain using the web console.
- The certificate used for the smart card authentication must be associated with a particular user in Identity Management or Active Directory.
  For more details about associating a certificate with the user in Identity Management, see Adding a certificate to a user entry in the IdM Web UI or Adding a certificate to a user entry in the IdM CLI.

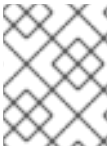
5.1. SMART CARD AUTHENTICATION FOR CENTRALLY MANAGED USERS

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. Special software and hardware is used to access them. You insert the smart card into a reader or a USB socket 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. For more details, see Configuring Identity Management for smart card authentication.
- User certificates issued by the Active Directory Certificate Service (ADCS) certificate authority. For more details, see Configuring certificates issued by ADCS for smart card authentication in IdM.



NOTE

If you want to start using smart card authentication, see the hardware requirements: Smart Card support in RHEL8+ .

5.2. INSTALLING TOOLS FOR MANAGING AND USING SMART CARDS

Before you can configure your smart card, you must install the corresponding tools that can generate certificates and start the **pscd** service.

Prerequisites

- You have **root** permissions.

Procedure

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

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

2. Start the **pcscd** service.

```
# systemctl start pcscd
```

Verification

- Verify that the **pcscd** service is up and running:

```
# systemctl status pcscd
```

5.3. PREPARING YOUR SMART CARD AND UPLOADING YOUR CERTIFICATES AND KEYS TO YOUR SMART CARD

Follow this procedure to configure your smart card 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
- If required, locking the smart card settings as certain smart cards require this type of finalization

The **pkcs15-init** tool may not work with all smart cards. You must use the tools that work with the smart card you are using.

Prerequisites

- The **opensc** package, which includes the **pkcs15-init** tool, is installed.
  For more details, see Installing tools for managing and using smart cards .

- The card is inserted in the reader and connected to the computer.
- You have a private key, a public key, and a 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.
- You have 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 **pcks15-init** tool creates a new slot on the smart card.

3. Set a 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 storing your certificate in the next step. Specifying your own value for **--id** is recommended as otherwise a more complicated value is calculated by the tool.

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

```
$ pkcs15-init --store-certificate testuser.crt --label testuser_crt \
    --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 or certificate, specify the same ID as the ID of the private key or certificate.

7. Optional: Certain smart cards require you to finalize the card by locking the settings:

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

At this stage, your smart card contains 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.

5.4. ENABLING SMART CARD AUTHENTICATION FOR THE WEB CONSOLE

To use smart card authentication in the web console, enable this authentication method in the **cockpit.conf** file.

Additionally, you can disable password authentication in the same file.

Prerequisites

- You have installed the RHEL 8 web console.
- You have enabled the cockpit service.
- Your user account is allowed to log in to the web console.
  For instructions, see Installing and enabling the web console .

Procedure

1. Log in to the RHEL 8 web console.
   For details, see Logging in to the web console .
2. Click **Terminal**.
3. In the **/etc/cockpit/cockpit.conf**, set the **ClientCertAuthentication** to **yes**:

```
[WebService]
ClientCertAuthentication = yes
```

4. Optional: Disable password based authentication in **cockpit.conf** with:

```
[Basic]
action = none
```

This configuration disables password authentication and you must always use the smart card.

5. Restart the web console to ensure that the **cockpit.service** accepts the change:

```
# systemctl restart cockpit
```

5.5. LOGGING IN TO THE WEB CONSOLE WITH SMART CARDS

You can use smart cards to log in to the web console.

Prerequisites

- A valid certificate stored in your smart card that is associated to a user account created in a Active Directory or Identity Management domain.
- PIN to unlock the smart card.
- The smart card has been put into the reader.
- You have installed the RHEL 8 web console.
- You have enabled the cockpit service.
- Your user account is allowed to log in to the web console.
  For instructions, see Installing and enabling the web console .

Procedure

1. Log in to the RHEL 8 web console.
   For details, see Logging in to the web console .

   The browser asks you to add the PIN protecting the certificate stored on the smart card.
2. In the **Password Required** dialog box, enter PIN and click **OK**.
3. In the **User Identification Request** dialog box, select the certificate stored in the smart card.
4. Select **Remember this decision**.
   The system does not open this window next time.

NOTE

This step does not apply to Google Chrome users.

5. Click **OK**.

You are now connected and the web console displays its content.

5.6. LIMITING USER SESSIONS AND MEMORY TO PREVENT A DOS ATTACK

A certificate authentication is protected by separating and isolating instances of the **cockpit-ws** web server against attackers who wants to impersonate another user. However, this introduces a potential

denial of service (DoS) attack: A remote attacker could create a large number of certificates and send a large number of HTTPS requests to **cockpit-ws** each using a different certificate.

To prevent such DoS attacks, the collective resources of these web server instances are limited. By default, limits for the number of connections and memory usage are set to 200 threads and 75 % (soft) or 90 % (hard) memory limit.

The example procedure demonstrates resource protection by limiting the number of connections and memory.

Procedure

1. In the terminal, open the **system-cockpithttps.slice** configuration file:

```
# systemctl edit system-cockpithttps.slice
```

2. Limit the **TasksMax** to *100* and **CPUQuota** to *30%*:

```
[Slice]
# change existing value
TasksMax=100
# add new restriction
CPUQuota=30%
```

3. To apply the changes, restart the system:

```
# systemctl daemon-reload
# systemctl stop cockpit
```

Now, the new memory and user session lower the risk of DoS attacks on the **cockpit-ws** web server.

5.7. ADDITIONAL RESOURCES

- Configuring Identity Management for smart card authentication .
- Configuring certificates issued by ADCS for smart card authentication in IdM .
- Configuring and importing local certificates to a smart card .

CHAPTER 6. CONFIGURING SMART CARD AUTHENTICATION WITH LOCAL CERTIFICATES

To configure smart card authentication with local certificates:

- The host is not connected to a domain.
- You want to authenticate with a smart card on this host.
- You want to configure SSH access using smart card authentication.
- You want to configure the smart card with **authselect**.

Use the following configuration to accomplish this scenario:

- Obtain a user certificate for the user who wants to authenticate with a smart card. The certificate should be generated by a trustworthy Certification Authority used in the domain. If you cannot get the certificate, you can generate a user certificate signed by a local certificate authority for testing purposes,
- Store the certificate and private key in a smart card.
- Configure the smart card authentication for SSH access.

IMPORTANT

If a host can be part of the domain, add the host to the domain and use certificates generated by Active Directory or Identity Management Certification Authority.

For details about how to create IdM certificates for a smart card, see Configuring Identity Management for smart card authentication.

Prerequisites

- Authselect installed
  The authselect tool configures user authentication on Linux hosts and you can use it to configure smart card authentication parameters. For details about authselect, see Explaining authselect.
- Smart Card or USB devices supported by RHEL 8
  For details, see Smart Card support in RHEL8 .

6.1. CREATING LOCAL CERTIFICATES

Follow this procedure to perform the following tasks:

- Generate the OpenSSL certificate authority
- Create a certificate signing request

WARNING

The following steps are intended for testing purposes only. Certificates generated by a local self-signed Certificate Authority are not as secure as using AD, IdM, or RHCS Certification Authority. You should use a certificate generated by your enterprise Certification Authority even if the host is not part of the domain.

Procedure

1. Create a directory where you can generate the certificate, for example:

```
# mkdir /tmp/ca
# cd /tmp/ca
```

2. Set up the certificate (copy this text to your command line in the **ca** directory):

```
# cat > ca.cnf <<EOF
[ ca ]
default_ca = CA_default

[ CA_default ]
dir             = .
database        = \$dir/index.txt
new_certs_dir   = \$dir/newcerts

certificate     = \$dir/rootCA.crt
serial          = \$dir/serial
private_key     = \$dir/rootCA.key
RANDFILE        = \$dir/rand

default_days    = 365
default_crl_days = 30
default_md      = sha256

policy          = policy_any
email_in_dn     = no

name_opt        = ca_default
cert_opt        = ca_default
copy_extensions  = copy

[ usr_cert ]
authorityKeyIdentifier = keyid, issuer

[ v3_ca ]
subjectKeyIdentifier   = hash
authorityKeyIdentifier = keyid:always,issuer:always
basicConstraints       = CA:true
keyUsage               = critical, digitalSignature, cRLSign, keyCertSign

[ policy_any ]
```

```
organizationName       = supplied
organizationalUnitName = supplied
commonName             = supplied
emailAddress           = optional

[ req ]
distinguished_name = req_distinguished_name
prompt             = no

[ req_distinguished_name ]
O  = Example
OU = Example Test
CN = Example Test CA
EOF
```

3. Create the following directories:

```
# mkdir certs crl newcerts
```

4. Create the following files:

```
# touch index.txt crlnumber index.txt.attr
```

5. Write the number 01 in the serial file:

```
# echo 01 > serial
```

This command writes a number 01 in the serial file. It is a serial number of the certificate. With each new certificate released by this CA the number increases by one.

6. Create an OpenSSL root CA key:

```
# openssl genrsa -out rootCA.key 2048
```

7. Create a self-signed root Certification Authority certificate:

```
# openssl req -batch -config ca.cnf \ -x509 -new -nodes -key rootCA.key -sha256 -days
10000 \ -set_serial 0 -extensions v3_ca -out rootCA.crt
```

8. Create the key for your username:

```
# openssl genrsa -out example.user.key 2048
```

This key is generated in the local system which is not secure, therefore, remove the key from the system when the key is stored in the card.

You can create a key directly in the smart card as well. For doing this, follow instructions created by the manufacturer of your smart card.

9. Create the certificate signing request configuration file (copy this text to your command line in the ca directory):

```
# cat > req.cnf <<EOF
[ req ]
```

```
distinguished_name = req_distinguished_name
prompt = no

[ req_distinguished_name ]
O = Example
OU = Example Test
CN = testuser

[ req_exts ]
basicConstraints = CA:FALSE
nsCertType = client, email
nsComment = "testuser"
subjectKeyIdentifier = hash
keyUsage = critical, nonRepudiation, digitalSignature, keyEncipherment
extendedKeyUsage = clientAuth, emailProtection, msSmartcardLogin
subjectAltName = otherName:msUPN;UTF8:testuser@EXAMPLE.COM,
email:testuser@example.com
EOF
```

10. Create a certificate signing request for your example.user certificate:

```
# openssl req -new -nodes -key example.user.key \ -reqexts req_exts -config req.cnf -
out example.user.csr
```

11. Configure the new certificate. Expiration period is set to 1 year:

```
# openssl ca -config ca.cnf -batch -notext \ -keyfile rootCA.key -in example.user.csr -
days 365 \ -extensions usr_cert -out example.user.crt
```

At this point, the certification authority and certificates are successfully generated and prepared for import into a smart card.

6.2. COPYING CERTIFICATES TO THE SSSD DIRECTORY

GNOME Desktop Manager (GDM) requires SSSD. If you use GDM, you need to copy the PEM certificate to the **/etc/sssd/pki** directory.

Prerequisites

- The local CA authority and certificates have been generated

Procedure

1. Ensure that you have SSSD installed on the system.

```
# rpm -q sssd
sssd-2.0.0.43.el8_0.3.x86_64
```

2. Create a **/etc/sssd/pki** directory:

```
# file /etc/sssd/pki
/etc/sssd/pki/: directory
```

3. Copy the **rootCA.crt** as a PEM file in the **/etc/sssd/pki/** directory:

```
# cp /tmp/ca/rootCA.crt /etc/sssd/pki/sssd_auth_ca_db.pem
```

Now you have successfully generated the certificate authority and certificates, and you have saved them in the **/etc/sssd/pki** directory.

NOTE

If you want to share the Certificate Authority certificates with another application, you can change the location in sssd.conf:

- SSSD PAM responder: **pam_cert_db_path** in the **[pam]** section
- SSSD ssh responder: **ca_db** in the **[ssh]** section

For details, see man page for **sssd.conf**.

Red Hat recommends keeping the default path and using a dedicated Certificate Authority certificate file for SSSD to make sure that only Certificate Authorities trusted for authentication are listed here.

6.3. INSTALLING TOOLS FOR MANAGING AND USING SMART CARDS

Before you can configure your smart card, you must install the corresponding tools that can generate certificates and start the **pscd** service.

Prerequisites

- You have **root** permissions.

Procedure

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

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

2. Start the **pcscd** service.

```
# systemctl start pcscd
```

Verification

- Verify that the **pcscd** service is up and running:

```
# systemctl status pcscd
```

6.4. PREPARING YOUR SMART CARD AND UPLOADING YOUR CERTIFICATES AND KEYS TO YOUR SMART CARD

Follow this procedure to configure your smart card 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
- If required, locking the smart card settings as certain smart cards require this type of finalization

The **pkcs15-init** tool may not work with all smart cards. You must use the tools that work with the smart card you are using.

Prerequisites

- The **opensc** package, which includes the **pkcs15-init** tool, is installed.
  For more details, see Installing tools for managing and using smart cards .
- The card is inserted in the reader and connected to the computer.
- You have a private key, a public key, and a 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.
- You have 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 **pcks15-init** tool creates a new slot on the smart card.

3. Set a 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 storing your certificate in the next step. Specifying your own value for **--id** is recommended as otherwise a more complicated value is calculated by the tool.

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

```
$ pkcs15-init --store-certificate testuser.crt --label testuser_crt \
    --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 or certificate, specify the same ID as the ID of the private key or certificate.

7. Optional: Certain smart cards require you to finalize the card by locking the settings:

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

At this stage, your smart card contains 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.

6.5. CONFIGURING SSH ACCESS USING SMART CARD AUTHENTICATION

SSH connections require authentication. You can use a password or a certificate. Follow this procedure to enable authentication using a certificate stored on a smart card.

For details about configuring smart cards with **authselect**, see Configuring smart cards using authselect .

Prerequisites

- The smart card contains your certificate and private key.
- The card is inserted in the reader and connected to the computer.
- The **pcscd** service is running on your local machine.
  For details, see Installing tools for managing and using smart cards .

Procedure

1. Create a new directory for SSH keys in the home directory of the user who uses smart card authentication:

```
# mkdir /home/<example_user>/.ssh
```

2. Run the **ssh-keygen -D** command with the **opensc** library to retrieve the existing public key paired with the private key on the smart card, and add it to the **authorized_keys** list of the user's SSH keys directory to enable SSH access with smart card authentication.

```
# ssh-keygen -D /usr/lib64/pkcs11/opensc-pkcs11.so >>
~<example_user>/.ssh/authorized_keys
```

3. SSH requires access right configuration for the **/.ssh** directory and the **authorized_keys** file. To set or change the access rights, enter:

```
# chown -R <example_user:example_user> ~<example_user>/.ssh/
# chmod 700 ~<example_user>/.ssh/
# chmod 600 ~<example_user>/.ssh/authorized_keys
```

Verification

1. Display the keys:

```
# cat ~<example_user>/.ssh/authorized_keys
```

   The terminal displays the keys.

You can verify the SSH access with the following command:

```
# ssh -I /usr/lib64/opensc-pkcs11.so -l <example_user> localhost hostname
```

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

The configuration works now locally. Now you can copy the public key and distribute it to **authorized_keys** files located on all servers on which you want to use SSH.

6.6. CREATING CERTIFICATE MAPPING RULES WHEN USING SMART CARDS

You need to create certificate mapping rules in order to log in using the certificate stored on a smart card.

Prerequisites

- The smart card contains your certificate and private key.
- The card is inserted in the reader and connected to the computer.
- The **pcscd** service is running on your local machine.

Procedure

1. Create a certificate mapping configuration file, such as **/etc/sssd/conf.d/sssd_certmap.conf**.
2. Add certificate mapping rules to the **sssd_certmap.conf** file:

```
[certmap/shadowutils/otheruser]
matchrule = <SUBJECT>.*CN=certificate_user.*<ISSUER>^CN=Example Test CA,OU=Example Test,O=EXAMPLE$
```

Note that you must define each certificate mapping rule in separate sections. Define each section as follows:

```
[certmap/<DOMAIN_NAME>/<RULE_NAME>]
```

If SSSD is configured to use the proxy provider to allow smart card authentication for local users instead of AD, IPA, or LDAP, the *<RULE_NAME>* can simply be the username of the user with the card matching the data provided in the **matchrule**.

Verification

Note that to verify SSH access with a smart card, SSH access must be configured. For more information, see Configuring SSH access using smart card authentication .

- You can verify the SSH access with the following command:

```
# ssh -I /usr/lib64/opensc-pkcs11.so -l otheruser localhost hostname
```

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

CHAPTER 7. CONFIGURING SMART CARD AUTHENTICATION USING AUTHSELECT

You can configure your smart card to achieve one of the following aims:

- Enable both password and smart card authentication
- Disable password and enable smart card authentication
- Enable lock on removal

Prerequisites

- The **authselect** tool is installed on your system
  The **authselect** tool configures user authentication on Linux hosts and you can use it to configure smart card authentication parameters. For details about **authselect**, see Configuring user authentication using authselect.
- Smart Card or USB devices supported by RHEL 8
  For details, see Smart Card support in RHEL8 .

7.1. CERTIFICATES ELIGIBLE FOR SMART CARDS

Before you can configure a smart card with **authselect**, you must import a certificate into your card. You can use the following tools to generate the certificate:

- Active Directory (AD)
- Identity Management (IdM)
  For details about how to create IdM certificates, see Requesting a new user certificate and exporting it to the client.
- Red Hat Certificate System (RHCS)
  For details, see Managing Smart Cards with the Enterprise Security Client .
- Third-party Certification Authority (CA)
- Local Certification Authority. You can use a certificate generated by the Local Certification Authority if the user is not part of a domain or for testing purposes.
  For details about how to create and import local certificates into a smart card, Configuring and importing local certificates to a smart card.

7.2. CONFIGURE YOUR SYSTEM TO ENABLE BOTH SMART CARD AND PASSWORD AUTHENTICATION

Follow this procedure to enable both smart card and password authentication on your system.

Prerequisites

- The Smart card contains your certificate and private key.
- The card is inserted into the reader and connected to the computer.
- The **authselect** tool is installed on your system.

Procedure

- Enter the following command to allow smart card and password authentication:

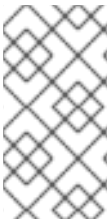
```
# authselect select sssd with-smartcard --force
```

At this point, smart card authentication is enabled, however, password authentication will work if you forget your smart card at home.

7.3. CONFIGURING YOUR SYSTEM TO ENFORCE SMART CARD AUTHENTICATION

The **authselect** tool enables you to configure smart card authentication on your system and to disable the default password authentication. The **authselect** command includes the following options:

- **with-smartcard** – enables smart card authentication in addition to password authentication
- **with-smartcard-required** – enables smart card authentication and disables password authentication



NOTE

The **with-smartcard-required** option only enforces exclusive smart card authentication for login services, such as **login**, **gdm**, **xdm**, **kdm**, **xscreensaver**, **gnome-screensaver**, and **kscreensaver**. Other services, such as **su** or **sudo** for switching users, do not use smart card authentication by default and will continue to prompt you for a password.

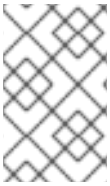
Prerequisites

- Smart card contains your certificate and private key.
- The card is inserted into the reader and connected to the computer.
- The **authselect** tool is installed on your local system.

Procedure

- Enter the following command to enforce smart card authentication:

```
# authselect select sssd with-smartcard with-smartcard-required --force
```



NOTE

Once you run this command, password authentication will no longer work and you can only log in with a smart card. Ensure smart card authentication is working before running this command or you may be locked out of your system.

7.4. CONFIGURING SMART CARD AUTHENTICATION WITH LOCK ON REMOVAL

The **authselect** service enables you to configure your smart card authentication to lock your screen instantly after removing the smart card from the reader. The **authselect** command must include the following variables:

- **with-smartcard** – enabling smart card authentication
- **with-smartcard-required** – enabling exclusive smart card authentication (authentication with a password is disabled)
- **with-smartcard-lock-on-removal** – enforcing log out after the smart card removal

NOTE

The **with-smartcard-lock-on-removal** option only works on systems with the GNOME desktop environment. If you are using a system that is **tty** or console based and you remove your smart card from its reader, you are not automatically locked out of the system.

Prerequisites

- Smart card contains your certificate and private key.
- The card is inserted into the reader and connected to the computer.
- The **authselect** tool is installed on your local system.

Procedure

- Enter the following command to enable smart card authentication, disable password authentication, and enforce lock on removal:

```
# authselect select sssd with-smartcard with-smartcard-required with-smartcard-lock-on-removal --force
```

Now, when you remove the card, the screen locks. You must re-insert your smart card to unlock it.

CHAPTER 8. AUTHENTICATING TO SUDO REMOTELY USING SMART CARDS

You can authenticate to **sudo** remotely using smart cards. After the **ssh-agent** service is running locally and can forward the **ssh-agent** socket to a remote machine, you can use the SSH authentication protocol in the **sudo** PAM module to authenticate users remotely.

After logging in locally using a smart card, you can log in through SSH to the remote machine and run the **sudo** command without being prompted for a password by using SSH forwarding of the smart card authentication.

For the purposes of this example, a client is connecting to the IPA server through SSH and running the **sudo** command on the IPA server with credentials stored on a smart card.

8.1. CREATING SUDO RULES IN IDM

Follow this procedure to create **sudo** rules in IdM to give ***<idm_user>*** permission to run **sudo** on the remote host.

For the purposes of this example, the **less** and **whoami** commands are added as **sudo** commands to test the procedure.

Prerequisites

- The IdM user has been created. For the purpose of this example, the user is ***<idm_user>***.
- You have the hostname of the system where you are running **sudo** remotely. For the purpose of this example, the host is **server.ipa.test**.

Procedure

1. Create a **sudo** rule named *<sudorule_name>* to allow a user to run commands. Replace *<sudorule_name>* with the actual name of the sudo rule you want to create.

```
# ipa sudorule-add <sudorule_name>
```

2. Add **less** and **whoami** as **sudo** commands:

```
# ipa sudocmd-add /usr/bin/less
# ipa sudocmd-add /usr/bin/whoami
```

3. Add the **less** and **whoami** commands to the *<sudorule_name>*:

```
# ipa sudorule-add-allow-command <sudorule_name> --sudocmds /usr/bin/less
# ipa sudorule-add-allow-command <sudorule_name> --sudocmds /usr/bin/whoami
```

4. Add the ***<idm_user>*** user to the *<sudorule_name>*:

```
# ipa sudorule-add-user <sudorule_name> --users <idm_user>
```

5. Add the host on which you are running **sudo** to the *<sudorule_name>*:

```
# ipa sudorule-add-host <sudorule_name> --hosts server.ipa.test
```

Additional resources

- See **ipa sudorule-add --help**.
- See **ipa sudocmd-add --help**.

8.2. SETTING UP THE PAM MODULE FOR SUDO

Follow this procedure to install and set up the **pam_ssh_agent_auth.so** PAM module for **sudo** authentication with a smart card on any host where you are running **sudo**.

Procedure

1. Install the PAM SSH agent:

```
# dnf -y install pam_ssh_agent_auth
```

2. Add the **authorized_keys_command** for **pam_ssh_agent_auth.so** to the **/etc/pam.d/sudo** file before any other **auth** entry:

```
#%PAM-1.0
auth sufficient pam_ssh_agent_auth.so
authorized_keys_command=/usr/bin/sss_ssh_authorizedkeys
auth       include      system-auth
account    include      system-auth
password   include      system-auth
session    include      system-auth
```

3. To enable the SSH agent forwarding to work when you run **sudo** commands, add the following to the **/etc/sudoers** file:

```
Defaults env_keep += "SSH_AUTH_SOCK"
```

This allows users who have their public keys from smart cards stored in IPA/SSSD to authenticate to **sudo** without entering a password.

4. Restart the **sssd** service:

```
# systemctl restart sssd
```

Additional resources

- **pam** man page on your system

8.3. CONNECTING TO SUDO REMOTELY USING A SMART CARD

Follow this procedure to configure the SSH agent and client to connect to **sudo** remotely using a smart card.

Prerequisites

- You have created **sudo** rules in IdM.
- You have installed and set up the **pam_ssh_agent_auth** PAM module for **sudo** authentication on the remote system where you are going to run **sudo**.

Procedure

1. Start the SSH agent (if not already running).

```
# eval `ssh-agent`
```

2. Add your smart card to the SSH agent. Enter your PIN when prompted:

```
# ssh-add -s /usr/lib64/opensc-pkcs11.so
```

3. Connect to the system where you need to run **sudo** remotely by using SSH with ssh-agent forwarding enabled. Use the **-A** option:

```
# ssh -A ipauser1@server.ipa.test
```

Verification

- Run the **whoami** command with **sudo**:

```
# sudo /usr/bin/whoami
```

You are not prompted for a PIN or password when the smart card is inserted.

NOTE

If the SSH agent is configured to use other sources, such as the GNOME Keyring, and you run the **sudo** command after removing the smart card, you might not be prompted for a PIN or password, as one of the other sources might provide access to a valid private key. To check the public keys of all identities known by the SSH agent, run the **ssh-add -L** command.

Additional resources

- Using secure communications between two systems with OpenSSH
- Connecting to remote machines with SSH keys using ssh-agent

CHAPTER 9. AUTHENTICATING AS AN ACTIVE DIRECTORY USER USING PKINIT WITH A SMART CARD

Active Directory (AD) users can authenticate with a smart card to a desktop client system joined to IdM and get a Kerberos ticket-granting ticket (TGT). These tickets can be used for single sign-on (SSO) authentication from the client.

Prerequisites

- The IdM server is configured for smart card authentication. For more information, see Configuring the IdM server for smart card authentication or Using Ansible to configure the IdM server for smart card authentication.
- The client is configured for smart card authentication. For more information, see Configuring the IdM client for smart card authentication or Using Ansible to configure IdM clients for smart card authentication.
- The **krb5-pkinit** package is installed.
- The AD server is configured to trust the certificate authority (CA) that issued the smart card certificate. Import the CA certificates into the NTAuth store (see Microsoft support) and add the CA as a trusted CA. See Active Directory documentation for details.

Procedure

1. Configure the Kerberos client to trust the CA that issued the smart card certificate:
   a. On the IdM client, open the **/etc/krb5.conf** file.
   b. Add the following lines to the file:

```
[realms]
  AD.DOMAIN.COM = {
    pkinit_eku_checking = kpServerAuth
    pkinit_kdc_hostname = adserver.ad.domain.com
  }
```

2. If the user certificates do not contain a certificate revocation list (CRL) distribution point extension, configure AD to ignore revocation errors:
   a. Save the following REG-formatted content in a plain text file and import it to the Windows registry:

```
Windows Registry Editor Version 5.00

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Kdc]
"UseCachedCRLOnlyAndIgnoreRevocationUnknownErrors"=dword:00000001

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\LSA\Kerberos\Parameters]
"UseCachedCRLOnlyAndIgnoreRevocationUnknownErrors"=dword:00000001
```

   Alternatively, you can set the values manually by using the **regedit.exe** application.
   b. Reboot the Windows system to apply the changes.

3. Authenticate by using the **kinit** utility on an Identity Management client. Specify the Active Directory user with the user name and domain name:

```
$ kinit -X X509_user_identity='PKCS11:opensc-pkcs11.so' ad_user@AD.DOMAIN.COM
```

The **-X** option specifies the **opensc-pkcs11.so module** as the pre-authentication attribute.

Additional resources

- **kinit(1)** man page on your system
- See MIT Kerberos Documentation for **/etc/krb5.conf** settings.

CHAPTER 10. TROUBLESHOOTING AUTHENTICATION WITH SMART CARDS

The following procedures describe how to resolve some of the issues you might encounter when setting up smart card authentication.

10.1. TESTING SMART CARD ACCESS ON THE SYSTEM

Follow this procedure to test whether you can access your smart card.

Prerequisites

- You have installed and configured your IdM Server and client for use with smart cards.
- You have installed the **certutil** tool from the **nss-tools** package.
- You have the PIN or password for your smart card.

Procedure

1. Using the **lsusb** command, verify that the smart card reader is visible to the operating system:

```
$ lsusb
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 003: ID 072f:b100 Advanced Card Systems, Ltd ACR39U
Bus 001 Device 002: ID 0627:0001 Adomax Technology Co., Ltd
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
```

   For more information about the smart cards and readers tested and supported in RHEL, see Smart Card support in RHEL 8 .

2. Ensure that the **pcscd** service and socket are enabled and running:

```
$ systemctl status pcscd.service pcscd.socket

● pcscd.service - PC/SC Smart Card Daemon
     Loaded: loaded (/usr/lib/systemd/system/pcscd.service; indirect;
vendor preset: disabled)
     Active: active (running) since Fri 2021-09-24 11:05:04 CEST; 2
weeks 6 days ago
TriggeredBy: ● pcscd.socket
       Docs: man:pcscd(8)
   Main PID: 3772184 (pcscd)
      Tasks: 12 (limit: 38201)
     Memory: 8.2M
        CPU: 1min 8.067s
     CGroup: /system.slice/pcscd.service
             └─3772184 /usr/sbin/pcscd --foreground --auto-exit

● pcscd.socket - PC/SC Smart Card Daemon Activation Socket
     Loaded: loaded (/usr/lib/systemd/system/pcscd.socket; enabled;
vendor preset: enabled)
     Active: active (running) since Fri 2021-09-24 11:05:04 CEST; 2
weeks 6 days ago
```

```
Triggers: ● pcscd.service
  Listen: /run/pcscd/pcscd.comm (Stream)
  CGroup: /system.slice/pcscd.socket
```

3. Using the **p11-kit list-modules** command, display information about the configured smart card and the tokens present on the smart card:

```
$ p11-kit list-modules
p11-kit-trust: p11-kit-trust.so
[...]
opensc: opensc-pkcs11.so
    library-description: OpenSC smartcard framework
    library-manufacturer: OpenSC Project
    library-version: 0.20
    token: MyEID (sctest)
        manufacturer: Aventra Ltd.
        model: PKCS#15
        serial-number: 8185043840990797
        firmware-version: 40.1
        flags:
            rng
            login-required
            user-pin-initialized
            token-initialized
```

4. Verify you can access the contents of your smart card:

```
$ pkcs11-tool --list-objects --login
Using slot 0 with a present token (0x0)
Logging in to "MyEID (sctest)".
Please enter User PIN:
Private Key Object; RSA
  label:      Certificate
  ID:         01
  Usage:      sign
  Access:     sensitive
Public Key Object; RSA 2048 bits
  label:      Public Key
  ID:         01
  Usage:      verify
  Access:     none
Certificate Object; type = X.509 cert
  label:      Certificate
  subject:    DN: O=IDM.EXAMPLE.COM, CN=idmuser1
  ID:         01
```

5. Display the contents of the certificate on your smart card using the **certutil** command:

    a. Run the following command to determine the correct name of your certificate:

```
$ certutil -d /etc/pki/nssdb -L -h all

Certificate Nickname                                         Trust Attributes
                                                             SSL,S/MIME,JAR/XPI
```

```
Enter Password or Pin for "MyEID (sctest)":
Smart Card CA 0f5019a8-7e65-46a1-afe5-8e17c256ae00          CT,C,C
MyEID (sctest):Certificate                                  u,u,u
```

b. Display the contents of the certificate on your smart card:

NOTE

Ensure the name of the certificate is an exact match for the output displayed in the previous step, in this example **MyEID (sctest):Certificate**.

```
$ certutil -d /etc/pki/nssdb -L -n "MyEID (sctest):Certificate"

Enter Password or Pin for "MyEID (sctest)":
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number: 15 (0xf)
        Signature Algorithm: PKCS #1 SHA-256 With RSA Encryption
        Issuer: "CN=Certificate Authority,O=IDM.EXAMPLE.COM"
        Validity:
            Not Before: Thu Sep 30 14:01:41 2021
            Not After : Sun Oct 01 14:01:41 2023
        Subject: "CN=idmuser1,O=IDM.EXAMPLE.COM"
        Subject Public Key Info:
            Public Key Algorithm: PKCS #1 RSA Encryption
            RSA Public Key:
                Modulus:
                    [...]
                Exponent: 65537 (0x10001)
        Signed Extensions:
            Name: Certificate Authority Key Identifier
            Key ID:
                e2:27:56:0d:2f:f5:f2:72:ce:de:37:20:44:8f:18:7f:
                2f:56:f9:1a

            Name: Authority Information Access
            Method: PKIX Online Certificate Status Protocol
            Location:
                URI: "http://ipa-ca.idm.example.com/ca/ocsp"

            Name: Certificate Key Usage
            Critical: True
            Usages: Digital Signature
                    Non-Repudiation
                    Key Encipherment
                    Data Encipherment

            Name: Extended Key Usage
                TLS Web Server Authentication Certificate
                TLS Web Client Authentication Certificate

            Name: CRL Distribution Points
            Distribution point:
                URI: "http://ipa-ca.idm.example.com/ipa/crl/MasterCRL.bin"
```

```
            CRL issuer:
                Directory Name: "CN=Certificate Authority,O=ipaca"

        Name: Certificate Subject Key ID
        Data:
            43:23:9f:c1:cf:b1:9f:51:18:be:05:b5:44:dc:e6:ab:
            be:07:1f:36

    Signature Algorithm: PKCS #1 SHA-256 With RSA Encryption
    Signature:
        [...]
    Fingerprint (SHA-256):

6A:F9:64:F7:F2:A2:B5:04:88:27:6E:B8:53:3E:44:3E:F5:75:85:91:34:ED:48:A8:0D:F0:31:5
D:7B:C9:E0:EC
    Fingerprint (SHA1):
        B4:9A:59:9F:1C:A8:5D:0E:C1:A2:41:EC:FD:43:E0:80:5F:63:DF:29

    Mozilla-CA-Policy: false (attribute missing)
    Certificate Trust Flags:
        SSL Flags:
            User
        Email Flags:
            User
        Object Signing Flags:
            User
```

Additional resources

- **certutil(1)** man page on your system

10.2. TROUBLESHOOTING SMART CARD AUTHENTICATION WITH SSSD

Follow this procedure to troubleshoot authentication with SSSD using smart cards.

Prerequisites

- You have installed and configured your IdM Server and client for use with smart cards.
- You have installed the **sssd-tools** package.
- You are able to detect your smart card reader and display the contents of your smart card. See Testing smart card access on the system .

Procedure

1. Verify you can authenticate with your smart card using **su**:

```
$ su - idmuser1 -c 'su - idmuser1 -c whoami'
PIN for MyEID (sctest):
idmuser1
```

   If you are not prompted for the smart card PIN, and either a password prompt or an

authorization error are returned, check the SSSD logs. See Troubleshooting authentication with SSSD in IdM for information about logging in SSSD. The following is an example of an authentication failure:

```
$ su - idmuser1 -c 'su - idmuser1 -c whoami'
PIN for MyEID (sctest):
su: Authentication failure
```

If the SSSD logs indicate an issue from the **krb5_child**, similar to the following, you may have an issue with your CA certificates. To troubleshoot issues with certificates, see Verifying that IdM Kerberos KDC can use Pkinit and that the CA certificates are correctly located.

```
[Pre-authentication failed: Failed to verify own certificate (depth 0): unable to get local issuer certificate: could not load the shared library]
```

If the SSSD logs indicate a timeout either from **p11_child** or **krb5_child**, you may need to increase the SSSD timeouts and try authenticating again with your smart card. See Increasing SSSD timeouts for details on how to increase the timeouts.

2. Verify your GDM smart card authentication configuration is correct. A success message for PAM authentication should be returned as shown below:

```
# sssctl user-checks -s gdm-smartcard "idmuser1" -a auth
user: idmuser1
action: auth
service: gdm-smartcard

SSSD nss user lookup result:
 - user name: idmuser1
 - user id: 603200210
 - group id: 603200210
 - gecos: idm user1
 - home directory: /home/idmuser1
 - shell: /bin/sh

SSSD InfoPipe user lookup result:
 - name: idmuser1
 - uidNumber: 603200210
 - gidNumber: 603200210
 - gecos: idm user1
 - homeDirectory: /home/idmuser1
 - loginShell: /bin/sh

testing pam_authenticate

PIN for MyEID (sctest)
pam_authenticate for user [idmuser1]: Success

PAM Environment:
 - PKCS11_LOGIN_TOKEN_NAME=MyEID (sctest)
 - KRB5CCNAME=KCM:
```

If an authentication error, similar to the following, is returned, check the SSSD logs to try and determine what is causing the issue. See Troubleshooting authentication with SSSD in IdM for information about logging in SSSD.

```
pam_authenticate for user [idmuser1]: Authentication failure

PAM Environment:
 - no env -
```

If PAM authentication continues to fail, clear your cache and run the command again.

```
# sssctl cache-remove
SSSD must not be running. Stop SSSD now? (yes/no) [yes] yes
Creating backup of local data…
Removing cache files…
SSSD needs to be running. Start SSSD now? (yes/no) [yes] yes
```

10.3. VERIFYING THAT IDM KERBEROS KDC CAN USE PKINIT AND THAT THE CA CERTIFICATES ARE CORRECTLY LOCATED

Follow this procedure to verify that IdM Kerberos KDC can use PKINIT and also describes how to verify your CA certificates are correctly located.

Prerequisites

- You have installed and configured your IdM Server and client for use with smart cards.
- You are able to detect your smart card reader and display the contents of your smart card. See Testing smart card access on the system .

Procedure

1. Run the **kinit** utility to authenticate as the **idmuser1** with the certificate stored on your smart card:

```
$ kinit -X X509_user_identity=PKCS11: idmuser1
MyEID (sctest)                  PIN:
```

2. Enter your smart card PIN. If you are not prompted for your PIN, check that you can detect your smart card reader and display the contents of your smart card. See Testing smart card authentication.
3. If your PIN is accepted and you are then prompted for your password, you might be missing your CA signing certificate.
   a. Verify the CA chain is listed in the default certificate bundle file using **openssl** commands:

```
$ openssl crl2pkcs7 -nocrl -certfile /var/lib/ipa-client/pki/ca-bundle.pem | openssl pkcs7 -
print_certs -noout
subject=O = IDM.EXAMPLE.COM, CN = Certificate Authority

issuer=O = IDM.EXAMPLE.COM, CN = Certificate Authority
```

   b. Verify the validity of your certificates:
      i. Find the user authentication certificate ID for **idmuser1**:

```
$ pkcs11-tool --list-objects --login
[...]
Certificate Object; type = X.509 cert
  label:      Certificate
  subject:    DN: O=IDM.EXAMPLE.COM, CN=idmuser1
 ID: 01
```

ii. Read the user certificate information from the smart card in DER format:

```
$ pkcs11-tool --read-object --id 01 --type cert --output-file cert.der
Using slot 0 with a present token (0x0)
```

iii. Convert the DER certificate to PEM format:

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

iv. Verify the certificate has valid issuer signatures up to the CA:

```
$ openssl verify -CAfile /var/lib/ipa-client/pki/ca-bundle.pem <path>/cert.pem
cert.pem: OK
```

4. If your smart card contains several certificates, **kinit** might fail to choose the correct certificate for authentication. In this case, you need to specify the certificate ID as an argument to the **kinit** command using the **certid=<ID>** option.

   a. Check how many certificates are stored on the smart card and get the certificate ID for the one you are using:

```
$ pkcs11-tool --list-objects --type cert --login
Using slot 0 with a present token (0x0)
Logging in to "MyEID (sctest)".
Please enter User PIN:
Certificate Object; type = X.509 cert
  label:      Certificate
  subject:    DN: O=IDM.EXAMPLE.COM, CN=idmuser1
  ID:         01
Certificate Object; type = X.509 cert
  label:      Second certificate
  subject:    DN: O=IDM.EXAMPLE.COM, CN=ipauser1
  ID:         02
```

   b. Run **kinit** with certificate ID 01:

```
$ kinit -X kinit -X X509_user_identity=PKCS11:certid=01 idmuser1
MyEID (sctest)                  PIN:
```

5. Run **klist** to view the contents of the Kerberos credentials cache:

```
$ klist
Ticket cache: KCM:0:11485
Default principal: idmuser1@EXAMPLE.COM
```

```
Valid starting       Expires              Service principal
10/04/2021 10:50:04  10/05/2021 10:49:55  krbtgt/EXAMPLE.COM@EXAMPLE.COM
```

6. Destroy your active Kerberos tickets once you have finished:

```
$ kdestroy -A
```

Additional resources

- See **kinit** man page on your system.
- See **kdestroy** man page on your system.

10.4. INCREASING SSSD TIMEOUTS

If you are having issues authenticating with a smart card, check the **krb5_child.log** and the **p11_child.log** file for timeout entries similar to the following:

```
krb5_child: Timeout for child [9607] reached.....consider increasing value of krb5_auth_timeout.
```

If there is a timeout entry in the log file, try increasing the SSSD timeouts as outlined in this procedure.

Prerequisites

- You have configured your IdM Server and client for smart card authentication.

Procedure

1. Open the **sssd.conf** file on the IdM client:

```
# vim /etc/sssd/sssd.conf
```

2. In your domain section, for example **[domain/idm.example.com]**, add the following option:

```
krb5_auth_timeout = 60
```

3. In the **[pam]** section, add the following:

```
p11_child_timeout = 60
```

4. Clear the SSSD cache:

```
# sssctl cache-remove
SSSD must not be running. Stop SSSD now? (yes/no) [yes] yes
Creating backup of local data…
Removing cache files…
SSSD needs to be running. Start SSSD now? (yes/no) [yes] yes
```

Once you have increased the timeouts, try authenticating again using your smart card. See Testing smart card authentication for more details.

10.5. TROUBLESHOOTING CERTIFICATE MAPPING AND MATCHING RULES

If you are having issues authenticating with a smart card, check that you have linked your smart card certificate correctly to a user. By default, a certificate is associated with a user when the user entry contains the full certificate as part of the **usercertificate** attribute. However, if you have defined certificate mapping rules, you may have changed how certificates are associated with users.

NOTE

If you are using your smart card to authenticate using SSH, you need to add the full certificate to the user entry in Identity Management (IdM). If you are not using your smart card to authenticate using SSH, you can add certificate mapping data using the **ipa user-add-certmapdata** command.

10.5.1. Checking how the certificates are mapped to users

By default, a certificate is associated with a user when the user entry contains the full certificate as part of the **usercertificate** attribute. However, if you have defined certificate mapping rules, you may have changed how certificates are associated with users. Follow this procedure to check your certificate mapping rules.

Prerequisites

- You have installed and configured your Identity Management (IdM) server and client for use with smart cards.
- You are able to detect your smart card reader and display the contents of your smart card. See Testing smart card access on the system .
- You have mapped your smart card certificate to an IdM user. See Certificate mapping rules for configuring authentication on smart cards.

Procedure

1. Verify the certificate mapping rules currently configured for IdM:

```
# ipa certmaprule-find
----------------------------------------
1 Certificate Identity Mapping Rule matched
----------------------------------------
  Rule name: smartcardrule
  Mapping rule: (ipacertmapdata=X509:<I>{issuer_dn!nss_x500}<S>{subject_dn!nss_x500})
  Matching rule: <ISSUER>CN=Certificate Authority,O=IDM.EXAMPLE.COM
  Enabled: TRUE
----------------------------
Number of entries returned 1
----------------------------
```

You can expect to see one of the following mapping rules defined:

- **ipacertmapdata** indicates that the IdM user entry **certmapdata** attribute is used.

- **altSecurityIdentities** specifies that Active Directory's user entry name mapping attribute is used.
- **userCertificate;binary=** indicates that the whole certificate in either IdM or AD is used.

You can define many matching options but some of the typically configured options are as follows:

- **<ISSUER>CN=[…]** specifies the issuer attribute of the certificate being used is checked to make sure it matches this.
- **<SUBJECT>.*,DC=MY,DC=DOMAIN** indicates the subject of the certificate is checked.

2. Enable System Security Services Daemon (SSSD) logging by adding **debug_level = 9** to the **/etc/sssd/sssd.conf** file on the IdM server:

```
[domain/idm.example.com]
...
debug_level = 9
```

3. Restart SSSD:

```
# systemctl restart sssd
```

4. You should see the following entry in the **/var/log/sssd/sssd_idm.example.com.log** file if the mapping is read correctly:

```
[be[idm.example.com]] [sdap_setup_certmap] (0x4000): Trying to add rule [smartcardrule][-1]
[<ISSUER>CN=Certificate Authority,O=IDM.EXAMPLE.COM][(|(userCertificate;binary=
{cert!bin})(ipacertmapdata=X509:<I>{issuer_dn!nss_x500}<S>{subject_dn!nss_x500}))].
```

5. If your mapping rule contains an invalid syntax, an entry similar to the following can be seen in the log file:

```
[be[idm.example.com]]] [sss_certmap_init] (0x0040): sss_certmap initialized.
[be[idm.example.com]]] [ipa_certmap_parse_results] (0x4000): Trying to add rule
[smartcardrule][-1][<ISSUER>CN=Certificate Authority,O=IDM.EXAMPLE.COM]
[(ipacertmapdata=X509:<I>{issuer_dn!x509}<S>{subject_dn})].
[be[idm.example.com]]] [parse_template] (0x0040): Parse template invalid.
[be[idm.example.com]]] [parse_ldap_mapping_rule] (0x0040): Failed to add template.
[be[idm.example.com]]] [parse_mapping_rule] (0x0040): Failed to parse LDAP mapping rule.
[be[idm.example.com]]] [ipa_certmap_parse_results] (0x0020): sss_certmap_add_rule failed
for rule [smartcardrule], skipping. Please check for typos and if rule syntax is supported.
[be[idm.example.com]]] [ipa_subdomains_certmap_done] (0x0040): Unable to parse certmap
results [22]: Invalid argument
[be[idm.example.com]]] [ipa_subdomains_refresh_certmap_done] (0x0020): Failed to read
certificate mapping rules [22]: Invalid argument
```

6. Check your mapping rule syntax.

```
# ipa certmaprule-show smartcardrule
  Rule name: smartcardrule
  Mapping rule: (|(userCertificate;binary={cert!bin})(ipacertmapdata=X509:<I>
{issuer_dn!nss_x500}<S>{subject_dn!nss_x500}))
```

```
  Matching rule: <ISSUER>CN=Certificate Authority,O=IDM.EXAMPLE.COM
  Domain name: ipa.test
  Enabled: TRUE
```

7. If required, modify your certificate mapping rule:

```
# ipa certmaprule-mod smartcardrule --maprule '(ipacertmapdata=X509:<I>
{issuer_dn!nss_x500}<S>{subject_dn!nss_x500})'
```

Additional resources

- See the **sss-certmap** man page on your system.

10.5.2. Checking the user associated with a smart card certificate

If you are having issues authenticating with a smart card, verify the correct user is associated with your smart card certificate.

Prerequisites

- You have installed and configured your Identity Management (IdM) server and client for use with smart cards.
- You are able to detect your smart card reader and display the contents of your smart card. See Testing smart card access on the system .
- You have mapped your smart card certificate to an IdM user. See Certificate mapping rules for configuring authentication on smart cards.
- You have a copy of the certificate from your smart card in PEM format, for example, **cert.pem**.

Procedure

1. Verify the user is associated with your smart card certificate:

```
# ipa certmap-match cert.pem
--------------
1 user matched
--------------
  Domain: IDM.EXAMPLE.COM
  User logins: idmuser1
----------------------------
Number of entries returned 1
----------------------------
```

   If the user or domain are not correct, check how your certificates are mapped to users. See Checking how the certificates are mapped to users .

2. Check if the user entry contains the certificate:

```
# ipa user-show idmuser1
  User login: idmuser1
[...]
```

```
Certificate:MIIEejCCAuKgAwIBAgIBCzANBgkqhkiG9w0BAQsFADAzMREwDwYDVQQKDAhJ
UEEuVEVTVDEeMBwGA1UEAwwVQ2VydGlmaWNhdGUgQXV0aG9yaXR5MB4XD
```

3. If your user entry does not contain the certificate, add your base-64 encoded certificate to the user entry:

   a. 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:

   ```
   $ export CERT=`openssl x509 -outform der -in idmuser1.crt | base64 -w0 -`
   ```

   Note that the certificate in the **idmuser1.crt** file must be in PEM format.

   b. Add the certificate to the profile of **idmuser1** using the **ipa user-add-cert** command:

   ```
   $ ipa user-add-cert idmuser1 --certificate=$CERT
   ```

   c. Clear the System Security Services Daemon (SSSD) cache.

   ```
   # sssctl cache-remove
   SSSD must not be running. Stop SSSD now? (yes/no) [yes] yes
   Creating backup of local data…
   Removing cache files…
   SSSD needs to be running. Start SSSD now? (yes/no) [yes] yes
   ```

4. Run **ipa certmap-match** again to confirm the user is associated with your smart card certificate.