Red Hat Enterprise Linux 9

Security hardening

Enhancing security of Red Hat Enterprise Linux 9 systems

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Enhancing security of Red Hat Enterprise Linux 9 systems

Notice légale

Résumé

Learn the processes and practices for securing Red Hat Enterprise Linux servers and workstations against local and remote intrusion, exploitation, and malicious activity. By using these approaches and tools, you can create a more secure computing environment for the data center, workplace, and home.

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RENDRE L'OPEN SOURCE PLUS INCLUSIF

Red Hat s'engage à remplacer les termes problématiques dans son code, sa documentation et ses propriétés Web. Nous commençons par ces quatre termes : master, slave, blacklist et whitelist. En raison de l'ampleur de cette entreprise, ces changements seront mis en œuvre progressivement au cours de plusieurs versions à venir. Pour plus de détails, voir le message de notre directeur technique Chris Wright.

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CHAPITRE 1. SECURING RHEL DURING INSTALLATION

Security begins even before you start the installation of Red Hat Enterprise Linux. Configuring your system securely from the beginning makes it easier to implement additional security settings later.

1.1. BIOS AND UEFI SECURITY

Password protection for the BIOS (or BIOS equivalent) and the boot loader can prevent unauthorized users who have physical access to systems from booting using removable media or obtaining root privileges through single user mode. The security measures you should take to protect against such attacks depends both on the sensitivity of the information about the workstation and the location of the machine.

For example, if a machine is used in a trade show and contains no sensitive information, then it may not be critical to prevent such attacks. However, if an employee's laptop with private, unencrypted SSH keys for the corporate network is left unattended at that same trade show, it could lead to a major security breach with ramifications for the entire company.

If the workstation is located in a place where only authorized or trusted people have access, however, then securing the BIOS or the boot loader may not be necessary.

1.1.1. BIOS passwords

The two primary reasons for password protecting the BIOS of a computer are[1]:

1. **Preventing changes to BIOS settings** – If an intruder has access to the BIOS, they can set it to boot from a CD-ROM or a flash drive. This makes it possible for them to enter rescue mode or single user mode, which in turn allows them to start arbitrary processes on the system or copy sensitive data.

2. **Preventing system booting** – Some BIOSes allow password protection of the boot process. When activated, an attacker is forced to enter a password before the BIOS launches the boot loader.

Because the methods for setting a BIOS password vary between computer manufacturers, consult the computer's manual for specific instructions.

If you forget the BIOS password, it can either be reset with jumpers on the motherboard or by disconnecting the CMOS battery. For this reason, it is good practice to lock the computer case if possible. However, consult the manual for the computer or motherboard before attempting to disconnect the CMOS battery.

1.1.2. Non-BIOS-based systems security

Other systems and architectures use different programs to perform low-level tasks roughly equivalent to those of the BIOS on x86 systems. For example, the *Unified Extensible Firmware Interface* (*UEFI*) shell.

For instructions on password protecting BIOS-like programs, see the manufacturer's instructions.

1.2. DISK PARTITIONING

Red Hat recommends creating separate partitions for the **/boot**, /, **/home**, **/tmp**, and **/var/tmp/** directories.

/boot

This partition is the first partition that is read by the system during boot up. The boot loader and kernel images that are used to boot your system into Red Hat Enterprise Linux 9 are stored in this partition. This partition should not be encrypted. If this partition is included in / and that partition is encrypted or otherwise becomes unavailable then your system is not able to boot.

/home

When user data (/**home**) is stored in / instead of in a separate partition, the partition can fill up causing the operating system to become unstable. Also, when upgrading your system to the next version of Red Hat Enterprise Linux 9 it is a lot easier when you can keep your data in the **/home** partition as it is not be overwritten during installation. If the root partition (/) becomes corrupt your data could be lost forever. By using a separate partition there is slightly more protection against data loss. You can also target this partition for frequent backups.

/tmp and **/var/tmp/**

Both the **/tmp** and **/var/tmp/** directories are used to store data that does not need to be stored for a long period of time. However, if a lot of data floods one of these directories it can consume all of your storage space. If this happens and these directories are stored within / then your system could become unstable and crash. For this reason, moving these directories into their own partitions is a good idea.

NOTE

During the installation process, you have an option to encrypt partitions. You must supply a passphrase. This passphrase serves as a key to unlock the bulk encryption key, which is used to secure the partition's data.

1.3. RESTRICTING NETWORK CONNECTIVITY DURING THE INSTALLATION PROCESS

When installing Red Hat Enterprise Linux 9, the installation medium represents a snapshot of the system at a particular time. Because of this, it may not be up-to-date with the latest security fixes and may be vulnerable to certain issues that were fixed only after the system provided by the installation medium was released.

When installing a potentially vulnerable operating system, always limit exposure only to the closest necessary network zone. The safest choice is the "no network" zone, which means to leave your machine disconnected during the installation process. In some cases, a LAN or intranet connection is sufficient while the Internet connection is the riskiest. To follow the best security practices, choose the closest zone with your repository while installing Red Hat Enterprise Linux 9 from a network.

1.4. INSTALLING THE MINIMUM AMOUNT OF PACKAGES REQUIRED

It is best practice to install only the packages you will use because each piece of software on your computer could possibly contain a vulnerability. If you are installing from the DVD media, take the opportunity to select exactly what packages you want to install during the installation. If you find you need another package, you can always add it to the system later.

1.5. POST-INSTALLATION PROCEDURES

The following steps are the security-related procedures that should be performed immediately after installation of Red Hat Enterprise Linux 9.

- Update your system. Enter the following command as root:

```
# dnf update
```

- Even though the firewall service, **firewalld**, is automatically enabled with the installation of Red Hat Enterprise Linux, there are scenarios where it might be explicitly disabled, for example in the kickstart configuration. In such a case, it is recommended to consider re-enabling the firewall.
  To start **firewalld** enter the following commands as root:

```
# systemctl start firewalld
# systemctl enable firewalld
```

- To enhance security, disable services you do not need. For example, if there are no printers installed on your computer, disable the **cups** service using the following command:

```
# systemctl disable cups
```

  To review active services, enter the following command:

```
$ systemctl list-units | grep service
```

[1] Because system BIOSes differ between manufacturers, some may not support password protection of either type, while others may support one type but not the other.

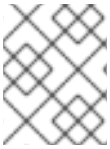
CHAPITRE 2. INSTALLING THE SYSTEM IN FIPS MODE

To enable the cryptographic module self-checks mandated by the Federal Information Processing Standard (FIPS) 140-3, you have to operate RHEL 9 in FIPS mode.

You can achieve this by:

- Starting the installation in FIPS mode.
- Switching the system into FIPS mode after the installation.

To avoid cryptographic key material regeneration and reevaluation of the compliance of the resulting system associated with converting already deployed systems, Red Hat recommends starting the installation in FIPS mode.



NOTE

The cryptographic modules of RHEL 9 are not yet certified for the FIPS 140-3 requirements.

2.1. FEDERAL INFORMATION PROCESSING STANDARD (FIPS)

The Federal Information Processing Standard (FIPS) Publication 140-3 is a computer security standard developed by the U.S. Government and industry working group to validate the quality of cryptographic modules. See the official FIPS publications at NIST Computer Security Resource Center .

The FIPS 140-3 standard ensures that cryptographic tools implement their algorithms correctly. One of the mechanisms for that is runtime self-checks. See the full FIPS 140-3 standard at FIPS PUB 140-3 for further details and other specifications of the FIPS standard.

To learn about compliance requirements, see the Red Hat Government Standards page.

2.2. INSTALLING THE SYSTEM WITH FIPS MODE ENABLED

To enable the cryptographic module self-checks mandated by the Federal Information Processing Standard (FIPS) Publication 140-3, enable FIPS mode during the system installation.

IMPORTANT

Red Hat recommends installing RHEL with FIPS mode enabled, as opposed to enabling FIPS mode later. Enabling FIPS mode during the installation ensures that the system generates all keys with FIPS-approved algorithms and continuous monitoring tests in place.

Procédure

- Add the **fips=1** option to the kernel command line during the system installation.
  During the software selection stage, do not install any third-party software.

After the installation, the system starts in FIPS mode automatically.

Vérification

- After the system starts, check that FIPS mode is enabled:

```
$ fips-mode-setup --check
FIPS mode is enabled.
```

Ressources supplémentaires

- Editing boot options section in the Boot options for RHEL Installer document

2.3. RESSOURCES SUPPLÉMENTAIRES

- Switching the system to FIPS mode
- Enabling FIPS mode in a container

CHAPITRE 3. USING SYSTEM-WIDE CRYPTOGRAPHIC POLICIES

The system-wide cryptographic policies is a system component that configures the core cryptographic subsystems, covering the TLS, IPsec, SSH, DNSSec, and Kerberos protocols. It provides a small set of policies, which the administrator can select.

3.1. POLITIQUES CRYPTOGRAPHIQUES À L'ÉCHELLE DU SYSTÈME

When a system-wide policy is set up, applications in RHEL follow it and refuse to use algorithms and protocols that do not meet the policy, unless you explicitly request the application to do so. That is, the policy applies to the default behavior of applications when running with the system-provided configuration but you can override it if required.

RHEL 9 contains the following predefined policies:

DEFAULT	The default system-wide cryptographic policy level offers secure settings for current threat models. It allows the TLS 1.2 and 1.3 protocols, as well as the IKEv2 and SSH2 protocols. The RSA keys and Diffie-Hellman parameters are accepted if they are at least 2048 bits long.
LEGACY	This policy ensures maximum compatibility with Red Hat Enterprise Linux 6 and earlier; it is less secure due to an increased attack surface. SHA-1 is allowed to be used as TLS hash, signature, and algorithm. CBC-mode ciphers are allowed to be used with SSH. Applications using GnuTLS allow certificates signed with SHA-1. It allows the TLS 1.2 and 1.3 protocols, as well as the IKEv2 and SSH2 protocols. The RSA keys and Diffie-Hellman parameters are accepted if they are at least 2048 bits long.
FUTURE	A conservative security level that is believed to withstand any near-term future attacks. This level does not allow the use of SHA-1 in DNSSec or as an HMAC. SHA2-224 and SHA3-224 hashes are disabled. 128-bit ciphers are disabled. CBC-mode ciphers are disabled except in Kerberos. It allows the TLS 1.2 and 1.3 protocols, as well as the IKEv2 and SSH2 protocols. The RSA keys and Diffie-Hellman parameters are accepted if they are at least 3072 bits long.
FIPS	A policy level that conforms with the FIPS 140-2 requirements. This is used internally by the **fips-mode-setup** tool, which switches the RHEL system into FIPS mode.

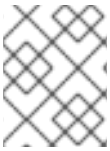
Red Hat continuously adjusts all policy levels so that all libraries, except when using the LEGACY policy, provide secure defaults. Even though the LEGACY profile does not provide secure defaults, it does not include any algorithms that are easily exploitable. As such, the set of enabled algorithms or acceptable key sizes in any provided policy may change during the lifetime of Red Hat Enterprise Linux.

Such changes reflect new security standards and new security research. If you must ensure interoperability with a specific system for the whole lifetime of Red Hat Enterprise Linux, you should opt-out from cryptographic-policies for components that interact with that system or re-enable specific algorithms using custom policies.

IMPORTANT

Because a cryptographic key used by a certificate on the Customer Portal API does not meet the requirements by the **FUTURE** system-wide cryptographic policy, the **redhat-support-tool** utility does not work with this policy level at the moment.

To work around this problem, use the **DEFAULT** crypto policy while connecting to the Customer Portal API.



NOTE

The specific algorithms and ciphers described in the policy levels as allowed are available only if an application supports them.

Tool for managing crypto policies

To view or change the current system-wide cryptographic policy, use the **update-crypto-policies** tool, for example:

```
$ update-crypto-policies --show
DEFAULT
# update-crypto-policies --set FUTURE
Setting system policy to FUTURE
```

To ensure that the change of the cryptographic policy is applied, restart the system.

Strong crypto defaults by removing insecure cipher suites and protocols

The following list contains cipher suites and protocols removed from the core cryptographic libraries in Red Hat Enterprise Linux 9. They are not present in the sources, or their support is disabled during the build, so applications cannot use them.

- DES (since RHEL 7)
- All export grade cipher suites (since RHEL 7)
- MD5 in signatures (since RHEL 7)
- SSLv2 (since RHEL 7)
- SSLv3 (since RHEL 8)
- All ECC curves < 224 bits (since RHEL 6)
- All binary field ECC curves (since RHEL 6)

Algorithmes désactivés à tous les niveaux de la politique

The following algorithms are disabled in **LEGACY**, **DEFAULT**, **FUTURE** and **FIPS** cryptographic policies included in RHEL 9. They can be enabled only by applying a custom cryptographic policy or by an explicit configuration of individual applications, but the resulting configuration would not be considered supported.

- TLS antérieur à la version 1.2 (depuis RHEL 9, était < 1.0 dans RHEL 8)
- DTLS antérieur à la version 1.2 (depuis RHEL 9, était < 1.0 dans RHEL 8)
- DH avec les paramètres < 2048 bits (depuis RHEL 9, était < 1024 bits dans RHEL 8)

- RSA avec une taille de clé de < 2048 bits (depuis RHEL 9, était < 1024 bits dans RHEL 8)
- DSA (depuis RHEL 9, était < 1024 bits dans RHEL 8)
- 3DES (depuis RHEL 9)
- RC4 (depuis RHEL 9)
- FFDHE-1024 (depuis RHEL 9)
- DHE-DSS (depuis RHEL 9)
- Camellia (depuis RHEL 9)
- ARIA
- IKEv1 (depuis RHEL 8)

Algorithms enabled in the crypto-policies levels

The following table shows the comparison of all four crypto-policies levels with regard to select algorithms.

	LEGACY	DEFAULT	FIPS	FUTURE
IKEv1	non	non	non	non
3DES	non	non	non	non
RC4	non	non	non	non
DH	min. 2048-bit	min. 2048-bit	min. 2048-bit	min. 3072-bit
RSA	min. 2048-bit	min. 2048-bit	min. 2048-bit	min. 3072-bit
DSA	non	non	non	non
TLS v1.1 and older	non	non	non	non
TLS v1.2 and newer	yes	yes	yes	yes
SHA-1 in digital signatures and certificates	yes	non	non	non
CBC mode ciphers	yes	no[a]	no[b]	no[c]
Symmetric ciphers with keys < 256 bits	yes	yes	yes	non

	LEGACY	DEFAULT	FIPS	FUTURE

[a] CBC ciphers are disabled for SSH

[b] CBC ciphers are disabled for all protocols except Kerberos

[c] CBC ciphers are disabled for all protocols except Kerberos

Ressources supplémentaires

- **update-crypto-policies(8)** man page

3.2. SWITCHING THE SYSTEM-WIDE CRYPTOGRAPHIC POLICY TO MODE COMPATIBLE WITH EARLIER RELEASES

The default system-wide cryptographic policy in Red Hat Enterprise Linux 9 does not allow communication using older, insecure protocols. For environments that require to be compatible with Red Hat Enterprise Linux 6 and in some cases also with earlier releases, the less secure **LEGACY** policy level is available.

AVERTISSEMENT

Switching to the **LEGACY** policy level results in a less secure system and applications.

Procédure

1. To switch the system-wide cryptographic policy to the **LEGACY** level, enter the following command as **root**:

```
# update-crypto-policies --set LEGACY
Setting system policy to LEGACY
```

Ressources supplémentaires

- For the list of available cryptographic policy levels, see the **update-crypto-policies(8)** man page.
- For defining custom cryptographic policies, see the **Custom Policies** section in the **update-crypto-policies(8)** man page and the **Crypto Policy Definition Format** section in the **crypto-policies(7)** man page.

3.3. MISE EN PLACE DE POLITIQUES CRYPTOGRAPHIQUES À L'ÉCHELLE DU SYSTÈME DANS LA CONSOLE WEB

You can set one of system-wide cryptographic policies and subpolicies directly in the RHEL web console interface. Besides the four predefined system-wide cryptographic policies, you can also apply the following combinations of policies and subpolicies through the graphical interface now:

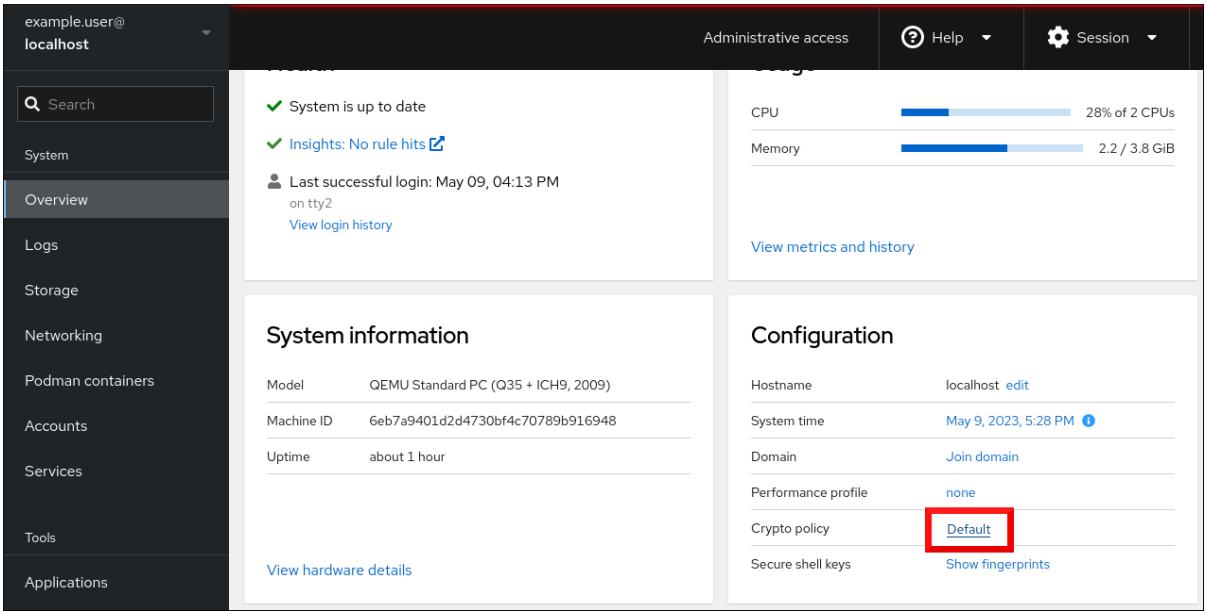
- **DEFAULT:SHA1** est la politique **DEFAULT** avec l'algorithme **SHA-1** activé.
- **LEGACY:AD-SUPPORT** est la stratégie **LEGACY** avec des paramètres moins sûrs qui améliorent l'interopérabilité des services Active Directory.
- **FIPS:OSPP** est la politique **FIPS** avec des restrictions supplémentaires inspirées de la norme Critères communs pour l'évaluation de la sécurité des technologies de l'information.

Conditions préalables

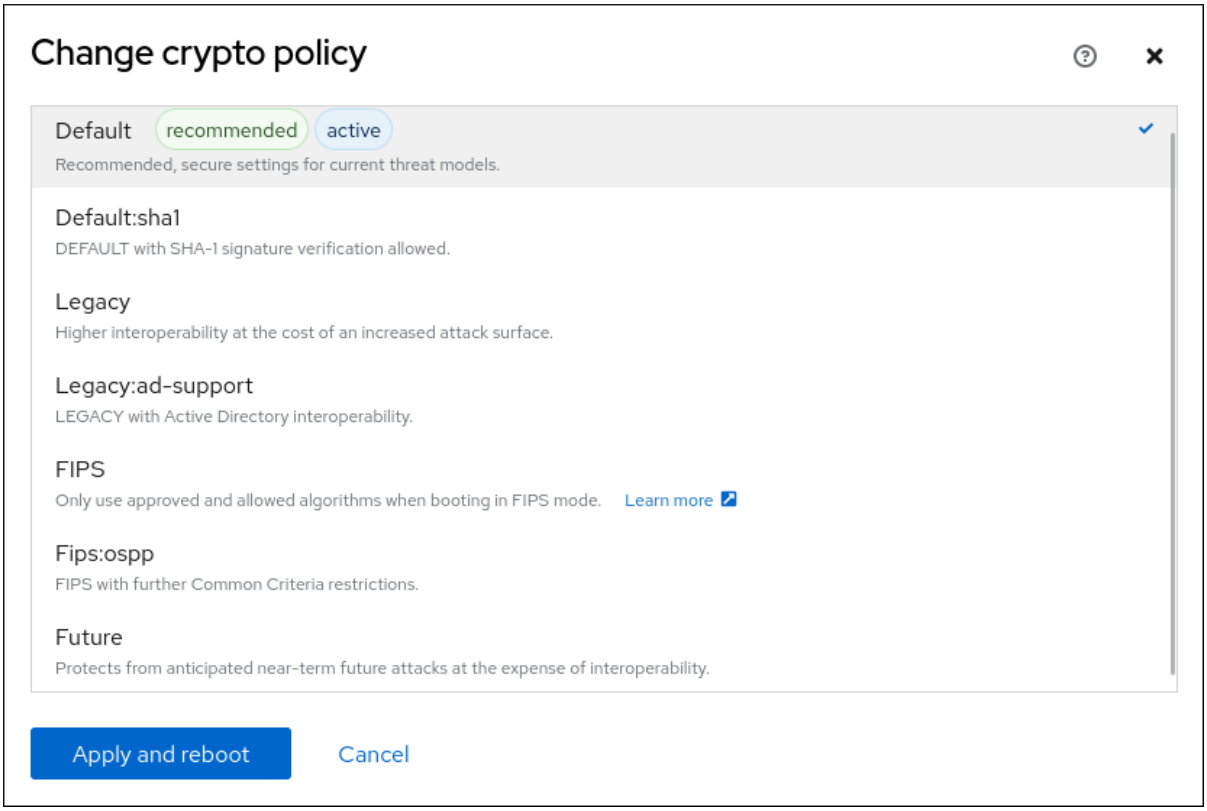
- La console web RHEL 9 a été installée. Pour plus de détails, voir Installation et activation de la console web.
- You have **root** privileges or permissions to enter administrative commands with **sudo**.

Procédure

1. Log in to the web console. For more information, see Logging in to the web console .
2. Dans la carte **Configuration** de la page **Overview**, cliquez sur la valeur actuelle de votre police d'assurance à côté de **Crypto policy**.



3. In the **Change crypto policy** dialog window, click on the policy you want to start using on your system.



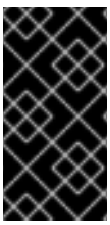
4. Cliquez sur le bouton **Appliquer et redémarrer**.

Vérification

- After the restart, log back in to web console, and check that the **Crypto policy** value corresponds to the one you selected. Alternatively, you can enter the **update-crypto-policies --show** command to display the current system-wide cryptographic policy in your terminal.

3.4. SWITCHING THE SYSTEM TO FIPS MODE

The system-wide cryptographic policies contain a policy level that enables cryptographic modules self-checks in accordance with the requirements by the Federal Information Processing Standard (FIPS) Publication 140-3. The **fips-mode-setup** tool that enables or disables FIPS mode internally uses the **FIPS** system-wide cryptographic policy level.



IMPORTANT

Red Hat recommends installing Red Hat Enterprise Linux 9 with FIPS mode enabled, as opposed to enabling FIPS mode later. Enabling FIPS mode during the installation ensures that the system generates all keys with FIPS-approved algorithms and continuous monitoring tests in place.

NOTE

The cryptographic modules of RHEL 9 are not yet certified for the FIPS 140-3 requirements.

Procédure

1. To switch the system to FIPS mode:

```
# fips-mode-setup --enable
Kernel initramdisks are being regenerated. This might take some time.
Setting system policy to FIPS
Note: System-wide crypto policies are applied on application start-up.
It is recommended to restart the system for the change of policies
to fully take place.
FIPS mode will be enabled.
Please reboot the system for the setting to take effect.
```

2. Redémarrez votre système pour permettre au noyau de passer en mode FIPS :

```
# reboot
```

Vérification

1. After the restart, you can check the current state of FIPS mode:

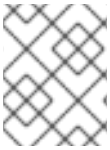
```
# fips-mode-setup --check
FIPS mode is enabled.
```

Ressources supplémentaires

- **fips-mode-setup(8)** man page
- Installing the system in FIPS mode
- Security Requirements for Cryptographic Modules on the National Institute of Standards and Technology (NIST) web site.

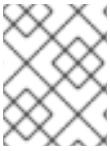
3.5. ENABLING FIPS MODE IN A CONTAINER

To enable the full set of cryptographic module self-checks mandated by the Federal Information Processing Standard Publication 140-2 (FIPS mode), the host system kernel must be running in FIPS mode. The **podman** utility automatically enables FIPS mode on supported containers.



NOTE

The **fips-mode-setup** command does not work correctly in containers, and it cannot be used to enable or check FIPS mode in this scenario.



NOTE

The cryptographic modules of RHEL 9 are not yet certified for the FIPS 140-3 requirements.

Conditions préalables

- The host system must be in FIPS mode.

Procédure

- On systems with FIPS mode enabled, the **podman** utility automatically enables FIPS mode on supported containers.

Ressources supplémentaires

- Switching the system to FIPS mode .
- Installing the system in FIPS mode

3.6. LIST OF RHEL APPLICATIONS USING CRYPTOGRAPHY THAT IS NOT COMPLIANT WITH FIPS 140-3

Red Hat recommends utilizing libraries from the core crypto components set, as they are guaranteed to pass all relevant crypto certifications, such as FIPS 140-3, and also follow the RHEL system-wide crypto policies.

See the RHEL core crypto components article for an overview of the core cryptographic components, the information about how are they selected, how are they integrated into the operating system, how do they support hardware security modules and smart cards, and how do cryptographic certifications apply to them.

Tableau 3.1. List of RHEL 8 applications using cryptography that is not compliant with FIPS 140-3

Application	Détails
Bacula	Implements the CRAM-MD5 authentication protocol.
Cyrus SASL	Uses the SCRAM-SHA-1 authentication method.
Dovecot	Uses SCRAM-SHA-1.
Emacs	Uses SCRAM-SHA-1.
FreeRADIUS	Uses MD5 and SHA-1 for authentication protocols.
Ghostscript	Custom cryptography implementation (MD5, RC4, SHA-2, AES) to encrypt and decrypt documents.
GRUB2	Supports legacy firmware protocols requiring SHA-1 and includes the **libgcrypt** library.
ipxe	Implements TLS stack.
Kerberos	Preserves support for SHA-1 (interoperability with Windows).
lasso	The **lasso_wsse_username_token_derive_key()** key derivation function (KDF) uses SHA-1.
MariaDB, MariaDB Connector	The **mysql_native_password** authentication plugin uses SHA-1.
MySQL	**mysql_native_password** uses SHA-1.

Application	Détails
OpenIPMI	The RAKP-HMAC-MD5 authentication method is not approved for FIPS usage and does not work in FIPS mode.
Ovmf (UEFI firmware), Edk2, shim	Full crypto stack (an embedded copy of the OpenSSL library).
perl-CPAN	Digest MD5 authentication.
perl-Digest-HMAC, perl-Digest-SHA	Uses HMAC, HMAC-SHA1, HMAC-MD5, SHA-1, SHA-224, and so on.
perl-Mail-DKIM	The Signer class uses the RSA-SHA1 algorithm by default.
PKCS #12 file processing (OpenSSL, GnuTLS, NSS, Firefox, Java)	All uses of PKCS #12 are not FIPS-compliant, because the Key Derivation Function (KDF) used for calculating the whole-file HMAC is not FIPS-approved. As such, PKCS #12 files are considered to be plain text for the purposes of FIPS compliance. For key-transport purposes, wrap PKCS #12 (.p12) files using a FIPS-approved encryption scheme.
Poppler	Can save PDFs with signatures, passwords, and encryption based on non-allowed algorithms if they are present in the original PDF (for example MD5, RC4, and SHA-1).
PostgreSQL	KDF uses SHA-1.
QAT Engine	Mixed hardware and software implementation of cryptographic primitives (RSA, EC, DH, AES, ...)
Rubis	Provides insecure MD5 and SHA-1 library functions.
Samba	Preserves support for RC4 and DES (interoperability with Windows).
Syslinux	BIOS passwords use SHA-1.
Unbound	DNS specification requires that DNSSEC resolvers use a SHA-1-based algorithm in DNSKEY records for validation.
Valgrind	AES, SHA hashes.[a]

[a] Re-implements in software hardware-offload operations, such as AES-NI or SHA-1 and SHA-2 on ARM.

3.7. EXCLUDING AN APPLICATION FROM FOLLOWING SYSTEM-WIDE CRYPTO POLICIES

You can customize cryptographic settings used by your application preferably by configuring supported cipher suites and protocols directly in the application.

You can also remove a symlink related to your application from the **/etc/crypto-policies/back-ends** directory and replace it with your customized cryptographic settings. This configuration prevents the use of system-wide cryptographic policies for applications that use the excluded back end. Furthermore, this modification is not supported by Red Hat.

3.7.1. Examples of opting out of system-wide crypto policies

wget

To customize cryptographic settings used by the **wget** network downloader, use **--secure-protocol** and **--ciphers** options. For example:

```
$ wget --secure-protocol=TLSv1_1 --ciphers="SECURE128" https://example.com
```

See the HTTPS (SSL/TLS) Options section of the **wget(1)** man page for more information.

boucler

To specify ciphers used by the **curl** tool, use the **--ciphers** option and provide a colon-separated list of ciphers as a value. For example:

```
$ curl https://example.com --ciphers '@SECLEVEL=0:DES-CBC3-SHA:RSA-DES-CBC3-SHA'
```

See the **curl(1)** man page for more information.

Firefox

Even though you cannot opt out of system-wide cryptographic policies in the **Firefox** web browser, you can further restrict supported ciphers and TLS versions in Firefox's Configuration Editor. Type **about:config** in the address bar and change the value of the **security.tls.version.min** option as required. Setting **security.tls.version.min** to **1** allows TLS 1.0 as the minimum required, **security.tls.version.min 2** enables TLS 1.1, and so on.

OpenSSH

To opt out of system-wide crypto policies for your OpenSSH client, perform one of the following tasks:

- For a given user, override the global **ssh_config** with a user-specific configuration in the **~/.ssh/config** file.
- For the entire system, specify the crypto policy in a drop-in configuration file located in the **/etc/ssh/ssh_config.d/** directory, with a two-digit number prefix smaller than 50, so that it lexicographically precedes the **50-redhat.conf** file, and with a **.conf** suffix, for example, **49-crypto-policy-override.conf**.

See the **ssh_config(5)** man page for more information.

Libreswan

See the Configuring IPsec connections that opt out of the system-wide crypto policies in the Securing networks document for detailed information.

Ressources supplémentaires

- **update-crypto-policies(8)** man page

3.8. CUSTOMIZING SYSTEM-WIDE CRYPTOGRAPHIC POLICIES WITH SUBPOLICIES

Use this procedure to adjust the set of enabled cryptographic algorithms or protocols.

You can either apply custom subpolicies on top of an existing system-wide cryptographic policy or define such a policy from scratch.

The concept of scoped policies allows enabling different sets of algorithms for different back ends. You can limit each configuration directive to specific protocols, libraries, or services.

Furthermore, directives can use asterisks for specifying multiple values using wildcards.

The **/etc/crypto-policies/state/CURRENT.pol** file lists all settings in the currently applied system-wide cryptographic policy after wildcard expansion. To make your cryptographic policy more strict, consider using values listed in the **/usr/share/crypto-policies/policies/FUTURE.pol** file.

You can find example subpolicies in the **/usr/share/crypto-policies/policies/modules/** directory. The subpolicy files in this directory contain also descriptions in lines that are commented out.

Procédure

1. Checkout to the **/etc/crypto-policies/policies/modules/** directory:

```
# cd /etc/crypto-policies/policies/modules/
```

2. Create subpolicies for your adjustments, for example:

```
# touch MYCRYPTO-1.pmod
# touch SCOPES-AND-WILDCARDS.pmod
```

IMPORTANT

Use upper-case letters in file names of policy modules.

3. Open the policy modules in a text editor of your choice and insert options that modify the system-wide cryptographic policy, for example:

```
# vi MYCRYPTO-1.pmod
```

```
min_rsa_size = 3072
hash = SHA2-384 SHA2-512 SHA3-384 SHA3-512
```

```
# vi SCOPES-AND-WILDCARDS.pmod
```

```
# Disable the AES-128 cipher, all modes
cipher = -AES-128-*

# Disable CHACHA20-POLY1305 for the TLS protocol (OpenSSL, GnuTLS, NSS, and
OpenJDK)
```

```
cipher@TLS = -CHACHA20-POLY1305

# Allow using the FFDHE-1024 group with the SSH protocol (libssh and OpenSSH)
group@SSH = FFDHE-1024+

# Disable all CBC mode ciphers for the SSH protocol (libssh and OpenSSH)
cipher@SSH = -*-CBC

# Allow the AES-256-CBC cipher in applications using libssh
cipher@libssh = AES-256-CBC+
```

4. Save the changes in the module files.
5. Apply your policy adjustments to the **DEFAULT** system-wide cryptographic policy level:

```
# update-crypto-policies --set DEFAULT:MYCRYPTO-1:SCOPES-AND-WILDCARDS
```

6. To make your cryptographic settings effective for already running services and applications, restart the system:

```
# reboot
```

Vérification

- Check that the **/etc/crypto-policies/state/CURRENT.pol** file contains your changes, for example:

```
$ cat /etc/crypto-policies/state/CURRENT.pol | grep rsa_size
min_rsa_size = 3072
```

Ressources supplémentaires

- **Custom Policies** section in the **update-crypto-policies(8)** man page
- **Crypto Policy Definition Format** section in the **crypto-policies(7)** man page
- How to customize crypto policies in RHEL 8.2 Red Hat blog article

3.9. RE-ENABLING SHA-1

The use of the SHA-1 algorithm for creating and verifying signatures is restricted in the **DEFAULT** cryptographic policy. If your scenario requires the use of SHA-1 for verifying existing or third-party cryptographic signatures, you can enable it by applying the **SHA1** subpolicy, which RHEL 9 provides by default. Note that it weakens the security of the system.

Conditions préalables

- The system uses the **DEFAULT** system-wide cryptographic policy.

Procédure

1. Apply the **SHA1** subpolicy to the **DEFAULT** cryptographic policy:

```
# update-crypto-policies --set DEFAULT:SHA1
Setting system policy to DEFAULT:SHA1
Note: System-wide crypto policies are applied on application start-up.
It is recommended to restart the system for the change of policies
to fully take place.
```

2. Redémarrer le système :

```
# reboot
```

Vérification

- Display the current cryptographic policy:

```
# update-crypto-policies --show
DEFAULT:SHA1
```

IMPORTANT

Switching to the **LEGACY** cryptographic policy by using the **update-crypto-policies --set LEGACY** command also enables SHA-1 for signatures. However, the **LEGACY** cryptographic policy makes your system much more vulnerable by also enabling other weak cryptographic algorithms. Use this workaround only for scenarios that require the enablement of other legacy cryptographic algorithms than SHA-1 signatures.

Ressources supplémentaires

- SSH from RHEL 9 to RHEL 6 systems does not work KCS article
- Packages signed with SHA-1 cannot be installed or upgraded KCS article

3.10. CREATING AND SETTING A CUSTOM SYSTEM-WIDE CRYPTOGRAPHIC POLICY

The following steps demonstrate customizing the system-wide cryptographic policies by a complete policy file.

Procédure

1. Create a policy file for your customizations:

```
# cd /etc/crypto-policies/policies/
# touch MYPOLICY.pol
```

Alternatively, start by copying one of the four predefined policy levels:

```
# cp /usr/share/crypto-policies/policies/DEFAULT.pol /etc/crypto-
policies/policies/MYPOLICY.pol
```

2. Edit the file with your custom cryptographic policy in a text editor of your choice to fit your requirements, for example:

```
# vi /etc/crypto-policies/policies/MYPOLICY.pol
```

3. Switch the system-wide cryptographic policy to your custom level:

```
# update-crypto-policies --set MYPOLICY
```

4. To make your cryptographic settings effective for already running services and applications, restart the system:

```
# reboot
```

Ressources supplémentaires

- **Custom Policies** section in the **update-crypto-policies(8)** man page and the **Crypto Policy Definition Format** section in the **crypto-policies(7)** man page
- How to customize crypto policies in RHEL Red Hat blog article

CHAPITRE 4. DÉFINITION D'UNE POLITIQUE CRYPTOGRAPHIQUE PERSONNALISÉE À L'AIDE DU RÔLE DE SYSTÈME RHEL CRYPTO-POLICIES

En tant qu'administrateur, vous pouvez utiliser le rôle système **crypto_policies** RHEL pour configurer rapidement et de manière cohérente des politiques cryptographiques personnalisées sur de nombreux systèmes différents à l'aide du package Ansible Core.

4.1. CRYPTO_POLICIES VARIABLES ET FAITS RELATIFS AU RÔLE DU SYSTÈME

Dans un playbook **crypto_policies** System Role, vous pouvez définir les paramètres du fichier de configuration **crypto_policies** en fonction de vos préférences et de vos limites.

Si vous ne configurez aucune variable, le rôle système ne configure pas le système et se contente de signaler les faits.

Variables sélectionnées pour le rôle du systèmecrypto_policies

crypto_policies_policy

Détermine la stratégie cryptographique que le rôle système applique aux nœuds gérés. Pour plus d'informations sur les différentes stratégies cryptographiques, voir Stratégies cryptographiques à l'échelle du système.

crypto_policies_reload

S'il est défini sur **yes**, les services concernés, actuellement les services **ipsec**, **bind** et **sshd**, se rechargent après l'application d'une stratégie cryptographique. La valeur par défaut est **yes**.

crypto_policies_reboot_ok

S'il est défini sur **yes** et qu'un redémarrage est nécessaire après que le rôle système a modifié la politique de cryptage, il définit **crypto_policies_reboot_required** sur **yes**. La valeur par défaut est **no**.

Faits définis par le systèmecrypto_policies Rôle

crypto_policies_active

Liste la politique actuellement sélectionnée.

crypto_policies_available_policies

Répertorie toutes les politiques disponibles sur le système.

crypto_policies_available_subpolicies

Répertorie toutes les sous-politiques disponibles sur le système.

Ressources supplémentaires

- Création et définition d'une politique cryptographique personnalisée à l'échelle du système .

4.2. DÉFINITION D'UNE POLITIQUE CRYPTOGRAPHIQUE PERSONNALISÉE À L'AIDE DU RÔLE DE SYSTÈME CRYPTO_POLICIES

Vous pouvez utiliser le rôle de système **crypto_policies** pour configurer un grand nombre de nœuds gérés de manière cohérente à partir d'un seul nœud de contrôle.

Conditions préalables

- Accès et autorisations à un ou plusieurs *managed nodes*, qui sont des systèmes que vous souhaitez configurer avec le rôle de système **crypto_policies**.
- Accès et autorisations à un nœud de contrôle, qui est un système à partir duquel Red Hat Ansible Core configure d'autres systèmes.
  Sur le nœud de contrôle :
  - Les paquets **ansible-core** et **rhel-system-roles** sont installés.

IMPORTANT

RHEL 8.0-8.5 provided access to a separate Ansible repository that contains Ansible Engine 2.9 for automation based on Ansible. Ansible Engine contains command-line utilities such as **ansible**, **ansible-playbook**, connectors such as **docker** and **podman**, and many plugins and modules. For information about how to obtain and install Ansible Engine, see the How to download and install Red Hat Ansible Engine Knowledgebase article.

RHEL 8.6 et 9.0 ont introduit Ansible Core (fourni en tant que paquetage **ansible-core**), qui contient les utilitaires de ligne de commande Ansible, les commandes et un petit ensemble de plugins Ansible intégrés. RHEL fournit ce paquetage par l'intermédiaire du dépôt AppStream, et sa prise en charge est limitée. Pour plus d'informations, consultez l'article de la base de connaissances intitulé Scope of support for the Ansible Core package included in the RHEL 9 and RHEL 8.6 and later AppStream repositories (Portée de la prise en charge du package Ansible Core inclus dans les dépôts AppStream RHEL 9 et RHEL 8.6 et versions ultérieures).

- Un fichier d'inventaire qui répertorie les nœuds gérés.

Procédure

1. Créez un nouveau fichier ***playbook.yml*** avec le contenu suivant :

```
---
- hosts: all
  tasks:
  - name: Configure crypto policies
    include_role:
      name: rhel-system-roles.crypto_policies
    vars:
      - crypto_policies_policy: FUTURE
      - crypto_policies_reboot_ok: true
```

Vous pouvez remplacer la valeur *FUTURE* par votre politique cryptographique préférée, par exemple : **DEFAULT**, **LEGACY**, et **FIPS:OSPP**.

La variable **crypto_policies_reboot_ok: true** provoque le redémarrage du système après que le rôle système a modifié la stratégie cryptographique.

Pour plus de détails, voir crypto_policies Variables et faits relatifs au rôle du système .

2. Facultatif : Vérifier la syntaxe du playbook.

```
# ansible-playbook --syntax-check playbook.yml
```

3. Exécutez le playbook sur votre fichier d'inventaire :

```
# ansible-playbook -i inventory_file playbook.yml
```

Vérification

1. Sur le nœud de contrôle, créez un autre playbook nommé, par exemple, ***verify_playbook.yml***:

```
- hosts: all
  tasks:
 - name: Verify active crypto policy
   include_role:
     name: rhel-system-roles.crypto_policies

 - debug:
     var: crypto_policies_active
```

Ce playbook ne modifie aucune configuration sur le système, mais signale uniquement la politique active sur les nœuds gérés.

2. Exécutez le playbook sur le même fichier d'inventaire :

```
# ansible-playbook -i inventory_file verify_playbook.yml

TASK [debug] ***************************
ok: [host] => {
    "crypto_policies_active": "FUTURE"
}
```

La variable **"crypto_policies_active":** indique la politique active sur le nœud géré.

4.3. RESSOURCES SUPPLÉMENTAIRES

- **/usr/share/ansible/roles/rhel-system-roles.crypto_policies/README.md** fichier.
- **ansible-playbook(1)** page de manuel.
- Préparation d'un nœud de contrôle et de nœuds gérés à l'utilisation des rôles système RHEL .

CHAPITRE 5. CONFIGURING APPLICATIONS TO USE CRYPTOGRAPHIC HARDWARE THROUGH PKCS #11

Separating parts of your secret information about dedicated cryptographic devices, such as smart cards and cryptographic tokens for end-user authentication and hardware security modules (HSM) for server applications, provides an additional layer of security. In RHEL, support for cryptographic hardware through the PKCS #11 API is consistent across different applications, and the isolation of secrets on cryptographic hardware is not a complicated task.

5.1. CRYPTOGRAPHIC HARDWARE SUPPORT THROUGH PKCS #11

PKCS #11 (Public-Key Cryptography Standard) defines an application programming interface (API) to cryptographic devices that hold cryptographic information and perform cryptographic functions. These devices are called tokens, and they can be implemented in a hardware or software form.

A PKCS #11 token can store various object types including a certificate; a data object; and a public, private, or secret key. These objects are uniquely identifiable through the PKCS #11 URI scheme.

A PKCS #11 URI is a standard way to identify a specific object in a PKCS #11 module according to the object attributes. This enables you to configure all libraries and applications with the same configuration string in the form of a URI.

RHEL provides the OpenSC PKCS #11 driver for smart cards by default. However, hardware tokens and HSMs can have their own PKCS #11 modules that do not have their counterpart in the system. You can register such PKCS #11 modules with the **p11-kit** tool, which acts as a wrapper over the registered smart-card drivers in the system.

To make your own PKCS #11 module work on the system, add a new text file to the **/etc/pkcs11/modules/** directory

You can add your own PKCS #11 module into the system by creating a new text file in the **/etc/pkcs11/modules/** directory. For example, the OpenSC configuration file in **p11-kit** looks as follows:

```
$ cat /usr/share/p11-kit/modules/opensc.module
module: opensc-pkcs11.so
```

Ressources supplémentaires

- The PKCS #11 URI Scheme
- Controlling access to smart cards

5.2. UTILISATION DE CLÉS SSH STOCKÉES SUR UNE CARTE À PUCE

Red Hat Enterprise Linux vous permet d'utiliser les clés RSA et ECDSA stockées sur une carte à puce sur les clients OpenSSH. Utilisez cette procédure pour activer l'authentification à l'aide d'une carte à puce au lieu d'un mot de passe.

Conditions préalables

- Côté client, le paquet **opensc** est installé et le service **pcscd** est en cours d'exécution.

Procédure

1. Dresser la liste de toutes les clés fournies par le module PKCS #11 d'OpenSC, y compris leurs URI PKCS #11, et enregistrer le résultat dans le fichier *keys.pub*:

```
$ ssh-keygen -D pkcs11: > keys.pub
$ ssh-keygen -D pkcs11:
ssh-rsa AAAAB3NzaC1yc2E...KKZMzcQZzx
pkcs11:id=%02;object=SIGN%20pubkey;token=SSH%20key;manufacturer=piv_II?module-
path=/usr/lib64/pkcs11/opensc-pkcs11.so
ecdsa-sha2-nistp256 AAA...J0hkYnnsM=
pkcs11:id=%01;object=PIV%20AUTH%20pubkey;token=SSH%20key;manufacturer=piv_II?
module-path=/usr/lib64/pkcs11/opensc-pkcs11.so
```

2. Pour permettre l'authentification à l'aide d'une carte à puce sur un serveur distant (*example.com*), transférez la clé publique sur le serveur distant. Utilisez la commande **ssh-copy-id** avec *keys.pub* créé à l'étape précédente :

```
$ ssh-copy-id -f -i keys.pub username@example.com
```

3. Pour vous connecter à *example.com* à l'aide de la clé ECDSA issue de la commande **ssh-keygen -D** à l'étape 1, vous pouvez utiliser uniquement un sous-ensemble de l'URI, qui fait référence de manière unique à votre clé, par exemple :

```
$ ssh -i "pkcs11:id=%01?module-path=/usr/lib64/pkcs11/opensc-pkcs11.so" example.com
Enter PIN for 'SSH key':
[example.com] $
```

4. Vous pouvez utiliser la même chaîne URI dans le fichier **~/.ssh/config** pour rendre la configuration permanente :

```
$ cat ~/.ssh/config
IdentityFile "pkcs11:id=%01?module-path=/usr/lib64/pkcs11/opensc-pkcs11.so"
$ ssh example.com
Enter PIN for 'SSH key':
[example.com] $
```

   Comme OpenSSH utilise le wrapper **p11-kit-proxy** et que le module OpenSC PKCS #11 est enregistré dans le kit PKCS#11, vous pouvez simplifier les commandes précédentes :

```
$ ssh -i "pkcs11:id=%01" example.com
Enter PIN for 'SSH key':
[example.com] $
```

Si vous omettez la partie **id=** d'un URI PKCS #11, OpenSSH charge toutes les clés disponibles dans le module proxy. Cela peut réduire la quantité de données à saisir :

```
$ ssh -i pkcs11: example.com
Enter PIN for 'SSH key':
[example.com] $
```

Ressources supplémentaires

- Fedora 28 : Meilleur support des cartes à puce dans OpenSSH

- **p11-kit(8)**, **opensc.conf(5)**, **pcscd(8)**, **ssh(1)**, et **ssh-keygen(1)** pages de manuel

5.3. CONFIGURING APPLICATIONS TO AUTHENTICATE USING CERTIFICATES FROM SMART CARDS

Authentication using smart cards in applications may increase security and simplify automation.

- The **wget** network downloader enables you to specify PKCS #11 URIs instead of paths to locally stored private keys, and thus simplifies creating scripts for tasks that require safely stored private keys and certificates. For example:

```
$ wget --private-key 'pkcs11:token=softhsm;id=%01;type=private?pin-value=111111' --
certificate 'pkcs11:token=softhsm;id=%01;type=cert' https://example.com/
```

  See the **wget(1)** man page for more information.

- Specifying PKCS #11 URI for use by the **curl** tool is analogous:

```
$ curl --key 'pkcs11:token=softhsm;id=%01;type=private?pin-value=111111' --cert
'pkcs11:token=softhsm;id=%01;type=cert' https://example.com/
```

  See the **curl(1)** man page for more information.

NOTE

Because a PIN is a security measure that controls access to keys stored on a smart card and the configuration file contains the PIN in the plain-text form, consider additional protection to prevent an attacker from reading the PIN. For example, you can use the **pin-source** attribute and provide a **file:** URI for reading the PIN from a file. See RFC 7512: PKCS #11 URI Scheme Query Attribute Semantics for more information. Note that using a command path as a value of the **pin-source** attribute is not supported.

- The **Firefox** web browser automatically loads the **p11-kit-proxy** module. This means that every supported smart card in the system is automatically detected. For using TLS client authentication, no additional setup is required and keys from a smart card are automatically used when a server requests them.

Using PKCS #11 URIs in custom applications

If your application uses the **GnuTLS** or **NSS** library, support for PKCS #11 URIs is ensured by their built-in support for PKCS #11. Also, applications relying on the **OpenSSL** library can access cryptographic hardware modules thanks to the **openssl-pkcs11** engine.

With applications that require working with private keys on smart cards and that do not use **NSS**, **GnuTLS**, and **OpenSSL**, use **p11-kit** to implement registering PKCS #11 modules.

Ressources supplémentaires

- **p11-kit(8)** man page.

5.4. USING HSMS PROTECTING PRIVATE KEYS IN APACHE

The **Apache** HTTP server can work with private keys stored on hardware security modules (HSMs), which helps to prevent the keys' disclosure and man-in-the-middle attacks. Note that this usually requires high-performance HSMs for busy servers.

For secure communication in the form of the HTTPS protocol, the **Apache** HTTP server (**httpd**) uses the OpenSSL library. OpenSSL does not support PKCS #11 natively. To use HSMs, you have to install the **openssl-pkcs11** package, which provides access to PKCS #11 modules through the engine interface. You can use a PKCS #11 URI instead of a regular file name to specify a server key and a certificate in the **/etc/httpd/conf.d/ssl.conf** configuration file, for example:

```
SSLCertificateFile    "pkcs11:id=%01;token=softhsm;type=cert"
SSLCertificateKeyFile "pkcs11:id=%01;token=softhsm;type=private?pin-value=111111"
```

Install the **httpd-manual** package to obtain complete documentation for the **Apache** HTTP Server, including TLS configuration. The directives available in the **/etc/httpd/conf.d/ssl.conf** configuration file are described in detail in the **/usr/share/httpd/manual/mod/mod_ssl.html** file.

5.5. USING HSMS PROTECTING PRIVATE KEYS IN NGINX

The **Nginx** HTTP server can work with private keys stored on hardware security modules (HSMs), which helps to prevent the keys' disclosure and man-in-the-middle attacks. Note that this usually requires high-performance HSMs for busy servers.

Because **Nginx** also uses the OpenSSL for cryptographic operations, support for PKCS #11 must go through the **openssl-pkcs11** engine. **Nginx** currently supports only loading private keys from an HSM, and a certificate must be provided separately as a regular file. Modify the **ssl_certificate** and **ssl_certificate_key** options in the **server** section of the **/etc/nginx/nginx.conf** configuration file:

```
ssl_certificate     /path/to/cert.pem
ssl_certificate_key "engine:pkcs11:pkcs11:token=softhsm;id=%01;type=private?pin-value=111111";
```

Note that the **engine:pkcs11:** prefix is needed for the PKCS #11 URI in the **Nginx** configuration file. This is because the other **pkcs11** prefix refers to the engine name.

5.6. RESSOURCES SUPPLÉMENTAIRES

- **pkcs11.conf(5)** man page.

CHAPITRE 6. CONTROLLING ACCESS TO SMART CARDS USING POLKIT

To cover possible threats that cannot be prevented by mechanisms built into smart cards, such as PINs, PIN pads, and biometrics, and for more fine-grained control, RHEL uses the **polkit** framework for controlling access control to smart cards.

System administrators can configure **polkit** to fit specific scenarios, such as smart-card access for non-privileged or non-local users or services.

6.1. SMART-CARD ACCESS CONTROL THROUGH POLKIT

The Personal Computer/Smart Card (PC/SC) protocol specifies a standard for integrating smart cards and their readers into computing systems. In RHEL, the **pcsc-lite** package provides middleware to access smart cards that use the PC/SC API. A part of this package, the **pcscd** (PC/SC Smart Card) daemon, ensures that the system can access a smart card using the PC/SC protocol.

Because access-control mechanisms built into smart cards, such as PINs, PIN pads, and biometrics, do not cover all possible threats, RHEL uses the **polkit** framework for more robust access control. The **polkit** authorization manager can grant access to privileged operations. In addition to granting access to disks, you can use **polkit** also to specify policies for securing smart cards. For example, you can define which users can perform which operations with a smart card.

After installing the **pcsc-lite** package and starting the **pcscd** daemon, the system enforces policies defined in the **/usr/share/polkit-1/actions/** directory. The default system-wide policy is in the **/usr/share/polkit-1/actions/org.debian.pcsc-lite.policy** file. Polkit policy files use the XML format and the syntax is described in the **polkit(8)** man page.

The **polkitd** service monitors the **/etc/polkit-1/rules.d/** and **/usr/share/polkit-1/rules.d/** directories for any changes in rule files stored in these directories. The files contain authorization rules in JavaScript format. System administrators can add custom rule files in both directories, and **polkitd** reads them in lexical order based on their file name. If two files have the same names, then the file in **/etc/polkit-1/rules.d/** is read first.

Ressources supplémentaires

- **polkit(8)**, **polkitd(8)**, and **pcscd(8)** man pages.

6.2. TROUBLESHOOTING PROBLEMS RELATED TO PC/SC AND POLKIT

Polkit policies that are automatically enforced after you install the **pcsc-lite** package and start the **pcscd** daemon may ask for authentication in the user's session even if the user does not directly interact with a smart card. In GNOME, you can see the following error message:

> Authentication is required to access the PC/SC daemon

Note that the system can install the **pcsc-lite** package as a dependency when you install other packages related to smart cards such as **opensc**.

If your scenario does not require any interaction with smart cards and you want to prevent displaying authorization requests for the PC/SC daemon, you can remove the **pcsc-lite** package. Keeping the minimum of necessary packages is a good security practice anyway.

If you use smart cards, start troubleshooting by checking the rules in the system-provided policy file at **/usr/share/polkit-1/actions/org.debian.pcsc-lite.policy**. You can add your custom rule files to the policy in the **/etc/polkit-1/rules.d/** directory, for example, **03-allow-pcscd.rules**. Note that the rule files use the JavaScript syntax, the policy file is in the XML format.

To understand what authorization requests the system displays, check the Journal log, for example:

```
$ journalctl -b | grep pcsc
...
Process 3087 (user: 1001) is NOT authorized for action: access_pcsc
...
```

The previous log entry means that the user is not authorized to perform an action by the policy. You can solve this denial by adding a corresponding rule to **/etc/polkit-1/rules.d/**.

You can search also for log entries related to the **polkitd** unit, for example:

```
$ journalctl -u polkit
...
polkitd[NNN]: Error compiling script /etc/polkit-1/rules.d/00-debug-pcscd.rules
...
polkitd[NNN]: Operator of unix-session:c2 FAILED to authenticate to gain authorization for action
org.debian.pcsc-lite.access_pcsc for unix-process:4800:14441 [/usr/libexec/gsd-smartcard] (owned
by unix-user:group)
...
```

In the previous output, the first entry means that the rule file contains some syntax error. The second entry means that the user failed to gain the access to **pcscd**.

You can also list all applications that use the PC/SC protocol by a short script. Create an executable file, for example, **pcsc-apps.sh**, and insert the following code:

```
#!/bin/bash

cd /proc

for p in [0-9]*
do
 if grep libpcsclite.so.1.0.0 $p/maps &> /dev/null
 then
  echo -n "process: "
  cat $p/cmdline
  echo " ($p)"
 fi
done
```

Run the script as **root**:

```
# ./pcsc-apps.sh
process: /usr/libexec/gsd-smartcard (3048)
enable-sync --auto-ssl-client-auth --enable-crashpad (4828)
...
```

Ressources supplémentaires

- **journalctl**, **polkit(8)**, **polkitd(8)**, and **pcscd(8)** man pages.

6.3. DISPLAYING MORE DETAILED INFORMATION ABOUT POLKIT AUTHORIZATION TO PC/SC

In the default configuration, the **polkit** authorization framework sends only limited information to the Journal log. You can extend **polkit** log entries related to the PC/SC protocol by adding new rules.

Conditions préalables

- You have installed the **pcsc-lite** package on your system.
- The **pcscd** daemon is running.

Procédure

1. Create a new file in the **/etc/polkit-1/rules.d/** directory:

```
# touch /etc/polkit-1/rules.d/00-test.rules
```

2. Edit the file in an editor of your choice, for example:

```
# vi /etc/polkit-1/rules.d/00-test.rules
```

3. Insert the following lines:

```
polkit.addRule(function(action, subject) {
  if (action.id == "org.debian.pcsc-lite.access_pcsc" ||
   action.id == "org.debian.pcsc-lite.access_card") {
 polkit.log("action=" + action);
 polkit.log("subject=" + subject);
  }
});
```

Save the file, and exit the editor.

4. Restart the **pcscd** and **polkit** services:

```
# systemctl restart pcscd.service pcscd.socket polkit.service
```

Vérification

1. Make an authorization request for **pcscd**. For example, open the Firefox web browser or use the **pkcs11-tool -L** command provided by the **opensc** package.

2. Display the extended log entries, for example:

```
# journalctl -u polkit --since "1 hour ago"
polkitd[1224]: <no filename>:4: action=[Action id='org.debian.pcsc-lite.access_pcsc']
polkitd[1224]: <no filename>:5: subject=[Subject pid=2020481 user=user'
groups=user,wheel,mock,wireshark seat=null session=null local=true active=true]
```

Ressources supplémentaires

- **polkit(8)** and **polkitd(8)** man pages.

6.4. RESSOURCES SUPPLÉMENTAIRES

- Controlling access to smart cards Red Hat Blog article.

CHAPITRE 7. SCANNING THE SYSTEM FOR CONFIGURATION COMPLIANCE AND VULNERABILITIES

A compliance audit is a process of determining whether a given object follows all the rules specified in a compliance policy. The compliance policy is defined by security professionals who specify the required settings, often in the form of a checklist, that a computing environment should use.

Compliance policies can vary substantially across organizations and even across different systems within the same organization. Differences among these policies are based on the purpose of each system and its importance for the organization. Custom software settings and deployment characteristics also raise a need for custom policy checklists.

7.1. CONFIGURATION COMPLIANCE TOOLS IN RHEL

Red Hat Enterprise Linux provides tools that enable you to perform a fully automated compliance audit. These tools are based on the Security Content Automation Protocol (SCAP) standard and are designed for automated tailoring of compliance policies.

- **SCAP Workbench** - The **scap-workbench** graphical utility is designed to perform configuration and vulnerability scans on a single local or remote system. You can also use it to generate security reports based on these scans and evaluations.
- **OpenSCAP** - The **OpenSCAP** library, with the accompanying **oscap** command-line utility, is designed to perform configuration and vulnerability scans on a local system, to validate configuration compliance content, and to generate reports and guides based on these scans and evaluations.

IMPORTANT

You can experience memory-consumption problems while using **OpenSCAP**, which can cause stopping the program prematurely and prevent generating any result files. See the OpenSCAP memory-consumption problems Knowledgebase article for details.

- **SCAP Security Guide (SSG)** - The **scap-security-guide** package provides the latest collection of security policies for Linux systems. The guidance consists of a catalog of practical hardening advice, linked to government requirements where applicable. The project bridges the gap between generalized policy requirements and specific implementation guidelines.
- **Script Check Engine (SCE)** - SCE is an extension to the SCAP protocol that enables administrators to write their security content using a scripting language, such as Bash, Python, and Ruby. The SCE extension is provided in the **openscap-engine-sce** package. The SCE itself is not part of the SCAP standard.

To perform automated compliance audits on multiple systems remotely, you can use the OpenSCAP solution for Red Hat Satellite.

Ressources supplémentaires

- **oscap(8)**, **scap-workbench(8)**, and **scap-security-guide(8)** man pages
- Red Hat Security Demos: Creating Customized Security Policy Content to Automate Security Compliance
- Red Hat Security Demos: Defend Yourself with RHEL Security Technologies

- Security Compliance Management in the Administering Red Hat Satellite Guide .

7.2. ANALYSE DE LA VULNÉRABILITÉ

7.2.1. Red Hat Security Advisories OVAL feed

Red Hat Enterprise Linux security auditing capabilities are based on the Security Content Automation Protocol (SCAP) standard. SCAP is a multi-purpose framework of specifications that supports automated configuration, vulnerability and patch checking, technical control compliance activities, and security measurement.

SCAP specifications create an ecosystem where the format of security content is well-known and standardized although the implementation of the scanner or policy editor is not mandated. This enables organizations to build their security policy (SCAP content) once, no matter how many security vendors they employ.

The Open Vulnerability Assessment Language (OVAL) is the essential and oldest component of SCAP. Unlike other tools and custom scripts, OVAL describes a required state of resources in a declarative manner. OVAL code is never executed directly but using an OVAL interpreter tool called scanner. The declarative nature of OVAL ensures that the state of the assessed system is not accidentally modified.

Like all other SCAP components, OVAL is based on XML. The SCAP standard defines several document formats. Each of them includes a different kind of information and serves a different purpose.

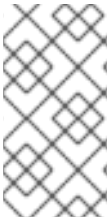
Red Hat Product Security helps customers evaluate and manage risk by tracking and investigating all security issues affecting Red Hat customers. It provides timely and concise patches and security advisories on the Red Hat Customer Portal. Red Hat creates and supports OVAL patch definitions, providing machine-readable versions of our security advisories.

Because of differences between platforms, versions, and other factors, Red Hat Product Security qualitative severity ratings of vulnerabilities do not directly align with the Common Vulnerability Scoring System (CVSS) baseline ratings provided by third parties. Therefore, we recommend that you use the RHSA OVAL definitions instead of those provided by third parties.

The RHSA OVAL definitions are available individually and as a complete package, and are updated within an hour of a new security advisory being made available on the Red Hat Customer Portal.

Each OVAL patch definition maps one-to-one to a Red Hat Security Advisory (RHSA). Because an RHSA can contain fixes for multiple vulnerabilities, each vulnerability is listed separately by its Common Vulnerabilities and Exposures (CVE) name and has a link to its entry in our public bug database.

The RHSA OVAL definitions are designed to check for vulnerable versions of RPM packages installed on a system. It is possible to extend these definitions to include further checks, for example, to find out if the packages are being used in a vulnerable configuration. These definitions are designed to cover software and updates shipped by Red Hat. Additional definitions are required to detect the patch status of third-party software.



NOTE

The Red Hat Insights for Red Hat Enterprise Linux compliance service helps IT security and compliance administrators to assess, monitor, and report on the security policy compliance of Red Hat Enterprise Linux systems. You can also create and manage your SCAP security policies entirely within the compliance service UI.

Ressources supplémentaires

- Red Hat and OVAL compatibility
- Red Hat and CVE compatibility
- Notifications and Advisories in the Product Security Overview
- Security Data Metrics

7.2.2. Scanning the system for vulnerabilities

The **oscap** command-line utility enables you to scan local systems, validate configuration compliance content, and generate reports and guides based on these scans and evaluations. This utility serves as a front end to the OpenSCAP library and groups its functionalities to modules (sub-commands) based on the type of SCAP content it processes.

Conditions préalables

- The **openscap-scanner** and **bzip2** packages are installed.

Procédure

1. Download the latest RHSA OVAL definitions for your system:

```
# wget -O - https://www.redhat.com/security/data/oval/v2/RHEL9/rhel-9.oval.xml.bz2 | bzip2 --decompress > rhel-9.oval.xml
```

2. Scan the system for vulnerabilities and save results to the *vulnerability.html* file:

```
# oscap oval eval --report vulnerability.html rhel-9.oval.xml
```

Vérification

- Check the results in a browser of your choice, for example:

```
$ firefox vulnerability.html &
```

Ressources supplémentaires

- **oscap(8)** man page
- Red Hat OVAL definitions
- OpenSCAP memory consumption problems

7.2.3. Scanning remote systems for vulnerabilities

You can check also remote systems for vulnerabilities with the OpenSCAP scanner using the **oscap-ssh** tool over the SSH protocol.

Conditions préalables

- The **openscap-utils** and **bzip2** packages are installed on the system you use for scanning.

- The **openscap-scanner** package is installed on the remote systems.
- The SSH server is running on the remote systems.

Procédure

1. Download the latest RHSA OVAL definitions for your system:

```
# wget -O - https://www.redhat.com/security/data/oval/v2/RHEL9/rhel-9.oval.xml.bz2 | bzip2 --decompress > rhel-9.oval.xml
```

2. Scan a remote system with the *machine1* host name, SSH running on port 22, and the *joesec* user name for vulnerabilities and save results to the *remote-vulnerability.html* file:

```
# oscap-ssh joesec@machine1 22 oval eval --report remote-vulnerability.html rhel-9.oval.xml
```

Ressources supplémentaires

- **oscap-ssh(8)**
- Red Hat OVAL definitions
- OpenSCAP memory consumption problems

7.3. CONFIGURATION COMPLIANCE SCANNING

7.3.1. Configuration compliance in RHEL

You can use configuration compliance scanning to conform to a baseline defined by a specific organization. For example, if you work with the US government, you might have to align your systems with the Operating System Protection Profile (OSPP), and if you are a payment processor, you might have to align your systems with the Payment Card Industry Data Security Standard (PCI-DSS). You can also perform configuration compliance scanning to harden your system security.

Red Hat recommends you follow the Security Content Automation Protocol (SCAP) content provided in the SCAP Security Guide package because it is in line with Red Hat best practices for affected components.

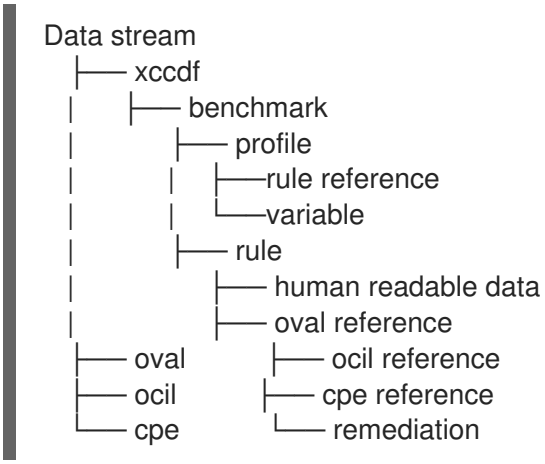
The SCAP Security Guide package provides content which conforms to the SCAP 1.2 and SCAP 1.3 standards. The **openscap scanner** utility is compatible with both SCAP 1.2 and SCAP 1.3 content provided in the SCAP Security Guide package.

IMPORTANT

Performing a configuration compliance scanning does not guarantee the system is compliant.

The SCAP Security Guide suite provides profiles for several platforms in a form of data stream documents. A data stream is a file that contains definitions, benchmarks, profiles, and individual rules. Each rule specifies the applicability and requirements for compliance. RHEL provides several profiles for compliance with security policies. In addition to the industry standard, Red Hat data streams also contain information for remediation of failed rules.

Structure of compliance scanning resources



A profile is a set of rules based on a security policy, such as OSPP, PCI-DSS, and Health Insurance Portability and Accountability Act (HIPAA). This enables you to audit the system in an automated way for compliance with security standards.

You can modify (tailor) a profile to customize certain rules, for example, password length. For more information about profile tailoring, see Customizing a security profile with SCAP Workbench .

7.3.2. Possible results of an OpenSCAP scan

Depending on various properties of your system and the data stream and profile applied to an OpenSCAP scan, each rule may produce a specific result. This is a list of possible results with brief explanations of what they mean.

Tableau 7.1. Possible results of an OpenSCAP scan

Résultat	Explication
Pass	The scan did not find any conflicts with this rule.
Fail	The scan found a conflict with this rule.
Not checked	OpenSCAP does not perform an automatic evaluation of this rule. Check whether your system conforms to this rule manually.
Sans objet	This rule does not apply to the current configuration.
Not selected	This rule is not part of the profile. OpenSCAP does not evaluate this rule and does not display these rules in the results.
Error	The scan encountered an error. For additional information, you can enter the **oscap** command with the **--verbose DEVEL** option. Consider opening a bug report.

Résultat	Explication
Inconnu	The scan encountered an unexpected situation. For additional information, you can enter the **oscap** command with the **`--verbose DEVEL** option. Consider opening a bug report.

7.3.3. Viewing profiles for configuration compliance

Before you decide to use profiles for scanning or remediation, you can list them and check their detailed descriptions using the **oscap info** subcommand.

Conditions préalables

- The **openscap-scanner** and **scap-security-guide** packages are installed.

Procédure

1. List all available files with security compliance profiles provided by the SCAP Security Guide project:

```
$ ls /usr/share/xml/scap/ssg/content/
ssg-rhel9-ds.xml
```

2. Display detailed information about a selected data stream using the **oscap info** subcommand. XML files containing data streams are indicated by the **-ds** string in their names. In the **Profiles** section, you can find a list of available profiles and their IDs:

```
$ oscap info /usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
Profiles:
...
  Title: Australian Cyber Security Centre (ACSC) Essential Eight
    Id: xccdf_org.ssgproject.content_profile_e8
  Title: Health Insurance Portability and Accountability Act (HIPAA)
    Id: xccdf_org.ssgproject.content_profile_hipaa
  Title: PCI-DSS v3.2.1 Control Baseline for Red Hat Enterprise Linux 9
    Id: xccdf_org.ssgproject.content_profile_pci-dss
...
```

3. Select a profile from the data-stream file and display additional details about the selected profile. To do so, use **oscap info** with the **--profile** option followed by the last section of the ID displayed in the output of the previous command. For example, the ID of the HIPPA profile is: **xccdf_org.ssgproject.content_profile_hipaa**, and the value for the **--profile** option is **hipaa**:

```
$ oscap info --profile hipaa /usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
...
Profile
 Title: [RHEL9 DRAFT] Health Insurance Portability and Accountability Act (HIPAA)
 Id: xccdf_org.ssgproject.content_profile_hipaa

 Description: The HIPAA Security Rule establishes U.S. national standards to protect
individuals' electronic personal health information that is created, received, used, or
maintained by a covered entity. The Security Rule requires appropriate administrative,
```

> physical and technical safeguards to ensure the confidentiality, integrity, and security of electronic protected health information. This profile configures Red Hat Enterprise Linux 9 to the HIPAA Security Rule identified for securing of electronic protected health information. Use of this profile in no way guarantees or makes claims against legal compliance against the HIPAA Security Rule(s).

Ressources supplémentaires

- **scap-security-guide(8)** man page
- OpenSCAP memory consumption problems

7.3.4. Assessing configuration compliance with a specific baseline

To determine whether your system conforms to a specific baseline, follow these steps.

Conditions préalables

- The **openscap-scanner** and **scap-security-guide** packages are installed
- You know the ID of the profile within the baseline with which the system should comply. To find the ID, see Viewing Profiles for Configuration Compliance.

Procédure

1. Evaluate the compliance of the system with the selected profile and save the scan results in the *report.html* HTML file, for example:

```
$ oscap xccdf eval --report report.html --profile hipaa /usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
```

2. Optional: Scan a remote system with the **machine1** host name, SSH running on port **22**, and the **joesec** user name for compliance and save results to the **remote-report.html** file:

```
$ oscap-ssh joesec@machine1 22 xccdf eval --report remote_report.html --profile hipaa /usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
```

Ressources supplémentaires

- **scap-security-guide(8)** man page
- **SCAP Security Guide** documentation in the **/usr/share/doc/scap-security-guide/** directory
- **/usr/share/doc/scap-security-guide/guides/ssg-rhel9-guide-index.html** - [Guide to the Secure Configuration of Red Hat Enterprise Linux 9] installed with the **scap-security-guide-doc** package
- OpenSCAP memory consumption problems

7.4. REMEDIATING THE SYSTEM TO ALIGN WITH A SPECIFIC BASELINE

Use this procedure to remediate the RHEL system to align with a specific baseline. This example uses the Health Insurance Portability and Accountability Act (HIPAA) profile.

AVERTISSEMENT

If not used carefully, running the system evaluation with the **Remediate** option enabled might render the system non-functional. Red Hat does not provide any automated method to revert changes made by security-hardening remediations. Remediations are supported on RHEL systems in the default configuration. If your system has been altered after the installation, running remediation might not make it compliant with the required security profile.

Conditions préalables

- The **scap-security-guide** package is installed on your RHEL system.

Procédure

1. Use the **oscap** command with the **--remediate** option:

```
# oscap xccdf eval --profile hipaa --remediate /usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
```

2. Restart your system.

Vérification

1. Evaluate compliance of the system with the HIPAA profile, and save scan results in the **hipaa_report.html** file:

```
$ oscap xccdf eval --report hipaa_report.html --profile hipaa /usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
```

Ressources supplémentaires

- **scap-security-guide(8)** and **oscap(8)** man pages

7.5. REMEDIATING THE SYSTEM TO ALIGN WITH A SPECIFIC BASELINE USING AN SSG ANSIBLE PLAYBOOK

Use this procedure to remediate your system with a specific baseline using an Ansible playbook file from the SCAP Security Guide project. This example uses the Health Insurance Portability and Accountability Act (HIPAA) profile.

AVERTISSEMENT

If not used carefully, running the system evaluation with the **Remediate** option enabled might render the system non-functional. Red Hat does not provide any automated method to revert changes made by security-hardening remediations. Remediations are supported on RHEL systems in the default configuration. If your system has been altered after the installation, running remediation might not make it compliant with the required security profile.

Conditions préalables

- The **scap-security-guide** package is installed.
- The **ansible-core** package is installed. See the Ansible Installation Guide for more information.

NOTE

In RHEL 8.6 and later versions, Ansible Engine is replaced by the **ansible-core** package, which contains only built-in modules. Note that many Ansible remediations use modules from the community and Portable Operating System Interface (POSIX) collections, which are not included in the built-in modules. In this case, you can use Bash remediations as a substitute to Ansible remediations. The Red Hat Connector in RHEL 9 includes the necessary Ansible modules to enable the remediation playbooks to function with Ansible Core.

Procédure

1. Remediate your system to align with HIPAA using Ansible:

```
# ansible-playbook -i localhost, -c local /usr/share/scap-security-guide/ansible/rhel9-playbook-hipaa.yml
```

2. Restart the system.

Vérification

1. Evaluate compliance of the system with the HIPAA profile, and save scan results in the **hipaa_report.html** file:

```
# oscap xccdf eval --profile hipaa --report hipaa_report.html /usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
```

Ressources supplémentaires

- **scap-security-guide(8)** and **oscap(8)** man pages
- Ansible Documentation

7.6. CREATING A REMEDIATION ANSIBLE PLAYBOOK TO ALIGN THE SYSTEM WITH A SPECIFIC BASELINE

You can create an Ansible playbook containing only the remediations that are required to align your system with a specific baseline. This example uses the Health Insurance Portability and Accountability Act (HIPAA) profile. With this procedure, you create a smaller playbook that does not cover already satisfied requirements. By following these steps, you do not modify your system in any way, you only prepare a file for later application.

NOTE

In RHEL 9, Ansible Engine is replaced by the **ansible-core** package, which contains only built-in modules. Note that many Ansible remediations use modules from the community and Portable Operating System Interface (POSIX) collections, which are not included in the built-in modules. In this case, you can use Bash remediations as a substitute for Ansible remediations. The Red Hat Connector in RHEL 9.0 includes the necessary Ansible modules to enable the remediation playbooks to function with Ansible Core.

Conditions préalables

- The **scap-security-guide** package is installed.

Procédure

1. Scan the system and save the results:

```
# oscap xccdf eval --profile hipaa --results hipaa-results.xml
/usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
```

2. Generate an Ansible playbook based on the file generated in the previous step:

```
# oscap xccdf generate fix --fix-type ansible --profile hipaa --output hipaa-remediations.yml
hipaa-results.xml
```

3. The **hipaa-remediations.yml** file contains Ansible remediations for rules that failed during the scan performed in step 1. After reviewing this generated file, you can apply it with the **ansible-playbook hipaa-remediations.yml** command.

Vérification

- In a text editor of your choice, review that the **hipaa-remediations.yml** file contains rules that failed in the scan performed in step 1.

Ressources supplémentaires

- **scap-security-guide(8)** and **oscap(8)** man pages
- Ansible Documentation

7.7. CREATING A REMEDIATION BASH SCRIPT FOR A LATER APPLICATION

Use this procedure to create a Bash script containing remediations that align your system with a security profile such as HIPAA. Using the following steps, you do not do any modifications to your system, you only prepare a file for later application.

Conditions préalables

- The **scap-security-guide** package is installed on your RHEL system.

Procédure

1. Use the **oscap** command to scan the system and to save the results to an XML file. In the following example, **oscap** evaluates the system against the **hipaa** profile:

```
# oscap xccdf eval --profile hipaa --results hipaa-results.xml
/usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
```

2. Generate a Bash script based on the results file generated in the previous step:

```
# oscap xccdf generate fix --profile hipaa --fix-type bash --output hipaa-remediations.sh
hipaa-results.xml
```

3. The **hipaa-remediations.sh** file contains remediations for rules that failed during the scan performed in step 1. After reviewing this generated file, you can apply it with the **./hipaa-remediations.sh** command when you are in the same directory as this file.

Vérification

- In a text editor of your choice, review that the **hipaa-remediations.sh** file contains rules that failed in the scan performed in step 1.

Ressources supplémentaires

- **scap-security-guide(8)**, **oscap(8)**, and **bash(1)** man pages

7.8. SCANNING THE SYSTEM WITH A CUSTOMIZED PROFILE USING SCAP WORKBENCH

SCAP Workbench, which is contained in the **scap-workbench** package, is a graphical utility that enables users to perform configuration and vulnerability scans on a single local or a remote system, perform remediation of the system, and generate reports based on scan evaluations. Note that **SCAP Workbench** has limited functionality compared with the **oscap** command-line utility. **SCAP Workbench** processes security content in the form of data-stream files.

7.8.1. Using SCAP Workbench to scan and remediate the system

To evaluate your system against the selected security policy, use the following procedure.

Conditions préalables

- The **scap-workbench** package is installed on your system.

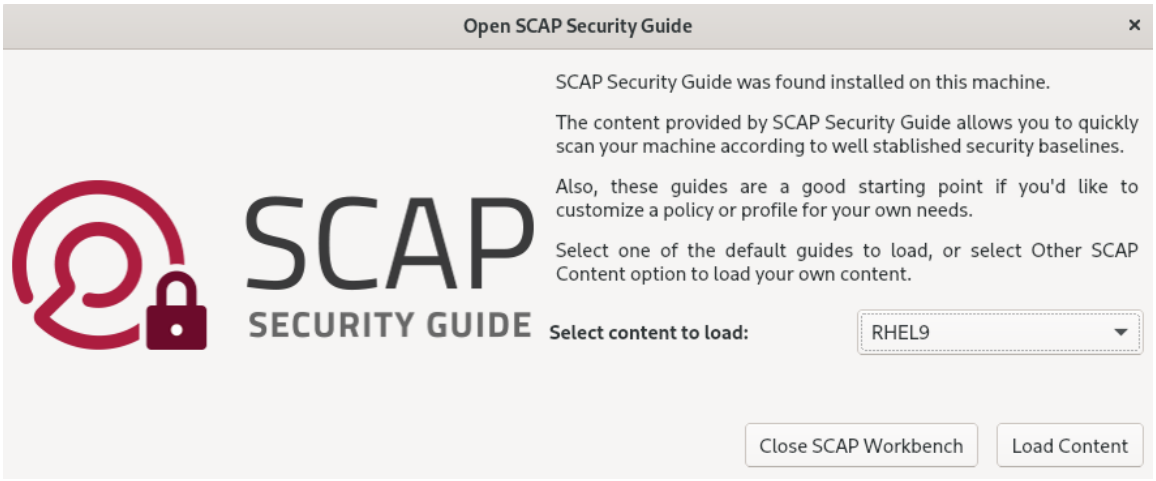
Procédure

1. To run **SCAP Workbench** from the **GNOME Classic** desktop environment, press the **Super** key to enter the **Activities Overview**, type **scap-workbench**, and then press **Enter**. Alternatively, use:

```
$ scap-workbench &
```

2. Select a security policy using either of the following options:

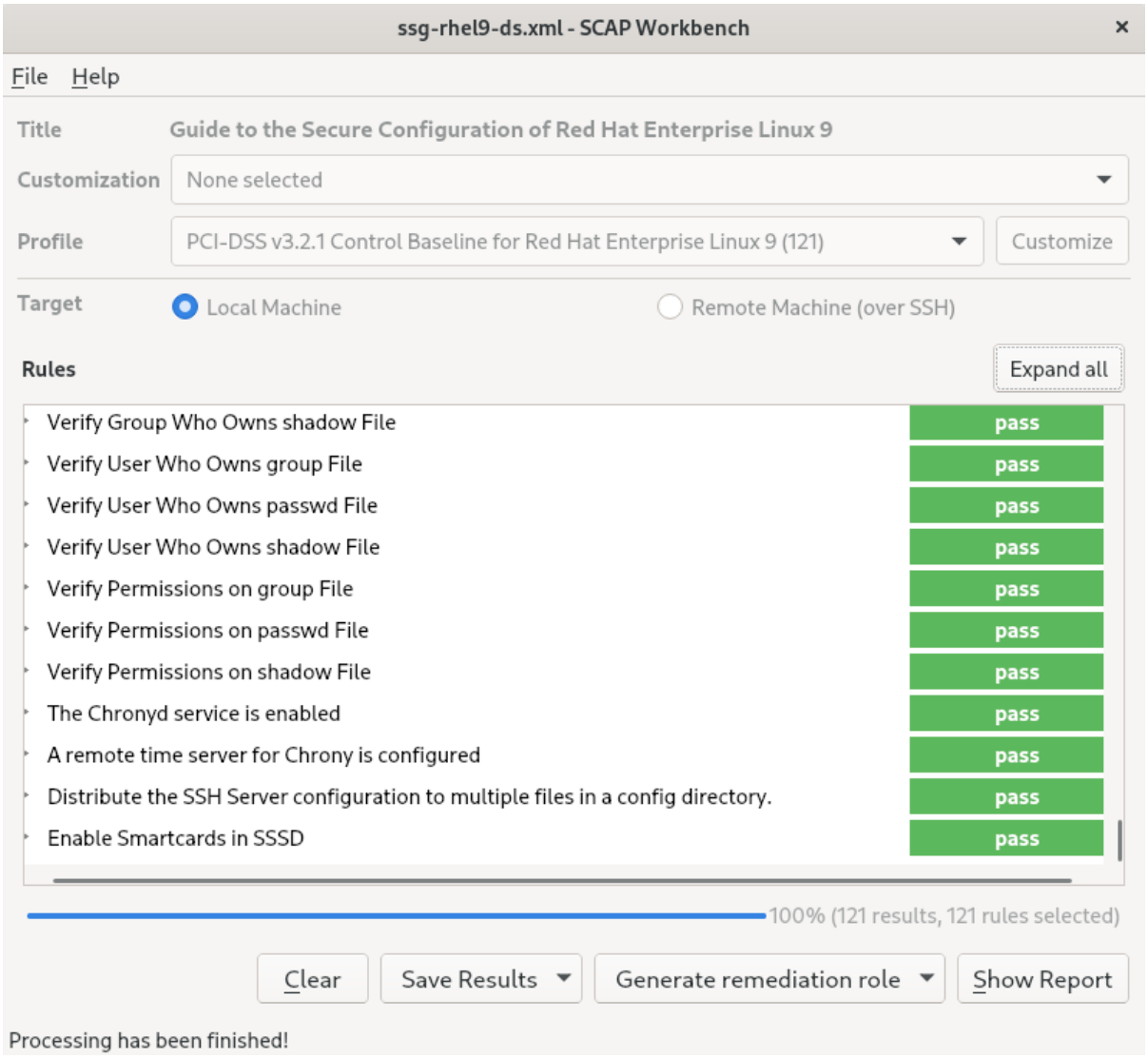
   - **Load Content** button on the starting window
   - **Open content from SCAP Security Guide**
   - **Open Other Content** in the **File** menu, and search the respective XCCDF, SCAP RPM, or data stream file.



3. You can allow automatic correction of the system configuration by selecting the **Remediate** check box. With this option enabled, **SCAP Workbench** attempts to change the system configuration in accordance with the security rules applied by the policy. This process should fix the related checks that fail during the system scan.

> **AVERTISSEMENT**
>
> If not used carefully, running the system evaluation with the **Remediate** option enabled might render the system non-functional. Red Hat does not provide any automated method to revert changes made by security-hardening remediations. Remediations are supported on RHEL systems in the default configuration. If your system has been altered after the installation, running remediation might not make it compliant with the required security profile.

4. Scan your system with the selected profile by clicking the **Scan** button.



5. To store the scan results in form of an XCCDF, ARF, or HTML file, click the **Save Results** combo box. Choose the **HTML Report** option to generate the scan report in human-readable format. The XCCDF and ARF (data stream) formats are suitable for further automatic processing. You can repeatedly choose all three options.

6. To export results-based remediations to a file, use the **Generate remediation role** pop-up menu.

7.8.2. Customizing a security profile with SCAP Workbench

You can customize a security profile by changing parameters in certain rules (for example, minimum password length), removing rules that you cover in a different way, and selecting additional rules, to implement internal policies. You cannot define new rules by customizing a profile.

The following procedure demonstrates the use of **SCAP Workbench** for customizing (tailoring) a profile. You can also save the tailored profile for use with the **oscap** command-line utility.

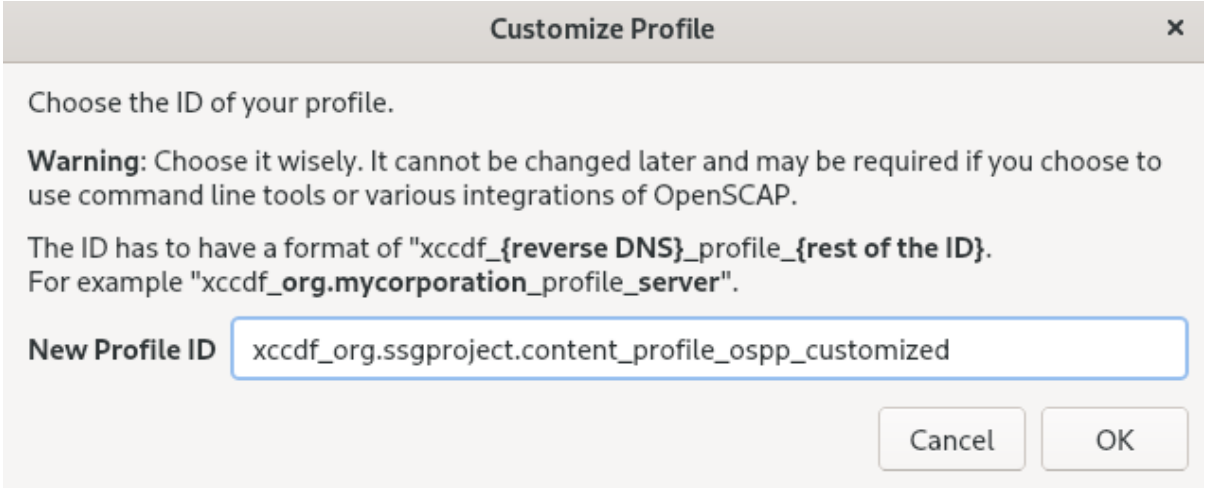
Conditions préalables

- The **scap-workbench** package is installed on your system.

Procédure

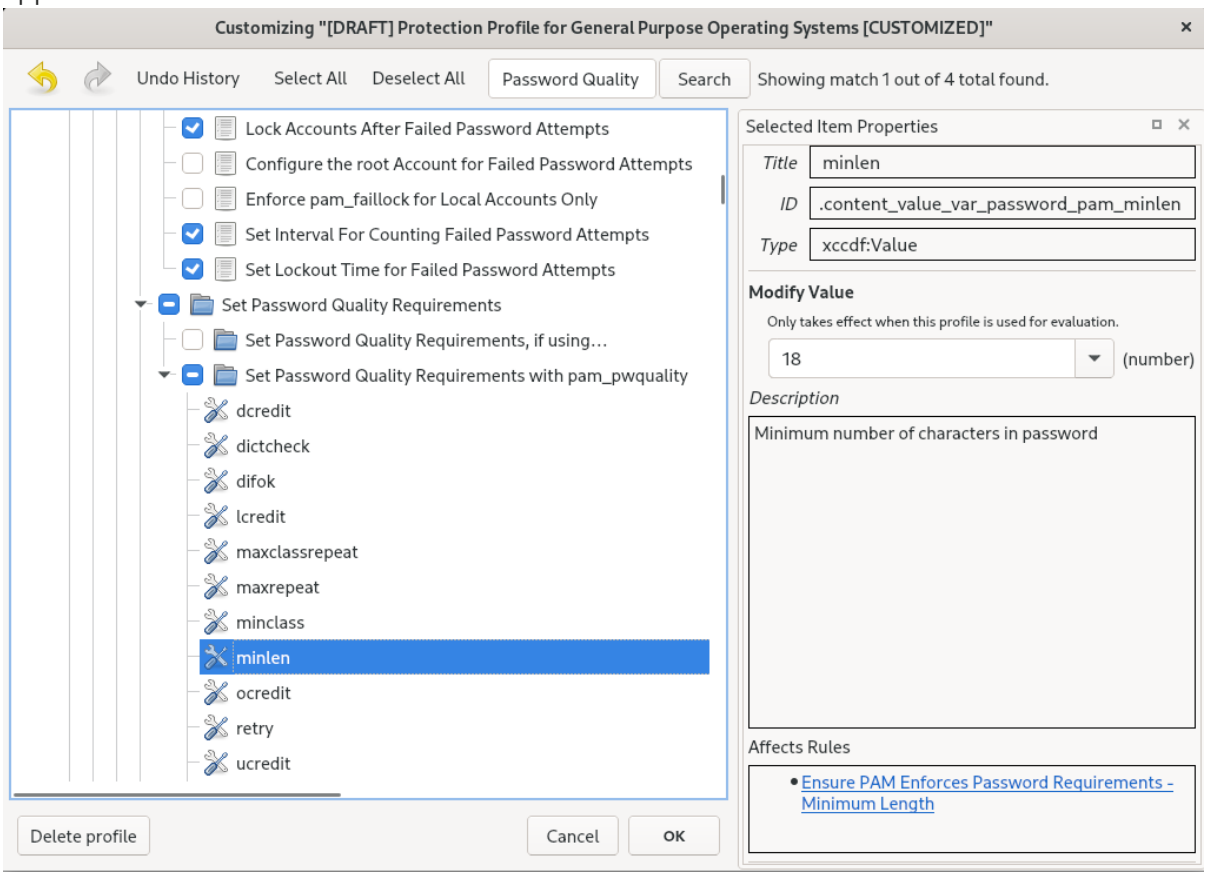
1. Run **SCAP Workbench**, and select the profile to customize by using either **Open content from SCAP Security Guide** or **Open Other Content** in the **File** menu.

2. To adjust the selected security profile according to your needs, click the **Customize** button. This opens the new Customization window that enables you to modify the currently selected profile without changing the original data stream file. Choose a new profile ID.



3. Find a rule to modify using either the tree structure with rules organized into logical groups or the **Search** field.

4. Include or exclude rules using check boxes in the tree structure, or modify values in rules where applicable.



5. Confirm the changes by clicking the **OK** button.

6. To store your changes permanently, use one of the following options:

   - Save a customization file separately by using **Save Customization Only** in the **File** menu.

- Save all security content at once by **Save All** in the **File** menu.
  If you select the **Into a directory** option, **SCAP Workbench** saves both the data stream file and the customization file to the specified location. You can use this as a backup solution.

  By selecting the **As RPM** option, you can instruct **SCAP Workbench** to create an RPM package containing the data stream file and the customization file. This is useful for distributing the security content to systems that cannot be scanned remotely, and for delivering the content for further processing.

NOTE

Because **SCAP Workbench** does not support results-based remediations for tailored profiles, use the exported remediations with the **oscap** command-line utility.

7.8.3. Ressources supplémentaires

- **scap-workbench(8)** man page
- **/usr/share/doc/scap-workbench/user_manual.html** file provided by the **scap-workbench** package
- Deploy customized SCAP policies with Satellite 6.x KCS article

7.9. DÉPLOYER DES SYSTÈMES CONFORMES À UN PROFIL DE SÉCURITÉ IMMÉDIATEMENT APRÈS L'INSTALLATION

Vous pouvez utiliser la suite OpenSCAP pour déployer des systèmes RHEL conformes à un profil de sécurité, tel que le profil OSPP, PCI-DSS et HIPAA, immédiatement après le processus d'installation. Grâce à cette méthode de déploiement, vous pouvez appliquer des règles spécifiques qui ne peuvent pas être appliquées ultérieurement à l'aide de scripts de remédiation, par exemple, une règle pour la force des mots de passe et le partitionnement.

7.9.1. Profils non compatibles avec le serveur avec interface graphique

Certains profils de sécurité fournis dans le cadre de **SCAP Security Guide** ne sont pas compatibles avec l'ensemble de paquets étendu inclus dans l'environnement de base **Server with GUI**. Par conséquent, ne sélectionnez pas **Server with GUI** lorsque vous installez des systèmes conformes à l'un des profils suivants :

Tableau 7.2. Profils non compatibles avec le serveur avec interface graphique

Nom du profil	ID du profil	Justification	Notes
[PROJET] CIS Red Hat Enterprise Linux 9 Benchmark pour le niveau 2 - Serveur	**xccdf_org.ssgproject.content_profile_cis**	Les paquets **xorg-x11-server-Xorg**, **xorg-x11-server-common**, **xorg-x11-server-utils**, et **xorg-x11-server-Xwayland** font partie de l'ensemble de paquets **Server with GUI**, mais la politique exige leur suppression.	

Nom du profil	ID du profil	Justification	Notes
[PROJET] CIS Red Hat Enterprise Linux 9 Benchmark pour le niveau 1 - Serveur	**xccdf_org.ssgproject.content_profile_cis_server_l1**	Les paquets **xorg-x11-server-Xorg**, **xorg-x11-server-common**, **xorg-x11-server-utils**, et **xorg-x11-server-Xwayland** font partie de l'ensemble de paquets **Server with GUI**, mais la politique exige leur suppression.	
[PROJET] STIG DISA pour Red Hat Enterprise Linux 9	**xccdf_org.ssgproject.content_profile_stig**	Les paquets **xorg-x11-server-Xorg**, **xorg-x11-server-common**, **xorg-x11-server-utils**, et **xorg-x11-server-Xwayland** font partie de l'ensemble de paquets **Server with GUI**, mais la politique exige leur suppression.	Pour installer un système RHEL en tant que **Server with GUI** aligné sur DISA STIG, vous pouvez utiliser le profil **DISA STIG with GUI** BZ#1648162

7.9.2. Déploiement de systèmes RHEL conformes aux normes de base à l'aide de l'installation graphique

Cette procédure permet de déployer un système RHEL conforme à une ligne de base spécifique. Cet exemple utilise le profil de protection pour le système d'exploitation général (OSPP).

AVERTISSEMENT

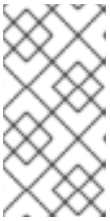
Certains profils de sécurité fournis dans le cadre de **SCAP Security Guide** ne sont pas compatibles avec l'ensemble de paquets étendu inclus dans l'environnement de base **Server with GUI**. Pour plus de détails, voir Profils non compatibles avec un serveur GUI.

Conditions préalables

- Vous avez démarré le programme d'installation **graphical**. Notez que le site **OSCAP Anaconda Add-on** ne prend pas en charge l'installation interactive en mode texte.
- Vous avez accédé à la fenêtre **Installation Summary**.

Procédure

1. Dans la fenêtre **Installation Summary**, cliquez sur **Software Selection**. La fenêtre **Software Selection** s'ouvre.
2. Dans le volet **Base Environment**, sélectionnez l'environnement **Server**. Vous ne pouvez sélectionner qu'un seul environnement de base.
3. Cliquez sur **Done** pour appliquer le réglage et revenir à la fenêtre **Installation Summary**.
4. L'OSPP ayant des exigences strictes en matière de partitionnement, créez des partitions distinctes pour **/boot**, **/home**, **/var**, **/tmp**, **/var/log**, **/var/tmp**, et **/var/log/audit**.
5. Cliquez sur **Security Policy**. La fenêtre **Security Policy** s'ouvre.
6. Pour activer les politiques de sécurité sur le système, basculez le commutateur **Apply security policy** sur **ON**.
7. Sélectionnez **Protection Profile for General Purpose Operating Systems** dans le volet des profils.
8. Cliquez sur **Select Profile** pour confirmer la sélection.
9. Confirmez les modifications dans le volet **Changes that were done or need to be done** qui s'affiche en bas de la fenêtre. Effectuez les modifications manuelles restantes.
10. Terminez la procédure d'installation graphique.



NOTE

Le programme d'installation graphique crée automatiquement un fichier Kickstart correspondant après une installation réussie. Vous pouvez utiliser le fichier **/root/anaconda-ks.cfg** pour installer automatiquement des systèmes compatibles OSPP.

Vérification

- Pour vérifier l'état actuel du système une fois l'installation terminée, redémarrez le système et lancez une nouvelle analyse :

```
# oscap xccdf eval --profile ospp --report eval_postinstall_report.html
/usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
```

Ressources supplémentaires

- Configuration du partitionnement manuel

7.9.3. Déploiement de systèmes RHEL conformes aux normes de base à l'aide de Kickstart

Cette procédure permet de déployer des systèmes RHEL alignés sur une ligne de base spécifique. Cet exemple utilise le profil de protection pour le système d'exploitation général (OSPP).

Conditions préalables

- Le paquetage **scap-security-guide** est installé sur votre système RHEL 9.

Procédure

1. Ouvrez le fichier **/usr/share/scap-security-guide/kickstart/ssg-rhel9-ospp-ks.cfg** Kickstart dans un éditeur de votre choix.

2. Mettez à jour le schéma de partitionnement pour qu'il corresponde aux exigences de votre configuration. Pour la conformité OSPP, les partitions séparées pour **/boot**, **/home**, **/var**, **/tmp**, **/var/log**, **/var/tmp**, et **/var/log/audit** doivent être préservées, et vous ne pouvez modifier que la taille des partitions.

3. Lancez une installation Kickstart comme décrit dans la section Effectuer une installation automatisée à l'aide de Kickstart.

IMPORTANT

Les mots de passe dans les fichiers Kickstart ne sont pas vérifiés pour les exigences de l'OSPP.

Vérification

1. Pour vérifier l'état actuel du système une fois l'installation terminée, redémarrez le système et lancez une nouvelle analyse :

```
# oscap xccdf eval --profile ospp --report eval_postinstall_report.html
/usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
```

Ressources supplémentaires

- OSCAP Anaconda Add-on

7.10. SCANNING CONTAINER AND CONTAINER IMAGES FOR VULNERABILITIES

Use this procedure to find security vulnerabilities in a container or a container image.

Conditions préalables

- The **openscap-utils** and **bzip2** packages are installed.

Procédure

1. Download the latest RHSA OVAL definitions for your system:

```
# wget -O - https://www.redhat.com/security/data/oval/v2/RHEL9/rhel-9.oval.xml.bz2 | bzip2 -
-decompress > rhel-9.oval.xml
```

2. Get the ID of a container or a container image, for example:

```
# podman images
REPOSITORY                          TAG      IMAGE ID      CREATED       SIZE
registry.access.redhat.com/ubi9/ubi   latest   096cae65a207   7 weeks ago   239 MB
```

3. Scan the container or the container image for vulnerabilities and save results to the *vulnerability.html* file:

```
# oscap-podman 096cae65a207 oval eval --report vulnerability.html rhel-9.oval.xml
```

Note that the **oscap-podman** command requires root privileges, and the ID of a container is the first argument.

Vérification

- Check the results in a browser of your choice, for example:

```
$ firefox vulnerability.html &
```

Ressources supplémentaires

- For more information, see the **oscap-podman(8)** and **oscap(8)** man pages.

7.11. ASSESSING SECURITY COMPLIANCE OF A CONTAINER OR A CONTAINER IMAGE WITH A SPECIFIC BASELINE

Follow these steps to assess compliance of your container or a container image with a specific security baseline, such as Operating System Protection Profile (OSPP), Payment Card Industry Data Security Standard (PCI-DSS), and Health Insurance Portability and Accountability Act (HIPAA).

Conditions préalables

- The **openscap-utils** and **scap-security-guide** packages are installed.

Procédure

1. Get the ID of a container or a container image, for example:

```
# podman images
REPOSITORY                          TAG      IMAGE ID       CREATED       SIZE
registry.access.redhat.com/ubi9/ubi   latest   096cae65a207   7 weeks ago   239 MB
```

2. Evaluate the compliance of the container image with the HIPAA profile and save scan results into the *report.html* HTML file

```
# oscap-podman 096cae65a207 xccdf eval --report report.html --profile hipaa
/usr/share/xml/scap/ssg/content/ssg-rhel9-ds.xml
```

Replace *096cae65a207* with the ID of your container image and the *hipaa* value with *ospp* or *pci-dss* if you assess security compliance with the OSPP or PCI-DSS baseline. Note that the **oscap-podman** command requires root privileges.

Vérification

- Check the results in a browser of your choice, for example:

```
$ firefox report.html &
```

NOTE

The rules marked as *notapplicable* are rules that do not apply to containerized systems. These rules apply only to bare-metal and virtualized systems.

Ressources supplémentaires

- **oscap-podman(8)** and **scap-security-guide(8)** man pages.
- **/usr/share/doc/scap-security-guide/** directory.

7.12. SCAP SECURITY GUIDE PROFILES SUPPORTED IN RHEL 9

Use only the SCAP content provided in the particular minor release of RHEL. This is because components that participate in hardening are sometimes updated with new capabilities. SCAP content changes to reflect these updates, but it is not always backward compatible.

In the following tables, you can find the profiles provided in RHEL 9, together with the version of the policy with which the profile aligns.

Tableau 7.3. SCAP Security Guide profiles supported in RHEL 9.2

Nom du profil	ID du profil	Version de la politique
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 niveau renforcé	**xccdf_org.ssgproject.content_profile_anssi_bp28_enhanced**	1.2
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 Haut niveau	**xccdf_org.ssgproject.content_profile_anssi_bp28_high**	1.2
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 Niveau intermédiaire	**xccdf_org.ssgproject.content_profile_anssi_bp28_intermediary**	1.2
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 Niveau minimal	**xccdf_org.ssgproject.content_profile_anssi_bp28_minimal**	1.2
CIS Red Hat Enterprise Linux 9 Benchmark for Level 2 - Server	**xccdf_org.ssgproject.content_profile_cis**	1.0.0
CIS Red Hat Enterprise Linux 9 Benchmark for Level 1 - Server	**xccdf_org.ssgproject.content_profile_cis_server_l1**	1.0.0
CIS Red Hat Enterprise Linux 9 Benchmark for Level 1 - Workstation	**xccdf_org.ssgproject.content_profile_cis_workstation_l1**	1.0.0

Nom du profil	ID du profil	Version de la politique
CIS Red Hat Enterprise Linux 9 Benchmark for Level 2 - Workstation	**xccdf_org.ssgproject.content_profile_cis_workstation_l2**	1.0.0
[Informations non classifiées dans les systèmes d'information et les organisations non fédérales (NIST 800-171)	**xccdf_org.ssgproject.content_profile_cui**	r2
Centre australien de cybersécurité (ACSC) Huit éléments essentiels	**xccdf_org.ssgproject.content_profile_e8**	non versionné
Loi sur la portabilité et la responsabilité en matière d'assurance maladie (HIPAA)	**xccdf_org.ssgproject.content_profile_hipaa**	non versionné
Centre australien de cybersécurité (ACSC) ISM Official	**xccdf_org.ssgproject.content_profile_ism_o**	non versionné
Protection Profile for General Purpose Operating Systems	**xccdf_org.ssgproject.content_profile_ospp**	4.2.1
Base de contrôle PCI-DSS v3.2.1 pour Red Hat Enterprise Linux 9	**xccdf_org.ssgproject.content_profile_pci-dss**	3.2.1
[PROJET] STIG DISA pour Red Hat Enterprise Linux 9	**xccdf_org.ssgproject.content_profile_stig**	PROJET[a]
[DRAFT] DISA STIG avec GUI pour Red Hat Enterprise Linux 9	**xccdf_org.ssgproject.content_profile_stig_gui**	PROJET[a]

[a] La DISA n'a pas encore publié de référence officielle pour RHEL 9

Tableau 7.4. SCAP Security Guide profiles supported in RHEL 9.1

Nom du profil	ID du profil	Version de la politique
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 niveau renforcé	**xccdf_org.ssgproject.content_profile_anssi_bp28_enhanced**	1.2

Nom du profil	ID du profil	Version de la politique
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 Haut niveau	**xccdf_org.ssgproject.content_profile_anssi_bp28_high**	1.2
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 Niveau intermédiaire	**xccdf_org.ssgproject.content_profile_anssi_bp28_intermediary**	1.2
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 Niveau minimal	**xccdf_org.ssgproject.content_profile_anssi_bp28_minimal**	1.2
CIS Red Hat Enterprise Linux 9 Benchmark for Level 2 - Server	**xccdf_org.ssgproject.content_profile_cis**	RHEL 9.1.0 and RHEL 9.1.1:DRAFT[a] RHEL 9.1.2 and later:1.0.0
CIS Red Hat Enterprise Linux 9 Benchmark for Level 1 - Server	**xccdf_org.ssgproject.content_profile_cis_server_l1**	RHEL 9.1.0 and RHEL 9.1.1:DRAFT[a] RHEL 9.1.2 and later:1.0.0
CIS Red Hat Enterprise Linux 9 Benchmark for Level 1 - Workstation	**xccdf_org.ssgproject.content_profile_cis_workstation_l1**	RHEL 9.1.0 and RHEL 9.1.1:DRAFT[a] RHEL 9.1.2 and later:1.0.0
CIS Red Hat Enterprise Linux 9 Benchmark for Level 2 - Workstation	**xccdf_org.ssgproject.content_profile_cis_workstation_l2**	RHEL 9.1.0 and RHEL 9.1.1:DRAFT[a] RHEL 9.1.2 and later:1.0.0
[Informations non classifiées dans les systèmes d'information et les organisations non fédérales (NIST 800-171)	**xccdf_org.ssgproject.content_profile_cui**	r2
Centre australien de cybersécurité (ACSC) Huit éléments essentiels	**xccdf_org.ssgproject.content_profile_e8**	non versionné
Loi sur la portabilité et la responsabilité en matière d'assurance maladie (HIPAA)	**xccdf_org.ssgproject.content_profile_hipaa**	non versionné
Centre australien de cybersécurité (ACSC) ISM Official	**xccdf_org.ssgproject.content_profile_ism_o**	non versionné

Nom du profil	ID du profil	Version de la politique
Protection Profile for General Purpose Operating Systems	**xccdf_org.ssgproject.content_profile_ospp**	4.2.1
Base de contrôle PCI-DSS v3.2.1 pour Red Hat Enterprise Linux 9	**xccdf_org.ssgproject.content_profile_pci-dss**	3.2.1
[PROJET] STIG DISA pour Red Hat Enterprise Linux 9	**xccdf_org.ssgproject.content_profile_stig**	PROJET[a]
[DRAFT] DISA STIG avec GUI pour Red Hat Enterprise Linux 9	**xccdf_org.ssgproject.content_profile_stig_gui**	PROJET[a]

[a] CIS has not yet published an official benchmark for RHEL 9

Tableau 7.5. Profils du guide de sécurité SCAP pris en charge dans RHEL 9.0

Nom du profil	ID du profil	Version de la politique
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 niveau renforcé	**xccdf_org.ssgproject.content_profile_anssi_bp28_enhanced**	1.2
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 Haut niveau	**xccdf_org.ssgproject.content_profile_anssi_bp28_high**	1.2
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 Niveau intermédiaire	**xccdf_org.ssgproject.content_profile_anssi_bp28_intermediary**	1.2
Agence nationale de la sécurité des systèmes d'information (ANSSI) BP-028 Niveau minimal	**xccdf_org.ssgproject.content_profile_anssi_bp28_minimal**	1.2
CIS Red Hat Enterprise Linux 9 Benchmark for Level 2 - Server	**xccdf_org.ssgproject.content_profile_cis**	RHEL 9.0.0 to RHEL 9.0.6:DRAFT[a] RHEL 9.0.7 and later:1.0.0
CIS Red Hat Enterprise Linux 9 Benchmark for Level 1 - Server	**xccdf_org.ssgproject.content_profile_cis_server_l1**	RHEL 9.0.0 to RHEL 9.0.6:DRAFT[a] RHEL 9.0.7 and later:1.0.0

Nom du profil	ID du profil	Version de la politique
CIS Red Hat Enterprise Linux 9 Benchmark for Level 1 - Workstation	**xccdf_org.ssgproject.content_profile_cis_workstation_l1**	RHEL 9.0.0 to RHEL 9.0.6:DRAFT[a] RHEL 9.0.7 and later:1.0.0
CIS Red Hat Enterprise Linux 9 Benchmark for Level 2 - Workstation	**xccdf_org.ssgproject.content_profile_cis_workstation_l2**	RHEL 9.0.0 to RHEL 9.0.6:DRAFT[a] RHEL 9.0.7 and later:1.0.0
[Informations non classifiées dans les systèmes d'information et les organisations non fédérales (NIST 800-171)	**xccdf_org.ssgproject.content_profile_cui**	r2
Centre australien de cybersécurité (ACSC) Huit éléments essentiels	**xccdf_org.ssgproject.content_profile_e8**	non versionné
Loi sur la portabilité et la responsabilité en matière d'assurance maladie (HIPAA)	**xccdf_org.ssgproject.content_profile_hipaa**	non versionné
Centre australien de cybersécurité (ACSC) ISM Official	**xccdf_org.ssgproject.content_profile_ism_o**	non versionné
Protection Profile for General Purpose Operating Systems	**xccdf_org.ssgproject.content_profile_ospp**	RHEL 9.0.0 to RHEL 9.0.2:DRAFT RHEL 9.0.3 and later:4.2.1
Base de contrôle PCI-DSS v3.2.1 pour Red Hat Enterprise Linux 9	**xccdf_org.ssgproject.content_profile_pci-dss**	3.2.1
[PROJET] STIG DISA pour Red Hat Enterprise Linux 9	**xccdf_org.ssgproject.content_profile_stig**	PROJET[a]
[DRAFT] DISA STIG avec GUI pour Red Hat Enterprise Linux 9	**xccdf_org.ssgproject.content_profile_stig_gui**	PROJET[a]

7.13. RESSOURCES SUPPLÉMENTAIRES

- Supported versions of the SCAP Security Guide in RHEL
- The OpenSCAP project page provides detailed information about the **oscap** utility and other components and projects related to SCAP.

- The SCAP Workbench project page provides detailed information about the **scap-workbench** application.
- The SCAP Security Guide (SSG) project page provides the latest security content for Red Hat Enterprise Linux.
- Using OpenSCAP for security compliance and vulnerability scanning - A hands-on lab on running tools based on the Security Content Automation Protocol (SCAP) standard for compliance and vulnerability scanning in RHEL.
- Red Hat Security Demos: Creating Customized Security Policy Content to Automate Security Compliance - A hands-on lab to get initial experience in automating security compliance using the tools that are included in RHEL to comply with both industry standard security policies and custom security policies. If you want training or access to these lab exercises for your team, contact your Red Hat account team for additional details.
- Red Hat Security Demos: Defend Yourself with RHEL Security Technologies - A hands-on lab to learn how to implement security at all levels of your RHEL system, using the key security technologies available to you in RHEL, including OpenSCAP. If you want training or access to these lab exercises for your team, contact your Red Hat account team for additional details.
- National Institute of Standards and Technology (NIST) SCAP page has a vast collection of SCAP-related materials, including SCAP publications, specifications, and the SCAP Validation Program.
- National Vulnerability Database (NVD) has the largest repository of SCAP content and other SCAP standards-based vulnerability management data.
- Red Hat OVAL content repository contains OVAL definitions for vulnerabilities of RHEL systems. This is the recommended source of vulnerability content.
- MITRE CVE - This is a database of publicly known security vulnerabilities provided by the MITRE corporation. For RHEL, using OVAL CVE content provided by Red Hat is recommended.
- MITRE OVAL - This is an OVAL-related project provided by the MITRE corporation. Among other OVAL-related information, these pages contain the OVAL language and a repository of OVAL content with thousands of OVAL definitions. Note that for scanning RHEL, using OVAL CVE content provided by Red Hat is recommended.
- Managing security compliance in Red Hat Satellite - This set of guides describes, among other topics, how to maintain system security on multiple systems by using OpenSCAP.

CHAPITRE 8. ENSURING SYSTEM INTEGRITY WITH KEYLIME

With Keylime, you can continuously monitor the integrity of remote systems and verify the state of systems at boot. You can also send encrypted files to the monitored systems, and specify automated actions triggered whenever a monitored system fails the integrity test.

8.1. HOW KEYLIME WORKS

You can deploy Keylime agents to perform one or more of the following actions:

Runtime integrity monitoring

Keylime runtime integrity monitoring continuously monitors the system on which the agent is deployed and measures the integrity of the files included in the allowlist and not included in the excludelist.

Measured boot

Keylime measured boot verifies the system state at boot.

Keylime's concept of trust is based on the Trusted Platform Module (TPM) technology. A TPM is a hardware, firmware, or virtual component with integrated cryptographic keys. By polling TPM quotes and comparing the hashes of objects, Keylime provides initial and runtime monitoring of remote systems.

IMPORTANT

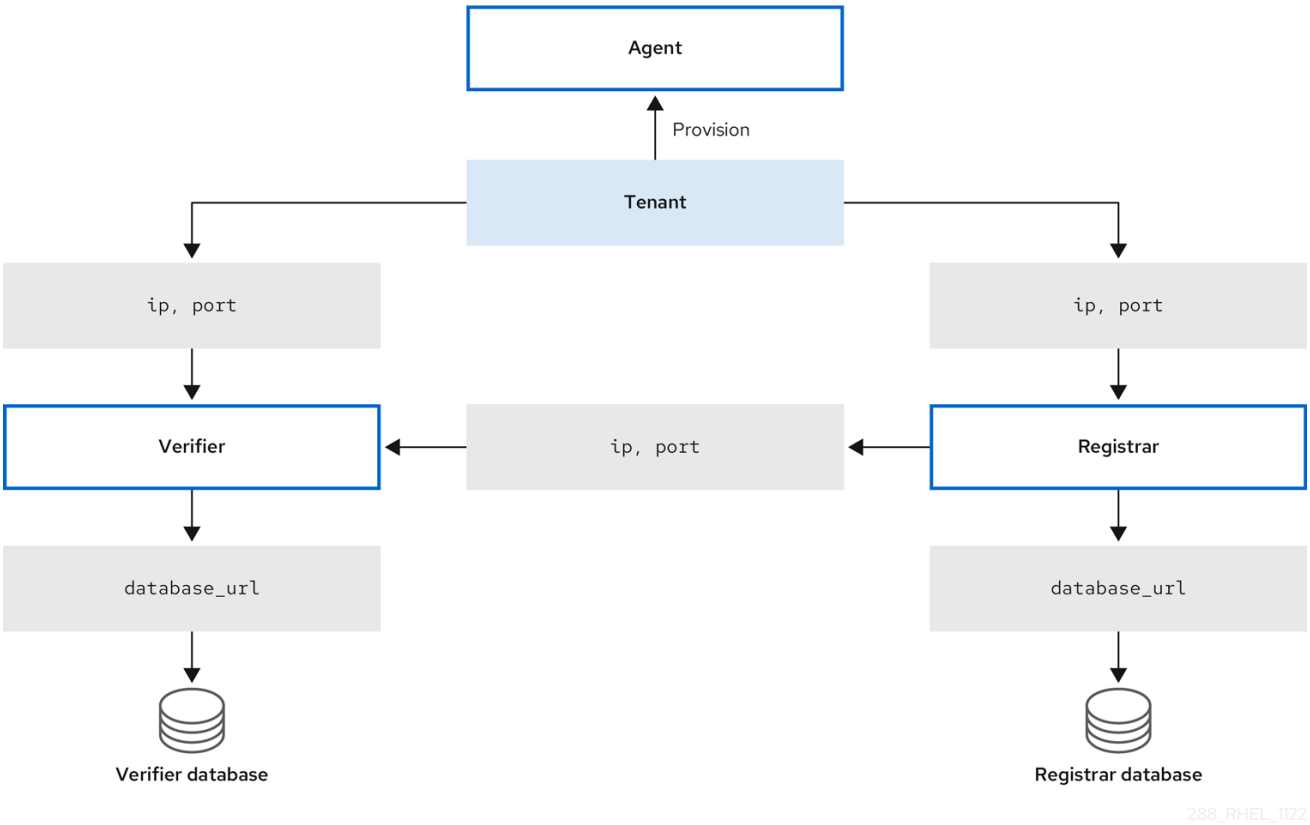
Keylime running in a virtual machine or using a virtual TPM depends upon the integrity of the underlying host. Ensure you trust the host environment before relying upon Keylime measurements in a virtual environment.

Keylime consists of three main components:

- The *verifier* initially and continuously verifies the integrity of the systems that run the agent.
- The *registrar* contains a database of all agents and it hosts the public keys of the TPM vendors.
- The *agent* is the component deployed to remote systems measured by the verifier.

In addition, Keylime uses the **keylime_tenant** utility for many functions, including provisioning the agents on the target systems.

Figure 8.1. Connections between Keylime components through configurations

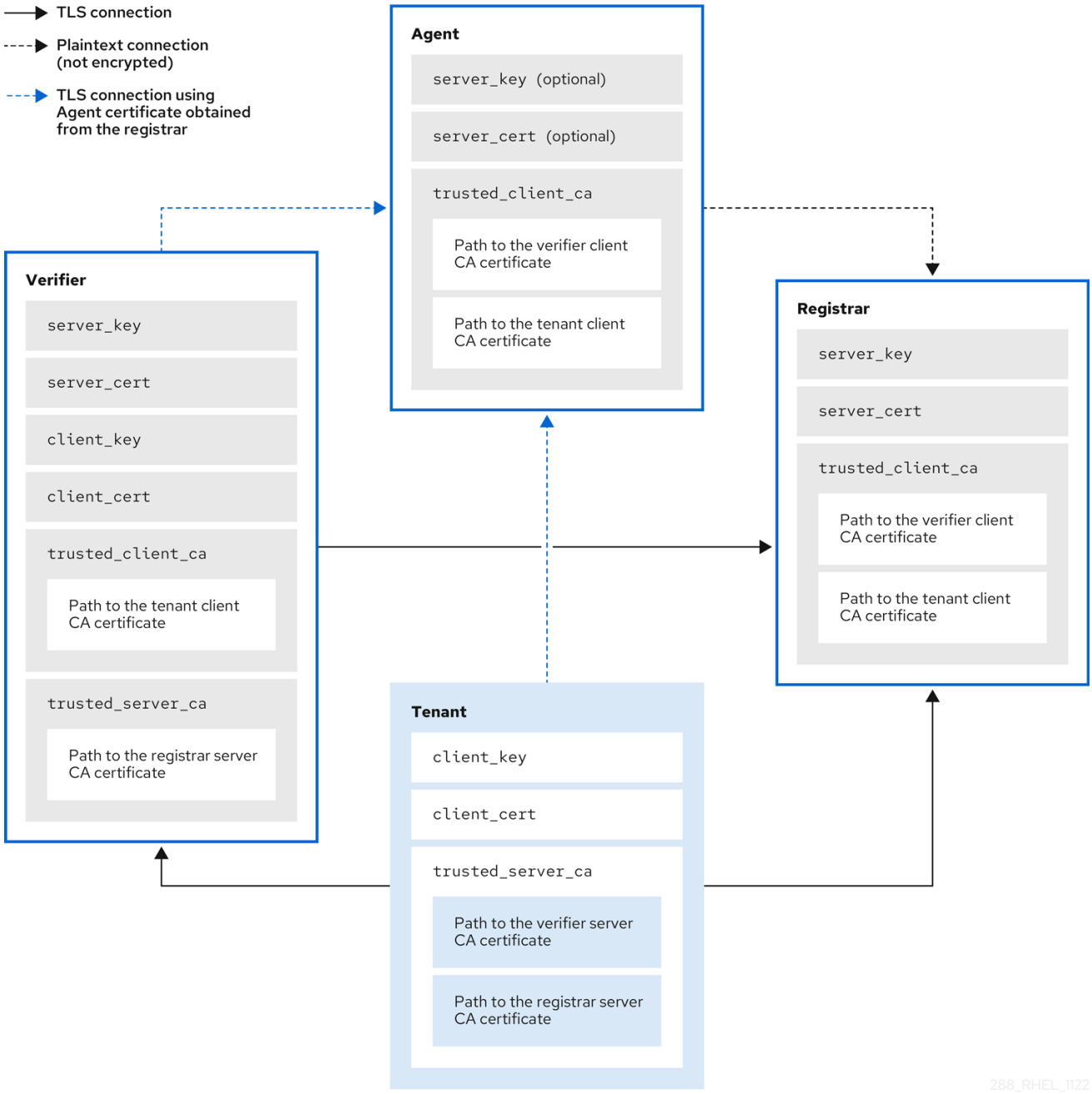


Keylime ensures the integrity of the monitored systems in a chain of trust by using keys and certificates exchanged between the components and the tenant. For a secure foundation of this chain, use a certificate authority (CA) that you can trust.

NOTE

If the agent receives no key and certificate, it generates a key and a self-signed certificate with no involvement from the CA.

Figure 8.2. Connections between Keylime components certificates and keys



8.2. CONFIGURING KEYLIME VERIFIER

The verifier is the most important component in Keylime. It performs initial and periodic checks of system integrity and supports bootstrapping a cryptographic key securely with the agent. The verifier uses mutual Transport Layer Security (TLS) for its control interface.

IMPORTANT

To maintain the chain of trust, keep the system that runs the verifier secure and under your control.

You can install the verifier on a separate system or on the same system as the Keylime registrar, depending on your requirements. Running the verifier and registrar on separate systems provides better performance.

NOTE

To keep the configuration files organized within the drop-in directories, use file names with a two-digit number prefix, for example **/etc/keylime/verifier.conf.d/00-verifier-ip.conf**. The configuration processing reads the files inside the drop-in directory in lexicographic order and sets each option to the last value it reads.

Conditions préalables

- You have **root** permissions and network connection to the system or systems on which you want to install Keylime components.
- You have valid keys and certificates from your certificate authority.
- Optional: You have access to two databases, where Keylime saves data from the registrar and from the verifier. You can use any of the following database management systems:
  - SQLite (default)
  - PostgreSQL
  - MySQL
  - MariaDB

Procédure

1. Install the Keylime verifier:

```
# dnf install keylime-verifier
```

2. Define the IP address and port of the registrar and verifier in the verifier configuration.
   a. Create a new **.conf** file in the **/etc/keylime/verifier.conf.d/** directory, for example, **/etc/keylime/verifier.conf.d/00-verifier-ip.conf**, with the following content:

```
[verifier]
ip = <verifier_IP_address>
```

   - Replace ***<verifier_IP_address>*** with the verifier's IP address. Alternatively, use **ip = *** or **ip = 0.0.0.0** to bind the verifier to all available IP addresses.
   - Optionally, you can also change the verifier's port from the default value **8881** by using the **port = *<verifier_port>*** option.

   b. Create a new **.conf** file in the **/etc/keylime/verifier.conf.d/** directory, for example, **/etc/keylime/verifier.conf.d/00-registrar-ip.conf**, with the following content:

```
[verifier]
registrar_ip = <registrar_IP_address>
```

   - Replace ***<registrar_IP_address>*** with the registrar's IP address.
   - If the registrar uses a different port than the default value **8891**, add the **registrar_port = *<registrar_port>*** setting.

3. Optional: Configure the verifier's database for the list of agents. The default configuration uses an SQLite database in the verifiers's **/var/lib/keylime/cv_data.sqlite/** directory. You can define a different database by creating a new **.conf** file in the **/etc/keylime/verifier.conf.d/** directory, for example, **/etc/keylime/verifier.conf.d/00-db-url.conf**, with the following content:

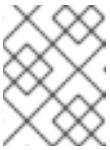
```
[verifier]
database_url = <protocol>://<name>:<password>@<ip_address_or_hostname>/<properties>
```

Replace ***<protocol>://<name>:<password>@<ip_address_or_hostname>/<properties>*** with the URL of the database, for example, **postgresql://verifier:UQ?nRNY9g7GZzN7@198.51.100.1/verifierdb**.

Ensure that the credentials you use have the permissions for Keylime to create the database structure.

4. Add certificates and keys to the verifier. You can either let Keylime generate them, or use existing keys and certificates:

   - With the default **tls_dir = generate** option, Keylime generates new certificates for the verifier, registrar, and tenant in the **/var/lib/keylime/cv_ca/** directory.
   - To load existing keys and certificates in the configuration, define their location in the verifier configuration.

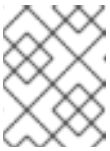


NOTE

Certificates must be accessible by the **keylime** user, under which the Keylime services are running.

Create a new **.conf** file in the **/etc/keylime/verifier.conf.d/** directory, for example, **/etc/keylime/verifier.conf.d/00-keys-and-certs.conf**, with the following content:

```
[verifier]
tls_dir = /var/lib/keylime/cv_ca
server_key = </path/to/server_key>
server_key_password = <passphrase1>
server_cert = </path/to/server_cert>
trusted_client_ca = ['</path/to/ca/cert1>', '</path/to/ca/cert2>']
client_key = </path/to/client_key>
client_key_password = <passphrase2>
client_cert = </path/to/client_cert>
trusted_server_ca = ['</path/to/ca/cert3>', '</path/to/ca/cert4>']
```



NOTE

Use absolute paths to define key and certificate locations. Alternatively, relative paths are resolved from the directory defined in the **tls_dir** option.

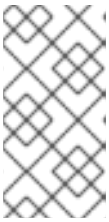
5. Open the port in firewall:

```
# firewall-cmd --add-port 8881/tcp
# firewall-cmd --runtime-to-permanent
```

If you use a different port, replace **8881** with the port number defined in the **.conf** file.

6. Start the verifier service:

```
# systemctl enable --now keylime_verifier
```



NOTE

In the default configuration, start the **keylime_verifier** before starting the **keylime_registrar** service because the verifier creates the CA and certificates for the other Keylime components. This order is not necessary when you use custom certificates.

Vérification

- Check that the **keylime_verifier** service is active and running:

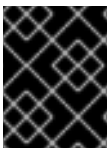
```
# systemctl status keylime_verifier
● keylime_verifier.service - The Keylime verifier
     Loaded: loaded (/usr/lib/systemd/system/keylime_verifier.service; disabled; vendor preset:
disabled)
     Active: active (running) since Wed 2022-11-09 10:10:08 EST; 1min 45s ago
```

Prochaines étapes

- Section 8.3, « Configuring Keylime registrar » .

8.3. CONFIGURING KEYLIME REGISTRAR

The registrar is the Keylime component that contains a database of all agents, and it hosts the public keys of the TPM vendors. After the registrar's HTTPS service accepts trusted platform module (TPM) public keys, it presents an interface to obtain these public keys for checking quotes.



IMPORTANT

To maintain the chain of trust, keep the system that runs the registrar secure and under your control.

You can install the registrar on a separate system or on the same system as the Keylime verifier, depending on your requirements. Running the verifier and registrar on separate systems provides better performance.

NOTE

To keep the configuration files organized within the drop-in directories, use file names with a two-digit number prefix, for example **/etc/keylime/registrar.conf.d/00-registrar-ip.conf**. The configuration processing reads the files inside the drop-in directory in lexicographic order and sets each option to the last value it reads.

Conditions préalables

- You have network access to the systems where the Keylime verifier is installed and running. For more information, see Section 8.2, « Configuring Keylime verifier » .

- You have **root** permissions and network connection to the system or systems on which you want to install Keylime components.
- You have access to two databases, where Keylime saves data from the registrar and from the verifier
  You can use any of the following database management systems:
  - SQLite (default)
  - PostgreSQL
  - MySQL
  - MariaDB
- You have valid keys and certificates from your certificate authority.

Procédure

1. Install the Keylime registrar:

```
# dnf install keylime-registrar
```

2. Define the IP address and port of the registrar:
   a. Create a new **.conf** file in the **/etc/keylime/registrar.conf.d/** directory, for example, **/etc/keylime/registrar.conf.d/00-registrar-ip.conf**, with the following content:

```
[registrar]
ip = <registrar_IP_address>
```

   - Replace ***<registrar_IP_address>*** with the registrar's IP address. Alternatively, use **ip = *** or **ip = 0.0.0.0** to bind the registrar to all available IP addresses.
   - Optionally, change the port to which the Keylime agents connect by using the **port =** option. The default value is **8890**.
   - Optionally, change the TLS port to which the Keylime verifier and tenant connect by using the **tls_port =** option. The default value is **8891**.

3. Optional: Configure the registrar's database for the list of agents. The default configuration uses an SQLite database in the registrar's **/var/lib/keylime/reg_data.sqlite** directory. You can create a new **.conf** file in the **/etc/keylime/registrar.conf.d/** directory, for example, **/etc/keylime/registrar.conf.d/00-db-url.conf**, with the following content:

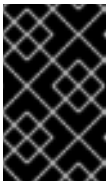
```
[registrar]
database_url = <protocol>:///<name>:<password>@<ip_address_or_hostname>/<properties>
```

   Replace ***<protocol>:///<name>:<password>@<ip_address_or_hostname>/<properties>*** with the URL of the database, for example, **postgresql:///registrar:EKYYX-bqY2?#raXm@198.51.100.1/registrardb**.

   Ensure that the credentials you use have the permissions for Keylime to create the database structure.

4. Add certificates and keys to the registrar:

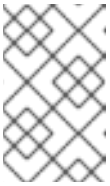
- You can use the default configuration and load the keys and certificates to the **/var/lib/keylime/reg_ca/** directory.
- Alternatively, you can define the location of the keys and certificates in the configuration. Create a new **.conf** file in the **/etc/keylime/registrar.conf.d/** directory, for example, **/etc/keylime/registrar.conf.d/00-keys-and-certs.conf**, with the following content:



IMPORTANT

Do not use the **tls_dir = default** setting with custom CA certificates. Instead, specify a path to the location of the certificates. For more information, see RHELPLAN-157337.

```
[registrar]
tls_dir = /var/lib/keylime/reg_ca
server_key = </path/to/server_key>
server_key_password = <passphrase1>
server_cert = </path/to/server_cert>
trusted_client_ca = ['</path/to/ca/cert1>', '</path/to/ca/cert2>']
```



NOTE

Use absolute paths to define key and certificate locations. Alternatively, you can define a directory in the **tls_dir** option and use paths relative to that directory.

5. Open the ports in firewall:

```
# firewall-cmd --add-port 8890/tcp --add-port 8891/tcp
# firewall-cmd --runtime-to-permanent
```

If you use a different port, replace **8890** or **8891** with the port number defined in the **.conf** file.

6. Start the **keylime_registrar** service:

```
# systemctl enable --now keylime_registrar
```

NOTE

In the default configuration, start the **keylime_verifier** before starting the **keylime_registrar** service because the verifier creates the CA and certificates for the other Keylime components. This order is not necessary when you use custom certificates.

Vérification

- Check that the **keylime_registrar** service is active and running:

```
# systemctl status keylime_registrar
● keylime_registrar.service - The Keylime registrar service
    Loaded: loaded (/usr/lib/systemd/system/keylime_registrar.service; disabled; vendor
```

```
preset: disabled)
     Active: active (running) since Wed 2022-11-09 10:10:17 EST; 1min 42s ago
...
```

Prochaines étapes

- Section 8.4, « Configuring Keylime tenant »

8.4. CONFIGURING KEYLIME TENANT

Keylime uses the **keylime_tenant** utility for many functions, including provisioning the agents on the target systems. You can install **keylime_tenant** on any system, including the systems that run other Keylime components, or on a separate system, depending on your requirements.

Conditions préalables

- You have **root** permissions and network connection to the system or systems on which you want to install Keylime components.
- You have network access to the systems where the other Keylime components are configured:

  Verifier

  For more information, see Section 8.2, « Configuring Keylime verifier » .

  Registrar

  For more information, see Section 8.3, « Configuring Keylime registrar » .

Procédure

1. Install the Keylime tenant:

```
# dnf install keylime-tenant
```

2. Define the tenant's connection to the Keylime verifier by editing the **/etc/keylime/tenant.conf.d/00-verifier-ip.conf** file:

```
[tenant]
verifier_ip = <verifier_ip>
```

   - Replace ***<verifier_ip>*** with the IP address to the verifier's system. Alternatively, use **ip = *** or **ip = 0.0.0.0** to bind the tenant to all available IP addresses.
   - If the verifier uses a different port than the default value **8881**, add the **verifier_port = *<verifier_port>*** setting.

3. Define the tenant's connection to the Keylime registrar by editing the **/etc/keylime/tenant.conf.d/00-registrar-ip.conf** file:

```
[tenant]
registrar_ip = <registrar_ip>
registrar_port = <registrar_port>
```

   - Replace ***<registrar_ip>*** with the IP address to the registrar's system.

- If the registrar uses a different port than the default value **8891**, add the **registrar_port = *<registrar_port>*** setting.

4. Add certificates and keys to the tenant:

   a. You can use the default configuration and load the keys and certificates to the **/var/lib/keylime/cv_ca** directory.

   b. Alternatively, you can define the location of the keys and certificates in the configuration. Create a new **.conf** file in the **/etc/keylime/tenant.conf.d/** directory, for example, **/etc/keylime/tenant.conf.d/00-keys-and-certs.conf**, with the following content:

```
[tenant]
tls_dir = /var/lib/keylime/cv_ca
client_key = tenant-key.pem
client_key_password = <passphrase1>
client_cert = tenant-cert.pem
trusted_server_ca = ['/var/lib/keylime/cv_ca/cacert.pem']
```

   The **trusted_server_ca** parameter accepts paths to the verifier and registrar server CA certificate. You can provide multiple comma-separated paths, for example if the verifier and registrar use different CAs.

NOTE

Use absolute paths to define key and certificate locations. Alternatively, you can define a directory in the **tls_dir** option and use paths relative to that directory.

5. Optional: If the trusted platform module (TPM) endorsement key (EK) cannot be verified by using certificates in the **/var/lib/keylime/tpm_cert_store** directory, add the certificate to that directory. This can occur particularly when using virtual machines with emulated TPMs.

Vérification

1. Check the status of the verifier:

```
3 keylime_tenant -c cvstatus
Reading configuration from ['/etc/keylime/logging.conf']
2022-10-14 12:56:08.155 - keylime.tpm - INFO - TPM2-TOOLS Version: 5.2
Reading configuration from ['/etc/keylime/tenant.conf']
2022-10-14 12:56:08.157 - keylime.tenant - INFO - Setting up client TLS...
2022-10-14 12:56:08.158 - keylime.tenant - INFO - Using default client_cert option for tenant
2022-10-14 12:56:08.158 - keylime.tenant - INFO - Using default client_key option for tenant
2022-10-14 12:56:08.178 - keylime.tenant - INFO - TLS is enabled.
2022-10-14 12:56:08.178 - keylime.tenant - WARNING - Using default UUID d432fbb3-d2f1-4a97-9ef7-75bd81c00000
2022-10-14 12:56:08.221 - keylime.tenant - INFO - Verifier at 127.0.0.1 with Port 8881 does not have agent d432fbb3-d2f1-4a97-9ef7-75bd81c00000.
```

   If correctly set up, and if no agent is configured, the verifier responds that it does not recognize the default agent UUID.

2. Check the status of the registrar:

```
# keylime_tenant -c regstatus
Reading configuration from ['/etc/keylime/logging.conf']
2022-10-14 12:56:02.114 - keylime.tpm - INFO - TPM2-TOOLS Version: 5.2
Reading configuration from ['/etc/keylime/tenant.conf']
2022-10-14 12:56:02.116 - keylime.tenant - INFO - Setting up client TLS...
2022-10-14 12:56:02.116 - keylime.tenant - INFO - Using default client_cert option for tenant
2022-10-14 12:56:02.116 - keylime.tenant - INFO - Using default client_key option for tenant
2022-10-14 12:56:02.137 - keylime.tenant - INFO - TLS is enabled.
2022-10-14 12:56:02.137 - keylime.tenant - WARNING - Using default UUID d432fbb3-d2f1-4a97-9ef7-75bd81c00000
2022-10-14 12:56:02.171 - keylime.registrar_client - CRITICAL - Error: could not get agent d432fbb3-d2f1-4a97-9ef7-75bd81c00000 data from Registrar Server: 404
2022-10-14 12:56:02.172 - keylime.registrar_client - CRITICAL - Response code 404: agent d432fbb3-d2f1-4a97-9ef7-75bd81c00000 not found
2022-10-14 12:56:02.172 - keylime.tenant - INFO - Agent d432fbb3-d2f1-4a97-9ef7-75bd81c00000 does not exist on the registrar. Please register the agent with the registrar.
2022-10-14 12:56:02.172 - keylime.tenant - INFO - {"code": 404, "status": "Agent d432fbb3-d2f1-4a97-9ef7-75bd81c00000 does not exist on registrar 127.0.0.1 port 8891.", "results": {}}
```

If correctly set up, and if no agent is configured, the registrar responds that it does not recognize the default agent UUID.

Ressources supplémentaires

- For additional advanced options for the **keylime_tenant** utility, enter the **keylime_tenant -h** command.

8.5. CONFIGURING KEYLIME AGENT

The Keylime agent is the component deployed to all systems to be monitored by Keylime.

By default, the Keylime agent stores all its data in the **/var/lib/keylime/** directory of the monitored system.

NOTE

To keep the configuration files organized within the drop-in directories, use file names with a two-digit number prefix, for example **/etc/keylime/agent.conf.d/00-registrar-ip.conf**. The configuration processing reads the files inside the drop-in directory in lexicographic order and sets each option to the last value it reads.

Conditions préalables

- You have **root** permissions to the monitored system.
- The monitored system has a Trusted Platform Module (TPM).

NOTE

To verify, enter the **tpm2_pcrread** command. If the output returns several hashes, a TPM is available.

- You have network access to the systems where the other Keylime components are configured:

Verifier

verifier

For more information, see Section 8.2, « Configuring Keylime verifier » .

Registrar

For more information, see Section 8.3, « Configuring Keylime registrar » .

Tenant

For more information, see Section 8.4, « Configuring Keylime tenant » .

- Integrity measurement architecture (IMA) is enabled on the monitored system. For more information, see Enabling integrity measurement architecture and extended verification module .

Procédure

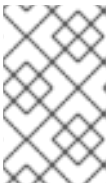
1. Install the Keylime agent:

```
# dnf install keylime-agent
```

This command installs the **keylime-agent-rust** package.

2. Define the agent's IP address and port in the configuration files. Create a new **.conf** file in the **/etc/keylime/agent.conf.d/** directory, for example, **/etc/keylime/agent.conf.d/00-agent-ip.conf**, with the following content:

```
[agent]
ip = '<agent_ip>'
```



NOTE

Because the Keylime agent configuration uses the TOML format, which is different from the INI format used for configuration of the other components, the values must be in single quotation marks.

- Replace ***<agent_IP_address>*** with the agent's IP address. Alternatively, use **ip = '*'** or **ip = '0.0.0.0'** to bind the agent to all available IP addresses.
- Optionally, you can also change the agent's port from the default value **9002** by using the **port = '*<agent_port>*'** option.

3. Define the registrar's IP address and port in the configuration files. Create a new **.conf** file in the **/etc/keylime/agent.conf.d/** directory, for example, **/etc/keylime/agent.conf.d/00-registrar-ip.conf**, with the following content:

```
[agent]
registrar_ip = '<registrar_IP_address>'
```

- Replace ***<registrar_IP_address>*** with the registrar's IP address.
- Optionally, you can also change the registrar's port from the default value **8890** by using the **registrar_port = '*<registrar_port>*'** option.

4. Optional: Define the agent's universally unique identifier (UUID). If it is not defined, the default UUID is used. Create a new **.conf** file in the **/etc/keylime/agent.conf.d/** directory, for example, **/etc/keylime/agent.conf.d/00-agent-uuid.conf**, with the following content:

```
[agent]
uuid = '<agent_UUID>'
```

- Replace ***<agent_UUID>*** with the agent's UUID, for example **d432fbb3-d2f1-4a97-9ef7-abcdef012345**. You can use the **uuidgen** utility to generate a UUID.

5. Optional: Load existing keys and certificates for the agent. If the agent receives no **server_key** and **server_cert**, it generates its own key and a self-signed certificate.

IMPORTANT

Do not use certificate chains. Keylime currently does not correctly use all the provided certificates during signature verification, which results in a TLS handshake failure. For more information, see RHEL-396.

Define the location of the keys and certificates in the configuration. Create a new **.conf** file in the **/etc/keylime/agent.conf.d/** directory, for example, **/etc/keylime/agent.conf.d/00-keys-and-certs.conf**, with the following content:

```
[agent]
server_key = '</path/to/server_key>'
server_key_password = '<passphrase1>'
server_cert = '</path/to/server_cert>'
trusted_client_ca = '</path/to/ca/cert>'
```

NOTE

Use absolute paths to define key and certificate locations. The Keylime agent does not accept relative paths.

6. Open the port in firewall:

```
# firewall-cmd --add-port 9002/tcp
# firewall-cmd --runtime-to-permanent
```

If you use a different port, replace **9002** with the port number defined in the **.conf** file.

7. Enable and start the **keylime_agent** service:

```
# systemctl enable --now keylime_agent
```

8. Optional: From the system where the Keylime tenant is configured, verify that the agent is correctly configured and can connect to the registrar.

```
# keylime_tenant -c regstatus --uuid <agent_uuid>
Reading configuration from ['/etc/keylime/logging.conf']
...
==\n-----END CERTIFICATE-----\n", "ip": "127.0.0.1", "port": 9002, "regcount": 1,
"operational_state": "Registered"}}}
```

- Replace ***<agent_uuid>*** with the agent's UUID.
  If the registrar and agent are correctly configured, the output displays the agent's IP address and port, followed by **"operational_state": "Registered"**.

9. Create a new IMA policy by entering the following content into the **/etc/ima/ima-policy** file:

```
# PROC_SUPER_MAGIC
dont_measure fsmagic=0x9fa0
# SYSFS_MAGIC
dont_measure fsmagic=0x62656572
# DEBUGFS_MAGIC
dont_measure fsmagic=0x64626720
# TMPFS_MAGIC
dont_measure fsmagic=0x01021994
# RAMFS_MAGIC
dont_measure fsmagic=0x858458f6
# SECURITYFS_MAGIC
dont_measure fsmagic=0x73636673
# SELINUX_MAGIC
dont_measure fsmagic=0xf97cff8c
# CGROUP_SUPER_MAGIC
dont_measure fsmagic=0x27e0eb
# OVERLAYFS_MAGIC
dont_measure fsmagic=0x794c7630
# Don't measure log, audit or tmp files
dont_measure obj_type=var_log_t
dont_measure obj_type=auditd_log_t
dont_measure obj_type=tmp_t
# MEASUREMENTS
measure func=BPRM_CHECK
measure func=FILE_MMAP mask=MAY_EXEC
measure func=MODULE_CHECK uid=0
```

10. Reboot the system to apply the new IMA policy.

Vérification

1. Verify that the agent is running:

```
# systemctl status keylime_agent
● keylime_agent.service - The Keylime compute agent
     Loaded: loaded (/usr/lib/systemd/system/keylime_agent.service; enabled; preset:
disabled)
     Active: active (running) since ...
```

Prochaines étapes

After the agent is configured on all systems you want to monitor, you can deploy Keylime to perform one or both of the following functions:

- Section 8.6, « Deploying Keylime for runtime monitoring »
- Section 8.7, « Deploying Keylime for measured boot attestation »

Ressources supplémentaires

- Integrity Measurement Architecture (IMA) Wiki

8.6. DEPLOYING KEYLIME FOR RUNTIME MONITORING

To verify that the state of monitored systems is correct, the Keylime agent must be running on the monitored systems.

IMPORTANT

Because Keylime runtime monitoring uses integrity measurement architecture (IMA) to measure large numbers of files, it might have a significant impact on the performance of your system.

When provisioning the agent, you can also define a file that Keylime sends to the monitored system. Keylime encrypts the file sent to the agent, and decrypts it only if the agent's system complies with the TPM policy and with the IMA allowlist.

You can make Keylime ignore changes of specific files or within specific directories by configuring a Keylime excludelist.

Conditions préalables

- You have network access to the systems where the Keylime components are configured:

  Verifier

  For more information, see Section 8.2, « Configuring Keylime verifier » .

  Registrar

  For more information, see Section 8.3, « Configuring Keylime registrar » .

  Tenant

  For more information, see Section 8.4, « Configuring Keylime tenant » .

  Agent

  For more information, see Section 8.5, « Configuring Keylime agent » .

Procédure

1. On the monitored system where the Keylime agent is configured and running, generate an allowlist from the current state of the system:

   ```
   # /usr/share/keylime/scripts/create_allowlist.sh -o <allowlist.txt> -h sha256sum
   ```

   Replace ***<allowlist.txt>*** with the file name of the allowlist.

   IMPORTANT

   Use the SHA-256 hash function. SHA-1 is not secure and has been deprecated in RHEL 9. For additional information, see SHA-1 deprecation in Red Hat Enterprise Linux 9.

2. Copy the generated allowlist to the system where the **keylime_tenant** utility is configured, for example:

   ```
   # scp allowlist.txt root@<tenant_._ip>:/root/allowlist.txt
   ```

3. Optional: You can define a list of files or directories excluded from Keylime measurements by creating a file on the tenant system and entering the files and directories to exclude. The

excludelist accepts Python regular expressions with one regular expression per line. For more information, see Regular expression operations at docs.python.org . For example, to exclude all files in the **/tmp/** directory from Keylime measurements, create a **/root/excludelist.txt** file with the following content:

```
/tmp/.*
```

Save the excludelist on the tenant system.

4. On the system where the Keylime tenant is configured, provision the agent by using the **keylime_tenant** utility:

```
# keylime_tenant -c add -t <agent_ip> -u <agent_uuid> --allowlist <allowlist.txt> --exclude
<excludelist> --cert default
```

- Replace ***<agent_ip>*** with the agent's IP address.
- Replace ***<agent_uuid>*** with the agent's UUID.
- Replace ***<allowlist.txt>*** with the path to the allowlist file.
- Replace ***<excludelist>*** with the path to the excludelist file. The **--exclude** option is optional; provisioning the agent works even without delivering a file.
- With the **--cert** option, the tenant generates and signs a certificate for the agent by using the CA certificates and keys located in the specified directory, or the default **/var/lib/keylime/ca/** directory. If the directory contains no CA certificates and keys, the tenant will generate them automatically according to the configuration in the **/etc/keylime/ca.conf** file and save them to the specified directory. The tenant then sends these keys and certificates to the agent.
  When generating CA certificates or signing agent certificates, you may be prompted for the password to access the CA private key: **Please enter the password to decrypt your keystore:**.

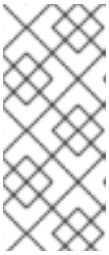
  If you do not want to use a certificate, use the **-f** option instead for delivering a file to the agent. Provisioning an agent requires sending any file, even an empty file.

NOTE

Keylime encrypts the file sent to the agent, and decrypts it only if the agent's system complies with the TPM policy and the IMA allowlist. By default, Keylime decompresses **.zip** files.

As an example, with the following command, **keylime_tenant** provisions a new Keylime agent at **127.0.0.1** with UUID **d432fbb3-d2f1-4a97-9ef7-75bd81c00000** and loads an allowlist named **allowlist.txt**. It also generates a certificate into the default directory and sends it to the agent. Keylime decrypts the file only if the TPM policy configured in **/etc/keylime/verifier.conf** is satisfied:

```
# keylime_tenant -c add -t 127.0.0.1 -u d432fbb3-d2f1-4a97-9ef7-75bd81c00000 -cert default
--allowlist allowlist.txt --exclude excludelist.txt
```



NOTE

You can stop Keylime from monitoring a node by using the **# keylime_tenant -c delete -u *<agent_uuid>*** command.

You can modify the configuration of an already registered agent by using the **keylime_tenant -c update** command.

Vérification

1. Optional: Reboot the monitored system before verification to verify that the settings are persistent.

2. Verify a successful attestation of the agent:

```
# keylime_tenant -c cvstatus -u <agent.uuid>
...
{"<agent.uuid>": {"operational_state": "Get Quote"..."attestation_count": 5
...
```

Replace ***<agent.uuid>*** with the agent's UUID.

If the value of **operational_state** is **Get Quote** and **attestation_count** is non-zero, the attestation of this agent is successful.

If the value of **operational_state** is **Invalid Quote** or **Failed** attestation fails, the command displays output similar to the following:

```
{"<agent.uuid>": {"operational_state": "Invalid Quote", ... "ima.validation.ima-ng.not_in_allowlist", "attestation_count": 5, "last_received_quote": 1684150329, "last_successful_attestation": 1684150327}}
```

3. If the attestation fails, display more details in the verifier log:

```
# journalctl -u keylime_verifier
keylime.tpm - INFO - Checking IMA measurement list...
keylime.ima - WARNING - File not found in allowlist: /root/bad-script.sh
keylime.ima - ERROR - IMA ERRORS: template-hash 0 fnf 1 hash 0 good 781
keylime.cloudverifier - WARNING - agent D432FBB3-D2F1-4A97-9EF7-75BD81C00000 failed, stopping polling
```

Ressources supplémentaires

- For more information about IMA, see Enhancing security with the kernel integrity subsystem.

8.7. DEPLOYING KEYLIME FOR MEASURED BOOT ATTESTATION

When you configure Keylime for measured boot attestation, Keylime checks that the boot process on the measured system corresponds to the state you defined.

Conditions préalables

- You have network access to the systems where the Keylime components are configured:

Verifier

For more information, see Section 8.2, « Configuring Keylime verifier » .

Registrar

For more information, see Section 8.3, « Configuring Keylime registrar » .

Tenant

For more information, see Section 8.4, « Configuring Keylime tenant » .

Agent

For more information, see Section 8.5, « Configuring Keylime agent » .

- Unified Extensible Firmware Interface (UEFI) is enabled on the agent system.

Procédure

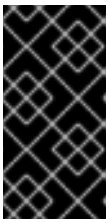
1. On the monitored system where the Keylime agent is configured and running, install the **python3-keylime**, which contains **create_mb_refstate** utility:

```
# dnf -y install python3-keylime
```

2. On the monitored system, generate a policy from the measured boot log of the current state of the system by using the **create_mb_refstate** script:

```
# /usr/share/keylime/scripts/create_mb_refstate
/sys/kernel/security/tpm0/binary_bios_measurements
<./measured_boot_reference_state.json>
```

Replace ***<./measured_boot_reference_state.json>*** with the path where the script saves the generated policy.



IMPORTANT

The policy generated with the **create_mb_refstate** script is based on the current state of the system and is very strict. Any modifications of the system including kernel updates and system updates will change the boot process and the system will fail the attestation.

3. Copy the generated policy to the system where the **keylime_tenant** utility is configured, for example:

```
# scp root@<agent_ip>:/root/measured_boot_reference_state.json
/root/measured_boot_reference_state.json
```

4. On the system where the Keylime tenant is configured, provision the agent by using the **keylime_tenant** utility:

```
# keylime_tenant -c add -t <agent_ip> -u <agent_uuid> --mb_refstate
<./measured_boot_reference_state.json>
```

- Replace ***<agent_ip>*** with the agent's IP address.
- Replace ***<agent_uuid>*** with the agent's UUID.

- Replace ***<./measured_boot_reference_state.json>*** with the path to the measured boot policy.

If you configure measured boot in combination with runtime monitoring, provide all the options from both use cases when entering the **keylime_tenant -c add** command.

NOTE

You can stop Keylime from monitoring a node by using the **# keylime_tenant -c delete -t *<agent_ip>* -u *<agent_uuid>*** command.

You can modify the configuration of an already registered agent by using the **keylime_tenant -c update** command.

Vérification

1. Reboot the monitored system and verify a successful attestation of the agent:

```
# keylime_tenant -c cvstatus -u <agent_uuid>
...
{"<agent.uuid>": {"operational_state": "Get Quote"..."attestation_count": 5
...
```

Replace ***<agent_uuid>*** with the agent's UUID.

If the value of **operational_state** is **Get Quote** and **attestation_count** is non-zero, the attestation of this agent is successful.

If the value of **operational_state** is **Invalid Quote** or **Failed** attestation fails, the command displays output similar to the following:

```
{"<agent.uuid>": {"operational_state": "Invalid Quote", ... "ima.validation.ima-ng.not_in_allowlist", "attestation_count": 5, "last_received_quote": 1684150329, "last_successful_attestation": 1684150327}}
```

2. If the attestation fails, display more details in the verifier log:

```
# journalctl -u keylime_verifier
{"d432fbb3-d2f1-4a97-9ef7-75bd81c00000": {"operational_state": "Tenant Quote Failed", ... "last_event_id": "measured_boot.invalid_pcr_0", "attestation_count": 0, "last_received_quote": 1684487093, "last_successful_attestation": 0}}
```

CHAPITRE 9. CHECKING INTEGRITY WITH AIDE

Advanced Intrusion Detection Environment (**AIDE**) is a utility that creates a database of files on the system, and then uses that database to ensure file integrity and detect system intrusions.

9.1. INSTALLING AIDE

The following steps are necessary to install **AIDE** and to initiate its database.

Conditions préalables

- Le référentiel **AppStream** est activé.

Procédure

1. To install the *aide* package:

```
# dnf install aide
```

2. To generate an initial database:

```
# aide --init
```

NOTE

In the default configuration, the **aide --init** command checks just a set of directories and files defined in the **/etc/aide.conf** file. To include additional directories or files in the **AIDE** database, and to change their watched parameters, edit **/etc/aide.conf** accordingly.

3. To start using the database, remove the **.new** substring from the initial database file name:

```
# mv /var/lib/aide/aide.db.new.gz /var/lib/aide/aide.db.gz
```

4. To change the location of the **AIDE** database, edit the **/etc/aide.conf** file and modify the **DBDIR** value. For additional security, store the database, configuration, and the **/usr/sbin/aide** binary file in a secure location such as a read-only media.

9.2. PERFORMING INTEGRITY CHECKS WITH AIDE

Conditions préalables

- **AIDE** is properly installed and its database is initialized. See Installing AIDE

Procédure

1. To initiate a manual check:

```
# aide --check
Start timestamp: 2018-07-11 12:41:20 +0200 (AIDE 0.16)
AIDE found differences between database and filesystem!!
```

```
...
[trimmed for clarity]
```

2. At a minimum, configure the system to run **AIDE** weekly. Optimally, run **AIDE** daily. For example, to schedule a daily execution of **AIDE** at *04:05* a.m. using the **cron** command, add the following line to the **/etc/crontab** file:

```
05 4 * * * root /usr/sbin/aide --check
```

9.3. UPDATING AN AIDE DATABASE

After verifying the changes of your system such as, package updates or configuration files adjustments, Red Hat recommends updating your baseline **AIDE** database.

Conditions préalables

- **AIDE** is properly installed and its database is initialized. See Installing AIDE

Procédure

1. Update your baseline **AIDE** database:

```
# aide --update
```

The **aide --update** command creates the **/var/lib/aide/aide.db.new.gz** database file.

2. To start using the updated database for integrity checks, remove the **.new** substring from the file name.

9.4. FILE-INTEGRITY TOOLS: AIDE AND IMA

Red Hat Enterprise Linux provides several tools for checking and preserving the integrity of files and directories on your system. The following table helps you decide which tool better fits your scenario.

Tableau 9.1. Comparison between AIDE and IMA

Question	Advanced Intrusion Detection Environment (AIDE)	Architecture de mesure de l'intégrité (IMA)
What	AIDE is a utility that creates a database of files and directories on the system. This database serves for checking file integrity and detect intrusion detection.	IMA detects if a file is altered by checking file measurement (hash values) compared to previously stored extended attributes.
How	AIDE uses rules to compare the integrity state of the files and directories.	IMA uses file hash values to detect the intrusion.

Question	Advanced Intrusion Detection Environment (AIDE)	Architecture de mesure de l'intégrité (IMA)
Why	Detection - AIDE detects if a file is modified by verifying the rules.	Detection and Prevention - IMA detects and prevents an attack by replacing the extended attribute of a file.
Utilisation	AIDE detects a threat when the file or directory is modified.	IMA detects a threat when someone tries to alter the entire file.
Extension	AIDE checks the integrity of files and directories on the local system.	IMA ensures security on the local and remote systems.

9.5. RESSOURCES SUPPLÉMENTAIRES

- **aide(1)** man page
- Kernel integrity subsystem

CHAPITRE 10. CHIFFREMENT DES BLOCS DE DONNÉES À L'AIDE DE LUKS

Le chiffrement de disque permet de protéger les données d'un bloc en les chiffrant. Pour accéder au contenu décrypté du périphérique, il faut entrer une phrase de passe ou une clé en guise d'authentification. Cette fonction est importante pour les ordinateurs mobiles et les supports amovibles, car elle permet de protéger le contenu du périphérique même s'il a été physiquement retiré du système. Le format LUKS est une implémentation par défaut du chiffrement par bloc des périphériques dans Red Hat Enterprise Linux.

10.1. CRYPTAGE DE DISQUE LUKS

Linux Unified Key Setup-on-disk-format (LUKS) fournit un ensemble d'outils qui simplifie la gestion des périphériques cryptés. Avec LUKS, vous pouvez chiffrer des périphériques en bloc et permettre à plusieurs clés d'utilisateur de déchiffrer une clé principale. Pour le chiffrement en bloc de la partition, utilisez cette clé principale.

Red Hat Enterprise Linux utilise LUKS pour effectuer le chiffrement du périphérique de bloc. Par défaut, l'option de chiffrement du périphérique de bloc n'est pas cochée lors de l'installation. Si vous sélectionnez l'option de chiffrer votre disque, le système vous demande une phrase de passe à chaque fois que vous démarrez l'ordinateur. Cette phrase de passe déverrouille la clé de chiffrement en bloc qui décrypte votre partition. Si vous souhaitez modifier la table de partition par défaut, vous pouvez sélectionner les partitions que vous souhaitez crypter. Cette option est définie dans les paramètres de la table de partitions.

Chiffres

Le chiffrement par défaut utilisé pour LUKS est **aes-xts-plain64**. La taille de clé par défaut de LUKS est de 512 bits. La taille de clé par défaut pour LUKS avec le mode **Anaconda** XTS est de 512 bits. Les codes disponibles sont les suivants :

- Norme de chiffrement avancée (AES)
- Twofish
- Serpent

LUKS effectue les opérations suivantes

- LUKS crypte des blocs entiers et est donc bien adapté à la protection du contenu des appareils mobiles tels que les supports de stockage amovibles ou les lecteurs de disques d'ordinateurs portables.
- Le contenu sous-jacent du bloc crypté est arbitraire, ce qui le rend utile pour crypter les périphériques d'échange. Cela peut également être utile pour certaines bases de données qui utilisent des périphériques de bloc spécialement formatés pour le stockage des données.
- LUKS utilise le sous-système de noyau existant pour le mappage de périphériques.
- LUKS permet de renforcer la phrase de passe, ce qui protège contre les attaques par dictionnaire.
- Les dispositifs LUKS contiennent plusieurs emplacements de clé, ce qui permet aux utilisateurs d'ajouter des clés de sauvegarde ou des phrases de passe.

LUKS n'est pas recommandé dans les cas suivants

- Les solutions de chiffrement de disque telles que LUKS ne protègent les données que lorsque le système est éteint. Une fois que le système est en marche et que LUKS a décrypté le disque, les fichiers qui s'y trouvent sont accessibles à tous ceux qui y ont accès.
- Scénarios nécessitant que plusieurs utilisateurs disposent de clés d'accès distinctes au même appareil. Le format LUKS1 offre huit emplacements de clé et le format LUKS2 en offre jusqu'à 32.
- Applications nécessitant un cryptage au niveau du fichier.

Ressources supplémentaires

- Page d'accueil du projet LUKS
- Spécification du format LUKS sur disque
- FIPS 197 : norme de cryptage avancée (AES)

10.2. VERSIONS DE LUKS DANS RHEL

Dans Red Hat Enterprise Linux, le format par défaut pour le chiffrement LUKS est LUKS2. L'ancien format LUKS1 reste entièrement pris en charge et est fourni en tant que format compatible avec les versions antérieures de Red Hat Enterprise Linux. Le recryptage LUKS2 est considéré comme plus robuste et plus sûr que le recryptage LUKS1.

Le format LUKS2 permet des mises à jour futures des différentes parties sans qu'il soit nécessaire de modifier les structures binaires. En interne, il utilise le format de texte JSON pour les métadonnées, assure la redondance des métadonnées, détecte la corruption des métadonnées et répare automatiquement à partir d'une copie des métadonnées.

IMPORTANT

N'utilisez pas LUKS2 dans les systèmes qui ne prennent en charge que LUKS1. Red Hat Enterprise Linux 7 prend en charge le format LUKS2 depuis la version 7.6.

Depuis Red Hat Enterprise Linux 9.2, vous pouvez utiliser la commande **cryptsetup reencrypt** pour les deux versions de LUKS afin de chiffrer le disque.

Recryptage en ligne

Le format LUKS2 permet de recrypter les périphériques cryptés pendant qu'ils sont utilisés. Par exemple, il n'est pas nécessaire de démonter le système de fichiers sur le périphérique pour effectuer les tâches suivantes :

- Modifier la touche de volume
- Modifier l'algorithme de cryptage
  Lorsque vous cryptez un périphérique non crypté, vous devez toujours démonter le système de fichiers. Vous pouvez remonter le système de fichiers après une brève initialisation du chiffrement.

  Le format LUKS1 ne prend pas en charge le rechiffrement en ligne.

Conversion

Dans certaines situations, vous pouvez convertir LUKS1 en LUKS2. La conversion n'est pas possible dans les cas suivants :

- Un périphérique LUKS1 est marqué comme étant utilisé par une solution Clevis de décryptage basé sur des règles (PBD). L'outil **cryptsetup** ne convertit pas le périphérique lorsque certaines métadonnées **luksmeta** sont détectées.
- Un appareil est actif. L'appareil doit être dans un état inactif avant qu'une conversion ne soit possible.

10.3. OPTIONS DE PROTECTION DES DONNÉES PENDANT LE RECRYPTAGE LUKS2

LUKS2 propose plusieurs options qui donnent la priorité aux performances ou à la protection des données pendant le processus de recryptage. Il propose les modes suivants pour l'option **resilience**, et vous pouvez sélectionner n'importe lequel de ces modes à l'aide de la commande **cryptsetup reencrypt --resilience resilience-mode** ***/dev/sdx*** pour sélectionner l'un de ces modes :

checksum

Le mode par défaut. Il permet d'équilibrer la protection des données et les performances.
Ce mode stocke les sommes de contrôle individuelles des secteurs dans la zone de rechiffrement, que le processus de récupération peut détecter pour les secteurs qui ont été rechiffrés par LUKS2.
Ce mode exige que l'écriture du secteur du dispositif de bloc soit atomique.

journal

C'est le mode le plus sûr, mais aussi le plus lent. Étant donné que ce mode journalise la zone de rechiffrement dans la zone binaire, le LUKS2 écrit les données deux fois.

none

Le mode **none** donne la priorité aux performances et ne fournit aucune protection des données. Il protège les données uniquement en cas d'arrêt sûr du processus, comme le signal **SIGTERM** ou l'appui de l'utilisateur sur la touche **Ctrl**+**C** par l'utilisateur. Toute défaillance inattendue du système ou de l'application peut entraîner une corruption des données.

Si un processus de rechiffrement LUKS2 se termine inopinément par la force, LUKS2 peut effectuer la récupération de l'une des manières suivantes :

Automatiquement

L'exécution de l'une des actions suivantes déclenche l'action de récupération automatique lors de la prochaine action d'ouverture du périphérique LUKS2 :

- Exécution de la commande **cryptsetup open**.
- Attacher l'appareil avec la commande **systemd-cryptsetup**.

Manuellement

En utilisant la commande **cryptsetup repair** ***/dev/sdx*** sur le périphérique LUKS2.

Ressources supplémentaires

- **cryptsetup-reencrypt(8)** et **cryptsetup-repair(8)** pages de manuel

10.4. CHIFFREMENT DES DONNÉES EXISTANTES SUR UN DISPOSITIF DE BLOCAGE À L'AIDE DE LUKS2

Vous pouvez crypter les données existantes sur un dispositif non encore crypté en utilisant le format LUKS2. Un nouvel en-tête LUKS est stocké dans la tête du dispositif.

Conditions préalables

- L'unité de bloc dispose d'un système de fichiers.
- Vous avez sauvegardé vos données.

AVERTISSEMENT

Vous pouvez perdre vos données au cours du processus de cryptage en raison d'une défaillance matérielle, du noyau ou d'une défaillance humaine. Assurez-vous de disposer d'une sauvegarde fiable avant de commencer à chiffrer les données.

Procédure

1. Démontez tous les systèmes de fichiers sur le périphérique que vous prévoyez de chiffrer, par exemple :

```
# umount /dev/mapper/vg00-lv00
```

2. Libérez de l'espace pour stocker un en-tête LUKS. Utilisez l'une des options suivantes en fonction de votre scénario :
   - Dans le cas du chiffrement d'un volume logique, vous pouvez étendre le volume logique sans redimensionner le système de fichiers. Par exemple, il est possible d'étendre un volume logique sans redimensionner le système de fichiers :

     ```
     # lvextend -L 32M /dev/mapper/vg00-lv00
     ```

   - Étendez la partition en utilisant des outils de gestion de partition, tels que **parted**.
   - Réduisez le système de fichiers sur le périphérique. Vous pouvez utiliser l'utilitaire **resize2fs** pour les systèmes de fichiers ext2, ext3 ou ext4. Notez que vous ne pouvez pas réduire le système de fichiers XFS.
3. Initialiser le cryptage :

```
# cryptsetup reencrypt --encrypt --init-only --reduce-device-size 32M /dev/mapper/vg00-lv00
lv00_encrypted

/dev/mapper/lv00_encrypted is now active and ready for online encryption.
```

4. Monter l'appareil :

```
# mount /dev/mapper/lv00_encrypted /mnt/lv00_encrypted
```

5. Ajouter une entrée pour un mappage persistant au fichier **/etc/crypttab**:

   a. Trouver le site **luksUUID**:

   ```
   # cryptsetup luksUUID /dev/mapper/vg00-lv00

   a52e2cc9-a5be-47b8-a95d-6bdf4f2d9325
   ```

   b. Ouvrez **/etc/crypttab** dans un éditeur de texte de votre choix et ajoutez un dispositif dans ce fichier :

   ```
   $ vi /etc/crypttab

   lv00_encrypted UUID=a52e2cc9-a5be-47b8-a95d-6bdf4f2d9325 none
   ```

   Remplacez *a52e2cc9-a5be-47b8-a95d-6bdf4f2d9325* par le site **luksUUID** de votre appareil.

   c. Rafraîchir les initramfs avec **dracut**:

   ```
   $ dracut -f --regenerate-all
   ```

6. Ajouter une entrée pour un montage persistant au fichier **/etc/fstab**:

   a. Recherchez l'UUID du système de fichiers du périphérique bloc LUKS actif :

   ```
   $ blkid -p /dev/mapper/lv00_encrypted

   /dev/mapper/lv00-encrypted: UUID="37bc2492-d8fa-4969-9d9b-bb64d3685aa9"
   BLOCK_SIZE="4096" TYPE="xfs" USAGE="filesystem"
   ```

   b. Ouvrez **/etc/fstab** dans un éditeur de texte de votre choix et ajoutez un dispositif dans ce fichier, par exemple :

   ```
   $ vi /etc/fstab

   UUID=37bc2492-d8fa-4969-9d9b-bb64d3685aa9 /home auto rw,user,auto 0
   ```

   Remplacez *37bc2492-d8fa-4969-9d9b-bb64d3685aa9* par l'UUID de votre système de fichiers.

7. Reprendre le cryptage en ligne :

```
# cryptsetup reencrypt --resume-only /dev/mapper/vg00-lv00

Enter passphrase for /dev/mapper/vg00-lv00:
Auto-detected active dm device 'lv00_encrypted' for data device /dev/mapper/vg00-lv00.
Finished, time 00:31.130, 10272 MiB written, speed 330.0 MiB/s
```

Vérification

1. Vérifier si les données existantes ont été cryptées :

```
# cryptsetup luksDump /dev/mapper/vg00-lv00

LUKS header information
Version: 2
Epoch: 4
Metadata area: 16384 [bytes]
Keyslots area: 16744448 [bytes]
UUID: a52e2cc9-a5be-47b8-a95d-6bdf4f2d9325
Label: (no label)
Subsystem: (no subsystem)
Flags: (no flags)

Data segments:
  0: crypt
 offset: 33554432 [bytes]
 length: (whole device)
 cipher: aes-xts-plain64
[...]
```

2. Affichez l'état du dispositif de bloc vierge crypté :

```
# cryptsetup status lv00_encrypted

/dev/mapper/lv00_encrypted is active and is in use.
  type:    LUKS2
  cipher:  aes-xts-plain64
  keysize: 512 bits
  key location: keyring
  device:  /dev/mapper/vg00-lv00
```

Ressources supplémentaires

- **cryptsetup(8)**, **cryptsetup-reencrypt(8)**, **lvextend(8)**, **resize2fs(8)**, et **parted(8)** pages de manuel

10.5. CHIFFREMENT DES DONNÉES EXISTANTES SUR UN PÉRIPHÉRIQUE DE BLOC À L'AIDE DE LUKS2 AVEC UN EN-TÊTE DÉTACHÉ

Vous pouvez chiffrer des données existantes sur un bloc sans créer d'espace libre pour le stockage d'un en-tête LUKS. L'en-tête est stocké dans un emplacement détaché, ce qui constitue également une couche de sécurité supplémentaire. La procédure utilise le format de cryptage LUKS2.

Conditions préalables

- L'unité de bloc dispose d'un système de fichiers.
- Vous avez sauvegardé vos données.

AVERTISSEMENT

Vous pouvez perdre vos données au cours du processus de cryptage en raison d'une défaillance matérielle, du noyau ou d'une défaillance humaine. Assurez-vous de disposer d'une sauvegarde fiable avant de commencer à chiffrer les données.

Procédure

1. Démonter tous les systèmes de fichiers sur l'appareil, par exemple :

```
# umount /dev/nvme0n1p1
```

2. Initialiser le cryptage :

```
# cryptsetup reencrypt --encrypt --init-only --header /home/header /dev/nvme0n1p1
nvme_encrypted

WARNING!
========
Header file does not exist, do you want to create it?

Are you sure? (Type 'yes' in capital letters): YES
Enter passphrase for /home/header:
Verify passphrase:
/dev/mapper/nvme_encrypted is now active and ready for online encryption.
```

Remplacez */home/header* par un chemin d'accès au fichier contenant un en-tête LUKS détaché. L'en-tête LUKS détaché doit être accessible pour déverrouiller ultérieurement le dispositif crypté.

3. Monter l'appareil :

```
# mount /dev/mapper/nvme_encrypted /mnt/nvme_encrypted
```

4. Reprendre le cryptage en ligne :

```
# cryptsetup reencrypt --resume-only --header /home/header /dev/nvme0n1p1

Enter passphrase for /dev/nvme0n1p1:
Auto-detected active dm device 'nvme_encrypted' for data device /dev/nvme0n1p1.
Finished, time 00m51s,   10 GiB written, speed 198.2 MiB/s
```

Vérification

1. Vérifiez si les données existantes sur un périphérique de bloc utilisant LUKS2 avec un en-tête détaché sont chiffrées :

```
# cryptsetup luksDump /home/header
```

```
LUKS header information
Version:        2
Epoch:          88
Metadata area:  16384 [bytes]
Keyslots area:  16744448 [bytes]
UUID:           c4f5d274-f4c0-41e3-ac36-22a917ab0386
Label:          (no label)
Subsystem:      (no subsystem)
Flags:        (no flags)

Data segments:
  0: crypt
 offset: 0 [bytes]
 length: (whole device)
 cipher: aes-xts-plain64
 sector: 512 [bytes]
[...]
```

2. Affichez l'état du dispositif de bloc vierge crypté :

```
# cryptsetup status nvme_encrypted

/dev/mapper/nvme_encrypted is active and is in use.
  type:    LUKS2
  cipher:  aes-xts-plain64
  keysize: 512 bits
  key location: keyring
  device:  /dev/nvme0n1p1
```

Ressources supplémentaires

- **cryptsetup(8)** et **cryptsetup-reencrypt(8)** pages de manuel

10.6. CHIFFREMENT D'UN BLOC VIERGE À L'AIDE DE LUKS2

Vous pouvez crypter un périphérique bloc vierge, que vous pouvez utiliser pour un stockage crypté à l'aide du format LUKS2.

Conditions préalables

- Un périphérique bloc vide. Vous pouvez utiliser des commandes telles que **lsblk** pour savoir s'il n'y a pas de données réelles sur ce périphérique, par exemple, un système de fichiers.

Procédure

1. Configurer une partition en tant que partition LUKS chiffrée :

```
# cryptsetup luksFormat /dev/nvme0n1p1

WARNING!
========
This will overwrite data on /dev/nvme0n1p1 irrevocably.
```

```
Are you sure? (Type 'yes' in capital letters): YES
Enter passphrase for /dev/nvme0n1p1:
Verify passphrase:
```

2. Ouvrez une partition LUKS chiffrée :

```
# cryptsetup open dev/nvme0n1p1 nvme0n1p1_encrypted

Enter passphrase for /dev/nvme0n1p1:
```

Cette commande déverrouille la partition et l'affecte à un nouveau périphérique en utilisant le mappeur de périphérique. Pour ne pas écraser les données chiffrées, cette commande avertit le noyau que le périphérique est un périphérique chiffré et qu'il est adressé par LUKS à l'aide de l'attribut **/dev/mapper/*device_mapped_name*** chemin.

3. Créez un système de fichiers pour écrire des données cryptées sur la partition, à laquelle il faut accéder par le nom mappé du périphérique :

```
# mkfs -t ext4 /dev/mapper/nvme0n1p1_encrypted
```

4. Monter l'appareil :

```
# mount /dev/mapper/nvme0n1p1_encrypted mount-point
```

Vérification

1. Vérifiez si le périphérique de blocage vierge est crypté :

```
# cryptsetup luksDump /dev/nvme0n1p1

LUKS header information
Version:        2
Epoch:          3
Metadata area:  16384 [bytes]
Keyslots area:  16744448 [bytes]
UUID:           34ce4870-ffdf-467c-9a9e-345a53ed8a25
Label:          (no label)
Subsystem:      (no subsystem)
Flags:          (no flags)

Data segments:
  0: crypt
 offset: 16777216 [bytes]
 length: (whole device)
 cipher: aes-xts-plain64
 sector: 512 [bytes]
[...]
```

2. Affichez l'état du dispositif de bloc vierge crypté :

```
# cryptsetup status nvme0n1p1_encrypted

/dev/mapper/nvme0n1p1_encrypted is active and is in use.
  type:    LUKS2
```

```
cipher:  aes-xts-plain64
keysize: 512 bits
key location: keyring
device:  /dev/nvme0n1p1
sector size:  512
offset:  32768 sectors
size:    20938752 sectors
mode:    read/write
```

Ressources supplémentaires

- **cryptsetup(8)**, **cryptsetup-open (8)**, et **cryptsetup-lusFormat(8)** pages de manuel

10.7. CRÉATION D'UN VOLUME CHIFFRÉ LUKS2 À L'AIDE DU RÔLE SYSTÈME STORAGE RHEL

Vous pouvez utiliser le rôle **storage** pour créer et configurer un volume chiffré avec LUKS en exécutant un manuel de jeu Ansible.

Conditions préalables

- Accès et autorisations à un ou plusieurs nœuds gérés, qui sont des systèmes que vous souhaitez configurer avec le rôle de système **crypto_policies**.
- Un fichier d'inventaire, qui répertorie les nœuds gérés.
- Accès et permissions à un nœud de contrôle, qui est un système à partir duquel Red Hat Ansible Core configure d'autres systèmes. Sur le nœud de contrôle, les paquets **ansible-core** et **rhel-system-roles** sont installés.

IMPORTANT

RHEL 8.0-8.5 provided access to a separate Ansible repository that contains Ansible Engine 2.9 for automation based on Ansible. Ansible Engine contains command-line utilities such as **ansible**, **ansible-playbook**, connectors such as **docker** and **podman**, and many plugins and modules. For information about how to obtain and install Ansible Engine, see the How to download and install Red Hat Ansible Engine Knowledgebase article.

RHEL 8.6 et 9.0 ont introduit Ansible Core (fourni en tant que paquetage **ansible-core**), qui contient les utilitaires de ligne de commande Ansible, les commandes et un petit ensemble de plugins Ansible intégrés. RHEL fournit ce paquetage par l'intermédiaire du dépôt AppStream, et sa prise en charge est limitée. Pour plus d'informations, consultez l'article de la base de connaissances intitulé Scope of support for the Ansible Core package included in the RHEL 9 and RHEL 8.6 and later AppStream repositories (Portée de la prise en charge du package Ansible Core inclus dans les dépôts AppStream RHEL 9 et RHEL 8.6 et versions ultérieures).

Procédure

1. Créez un nouveau fichier ***playbook.yml*** avec le contenu suivant :

```
- hosts: all
  vars:
```

```
    storage_volumes:
      - name: barefs
        type: disk
        disks:
         - sdb
        fs_type: xfs
        fs_label: label-name
        mount_point: /mnt/data
        encryption: true
        encryption_password: your-password
    roles:
     - rhel-system-roles.storage
```

Vous pouvez également ajouter les autres paramètres de cryptage tels que **encryption_key**, **encryption_cipher**, **encryption_key_size**, et **encryption_luks** version dans le fichier *playbook.yml*.

2. Facultatif : Vérifier la syntaxe du playbook :

```
# ansible-playbook --syntax-check playbook.yml
```

3. Exécutez le playbook sur votre fichier d'inventaire :

```
# ansible-playbook -i inventory.file /path/to/file/playbook.yml
```

Vérification

1. Visualiser l'état du cryptage :

```
# cryptsetup status sdb

/dev/mapper/sdb is active and is in use.
type: LUKS2
cipher: aes-xts-plain64
keysize: 512 bits
key location: keyring
device: /dev/sdb
[...]
```

2. Vérifiez le volume crypté LUKS créé :

```
# cryptsetup luksDump /dev/sdb

Version:        2
Epoch:          6
Metadata area:  16384 [bytes]
Keyslots area:  33521664 [bytes]
UUID:           a4c6be82-7347-4a91-a8ad-9479b72c9426
Label:          (no label)
Subsystem:      (no subsystem)
Flags:          allow-discards

Data segments:
  0: crypt
```

```
  offset: 33554432 [bytes]
  length: (whole device)
  cipher: aes-xts-plain64
  sector: 4096 [bytes]
[...]
```

3. Consultez les paramètres **cryptsetup** dans le fichier ***playbook.yml*** que le rôle **storage** prend en charge :

```
# cat ~/playbook.yml

- hosts: all
  vars:
    storage_volumes:
      - name: foo
        type: disk
        disks:
         - nvme0n1
        fs_type: xfs
        fs_label: label-name
        mount_point: /mnt/data
        encryption: true
        #encryption_password: passwdpasswd
        encryption_key: /home/passwd_key
        encryption_cipher: aes-xts-plain64
        encryption_key_size: 512
        encryption_luks_version: luks2

  roles:
   - rhel-system-roles.storage
```

Ressources supplémentaires

- Chiffrement des blocs de données à l'aide de LUKS
- **/usr/share/ansible/roles/rhel-system-roles.storage/README.md** fichier

CHAPITRE 11. CONFIGURING AUTOMATED UNLOCKING OF ENCRYPTED VOLUMES USING POLICY-BASED DECRYPTION

Policy-Based Decryption (PBD) is a collection of technologies that enable unlocking encrypted root and secondary volumes of hard drives on physical and virtual machines. PBD uses a variety of unlocking methods, such as user passwords, a Trusted Platform Module (TPM) device, a PKCS #11 device connected to a system, for example, a smart card, or a special network server.

PBD allows combining different unlocking methods into a policy, which makes it possible to unlock the same volume in different ways. The current implementation of the PBD in RHEL consists of the Clevis framework and plug-ins called *pins*. Each pin provides a separate unlocking capability. Currently, the following pins are available:

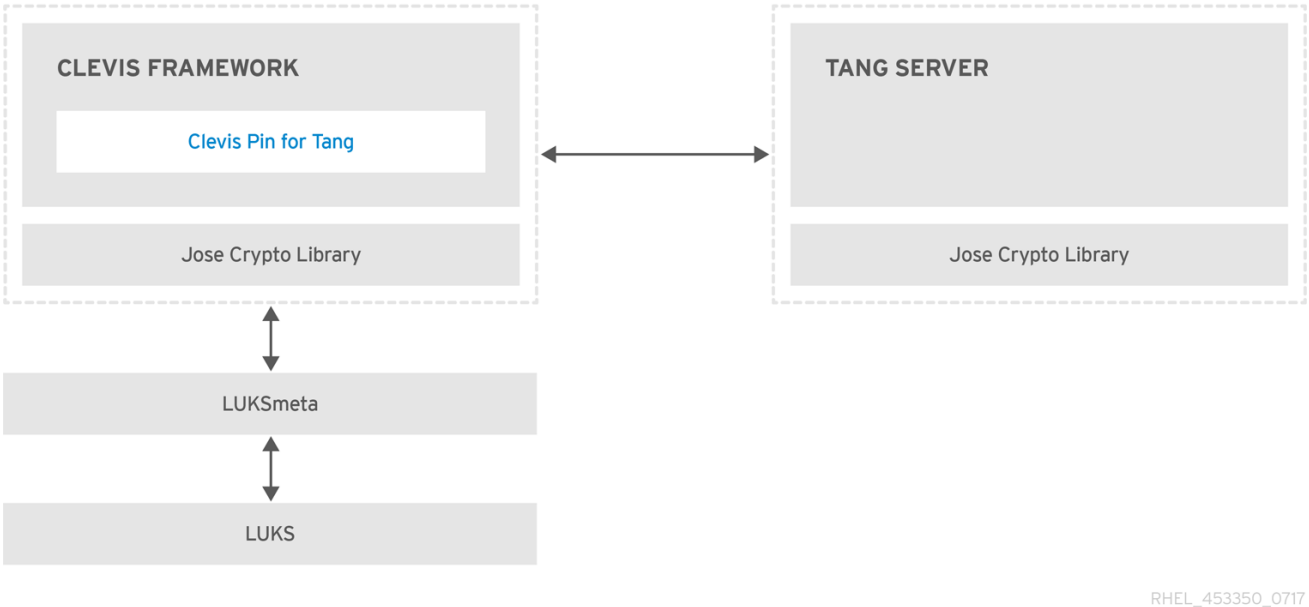
- **tang** - allows unlocking volumes using a network server
- **tpm2** - allows unlocking volumes using a TPM2 policy
- **sss** - allows deploying high-availability systems using the Shamir's Secret Sharing (SSS) cryptographic scheme

11.1. NETWORK-BOUND DISK ENCRYPTION

The Network Bound Disc Encryption (NBDE) is a subcategory of Policy-Based Decryption (PBD) that allows binding encrypted volumes to a special network server. The current implementation of the NBDE includes a Clevis pin for the Tang server and the Tang server itself.

In RHEL, NBDE is implemented through the following components and technologies:

Figure 11.1. NBDE scheme when using a LUKS1-encrypted volume. The luksmeta package is not used for LUKS2 volumes.



Tang is a server for binding data to network presence. It makes a system containing your data available when the system is bound to a certain secure network. Tang is stateless and does not require TLS or authentication. Unlike escrow-based solutions, where the server stores all encryption keys and has knowledge of every key ever used, Tang never interacts with any client keys, so it never gains any identifying information from the client.

Clevis is a pluggable framework for automated decryption. In NBDE, Clevis provides automated unlocking of LUKS volumes. The **clevis** package provides the client side of the feature.

A *Clevis pin* is a plug-in into the Clevis framework. One of such pins is a plug-in that implements interactions with the NBDE server – Tang.

Clevis and Tang are generic client and server components that provide network-bound encryption. In RHEL, they are used in conjunction with LUKS to encrypt and decrypt root and non-root storage volumes to accomplish Network-Bound Disk Encryption.

Both client- and server-side components use the *José* library to perform encryption and decryption operations.

When you begin provisioning NBDE, the Clevis pin for Tang server gets a list of the Tang server's advertised asymmetric keys. Alternatively, since the keys are asymmetric, a list of Tang's public keys can be distributed out of band so that clients can operate without access to the Tang server. This mode is called *offline provisioning*.

The Clevis pin for Tang uses one of the public keys to generate a unique, cryptographically-strong encryption key. Once the data is encrypted using this key, the key is discarded. The Clevis client should store the state produced by this provisioning operation in a convenient location. This process of encrypting data is the *provisioning step*.

The LUKS version 2 (LUKS2) is the default disk-encryption format in RHEL, hence, the provisioning state for NBDE is stored as a token in a LUKS2 header. The leveraging of provisioning state for NBDE by the **luksmeta** package is used only for volumes encrypted with LUKS1.

The Clevis pin for Tang supports both LUKS1 and LUKS2 without specification need. Clevis can encrypt plain-text files but you have to use the **cryptsetup** tool for encrypting block devices. See the Encrypting block devices using LUKS for more information.

When the client is ready to access its data, it loads the metadata produced in the provisioning step and it responds to recover the encryption key. This process is the *recovery step*.

In NBDE, Clevis binds a LUKS volume using a pin so that it can be automatically unlocked. After successful completion of the binding process, the disk can be unlocked using the provided Dracut unlocker.

NOTE

If the **kdump** kernel crash dumping mechanism is set to save the content of the system memory to a LUKS-encrypted device, you are prompted for entering a password during the second kernel boot.

Ressources supplémentaires

- NBDE (Network-Bound Disk Encryption) Technology Knowledgebase article
- **tang(8)**, **clevis(1)**, **jose(1)**, and **clevis-luks-unlockers(7)** man pages
- How to set up Network-Bound Disk Encryption with multiple LUKS devices (Clevis + Tang unlocking) Knowledgebase article

11.2. INSTALLING AN ENCRYPTION CLIENT - CLEVIS

Use this procedure to deploy and start using the Clevis pluggable framework on your system.

Procédure

1. To install Clevis and its pins on a system with an encrypted volume:

```
# dnf install clevis
```

2. To decrypt data, use a **clevis decrypt** command and provide a cipher text in the JSON Web Encryption (JWE) format, for example:

```
$ clevis decrypt < secret.jwe
```

Ressources supplémentaires

- **clevis(1)** man page
- Built-in CLI help after entering the **clevis** command without any argument:

```
$ clevis
Usage: clevis COMMAND [OPTIONS]

clevis decrypt      Decrypts using the policy defined at encryption time
clevis encrypt sss  Encrypts using a Shamir's Secret Sharing policy
clevis encrypt tang Encrypts using a Tang binding server policy
clevis encrypt tpm2 Encrypts using a TPM2.0 chip binding policy
clevis luks bind    Binds a LUKS device using the specified policy
clevis luks edit    Edit a binding from a clevis-bound slot in a LUKS device
clevis luks list    Lists pins bound to a LUKSv1 or LUKSv2 device
clevis luks pass    Returns the LUKS passphrase used for binding a particular slot.
clevis luks regen   Regenerate clevis binding
clevis luks report  Report tang keys' rotations
clevis luks unbind  Unbinds a pin bound to a LUKS volume
clevis luks unlock  Unlocks a LUKS volume
```

11.3. DEPLOYING A TANG SERVER WITH SELINUX IN ENFORCING MODE

Use this procedure to deploy a Tang server running on a custom port as a confined service in SELinux enforcing mode.

Conditions préalables

- The **policycoreutils-python-utils** package and its dependencies are installed.
- Le service **firewalld** est en cours d'exécution.

Procédure

1. To install the **tang** package and its dependencies, enter the following command as **root**:

```
# dnf install tang
```

2. Pick an unoccupied port, for example, *7500/tcp*, and allow the **tangd** service to bind to that port:

```
# semanage port -a -t tangd_port_t -p tcp 7500
```

Note that a port can be used only by one service at a time, and thus an attempt to use an already occupied port implies the **ValueError: Port already defined** error message.

3. Ouvrez le port dans le pare-feu :

```
# firewall-cmd --add-port=7500/tcp
# firewall-cmd --runtime-to-permanent
```

4. Enable the **tangd** service:

```
# systemctl enable tangd.socket
```

5. Create an override file:

```
# systemctl edit tangd.socket
```

6. In the following editor screen, which opens an empty **override.conf** file located in the **/etc/systemd/system/tangd.socket.d/** directory, change the default port for the Tang server from 80 to the previously picked number by adding the following lines:

```
[Socket]
ListenStream=
ListenStream=7500
```

Save the file and exit the editor.

7. Reload the changed configuration:

```
# systemctl daemon-reload
```

8. Check that your configuration is working:

```
# systemctl show tangd.socket -p Listen
Listen=[::]:7500 (Stream)
```

9. Start the **tangd** service:

```
# systemctl restart tangd.socket
```

Because **tangd** uses the **systemd** socket activation mechanism, the server starts as soon as the first connection comes in. A new set of cryptographic keys is automatically generated at the first start. To perform cryptographic operations such as manual key generation, use the **jose** utility.

Ressources supplémentaires

- **tang(8)**, **semanage(8)**, **firewall-cmd(1)**, **jose(1)**, **systemd.unit(5)**, and **systemd.socket(5)** man pages

11.4. ROTATING TANG SERVER KEYS AND UPDATING BINDINGS ON CLIENTS

Use the following steps to rotate your Tang server keys and update existing bindings on clients. The precise interval at which you should rotate them depends on your application, key sizes, and institutional policy.

Alternatively, you can rotate Tang keys by using the **nbde_server** RHEL system role. See Using the nbde_server system role for setting up multiple Tang servers for more information.

Conditions préalables

- A Tang server is running.
- The **clevis** and **clevis-luks** packages are installed on your clients.

Procédure

1. Rename all keys in the **/var/db/tang** key database directory to have a leading **.** to hide them from advertisement. Note that the file names in the following example differs from unique file names in the key database directory of your Tang server:

```
# cd /var/db/tang
# ls -l
-rw-r--r--. 1 root root 349 Feb  7 14:55 UV6dqXSwe1bRKG3KbJmdiR020hY.jwk
-rw-r--r--. 1 root root 354 Feb  7 14:55 y9hxLTQSiSB5jSEGWnjhY8fDTJU.jwk
# mv UV6dqXSwe1bRKG3KbJmdiR020hY.jwk .UV6dqXSwe1bRKG3KbJmdiR020hY.jwk
# mv y9hxLTQSiSB5jSEGWnjhY8fDTJU.jwk .y9hxLTQSiSB5jSEGWnjhY8fDTJU.jwk
```

2. Check that you renamed and therefore hid all keys from the Tang server advertisement:

```
# ls -l
total 0
```

3. Generate new keys using the **/usr/libexec/tangd-keygen** command in **/var/db/tang** on the Tang server:

```
# /usr/libexec/tangd-keygen /var/db/tang
# ls /var/db/tang
3ZWS6-cDrCG61UPJS2BMmPU4I54.jwk zyLuX6hijUy_PSeUEFDi7hi38.jwk
```

4. Check that your Tang server advertises the signing key from the new key pair, for example:

```
# tang-show-keys 7500
3ZWS6-cDrCG61UPJS2BMmPU4I54
```

5. On your NBDE clients, use the **clevis luks report** command to check if the keys advertised by the Tang server remains the same. You can identify slots with the relevant binding using the **clevis luks list** command, for example:

```
# clevis luks list -d /dev/sda2
1: tang '{"url":"http://tang.srv"}'
# clevis luks report -d /dev/sda2 -s 1
...
Report detected that some keys were rotated.
Do you want to regenerate luks metadata with "clevis luks regen -d /dev/sda2 -s 1"? [ynYN]
```

6. To regenerate LUKS metadata for the new keys either press **y** to the prompt of the previous command, or use the **clevis luks regen** command:

```
# clevis luks regen -d /dev/sda2 -s 1
```

7. When you are sure that all old clients use the new keys, you can remove the old keys from the Tang server, for example:

```
# cd /var/db/tang
# rm .*.jwk
```

AVERTISSEMENT

Removing the old keys while clients are still using them can result in data loss. If you accidentally remove such keys, use the **clevis luks regen** command on the clients, and provide your LUKS password manually.

Ressources supplémentaires

- **tang-show-keys(1)**, **clevis-luks-list(1)**, **clevis-luks-report(1)**, and **clevis-luks-regen(1)** man pages

11.5. CONFIGURING AUTOMATED UNLOCKING USING A TANG KEY IN THE WEB CONSOLE

Configure automated unlocking of a LUKS-encrypted storage device using a key provided by a Tang server.

Conditions préalables

- La console web RHEL 9 a été installée.
  Pour plus de détails, voir Installation de la console web.
- Le paquetage **cockpit-storaged** est installé sur votre système.
- The **cockpit.socket** service is running at port 9090.
- The **clevis**, **tang**, and **clevis-dracut** packages are installed.
- A Tang server is running.

Procédure

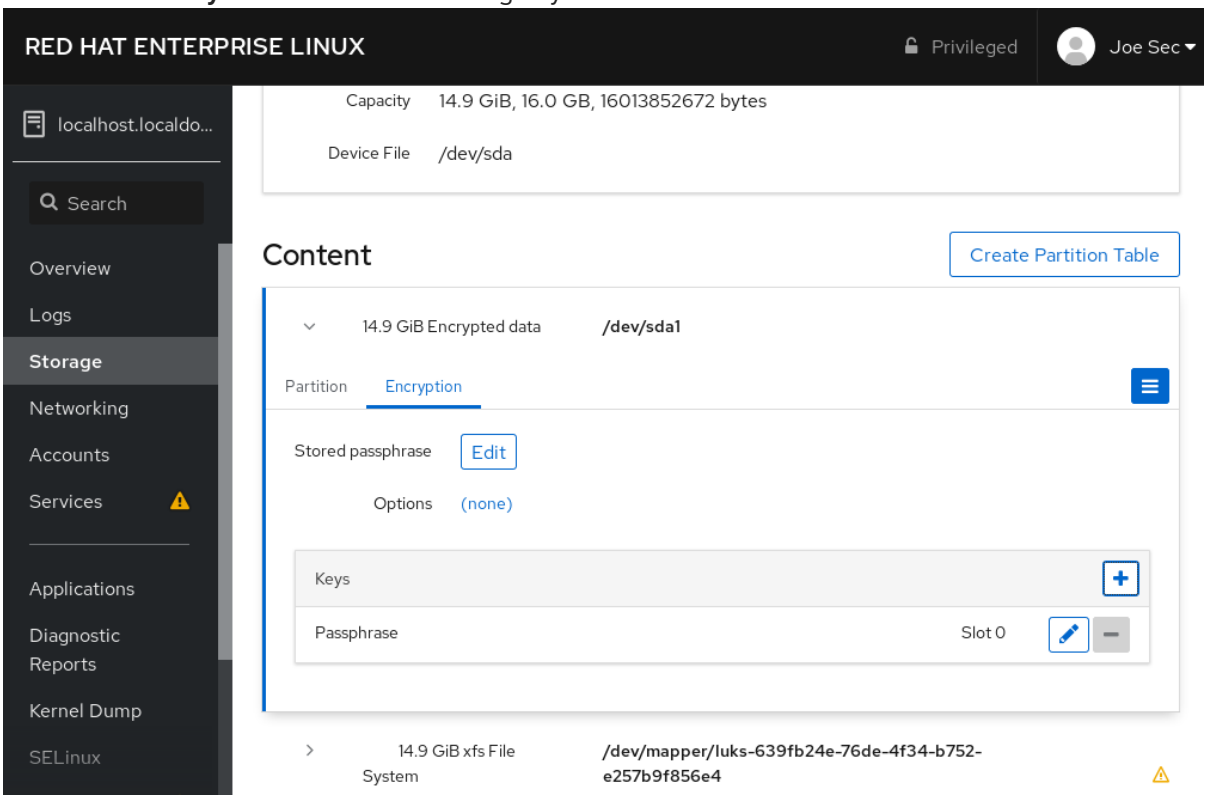
1. Open the RHEL web console by entering the following address in a web browser:

```
https://localhost:9090
```

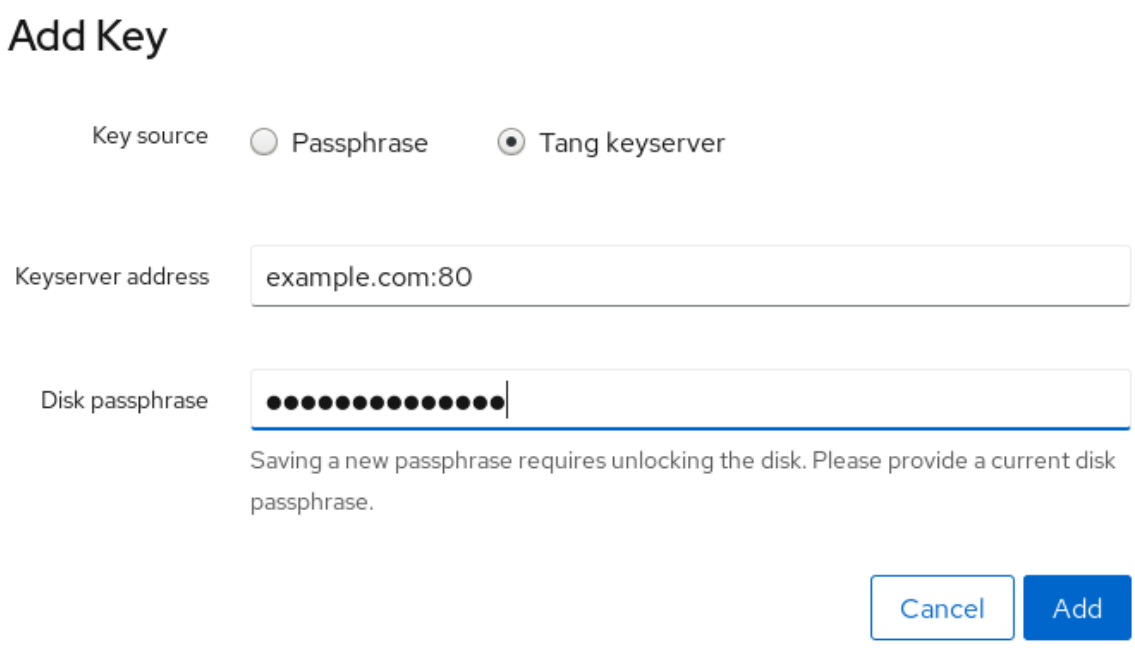
   Replace the *localhost* part by the remote server's host name or IP address when you connect to a remote system.

2. Provide your credentials and click **Storage**. Click **>** to expand details of the encrypted device you want to unlock using the Tang server, and click **Encryption**.

3. Click **+** in the **Keys** section to add a Tang key:



4. Provide the address of your Tang server and a password that unlocks the LUKS-encrypted device. Click **Add** to confirm:

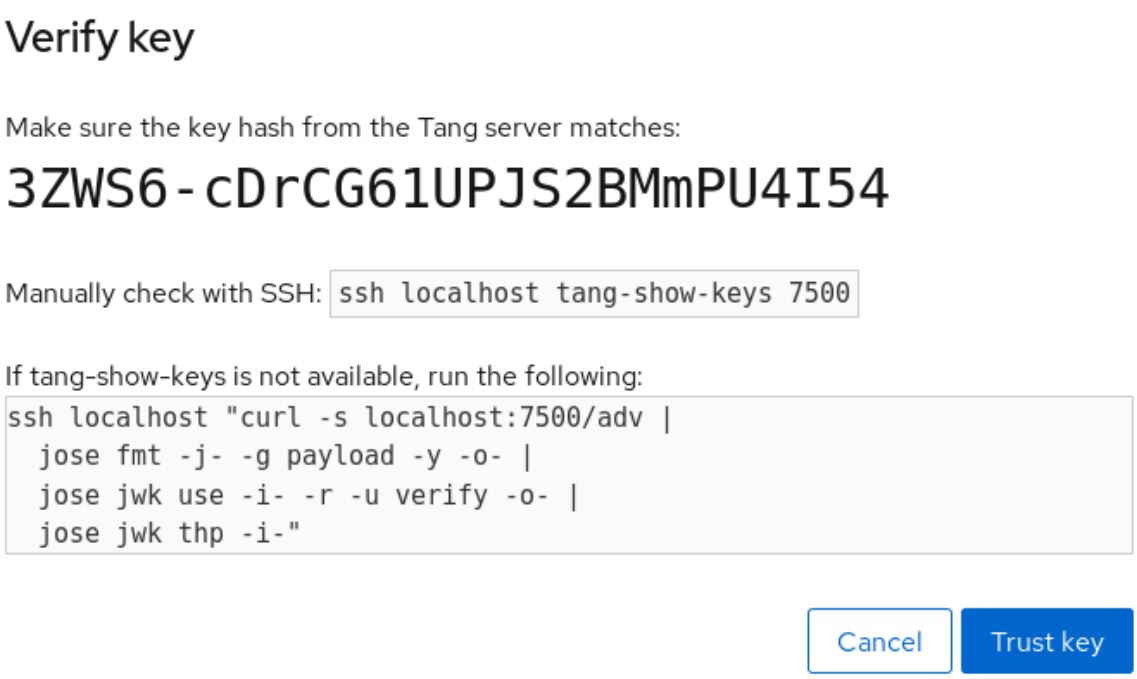


The following dialog window provides a command to verify that the key hash matches.

5. In a terminal on the Tang server, use the **tang-show-keys** command to display the key hash for comparison. In this example, the Tang server is running on the port *7500*:

```
# tang-show-keys 7500
fM-EwYeiTxS66X3s1UAywsGKGnxnpll8ig0KOQmr9CM
```

6. Click **Trust key** when the key hashes in the web console and in the output of previously listed commands are the same:

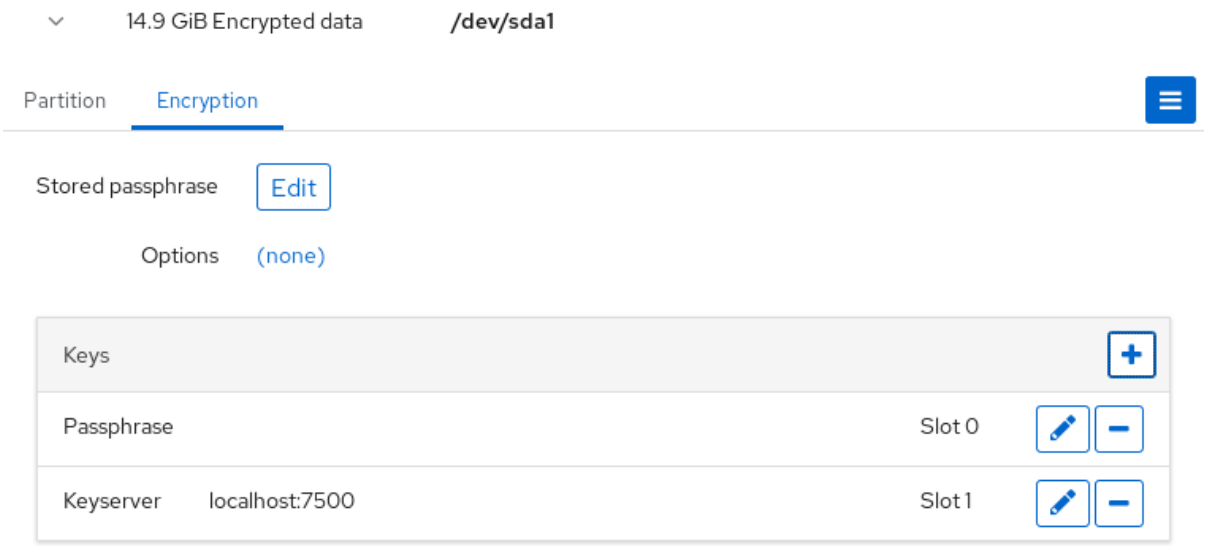


7. To enable the early boot system to process the disk binding, click **Terminal** at the bottom of the left navigation bar and enter the following commands:

```
# dnf install clevis-dracut
# grubby --update-kernel=ALL --args="rd.neednet=1"
# dracut -fv --regenerate-all
```

Vérification

1. Check that the newly added Tang key is now listed in the **Keys** section with the **Keyserver** type:



2. Verify that the bindings are available for the early boot, for example:

```
# lsinitrd | grep clevis
clevis
clevis-pin-sss
clevis-pin-tang
clevis-pin-tpm2
-rwxr-xr-x   1 root     root        1600 Feb 11 16:30 usr/bin/clevis
-rwxr-xr-x   1 root     root        1654 Feb 11 16:30 usr/bin/clevis-decrypt
...
-rwxr-xr-x   2 root     root          45 Feb 11 16:30 usr/lib/dracut/hooks/initqueue/settled/60-
clevis-hook.sh
-rwxr-xr-x   1 root     root        2257 Feb 11 16:30 usr/libexec/clevis-luks-askpass
```

Ressources supplémentaires

- Commencer à utiliser la console web RHEL

11.6. BASIC NBDE AND TPM2 ENCRYPTION-CLIENT OPERATIONS

The Clevis framework can encrypt plain-text files and decrypt both ciphertexts in the JSON Web Encryption (JWE) format and LUKS-encrypted block devices. Clevis clients can use either Tang network servers or Trusted Platform Module 2.0 (TPM 2.0) chips for cryptographic operations.

The following commands demonstrate the basic functionality provided by Clevis on examples containing plain-text files. You can also use them for troubleshooting your NBDE or Clevis+TPM deployments.

Encryption client bound to a Tang server

- To check that a Clevis encryption client binds to a Tang server, use the **clevis encrypt tang** sub-command:

```
$ clevis encrypt tang '{"url":"http://tang.srv:port"}' < input-plain.txt > secret.jwe
The advertisement contains the following signing keys:

_OsIk0T-E2l6qjfdDiwVmidoZjA

Do you wish to trust these keys? [ynYN] y
```

Change the *http://tang.srv:port* URL in the previous example to match the URL of the server where **tang** is installed. The *secret.jwe* output file contains your encrypted cipher text in the JWE format. This cipher text is read from the *input-plain.txt* input file.

Alternatively, if your configuration requires a non-interactive communication with a Tang server without SSH access, you can download an advertisement and save it to a file:

```
$ curl -sfg http://tang.srv:port/adv -o adv.jws
```

Use the advertisement in the *adv.jws* file for any following tasks, such as encryption of files or messages:

```
$ echo 'hello' | clevis encrypt tang '{"url":"http://tang.srv:port","adv":"adv.jws"}'
```

- To decrypt data, use the **clevis decrypt** command and provide the cipher text (JWE):

```
$ clevis decrypt < secret.jwe > output-plain.txt
```

Encryption client using TPM 2.0

- To encrypt using a TPM 2.0 chip, use the **clevis encrypt tpm2** sub-command with the only argument in form of the JSON configuration object:

```
$ clevis encrypt tpm2 '{}' < input-plain.txt > secret.jwe
```

  To choose a different hierarchy, hash, and key algorithms, specify configuration properties, for example:

```
$ clevis encrypt tpm2 '{"hash":"sha256","key":"rsa"}' < input-plain.txt > secret.jwe
```

- To decrypt the data, provide the ciphertext in the JSON Web Encryption (JWE) format:

```
$ clevis decrypt < secret.jwe > output-plain.txt
```

The pin also supports sealing data to a Platform Configuration Registers (PCR) state. That way, the data can only be unsealed if the PCR hashes values match the policy used when sealing.

For example, to seal the data to the PCR with index 0 and 7 for the SHA-256 bank:

```
$ clevis encrypt tpm2 '{"pcr_bank":"sha256","pcr_ids":"0,7"}' < input-plain.txt > secret.jwe
```

AVERTISSEMENT

Hashes in PCRs can be rewritten, and you no longer can unlock your encrypted volume. For this reason, add a strong passphrase that enable you to unlock the encrypted volume manually even when a value in a PCR changes.

If the system cannot automatically unlock your encrypted volume after an upgrade of the **shim-x64** package, follow the steps in the Clevis TPM2 no longer decrypts LUKS devices after a restart KCS article.

Ressources supplémentaires

- **clevis-encrypt-tang(1)**, **clevis-luks-unlockers(7)**, **clevis(1)**, and **clevis-encrypt-tpm2(1)** man pages
- **clevis**, **clevis decrypt**, and **clevis encrypt tang** commands without any arguments show the built-in CLI help, for example:

```
$ clevis encrypt tang
Usage: clevis encrypt tang CONFIG < PLAINTEXT > JWE
...
```

11.7. CONFIGURING MANUAL ENROLLMENT OF LUKS-ENCRYPTED VOLUMES

Use the following steps to configure unlocking of LUKS-encrypted volumes with NBDE.

Conditions préalables

- A Tang server is running and available.

Procédure

1. To automatically unlock an existing LUKS-encrypted volume, install the **clevis-luks** subpackage:

```
# dnf install clevis-luks
```

2. Identify the LUKS-encrypted volume for PBD. In the following example, the block device is referred as */dev/sda2*:

```
# lsblk
NAME                                          MAJ:MIN RM   SIZE RO TYPE  MOUNTPOINT
sda                                             8:0    0    12G  0 disk
├─sda1                                          8:1    0     1G  0 part  /boot
└─sda2                                          8:2    0    11G  0 part
  └─luks-40e20552-2ade-4954-9d56-565aa7994fb6 253:0    0    11G  0 crypt
    ├─rhel-root                               253:0    0   9.8G  0 lvm   /
    └─rhel-swap                               253:1    0   1.2G  0 lvm   [SWAP]
```

3. Bind the volume to a Tang server using the **clevis luks bind** command:

```
# clevis luks bind -d /dev/sda2 tang '{"url":"http://tang.srv"}'
The advertisement contains the following signing keys:

_OsIk0T-E2l6qjfdDiwVmidoZjA

Do you wish to trust these keys? [ynYN] y
You are about to initialize a LUKS device for metadata storage.
Attempting to initialize it may result in data loss if data was
already written into the LUKS header gap in a different format.
A backup is advised before initialization is performed.

Do you wish to initialize /dev/sda2? [yn] y
Enter existing LUKS password:
```

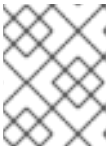
This command performs four steps:

a. Creates a new key with the same entropy as the LUKS master key.

b. Encrypts the new key with Clevis.

c. Stores the Clevis JWE object in the LUKS2 header token or uses LUKSMeta if the non-default LUKS1 header is used.

d. Enables the new key for use with LUKS.



NOTE

The binding procedure assumes that there is at least one free LUKS password slot. The **clevis luks bind** command takes one of the slots.

The volume can now be unlocked with your existing password as well as with the Clevis policy.

4. To enable the early boot system to process the disk binding, use the **dracut** tool on an already installed system:

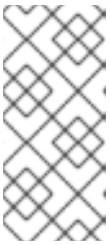
```
# dnf install clevis-dracut
```

In RHEL, Clevis produces a generic **initrd** (initial ramdisk) without host-specific configuration options and does not automatically add parameters such as **rd.neednet=1** to the kernel command line. If your configuration relies on a Tang pin that requires network during early boot, use the **--hostonly-cmdline** argument and **dracut** adds **rd.neednet=1** when it detects a Tang binding:

```
# dracut -fv --regenerate-all --hostonly-cmdline
```

Alternatively, create a .conf file in the **/etc/dracut.conf.d/**, and add the **hostonly_cmdline=yes** option to the file, for example:

```
# echo "hostonly_cmdline=yes" > /etc/dracut.conf.d/clevis.conf
```



NOTE

You can also ensure that networking for a Tang pin is available during early boot by using the **grubby** tool on the system where Clevis is installed:

```
# grubby --update-kernel=ALL --args="rd.neednet=1"
```

Then you can use **dracut** without **--hostonly-cmdline**:

```
# dracut -fv --regenerate-all
```

Vérification

1. To verify that the Clevis JWE object is successfully placed in a LUKS header, use the **clevis luks list** command:

```
# clevis luks list -d /dev/sda2
1: tang '{"url":"http://tang.srv:port"}'
```

IMPORTANT

To use NBDE for clients with static IP configuration (without DHCP), pass your network configuration to the **dracut** tool manually, for example:

```
# dracut -fv --regenerate-all --kernel-cmdline
"ip=192.0.2.10::192.0.2.1:255.255.255.0::ens3:none"
```

Alternatively, create a .conf file in the **/etc/dracut.conf.d/** directory with the static network information. For example:

```
# cat /etc/dracut.conf.d/static_ip.conf
kernel_cmdline="ip=192.0.2.10::192.0.2.1:255.255.255.0::ens3:none"
```

Regenerate the initial RAM disk image:

```
# dracut -fv --regenerate-all
```

Ressources supplémentaires

- **clevis-luks-bind(1)** and **dracut.cmdline(7)** man pages.
- Kickstart commands for network configuration

11.8. CONFIGURING MANUAL ENROLLMENT OF LUKS-ENCRYPTED VOLUMES USING A TPM 2.0 POLICY

Use the following steps to configure unlocking of LUKS-encrypted volumes by using a Trusted Platform Module 2.0 (TPM 2.0) policy.

Conditions préalables

- An accessible TPM 2.0-compatible device.
- A system with the 64-bit Intel or 64-bit AMD architecture.

Procédure

1. To automatically unlock an existing LUKS-encrypted volume, install the **clevis-luks** subpackage:

```
# dnf install clevis-luks
```

2. Identify the LUKS-encrypted volume for PBD. In the following example, the block device is referred as */dev/sda2*:

```
# lsblk
NAME                                          MAJ:MIN RM   SIZE RO TYPE  MOUNTPOINT
sda                                             8:0    0    12G  0 disk
├─sda1                                          8:1    0     1G  0 part  /boot
└─sda2                                          8:2    0    11G  0 part
  └─luks-40e20552-2ade-4954-9d56-565aa7994fb6 253:0    0    11G  0 crypt
    ├─rhel-root                               253:0    0   9.8G  0 lvm   /
    └─rhel-swap                               253:1    0   1.2G  0 lvm   [SWAP]
```

3. Bind the volume to a TPM 2.0 device using the **clevis luks bind** command, for example:

```
# clevis luks bind -d /dev/sda2 tpm2 '{"hash":"sha256","key":"rsa"}'
...
Do you wish to initialize /dev/sda2? [yn] y
Enter existing LUKS password:
```

This command performs four steps:

a. Creates a new key with the same entropy as the LUKS master key.

b. Encrypts the new key with Clevis.

c. Stores the Clevis JWE object in the LUKS2 header token or uses LUKSMeta if the non-default LUKS1 header is used.

d. Enables the new key for use with LUKS.

NOTE

The binding procedure assumes that there is at least one free LUKS password slot. The **clevis luks bind** command takes one of the slots.

Alternatively, if you want to seal data to specific Platform Configuration Registers (PCR) states, add the **pcr_bank** and **pcr_ids** values to the **clevis luks bind** command, for example:

```
# clevis luks bind -d /dev/sda2 tpm2
'{"hash":"sha256","key":"rsa","pcr_bank":"sha256","pcr_ids":"0,1"}'
```

AVERTISSEMENT

Because the data can only be unsealed if PCR hashes values match the policy used when sealing and the hashes can be rewritten, add a strong passphrase that enable you to unlock the encrypted volume manually when a value in a PCR changes.

If the system cannot automatically unlock your encrypted volume after an upgrade of the **shim-x64** package, follow the steps in the Clevis TPM2 no longer decrypts LUKS devices after a restart KCS article.

4. The volume can now be unlocked with your existing password as well as with the Clevis policy.

5. To enable the early boot system to process the disk binding, use the **dracut** tool on an already installed system:

```
# dnf install clevis-dracut
# dracut -fv --regenerate-all
```

Vérification

1. To verify that the Clevis JWE object is successfully placed in a LUKS header, use the **clevis luks list** command:

```
# clevis luks list -d /dev/sda2
1: tpm2 '{"hash":"sha256","key":"rsa"}'
```

Ressources supplémentaires

- **clevis-luks-bind(1)**, **clevis-encrypt-tpm2(1)**, and **dracut.cmdline(7)** man pages

11.9. REMOVING A CLEVIS PIN FROM A LUKS-ENCRYPTED VOLUME MANUALLY

Use the following procedure for manual removing the metadata created by the **clevis luks bind** command and also for wiping a key slot that contains passphrase added by Clevis.

IMPORTANT

The recommended way to remove a Clevis pin from a LUKS-encrypted volume is through the **clevis luks unbind** command. The removal procedure using **clevis luks unbind** consists of only one step and works for both LUKS1 and LUKS2 volumes. The following example command removes the metadata created by the binding step and wipe the key slot *1* on the */dev/sda2* device:

```
# clevis luks unbind -d /dev/sda2 -s 1
```

Conditions préalables

- A LUKS-encrypted volume with a Clevis binding.

Procédure

1. Check which LUKS version the volume, for example */dev/sda2*, is encrypted by and identify a slot and a token that is bound to Clevis:

```
# cryptsetup luksDump /dev/sda2
LUKS header information
Version:        2
...
Keyslots:
  0: luks2
...
1: luks2
      Key:        512 bits
      Priority:   normal
      Cipher:     aes-xts-plain64
...
      Tokens:
        0: clevis
              Keyslot:  1
...
```

In the previous example, the Clevis token is identified by *0* and the associated key slot is *1*.

2. In case of LUKS2 encryption, remove the token:

```
# cryptsetup token remove --token-id 0 /dev/sda2
```

3. If your device is encrypted by LUKS1, which is indicated by the **Version: 1** string in the output of the **cryptsetup luksDump** command, perform this additional step with the **luksmeta wipe** command:

```
# luksmeta wipe -d /dev/sda2 -s 1
```

4. Wipe the key slot containing the Clevis passphrase:

```
# cryptsetup luksKillSlot /dev/sda2 1
```

Ressources supplémentaires

- **clevis-luks-unbind(1)**, **cryptsetup(8)**, and **luksmeta(8)** man pages

11.10. CONFIGURING AUTOMATED ENROLLMENT OF LUKS-ENCRYPTED VOLUMES USING KICKSTART

Follow the steps in this procedure to configure an automated installation process that uses Clevis for the enrollment of LUKS-encrypted volumes.

Procédure

1. Instruct Kickstart to partition the disk such that LUKS encryption has enabled for all mount points, other than **/boot**, with a temporary password. The password is temporary for this step of the enrollment process.

```
part /boot --fstype="xfs" --ondisk=vda --size=256
part / --fstype="xfs" --ondisk=vda --grow --encrypted --passphrase=temppass
```

Note that OSPP-compliant systems require a more complex configuration, for example:

```
part /boot --fstype="xfs" --ondisk=vda --size=256
part / --fstype="xfs" --ondisk=vda --size=2048 --encrypted --passphrase=temppass
part /var --fstype="xfs" --ondisk=vda --size=1024 --encrypted --passphrase=temppass
part /tmp --fstype="xfs" --ondisk=vda --size=1024 --encrypted --passphrase=temppass
part /home --fstype="xfs" --ondisk=vda --size=2048 --grow --encrypted --
passphrase=temppass
part /var/log --fstype="xfs" --ondisk=vda --size=1024 --encrypted --passphrase=temppass
part /var/log/audit --fstype="xfs" --ondisk=vda --size=1024 --encrypted --
passphrase=temppass
```

2. Install the related Clevis packages by listing them in the **%packages** section:

```
%packages
clevis-dracut
clevis-luks
```

```
clevis-systemd
%end
```

3. Optionally, to ensure that you can unlock the encrypted volume manually when required, add a strong passphrase before you remove the temporary passphrase. See the How to add a passphrase, key, or keyfile to an existing LUKS device article for more information.

4. Call **clevis luks bind** to perform binding in the **%post** section. Afterward, remove the temporary password:

```
%post
clevis luks bind -y -k - -d /dev/vda2 \
tang '{"url":"http://tang.srv"}' <<< "temppass"
cryptsetup luksRemoveKey /dev/vda2 <<< "temppass"
dracut -fv --regenerate-all
%end
```

If your configuration relies on a Tang pin that requires network during early boot or you use NBDE clients with static IP configurations, you have to modify the **dracut** command as described in Configuring manual enrollment of LUKS-encrypted volumes.

Note that the **-y** option for the **clevis luks bind** command is available from RHEL 8.3. In RHEL 8.2 and older, replace **-y** by **-f** in the **clevis luks bind** command and download the advertisement from the Tang server:

```
%post
curl -sfg http://tang.srv/adv -o adv.jws
clevis luks bind -f -k - -d /dev/vda2 \
tang '{"url":"http://tang.srv","adv":"adv.jws"}' <<< "temppass"
cryptsetup luksRemoveKey /dev/vda2 <<< "temppass"
dracut -fv --regenerate-all
%end
```

AVERTISSEMENT

The **cryptsetup luksRemoveKey** command prevents any further administration of a LUKS2 device on which you apply it. You can recover a removed master key using the **dmsetup** command only for LUKS1 devices.

You can use an analogous procedure when using a TPM 2.0 policy instead of a Tang server.

Ressources supplémentaires

- **clevis(1)**, **clevis-luks-bind(1)**, **cryptsetup(8)**, and **dmsetup(8)** man pages
- Installing Red Hat Enterprise Linux 9 using Kickstart

11.11. CONFIGURING AUTOMATED UNLOCKING OF A LUKS-ENCRYPTED REMOVABLE STORAGE DEVICE

Use this procedure to set up an automated unlocking process of a LUKS-encrypted USB storage device.

Procédure

1. To automatically unlock a LUKS-encrypted removable storage device, such as a USB drive, install the **clevis-udisks2** package:

```
# dnf install clevis-udisks2
```

2. Reboot the system, and then perform the binding step using the **clevis luks bind** command as described in Configuring manual enrollment of LUKS-encrypted volumes, for example:

```
# clevis luks bind -d /dev/sdb1 tang '{"url":"http://tang.srv"}'
```

3. The LUKS-encrypted removable device can be now unlocked automatically in your GNOME desktop session. The device bound to a Clevis policy can be also unlocked by the **clevis luks unlock** command:

```
# clevis luks unlock -d /dev/sdb1
```

You can use an analogous procedure when using a TPM 2.0 policy instead of a Tang server.

Ressources supplémentaires

- **clevis-luks-unlockers(7)** man page

11.12. DEPLOYING HIGH-AVAILABILITY NBDE SYSTEMS

Tang provides two methods for building a high-availability deployment:

Client redundancy (recommended)

Clients should be configured with the ability to bind to multiple Tang servers. In this setup, each Tang server has its own keys and clients can decrypt by contacting a subset of these servers. Clevis already supports this workflow through its **sss** plug-in. Red Hat recommends this method for a high-availability deployment.

Key sharing

For redundancy purposes, more than one instance of Tang can be deployed. To set up a second or any subsequent instance, install the **tang** packages and copy the key directory to the new host using **rsync** over **SSH**. Note that Red Hat does not recommend this method because sharing keys increases the risk of key compromise and requires additional automation infrastructure.

11.12.1. High-available NBDE using Shamir's Secret Sharing

Shamir's Secret Sharing (SSS) is a cryptographic scheme that divides a secret into several unique parts. To reconstruct the secret, a number of parts is required. The number is called threshold and SSS is also referred to as a thresholding scheme.

Clevis provides an implementation of SSS. It creates a key and divides it into a number of pieces. Each piece is encrypted using another pin including even SSS recursively. Additionally, you define the threshold **t**. If an NBDE deployment decrypts at least **t** pieces, then it recovers the encryption key and the decryption process succeeds. When Clevis detects a smaller number of parts than specified in the threshold, it prints an error message.

11.12.1.1. Example 1: Redundancy with two Tang servers

The following command decrypts a LUKS-encrypted device when at least one of two Tang servers is available:

```
# clevis luks bind -d /dev/sda1 sss '{"t":1,"pins":{"tang":[{"url":"http://tang1.srv"},
{"url":"http://tang2.srv"}]}}'
```

The previous command used the following configuration scheme:

```
{
    "t":1,
    "pins":{
        "tang":[
            {
                "url":"http://tang1.srv"
            },
            {
                "url":"http://tang2.srv"
            }
        ]
    }
}
```

In this configuration, the SSS threshold **t** is set to **1** and the **clevis luks bind** command successfully reconstructs the secret if at least one from two listed **tang** servers is available.

11.12.1.2. Example 2: Shared secret on a Tang server and a TPM device

The following command successfully decrypts a LUKS-encrypted device when both the **tang** server and the **tpm2** device are available:

```
# clevis luks bind -d /dev/sda1 sss '{"t":2,"pins":{"tang":[{"url":"http://tang1.srv"}], "tpm2":
{"pcr_ids":"0,7"}}}'
```

The configuration scheme with the SSS threshold 't' set to '2' is now:

```
{
    "t":2,
    "pins":{
        "tang":[
            {
                "url":"http://tang1.srv"
            }
        ],
        "tpm2":{
            "pcr_ids":"0,7"
        }
    }
}
```

Ressources supplémentaires

- **tang(8)** (section **High Availability**), **clevis(1)** (section **Shamir's Secret Sharing**), and **clevis-encrypt-sss(1)** man pages

11.13. DEPLOYMENT OF VIRTUAL MACHINES IN A NBDE NETWORK

The **clevis luks bind** command does not change the LUKS master key. This implies that if you create a LUKS-encrypted image for use in a virtual machine or cloud environment, all the instances that run this image share a master key. This is extremely insecure and should be avoided at all times.

This is not a limitation of Clevis but a design principle of LUKS. If your scenario requires having encrypted root volumes in a cloud, perform the installation process (usually using Kickstart) for each instance of Red Hat Enterprise Linux in the cloud as well. The images cannot be shared without also sharing a LUKS master key.

To deploy automated unlocking in a virtualized environment, use systems such as **lorax** or **virt-install** together with a Kickstart file (see Configuring automated enrollment of LUKS-encrypted volumes using Kickstart) or another automated provisioning tool to ensure that each encrypted VM has a unique master key.

Ressources supplémentaires

- **clevis-luks-bind(1)** man page

11.14. BUILDING AUTOMATICALLY-ENROLLABLE VM IMAGES FOR CLOUD ENVIRONMENTS USING NBDE

Deploying automatically-enrollable encrypted images in a cloud environment can provide a unique set of challenges. Like other virtualization environments, it is recommended to reduce the number of instances started from a single image to avoid sharing the LUKS master key.

Therefore, the best practice is to create customized images that are not shared in any public repository and that provide a base for the deployment of a limited amount of instances. The exact number of instances to create should be defined by deployment's security policies and based on the risk tolerance associated with the LUKS master key attack vector.

To build LUKS-enabled automated deployments, systems such as Lorax or virt-install together with a Kickstart file should be used to ensure master key uniqueness during the image building process.

Cloud environments enable two Tang server deployment options which we consider here. First, the Tang server can be deployed within the cloud environment itself. Second, the Tang server can be deployed outside of the cloud on independent infrastructure with a VPN link between the two infrastructures.

Deploying Tang natively in the cloud does allow for easy deployment. However, given that it shares infrastructure with the data persistence layer of ciphertext of other systems, it may be possible for both the Tang server's private key and the Clevis metadata to be stored on the same physical disk. Access to this physical disk permits a full compromise of the ciphertext data.

IMPORTANT

For this reason, Red Hat strongly recommends maintaining a physical separation between the location where the data is stored and the system where Tang is running. This separation between the cloud and the Tang server ensures that the Tang server's private key cannot be accidentally combined with the Clevis metadata. It also provides local control of the Tang server if the cloud infrastructure is at risk.

11.15. DEPLOYING TANG AS A CONTAINER

The **tang** container image provides Tang-server decryption capabilities for Clevis clients that run either in OpenShift Container Platform (OCP) clusters or in separate virtual machines.

Conditions préalables

- The **podman** package and its dependencies are installed on the system.
- You have logged in on the **registry.redhat.io** container catalog using the **podman login registry.redhat.io** command. See Red Hat Container Registry Authentication for more information.
- The Clevis client is installed on systems containing LUKS-encrypted volumes that you want to automatically unlock by using a Tang server.

Procédure

1. Pull the **tang** container image from the **registry.redhat.io** registry:

```
# podman pull registry.redhat.io/rhel9/tang
```

2. Run the container, specify its port, and specify the path to the Tang keys. The previous example runs the **tang** container, specifies the port *7500*, and indicates a path to the Tang keys of the **/var/db/tang** directory:

```
# podman run -d -p 7500:7500 -v tang-keys:/var/db/tang --name tang
registry.redhat.io/rhel9/tang
```

   Note that Tang uses port 80 by default but this may collide with other services such as the Apache HTTP server.

3. [Optional] For increased security, rotate the Tang keys periodically. You can use the **tangd-rotate-keys** script, for example:

```
# podman run --rm -v tang-keys:/var/db/tang registry.redhat.io/rhel9/tang tangd-rotate-keys -
v -d /var/db/tang
Rotated key 'rZAMKAseaXBe0rcKXL1hCCIq-DY.jwk' -> .'rZAMKAseaXBe0rcKXL1hCCIq-
DY.jwk'
Rotated key 'x1AIpc6WmnCU-CabD8_4q18vDuw.jwk' -> .'x1AIpc6WmnCU-
CabD8_4q18vDuw.jwk'
Created new key GrMMX_WfdqomIU_4RyjpcdIXb0E.jwk
Created new key _dTTfn17sZZqVAp80u3ygFDHtjk.jwk
Keys rotated successfully.
```

Vérification

- On a system that contains LUKS-encrypted volumes for automated unlocking by the presence of the Tang server, check that the Clevis client can encrypt and decrypt a plain-text message using Tang:

```
# echo test | clevis encrypt tang '{"url":"http://localhost:7500"}' | clevis decrypt
The advertisement contains the following signing keys:
```

```
x1AIpc6WmnCU-CabD8_4q18vDuw

Do you wish to trust these keys? [ynYN] y
test
```

The previous example command shows the **test** string at the end of its output when a Tang server is available on the *localhost* URL and communicates through port *7500*.

Ressources supplémentaires

- **podman(1)**, **clevis(1)**, and **tang(8)** man pages

11.16. INTRODUCTION AUX RÔLES DES SYSTÈMES NBDE_CLIENT ET NBDE_SERVER (CLEVIS ET TANG)

RHEL System Roles est une collection de rôles et de modules Ansible qui fournissent une interface de configuration cohérente pour gérer à distance plusieurs systèmes RHEL.

Vous pouvez utiliser les rôles Ansible pour les déploiements automatisés de solutions de décryptage basé sur des politiques (PBD) à l'aide de Clevis et Tang. Le paquetage **rhel-system-roles** contient ces rôles système, les exemples associés ainsi que la documentation de référence.

Le rôle de système **nbde_client** vous permet de déployer plusieurs clients Clevis de manière automatisée. Notez que le rôle **nbde_client** ne prend en charge que les liaisons Tang, et que vous ne pouvez pas l'utiliser pour les liaisons TPM2 pour le moment.

Le rôle **nbde_client** nécessite des volumes qui sont déjà chiffrés à l'aide de LUKS. Ce rôle permet de lier un volume chiffré à l'aide de LUKS à un ou plusieurs serveurs liés au réseau (NBDE) - serveurs Tang. Vous pouvez soit préserver le chiffrement existant du volume à l'aide d'une phrase d'authentification, soit le supprimer. Après avoir supprimé la phrase d'authentification, vous pouvez déverrouiller le volume uniquement à l'aide de l'EDNB. Cette option est utile lorsqu'un volume est initialement crypté à l'aide d'une clé ou d'un mot de passe temporaire que vous devez supprimer après avoir approvisionné le système.

Si vous fournissez à la fois une phrase d'authentification et un fichier clé, le rôle utilise d'abord ce que vous avez fourni. S'il ne trouve aucun fichier valide, il tente de récupérer une phrase d'authentification à partir d'une liaison existante.

La PBD définit une liaison comme une correspondance entre un appareil et un emplacement. Cela signifie que vous pouvez avoir plusieurs liaisons pour le même appareil. L'emplacement par défaut est l'emplacement 1.

Le rôle **nbde_client** fournit également la variable **state**. Utilisez la valeur **present** pour créer une nouvelle liaison ou mettre à jour une liaison existante. Contrairement à la commande **clevis luks bind**, vous pouvez également utiliser **state: present** pour écraser une liaison existante dans son emplacement. La valeur **absent** supprime une liaison spécifiée.

Le rôle de système **nbde_client** vous permet de déployer et de gérer un serveur Tang dans le cadre d'une solution de chiffrement de disque automatisée. Ce rôle prend en charge les fonctionnalités suivantes :

- Touches Tang rotatives
- Déploiement et sauvegarde des clés Tang

Ressources supplémentaires

Ressources supplémentaires

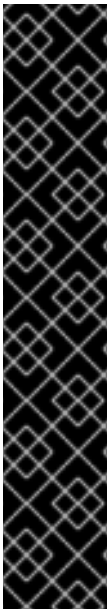
- Pour une référence détaillée sur les variables de rôle NBDE (Network-Bound Disk Encryption), installez le paquetage **rhel-system-roles** et consultez les fichiers **README.md** et **README.html** dans les répertoires **/usr/share/doc/rhel-system-roles/nbde_client/** et **/usr/share/doc/rhel-system-roles/nbde_server/**.
- Par exemple, les playbooks system-roles, installez le paquetage **rhel-system-roles** et consultez les répertoires **/usr/share/ansible/roles/rhel-system-roles.nbde_server/examples/**.
- For more information about RHEL System Roles, see Preparing a control node and managed nodes to use RHEL System Roles.

11.17. UTILISATION DU RÔLE DE SYSTÈME NBDE_SERVER POUR CONFIGURER PLUSIEURS SERVEURS TANG

Suivez les étapes pour préparer et appliquer un playbook Ansible contenant les paramètres de votre serveur Tang.

Conditions préalables

- Accès et autorisations à un ou plusieurs *managed nodes*, qui sont des systèmes que vous souhaitez configurer avec le rôle de système **nbde_server**.
- Accès et autorisations à un nœud de contrôle, qui est un système à partir duquel Red Hat Ansible Core configure d'autres systèmes.
  Sur le nœud de contrôle :
  - Les paquets **ansible-core** et **rhel-system-roles** sont installés.



IMPORTANT

RHEL 8.0-8.5 provided access to a separate Ansible repository that contains Ansible Engine 2.9 for automation based on Ansible. Ansible Engine contains command-line utilities such as **ansible**, **ansible-playbook**, connectors such as **docker** and **podman**, and many plugins and modules. For information about how to obtain and install Ansible Engine, see the How to download and install Red Hat Ansible Engine Knowledgebase article.

RHEL 8.6 et 9.0 ont introduit Ansible Core (fourni en tant que paquetage **ansible-core**), qui contient les utilitaires de ligne de commande Ansible, les commandes et un petit ensemble de plugins Ansible intégrés. RHEL fournit ce paquetage par l'intermédiaire du dépôt AppStream, et sa prise en charge est limitée. Pour plus d'informations, consultez l'article de la base de connaissances intitulé Scope of support for the Ansible Core package included in the RHEL 9 and RHEL 8.6 and later AppStream repositories (Portée de la prise en charge du package Ansible Core inclus dans les dépôts AppStream RHEL 9 et RHEL 8.6 et versions ultérieures).

- Un fichier d'inventaire qui répertorie les nœuds gérés.

Procédure

1. Préparez votre playbook contenant les paramètres des serveurs Tang. Vous pouvez partir de zéro ou utiliser l'un des playbooks d'exemple du répertoire **/usr/share/ansible/roles/rhel-system-roles.nbde_server/examples/**.

```
# cp /usr/share/ansible/roles/rhel-system-roles.nbde_server/examples/simple_deploy.yml
./my-tang-playbook.yml
```

2. Modifiez le playbook dans un éditeur de texte de votre choix, par exemple :

```
# vi my-tang-playbook.yml
```

3. Ajoutez les paramètres requis. L'exemple de playbook suivant assure le déploiement de votre serveur Tang et une rotation des clés :

```
---
- hosts: all

  vars:
    nbde_server_rotate_keys: yes
    nbde_server_manage_firewall: true
    nbde_server_manage_selinux: true

  roles:
    - rhel-system-roles.nbde_server
```

NOTE

Puisque **nbde_server_manage_firewall** et **nbde_server_manage_selinux** sont tous deux définis sur true, le rôle **nbde_server** utilisera les rôles **firewall** et **selinux** pour gérer les ports utilisés par le rôle **nbde_server**.

4. Appliquer le manuel de jeu terminé :

```
# ansible-playbook -i inventory-file my-tang-playbook.yml
```

Where: * ***inventory-file*** is the inventory file. * ***logging-playbook.yml*** is the playbook you use.

IMPORTANT

Pour s'assurer que la mise en réseau d'une broche Tang est disponible lors du démarrage anticipé, utilisez l'outil **grubby** sur les systèmes où Clevis est installé :

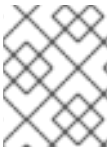
```
# grubby --update-kernel=ALL --args="rd.neednet=1"
```

Ressources supplémentaires

- Pour plus d'informations, installez le paquetage **rhel-system-roles** et consultez les répertoires **/usr/share/doc/rhel-system-roles/nbde_server/** et **usr/share/ansible/roles/rhel-system-roles.nbde_server/**.

11.18. UTILISATION DU RÔLE DE SYSTÈME NBDE_CLIENT POUR CONFIGURER PLUSIEURS CLIENTS CLEVIS

Suivez les étapes pour préparer et appliquer un playbook Ansible contenant les paramètres de votre client Clevis.



NOTE

Le rôle de système **nbde_client** ne prend en charge que les liaisons Tang. Cela signifie que vous ne pouvez pas l'utiliser pour les liaisons TPM2 pour le moment.

Conditions préalables

- Accès et autorisations à un ou plusieurs *managed nodes*, qui sont des systèmes que vous souhaitez configurer avec le rôle de système **nbde_client**.
- Accès et permissions à un *control node*, qui est un système à partir duquel Red Hat Ansible Core configure d'autres systèmes.
- Le paquetage Ansible Core est installé sur la machine de contrôle.
- Le paquetage **rhel-system-roles** est installé sur le système à partir duquel vous souhaitez exécuter le guide de lecture.

Procédure

1. Préparez votre playbook contenant les paramètres pour les clients Clevis. Vous pouvez partir de zéro ou utiliser l'un des playbooks d'exemple du répertoire **/usr/share/ansible/roles/rhel-system-roles.nbde_client/examples/**.

```
# cp /usr/share/ansible/roles/rhel-system-roles.nbde_client/examples/high_availability.yml
./my-clevis-playbook.yml
```

2. Modifiez le playbook dans un éditeur de texte de votre choix, par exemple :

```
# vi my-clevis-playbook.yml
```

3. Ajoutez les paramètres requis. L'exemple suivant configure les clients Clevis pour le déverrouillage automatique de deux volumes cryptés LUKS lorsqu'au moins l'un des deux serveurs Tang est disponible :

```
---
- hosts: all

  vars:
    nbde_client_bindings:
      - device: /dev/rhel/root
        encryption_key_src: /etc/luks/keyfile
        servers:
          - http://server1.example.com
          - http://server2.example.com
      - device: /dev/rhel/swap
        encryption_key_src: /etc/luks/keyfile
        servers:
          - http://server1.example.com
          - http://server2.example.com

  roles:
    - rhel-system-roles.nbde_client
```

4. Appliquer le manuel de jeu terminé :

```
# ansible-playbook -i host1,host2,host3 my-clevis-playbook.yml
```

IMPORTANT

Pour s'assurer que la mise en réseau d'une broche Tang est disponible lors du démarrage anticipé, utilisez l'outil **grubby** sur le système où Clevis est installé :

```
# grubby --update-kernel=ALL --args="rd.neednet=1"
```

Ressources supplémentaires

- Pour plus de détails sur les paramètres et des informations supplémentaires sur le rôle du système client NBDE, installez le paquetage **rhel-system-roles** et consultez les répertoires **/usr/share/doc/rhel-system-roles/nbde_client/** et **/usr/share/ansible/roles/rhel-system-roles.nbde_client/**.

CHAPITRE 12. AUDITING THE SYSTEM

Audit does not provide additional security to your system; rather, it can be used to discover violations of security policies used on your system. These violations can further be prevented by additional security measures such as SELinux.

12.1. LINUX AUDIT

The Linux Audit system provides a way to track security-relevant information about your system. Based on pre-configured rules, Audit generates log entries to record as much information about the events that are happening on your system as possible. This information is crucial for mission-critical environments to determine the violator of the security policy and the actions they performed.

The following list summarizes some of the information that Audit is capable of recording in its log files:

- Date and time, type, and outcome of an event.
- Sensitivity labels of subjects and objects.
- Association of an event with the identity of the user who triggered the event.
- All modifications to Audit configuration and attempts to access Audit log files.
- All uses of authentication mechanisms, such as SSH, Kerberos, and others.
- Changes to any trusted database, such as **/etc/passwd**.
- Attempts to import or export information into or from the system.
- Include or exclude events based on user identity, subject and object labels, and other attributes.

The use of the Audit system is also a requirement for a number of security-related certifications. Audit is designed to meet or exceed the requirements of the following certifications or compliance guides:

- Controlled Access Protection Profile (CAPP)
- Labeled Security Protection Profile (LSPP)
- Rule Set Base Access Control (RSBAC)
- National Industrial Security Program Operating Manual (NISPOM)
- Federal Information Security Management Act (FISMA)
- Payment Card Industry – Data Security Standard (PCI-DSS)
- Security Technical Implementation Guides (STIG)

Audit has also been:

- Evaluated by National Information Assurance Partnership (NIAP) and Best Security Industries (BSI).
- Certified to LSPP/CAPP/RSBAC/EAL4+ on Red Hat Enterprise Linux 5.
- Certified to Operating System Protection Profile / Evaluation Assurance Level 4+ (OSPP/EAL4+) on Red Hat Enterprise Linux 6.

Use Cases

Watching file access

Audit can track whether a file or a directory has been accessed, modified, executed, or the file's attributes have been changed. This is useful, for example, to detect access to important files and have an Audit trail available in case one of these files is corrupted.

Monitoring system calls

Audit can be configured to generate a log entry every time a particular system call is used. This can be used, for example, to track changes to the system time by monitoring the **settimeofday**, **clock_adjtime**, and other time-related system calls.

Recording commands run by a user

Audit can track whether a file has been executed, so rules can be defined to record every execution of a particular command. For example, a rule can be defined for every executable in the /**bin** directory. The resulting log entries can then be searched by user ID to generate an audit trail of executed commands per user.

Recording execution of system pathnames

Aside from watching file access which translates a path to an inode at rule invocation, Audit can now watch the execution of a path even if it does not exist at rule invocation, or if the file is replaced after rule invocation. This allows rules to continue to work after upgrading a program executable or before it is even installed.

Recording security events

The **pam_faillock** authentication module is capable of recording failed login attempts. Audit can be set up to record failed login attempts as well and provides additional information about the user who attempted to log in.

Searching for events

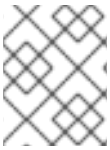
Audit provides the **ausearch** utility, which can be used to filter the log entries and provide a complete audit trail based on several conditions.

Running summary reports

The **aureport** utility can be used to generate, among other things, daily reports of recorded events. A system administrator can then analyze these reports and investigate suspicious activity further.

Monitoring network access

The **nftables**, **iptables**, and **ebtables** utilities can be configured to trigger Audit events, allowing system administrators to monitor network access.



NOTE

System performance may be affected depending on the amount of information that is collected by Audit.

12.2. AUDIT SYSTEM ARCHITECTURE

The Audit system consists of two main parts: the user-space applications and utilities, and the kernel-side system call processing. The kernel component receives system calls from user-space applications and filters them through one of the following filters: **user**, **task**, **fstype**, or **exit**.

Once a system call passes the **exclude** filter, it is sent through one of the aforementioned filters, which, based on the Audit rule configuration, sends it to the Audit daemon for further processing.

The user-space Audit daemon collects the information from the kernel and creates entries in a log file. Other Audit user-space utilities interact with the Audit daemon, the kernel Audit component, or the Audit log files:

- **auditctl** – the Audit control utility interacts with the kernel Audit component to manage rules and to control many settings and parameters of the event generation process.
- The remaining Audit utilities take the contents of the Audit log files as input and generate output based on user's requirements. For example, the **aureport** utility generates a report of all recorded events.

In RHEL 9, the Audit dispatcher daemon (**audisp**) functionality is integrated in the Audit daemon (**auditd**). Configuration files of plugins for the interaction of real-time analytical programs with Audit events are located in the **/etc/audit/plugins.d/** directory by default.

12.3. CONFIGURING AUDITD FOR A SECURE ENVIRONMENT

The default **auditd** configuration should be suitable for most environments. However, if your environment must meet strict security policies, the following settings are suggested for the Audit daemon configuration in the **/etc/audit/auditd.conf** file:

log_file

The directory that holds the Audit log files (usually **/var/log/audit/**) should reside on a separate mount point. This prevents other processes from consuming space in this directory and provides accurate detection of the remaining space for the Audit daemon.

max_log_file

Specifies the maximum size of a single Audit log file, must be set to make full use of the available space on the partition that holds the Audit log files. The **max_log_file**` parameter specifies the maximum file size in megabytes. The value given must be numeric.

max_log_file_action

Decides what action is taken once the limit set in **max_log_file** is reached, should be set to **keep_logs** to prevent Audit log files from being overwritten.

space_left

Specifies the amount of free space left on the disk for which an action that is set in the **space_left_action** parameter is triggered. Must be set to a number that gives the administrator enough time to respond and free up disk space. The **space_left** value depends on the rate at which the Audit log files are generated. If the value of space_left is specified as a whole number, it is interpreted as an absolute size in megabytes (MiB). If the value is specified as a number between 1 and 99 followed by a percentage sign (for example, 5%), the Audit daemon calculates the absolute size in megabytes based on the size of the file system containing **log_file**.

space_left_action

It is recommended to set the **space_left_action** parameter to **email** or **exec** with an appropriate notification method.

admin_space_left

Specifies the absolute minimum amount of free space for which an action that is set in the **admin_space_left_action** parameter is triggered, must be set to a value that leaves enough space to log actions performed by the administrator. The numeric value for this parameter should be lower than the number for space_left. You can also append a percent sign (for example, 1%) to the number to have the audit daemon calculate the number based on the disk partition size.

admin_space_left_action

Should be set to **single** to put the system into single-user mode and allow the administrator to free up some disk space.

disk_full_action

Specifies an action that is triggered when no free space is available on the partition that holds the Audit log files, must be set to **halt** or **single**. This ensures that the system is either shut down or operating in single-user mode when Audit can no longer log events.

disk_error_action

Specifies an action that is triggered in case an error is detected on the partition that holds the Audit log files, must be set to **syslog**, **single**, or **halt**, depending on your local security policies regarding the handling of hardware malfunctions.

flush

Should be set to **incremental_async**. It works in combination with the **freq** parameter, which determines how many records can be sent to the disk before forcing a hard synchronization with the hard drive. The **freq** parameter should be set to **100**. These parameters assure that Audit event data is synchronized with the log files on the disk while keeping good performance for bursts of activity.

The remaining configuration options should be set according to your local security policy.

12.4. STARTING AND CONTROLLING AUDITD

After **auditd** is configured, start the service to collect Audit information and store it in the log files. Use the following command as the root user to start **auditd**:

```
# service auditd start
```

To configure **auditd** to start at boot time:

```
# systemctl enable auditd
```

You can temporarily disable **auditd** with the **# auditctl -e 0** command and re-enable it with **# auditctl -e 1**.

A number of other actions can be performed on **auditd** using the **service auditd *action*** command, where *action* can be one of the following:

stop

Stops **auditd**.

restart

Restarts **auditd**.

reload or **force-reload**

Reloads the configuration of **auditd** from the **/etc/audit/auditd.conf** file.

rotate

Rotates the log files in the **/var/log/audit/** directory.

resume

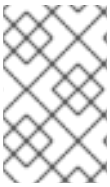
Resumes logging of Audit events after it has been previously suspended, for example, when there is not enough free space on the disk partition that holds the Audit log files.

condrestart or **try-restart**

Restarts **auditd** only if it is already running.

status

Displays the running status of **auditd**.



NOTE

The **service** command is the only way to correctly interact with the **auditd** daemon. You need to use the **service** command so that the **auid** value is properly recorded. You can use the **systemctl** command only for two actions: **enable** and **status**.

12.5. UNDERSTANDING AUDIT LOG FILES

By default, the Audit system stores log entries in the **/var/log/audit/audit.log** file; if log rotation is enabled, rotated **audit.log** files are stored in the same directory.

Add the following Audit rule to log every attempt to read or modify the **/etc/ssh/sshd_config** file:

```
# auditctl -w /etc/ssh/sshd_config -p warx -k sshd_config
```

If the **auditd** daemon is running, for example, using the following command creates a new event in the Audit log file:

```
$ cat /etc/ssh/sshd_config
```

This event in the **audit.log** file looks as follows:

```
type=SYSCALL msg=audit(1364481363.243:24287): arch=c000003e syscall=2 success=no exit=-13
a0=7fffd19c5592 a1=0 a2=7fffd19c4b50 a3=a items=1 ppid=2686 pid=3538 auid=1000 uid=1000
gid=1000 euid=1000 suid=1000 fsuid=1000 egid=1000 sgid=1000 fsgid=1000 tty=pts0 ses=1
comm="cat" exe="/bin/cat" subj=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023
key="sshd_config"
type=CWD msg=audit(1364481363.243:24287):  cwd="/home/shadowman"
type=PATH msg=audit(1364481363.243:24287): item=0 name="/etc/ssh/sshd_config" inode=409248
dev=fd:00 mode=0100600 ouid=0 ogid=0 rdev=00:00 obj=system_u:object_r:etc_t:s0
nametype=NORMAL cap_fp=none cap_fi=none cap_fe=0 cap_fver=0
type=PROCTITLE msg=audit(1364481363.243:24287) :
proctitle=636174002F6574632F7373682F737368645F636F6E666967
```

The above event consists of four records, which share the same time stamp and serial number. Records always start with the **type=** keyword. Each record consists of several ***name=value*** pairs separated by a white space or a comma. A detailed analysis of the above event follows:

First Record

type=SYSCALL

The **type** field contains the type of the record. In this example, the **SYSCALL** value specifies that this record was triggered by a system call to the kernel.

msg=audit(1364481363.243:24287):

The **msg** field records:

- a time stamp and a unique ID of the record in the form **audit(*time_stamp*:*ID*)**. Multiple records can share the same time stamp and ID if they were generated as part of the same Audit event. The time stamp is using the Unix time format - seconds since 00:00:00 UTC on 1 January 1970.

- various event-specific ***name=value*** pairs provided by the kernel or user-space applications.

arch=c000003e

The **arch** field contains information about the CPU architecture of the system. The value, **c000003e**, is encoded in hexadecimal notation. When searching Audit records with the **ausearch** command, use the **-i** or **--interpret** option to automatically convert hexadecimal values into their human-readable equivalents. The **c000003e** value is interpreted as **x86_64**.

syscall=2

The **syscall** field records the type of the system call that was sent to the kernel. The value, **2**, can be matched with its human-readable equivalent in the **/usr/include/asm/unistd_64.h** file. In this case, **2** is the **open** system call. Note that the **ausyscall** utility allows you to convert system call numbers to their human-readable equivalents. Use the **ausyscall --dump** command to display a listing of all system calls along with their numbers. For more information, see the **ausyscall**(8) man page.

success=no

The **success** field records whether the system call recorded in that particular event succeeded or failed. In this case, the call did not succeed.

exit=-13

The **exit** field contains a value that specifies the exit code returned by the system call. This value varies for a different system call. You can interpret the value to its human-readable equivalent with the following command:

```
# ausearch --interpret --exit -13
```

Note that the previous example assumes that your Audit log contains an event that failed with exit code **-13**.

a0=7fffd19c5592, a1=0, a2=7fffd19c5592, a3=a

The **a0** to **a3** fields record the first four arguments, encoded in hexadecimal notation, of the system call in this event. These arguments depend on the system call that is used; they can be interpreted by the **ausearch** utility.

items=1

The **items** field contains the number of PATH auxiliary records that follow the syscall record.

ppid=2686

The **ppid** field records the Parent Process ID (PPID). In this case, **2686** was the PPID of the parent process such as **bash**.

pid=3538

The **pid** field records the Process ID (PID). In this case, **3538** was the PID of the **cat** process.

auid=1000

The **auid** field records the Audit user ID, that is the loginuid. This ID is assigned to a user upon login and is inherited by every process even when the user's identity changes, for example, by switching user accounts with the **su - john** command.

uid=1000

The **uid** field records the user ID of the user who started the analyzed process. The user ID can be interpreted into user names with the following command: **ausearch -i --uid *UID***.

gid=1000

The **gid** field records the group ID of the user who started the analyzed process.

euid=1000

The **euid** field records the effective user ID of the user who started the analyzed process.

suid=1000

The **suid** field records the set user ID of the user who started the analyzed process.

fsuid=1000

The **fsuid** field records the file system user ID of the user who started the analyzed process.

egid=1000

The **egid** field records the effective group ID of the user who started the analyzed process.

sgid=1000

The **sgid** field records the set group ID of the user who started the analyzed process.

fsgid=1000

The **fsgid** field records the file system group ID of the user who started the analyzed process.

tty=pts0

The **tty** field records the terminal from which the analyzed process was invoked.

ses=1

The **ses** field records the session ID of the session from which the analyzed process was invoked.

comm="cat"

The **comm** field records the command-line name of the command that was used to invoke the analyzed process. In this case, the **cat** command was used to trigger this Audit event.

exe="/bin/cat"

The **exe** field records the path to the executable that was used to invoke the analyzed process.

subj=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023

The **subj** field records the SELinux context with which the analyzed process was labeled at the time of execution.

key="sshd_config"

The **key** field records the administrator-defined string associated with the rule that generated this event in the Audit log.

Second Record

type=CWD

In the second record, the **type** field value is **CWD** – current working directory. This type is used to record the working directory from which the process that invoked the system call specified in the first record was executed.
The purpose of this record is to record the current process's location in case a relative path winds up being captured in the associated PATH record. This way the absolute path can be reconstructed.

msg=audit(1364481363.243:24287)

The **msg** field holds the same time stamp and ID value as the value in the first record. The time stamp is using the Unix time format - seconds since 00:00:00 UTC on 1 January 1970.

cwd="/home/*user_name*"

The **cwd** field contains the path to the directory in which the system call was invoked.

Third Record

type=PATH

In the third record, the **type** field value is **PATH**. An Audit event contains a **PATH**-type record for every path that is passed to the system call as an argument. In this Audit event, only one path (**/etc/ssh/sshd_config**) was used as an argument.

msg=audit(1364481363.243:24287):

The **msg** field holds the same time stamp and ID value as the value in the first and second record.

item=0

The **item** field indicates which item, of the total number of items referenced in the **SYSCALL** type record, the current record is. This number is zero-based; a value of **0** means it is the first item.

name="/etc/ssh/sshd_config"

The **name** field records the path of the file or directory that was passed to the system call as an argument. In this case, it was the **/etc/ssh/sshd_config** file.

inode=409248

The **inode** field contains the inode number associated with the file or directory recorded in this event. The following command displays the file or directory that is associated with the **409248** inode number:

```
# find / -inum 409248 -print
/etc/ssh/sshd_config
```

dev=fd:00

The **dev** field specifies the minor and major ID of the device that contains the file or directory recorded in this event. In this case, the value represents the **/dev/fd/0** device.

mode=0100600

The **mode** field records the file or directory permissions, encoded in numerical notation as returned by the **stat** command in the **st_mode** field. See the **stat(2)** man page for more information. In this case, **0100600** can be interpreted as **-rw-------**, meaning that only the root user has read and write permissions to the **/etc/ssh/sshd_config** file.

ouid=0

The **ouid** field records the object owner's user ID.

ogid=0

The **ogid** field records the object owner's group ID.

rdev=00:00

The **rdev** field contains a recorded device identifier for special files only. In this case, it is not used as the recorded file is a regular file.

obj=system_u:object_r:etc_t:s0

The **obj** field records the SELinux context with which the recorded file or directory was labeled at the time of execution.

nametype=NORMAL

The **nametype** field records the intent of each path record's operation in the context of a given syscall.

cap_fp=none

The **cap_fp** field records data related to the setting of a permitted file system-based capability of the file or directory object.

cap_fi=none

The **cap_fi** field records data related to the setting of an inherited file system-based capability of the file or directory object.

cap_fe=0

The **cap_fe** field records the setting of the effective bit of the file system-based capability of the file or directory object.

cap_fver=0

The **cap_fver** field records the version of the file system-based capability of the file or directory object.

Fourth Record

type=PROCTITLE

The **type** field contains the type of the record. In this example, the **PROCTITLE** value specifies that this record gives the full command-line that triggered this Audit event, triggered by a system call to the kernel.

proctitle=636174002F6574632F7373682F737368645F636F6E666967

The **proctitle** field records the full command-line of the command that was used to invoke the analyzed process. The field is encoded in hexadecimal notation to not allow the user to influence the Audit log parser. The text decodes to the command that triggered this Audit event. When searching Audit records with the **ausearch** command, use the **-i** or **--interpret** option to automatically convert hexadecimal values into their human-readable equivalents. The **636174002F6574632F7373682F737368645F636F6E666967** value is interpreted as **cat /etc/ssh/sshd_config**.

12.6. USING AUDITCTL FOR DEFINING AND EXECUTING AUDIT RULES

The Audit system operates on a set of rules that define what is captured in the log files. Audit rules can be set either on the command line using the **auditctl** utility or in the **/etc/audit/rules.d/** directory.

The **auditctl** command enables you to control the basic functionality of the Audit system and to define rules that decide which Audit events are logged.

File-system rules examples

1. To define a rule that logs all write access to, and every attribute change of, the **/etc/passwd** file:

```
# auditctl -w /etc/passwd -p wa -k passwd_changes
```

2. To define a rule that logs all write access to, and every attribute change of, all the files in the **/etc/selinux/** directory:

```
# auditctl -w /etc/selinux/ -p wa -k selinux_changes
```

System-call rules examples

1. To define a rule that creates a log entry every time the **adjtimex** or **settimeofday** system calls are used by a program, and the system uses the 64-bit architecture:

```
# auditctl -a always,exit -F arch=b64 -S adjtimex -S settimeofday -k time_change
```

2. To define a rule that creates a log entry every time a file is deleted or renamed by a system user whose ID is 1000 or larger:

```
# auditctl -a always,exit -S unlink -S unlinkat -S rename -S renameat -F auid>=1000 -F
auid!=4294967295 -k delete
```

Note that the **-F auid!=4294967295** option is used to exclude users whose login UID is not set.

Executable-file rules

To define a rule that logs all execution of the **/bin/id** program, execute the following command:

```
# auditctl -a always,exit -F exe=/bin/id -F arch=b64 -S execve -k execution_bin_id
```

Ressources supplémentaires

- **auditctl(8)** man page.

12.7. DEFINING PERSISTENT AUDIT RULES

To define Audit rules that are persistent across reboots, you must either directly include them in the **/etc/audit/rules.d/audit.rules** file or use the **augenrules** program that reads rules located in the **/etc/audit/rules.d/** directory.

Note that the **/etc/audit/audit.rules** file is generated whenever the **auditd** service starts. Files in **/etc/audit/rules.d/** use the same **auditctl** command-line syntax to specify the rules. Empty lines and text following a hash sign (#) are ignored.

Furthermore, you can use the **auditctl** command to read rules from a specified file using the **-R** option, for example:

```
# auditctl -R /usr/share/audit/sample-rules/30-stig.rules
```

12.8. USING PRE-CONFIGURED RULES FILES

In the **/usr/share/audit/sample-rules** directory, the **audit** package provides a set of pre-configured rules files according to various certification standards:

30-nispom.rules

Audit rule configuration that meets the requirements specified in the Information System Security chapter of the National Industrial Security Program Operating Manual.

30-ospp-v42*.rules

Audit rule configuration that meets the requirements defined in the OSPP (Protection Profile for General Purpose Operating Systems) profile version 4.2.

30-pci-dss-v31.rules

Audit rule configuration that meets the requirements set by Payment Card Industry Data Security Standard (PCI DSS) v3.1.

30-stig.rules

Audit rule configuration that meets the requirements set by Security Technical Implementation Guides (STIG).

To use these configuration files, copy them to the **/etc/audit/rules.d/** directory and use the **augenrules --load** command, for example:

```
# cd /usr/share/audit/sample-rules/
# cp 10-base-config.rules 30-stig.rules 31-privileged.rules 99-finalize.rules /etc/audit/rules.d/
# augenrules --load
```

You can order Audit rules using a numbering scheme. See the **/usr/share/audit/sample-rules/README-rules** file for more information.

Ressources supplémentaires

- **audit.rules(7)** man page.

12.9. USING AUGENRULES TO DEFINE PERSISTENT RULES

The **augenrules** script reads rules located in the **/etc/audit/rules.d/** directory and compiles them into an **audit.rules** file. This script processes all files that end with **.rules** in a specific order based on their natural sort order. The files in this directory are organized into groups with the following meanings:

- 10 - Kernel and auditctl configuration
- 20 - Rules that could match general rules but you want a different match
- 30 - Main rules
- 40 - Optional rules
- 50 - Server-specific rules
- 70 - System local rules
- 90 - Finalize (immutable)

The rules are not meant to be used all at once. They are pieces of a policy that should be thought out and individual files copied to **/etc/audit/rules.d/**. For example, to set a system up in the STIG configuration, copy rules **10-base-config**, **30-stig**, **31-privileged**, and **99-finalize**.

Once you have the rules in the **/etc/audit/rules.d/** directory, load them by running the **augenrules** script with the **--load** directive:

```
# augenrules --load
/sbin/augenrules: No change
No rules
enabled 1
failure 1
pid 742
rate_limit 0
...
```

Ressources supplémentaires

- **audit.rules(8)** and **augenrules(8)** man pages.

12.10. DISABLING AUGENRULES

Use the following steps to disable the **augenrules** utility. This switches Audit to use rules defined in the **/etc/audit/audit.rules** file.

Procédure

1. Copy the **/usr/lib/systemd/system/auditd.service** file to the **/etc/systemd/system/** directory:

```
# cp -f /usr/lib/systemd/system/auditd.service /etc/systemd/system/
```

2. Edit the **/etc/systemd/system/auditd.service** file in a text editor of your choice, for example:

```
# vi /etc/systemd/system/auditd.service
```

3. Comment out the line containing **augenrules**, and uncomment the line containing the **auditctl -R** command:

```
#ExecStartPost=-/sbin/augenrules --load
ExecStartPost=-/sbin/auditctl -R /etc/audit/audit.rules
```

4. Reload the **systemd** daemon to fetch changes in the **auditd.service** file:

```
# systemctl daemon-reload
```

5. Restart the **auditd** service:

```
# service auditd restart
```

Ressources supplémentaires

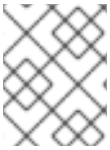
- **augenrules(8)** and **audit.rules(8)** man pages.
- Auditd service restart overrides changes made to /etc/audit/audit.rules .

12.11. SETTING UP AUDIT TO MONITOR SOFTWARE UPDATES

You can use the pre-configured rule **44-installers.rules** to configure Audit to monitor the following utilities that install software:

- **dnf** [2]
- **yum**
- **pip**
- **npm**
- **cpan**
- **gem**
- **luarocks**

To monitor the **rpm** utility, install the **rpm-plugin-audit** package. Audit will then generate **SOFTWARE_UPDATE** events when it installs or updates a package. You can list these events by entering **ausearch -m SOFTWARE_UPDATE** on the command line.



NOTE

Pre-configured rule files cannot be used on systems with the **ppc64le** and **aarch64** architectures.

Conditions préalables

- **auditd** is configured in accordance with the settings provided in Configuring auditd for a secure environment .

Procédure

1. Copy the pre-configured rule file **44-installers.rules** from the **/usr/share/audit/sample-rules/** directory to the **/etc/audit/rules.d/** directory:

```
# cp /usr/share/audit/sample-rules/44-installers.rules /etc/audit/rules.d/
```

2. Load the audit rules:

```
# augenrules --load
```

Vérification

1. List the loaded rules:

```
# auditctl -l
-p x-w /usr/bin/dnf-3 -k software-installer
-p x-w /usr/bin/yum -k software-installer
-p x-w /usr/bin/pip -k software-installer
-p x-w /usr/bin/npm -k software-installer
-p x-w /usr/bin/cpan -k software-installer
-p x-w /usr/bin/gem -k software-installer
-p x-w /usr/bin/luarocks -k software-installer
```

2. Perform an installation, for example:

```
# dnf reinstall -y vim-enhanced
```

3. Search the Audit log for recent installation events, for example:

```
# ausearch -ts recent -k software-installer
----
time->Thu Dec 16 10:33:46 2021
type=PROCTITLE msg=audit(1639668826.074:298):
proctitle=2F7573722F6C6962657865632F706C6174666F726D2D707974686F6E002F75737
22F62696E2F646E66007265696E7374616C6C002D790076696D2D656E68616E636564
type=PATH msg=audit(1639668826.074:298): item=2 name="/lib64/ld-linux-x86-64.so.2"
inode=10092 dev=fd:01 mode=0100755 ouid=0 ogid=0 rdev=00:00
obj=system_u:object_r:ld_so_t:s0 nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0
```

```
cap_fver=0 cap_frootid=0
type=PATH msg=audit(1639668826.074:298): item=1 name="/usr/libexec/platform-python"
inode=4618433 dev=fd:01 mode=0100755 ouid=0 ogid=0 rdev=00:00
obj=system_u:object_r:bin_t:s0 nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0
cap_fver=0 cap_frootid=0
type=PATH msg=audit(1639668826.074:298): item=0 name="/usr/bin/dnf" inode=6886099
dev=fd:01 mode=0100755 ouid=0 ogid=0 rdev=00:00 obj=system_u:object_r:rpm_exec_t:s0
nametype=NORMAL cap_fp=0 cap_fi=0 cap_fe=0 cap_fver=0 cap_frootid=0
type=CWD msg=audit(1639668826.074:298): cwd="/root"
type=EXECVE msg=audit(1639668826.074:298): argc=5 a0="/usr/libexec/platform-python"
a1="/usr/bin/dnf" a2="reinstall" a3="-y" a4="vim-enhanced"
type=SYSCALL msg=audit(1639668826.074:298): arch=c000003e syscall=59 success=yes
exit=0 a0=55c437f22b20 a1=55c437f2c9d0 a2=55c437f2aeb0 a3=8 items=3 ppid=5256
pid=5375 auid=0 uid=0 gid=0 euid=0 suid=0 fsuid=0 egid=0 sgid=0 fsgid=0 tty=pts0 ses=3
comm="dnf" exe="/usr/libexec/platform-python3.6"
subj=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023 key="software-installer"
```

12.12. MONITORING USER LOGIN TIMES WITH AUDIT

To monitor which users logged in at specific times, you do not need to configure Audit in any special way. You can use the **ausearch** or **aureport** tools, which provide different ways of presenting the same information.

Conditions préalables

- **auditd** is configured in accordance with the settings provided in Configuring auditd for a secure environment .

Procédure

To display user log in times, use any one of the following commands:

- Search the audit log for the **USER_LOGIN** message type:

```
# ausearch -m USER_LOGIN -ts '12/02/2020' '18:00:00' -sv no
time->Mon Nov 22 07:33:22 2021
type=USER_LOGIN msg=audit(1637584402.416:92): pid=1939 uid=0 auid=4294967295
ses=4294967295 subj=system_u:system_r:sshd_t:s0-s0:c0.c1023 msg='op=login acct="
(unknown)" exe="/usr/sbin/sshd" hostname=? addr=10.37.128.108 terminal=ssh res=failed'
```

  - You can specify the date and time with the **-ts** option. If you do not use this option, **ausearch** provides results from today, and if you omit time, **ausearch** provides results from midnight.
  - You can use the **-sv yes** option to filter out successful login attempts and **-sv no** for unsuccessful login attempts.

- Pipe the raw output of the **ausearch** command into the **aulast** utility, which displays the output in a format similar to the output of the **last** command. For example:

```
# ausearch --raw | aulast --stdin
root     ssh          10.37.128.108    Mon Nov 22 07:33 - 07:33  (00:00)
root     ssh          10.37.128.108    Mon Nov 22 07:33 - 07:33  (00:00)
root     ssh          10.22.16.106     Mon Nov 22 07:40 - 07:40  (00:00)
reboot   system boot  4.18.0-348.6.el8 Mon Nov 22 07:33
```

- Display the list of login events by using the **aureport** command with the **--login -i** options.

```
# aureport --login -i

Login Report
============================================
# date time auid host term exe success event
============================================
1. 11/16/2021 13:11:30 root 10.40.192.190 ssh /usr/sbin/sshd yes 6920
2. 11/16/2021 13:11:31 root 10.40.192.190 ssh /usr/sbin/sshd yes 6925
3. 11/16/2021 13:11:31 root 10.40.192.190 ssh /usr/sbin/sshd yes 6930
4. 11/16/2021 13:11:31 root 10.40.192.190 ssh /usr/sbin/sshd yes 6935
5. 11/16/2021 13:11:33 root 10.40.192.190 ssh /usr/sbin/sshd yes 6940
6. 11/16/2021 13:11:33 root 10.40.192.190 /dev/pts/0 /usr/sbin/sshd yes 6945
```

Ressources supplémentaires

- The **ausearch(8)** man page.
- The **aulast(8)** man page.
- The **aureport(8)** man page.

12.13. RESSOURCES SUPPLÉMENTAIRES

- The RHEL Audit System Reference Knowledgebase article.
- The Auditd execution options in a container Knowledgebase article.
- The Linux Audit Documentation Project page .
- The **audit** package provides documentation in the **/usr/share/doc/audit/** directory.
- **auditd(8)**, **auditctl(8)**, **ausearch(8)**, **audit.rules(7)**, **audispd.conf(5)**, **audispd(8)**, **auditd.conf(5)**, **ausearch-expression(5)**, **aulast(8)**, **aulastlog(8)**, **aureport(8)**, **ausyscall(8)**, **autrace(8)**, and **auvirt(8)** man pages.

[2] Because **dnf** is a symlink in RHEL, the path in the**dnf** Audit rule must include the target of the symlink. To receive correct Audit events, modify the **44-installers.rules** file by changing the **path=/usr/bin/dnf** path to **/usr/bin/dnf-3**.

CHAPITRE 13. BLOCKING AND ALLOWING APPLICATIONS USING FAPOLICYD

Setting and enforcing a policy that either allows or denies application execution based on a rule set efficiently prevents the execution of unknown and potentially malicious software.

13.1. INTRODUCTION TO FAPOLICYD

The **fapolicyd** software framework controls the execution of applications based on a user-defined policy. This is one of the most efficient ways to prevent running untrusted and possibly malicious applications on the system.

The **fapolicyd** framework provides the following components:

- **fapolicyd** service
- **fapolicyd** command-line utilities
- **fapolicyd** RPM plugin
- **fapolicyd** rule language
- **fagenrules** script

The administrator can define the **allow** and **deny** execution rules for any application with the possibility of auditing based on a path, hash, MIME type, or trust.

The **fapolicyd** framework introduces the concept of trust. An application is trusted when it is properly installed by the system package manager, and therefore it is registered in the system RPM database. The **fapolicyd** daemon uses the RPM database as a list of trusted binaries and scripts. The **fapolicyd** RPM plugin registers any system update that is handled by either the DNF package manager or the RPM Package Manager. The plugin notifies the **fapolicyd** daemon about changes in this database. Other ways of adding applications require the creation of custom rules and restarting the **fapolicyd** service.

The **fapolicyd** service configuration is located in the **/etc/fapolicyd/** directory with the following structure:

- The **/etc/fapolicyd/fapolicyd.trust** file contains a list of trusted files. You can also use multiple trust files in the **/etc/fapolicyd/trust.d/** directory.
- The **/etc/fapolicyd/rules.d/** directory for files containing **allow** and **deny** execution rules. The **fagenrules** script merges these component rules files to the **/etc/fapolicyd/compiled.rules** file.
- The **fapolicyd.conf** file contains the daemon's configuration options. This file is useful primarily for performance-tuning purposes.

Rules in **/etc/fapolicyd/rules.d/** are organized in several files, each representing a different policy goal. The numbers at the beginning of the corresponding file names determine the order in **/etc/fapolicyd/compiled.rules**:

- 10 - language rules
- 20 - Dracut-related Rules
- 21 - rules for updaters

- 30 - patterns
- 40 - ELF rules
- 41 - shared objects rules
- 42 - trusted ELF rules
- 70 - trusted language rules
- 72 - shell rules
- 90 - deny execute rules
- 95 - allow open rules

You can use one of the ways for **fapolicyd** integrity checking:

- file-size checking
- comparing SHA-256 hashes
- Integrity Measurement Architecture (IMA) subsystem

By default, **fapolicyd** does no integrity checking. Integrity checking based on the file size is fast, but an attacker can replace the content of the file and preserve its byte size. Computing and checking SHA-256 checksums is more secure, but it affects the performance of the system. The **integrity = ima** option in **fapolicyd.conf** requires support for files extended attributes (also known as *xattr*) on all file systems containing executable files.

Ressources supplémentaires

- **fapolicyd(8)**, **fapolicyd.rules(5)**, **fapolicyd.conf(5)**, **fapolicyd.trust(13)**, **fagenrules(8)**, and **fapolicyd-cli(1)** man pages.
- The Enhancing security with the kernel integrity subsystem chapter in the Managing, monitoring, and updating the kernel document.
- The documentation installed with the **fapolicyd** package in the **/usr/share/doc/fapolicyd/** directory and the **/usr/share/fapolicyd/sample-rules/README-rules** file.

13.2. DEPLOYING FAPOLICYD

To deploy the **fapolicyd** framework in RHEL:

Procédure

1. Install the **fapolicyd** package:

```
# dnf install fapolicyd
```

2. Enable and start the **fapolicyd** service:

```
# systemctl enable --now fapolicyd
```

Vérification

1. Verify that the **fapolicyd** service is running correctly:

```
# systemctl status fapolicyd
● fapolicyd.service - File Access Policy Daemon
   Loaded: loaded (/usr/lib/systemd/system/fapolicyd.service; enabled; vendor p>
   Active: active (running) since Tue 2019-10-15 18:02:35 CEST; 55s ago
  Process: 8818 ExecStart=/usr/sbin/fapolicyd (code=exited, status=0/SUCCESS)
 Main PID: 8819 (fapolicyd)
    Tasks: 4 (limit: 11500)
   Memory: 78.2M
   CGroup: /system.slice/fapolicyd.service
           └─8819 /usr/sbin/fapolicyd

Oct 15 18:02:35 localhost.localdomain systemd[1]: Starting File Access Policy D>
Oct 15 18:02:35 localhost.localdomain fapolicyd[8819]: Initialization of the da>
Oct 15 18:02:35 localhost.localdomain fapolicyd[8819]: Reading RPMDB into memory
Oct 15 18:02:35 localhost.localdomain systemd[1]: Started File Access Policy Da>
Oct 15 18:02:36 localhost.localdomain fapolicyd[8819]: Creating database
```

2. Log in as a user without root privileges, and check that **fapolicyd** is working, for example:

```
$ cp /bin/ls /tmp
$ /tmp/ls
bash: /tmp/ls: Operation not permitted
```

13.3. MARKING FILES AS TRUSTED USING AN ADDITIONAL SOURCE OF TRUST

The **fapolicyd** framework trusts files contained in the RPM database. You can mark additional files as trusted by adding the corresponding entries to the **/etc/fapolicyd/fapolicyd.trust** plain-text file or the **/etc/fapolicyd/trust.d/** directory, which supports separating a list of trusted files into more files. You can modify **fapolicyd.trust** or the files in **/etc/fapolicyd/trust.d** either directly using a text editor or through **fapolicyd-cli** commands.

NOTE

Marking files as trusted using **fapolicyd.trust** or **trust.d/** is better than writing custom **fapolicyd** rules due to performance reasons.

Conditions préalables

- The **fapolicyd** framework is deployed on your system.

Procédure

1. Copy your custom binary to the required directory, for example:

```
$ cp /bin/ls /tmp
$ /tmp/ls
bash: /tmp/ls: Operation not permitted
```

2. Mark your custom binary as trusted, and store the corresponding entry to the **myapp** file in **/etc/fapolicyd/trust.d/**:

```
# fapolicyd-cli --file add /tmp/ls --trust-file myapp
```

   - If you skip the **--trust-file** option, then the previous command adds the corresponding line to **/etc/fapolicyd/fapolicyd.trust**.
   - To mark all existing files in a directory as trusted, provide the directory path as an argument of the **--file** option, for example: **fapolicyd-cli --file add /tmp/my_bin_dir/ --trust-file myapp**.

3. Update the **fapolicyd** database:

```
# fapolicyd-cli --update
```

NOTE

Changing the content of a trusted file or directory changes their checksum, and therefore **fapolicyd** no longer considers them trusted.

To make the new content trusted again, refresh the file trust database by using the **fapolicyd-cli --file update** command. If you do not provide any argument, the entire database refreshes. Alternatively, you can specify a path to a specific file or directory. Then, update the database by using **fapolicyd-cli --update**.

Vérification

1. Check that your custom binary can be now executed, for example:

```
$ /tmp/ls
ls
```

Ressources supplémentaires

- **fapolicyd.trust(13)** man page.

13.4. ADDING CUSTOM ALLOW AND DENY RULES FOR FAPOLICYD

The default set of rules in the **fapolicyd** package does not affect system functions. For custom scenarios, such as storing binaries and scripts in a non-standard directory or adding applications without the **dnf** or **rpm** installers, you must either mark additional files as trusted or add new custom rules.

For basic scenarios, prefer Marking files as trusted using an additional source of trust . In more advanced scenarios such as allowing to execute a custom binary only for specific user and group identifiers, add new custom rules to the **/etc/fapolicyd/rules.d/** directory.

The following steps demonstrate adding a new rule to allow a custom binary.

Conditions préalables

- The **fapolicyd** framework is deployed on your system.

Procédure

1. Copy your custom binary to the required directory, for example:

```
$ cp /bin/ls /tmp
$ /tmp/ls
bash: /tmp/ls: Operation not permitted
```

2. Stop the **fapolicyd** service:

```
# systemctl stop fapolicyd
```

3. Use debug mode to identify a corresponding rule. Because the output of the **fapolicyd --debug** command is verbose and you can stop it only by pressing **Ctrl**+**C** or killing the corresponding process, redirect the error output to a file. In this case, you can limit the output only to access denials by using the **--debug-deny** option instead of **--debug**:

```
# fapolicyd --debug-deny 2> fapolicy.output &
[1] 51341
```

   Alternatively, you can run **fapolicyd** debug mode in another terminal.

4. Repeat the command that **fapolicyd** denied:

```
$ /tmp/ls
bash: /tmp/ls: Operation not permitted
```

5. Stop debug mode by resuming it in the foreground and pressing **Ctrl**+**C**:

```
# fg
fapolicyd --debug 2> fapolicy.output
^C
...
```

   Alternatively, kill the process of **fapolicyd** debug mode:

```
# kill 51341
```

6. Find a rule that denies the execution of your application:

```
# cat fapolicy.output | grep 'deny_audit'
...
rule=13 dec=deny_audit perm=execute auid=0 pid=6855 exe=/usr/bin/bash : path=/tmp/ls
ftype=application/x-executable trust=0
```

7. Locate the file that contains a rule that prevented the execution of your custom binary. In this case, the **deny_audit perm=execute** rule belongs to the **90-deny-execute.rules** file:

```
# ls /etc/fapolicyd/rules.d/
10-languages.rules  40-bad-elf.rules    72-shell.rules
20-dracut.rules     41-shared-obj.rules    90-deny-execute.rules
21-updaters.rules   42-trusted-elf.rules   95-allow-open.rules
30-patterns.rules   70-trusted-lang.rules
```

```
# cat /etc/fapolicyd/rules.d/90-deny-execute.rules
# Deny execution for anything untrusted

deny_audit perm=execute all : all
```

8. Add a new **allow** rule to the file that lexically *precedes* the rule file that contains the rule that denied the execution of your custom binary in the **/etc/fapolicyd/rules.d/** directory:

```
# touch /etc/fapolicyd/rules.d/80-myapps.rules
# vi /etc/fapolicyd/rules.d/80-myapps.rules
```

Insert the following rule to the **80-myapps.rules** file:

```
allow perm=execute exe=/usr/bin/bash trust=1 : path=/tmp/ls ftype=application/x-executable
trust=0
```

Alternatively, you can allow executions of all binaries in the **/tmp** directory by adding the following rule to the rule file in **/etc/fapolicyd/rules.d/**:

```
allow perm=execute exe=/usr/bin/bash trust=1 : dir=/tmp/ trust=0
```

9. To prevent changes in the content of your custom binary, define the required rule using an SHA-256 checksum:

```
$ sha256sum /tmp/ls
780b75c90b2d41ea41679fcb358c892b1251b68d1927c80fbc0d9d148b25e836  ls
```

Change the rule to the following definition:

```
allow perm=execute exe=/usr/bin/bash trust=1 :
sha256hash=780b75c90b2d41ea41679fcb358c892b1251b68d1927c80fbc0d9d148b25e836
```

10. Check that the list of compiled differs from the rule set in **/etc/fapolicyd/rules.d/**, and update the list, which is stored in the **/etc/fapolicyd/compiled.rules** file:

```
# fagenrules --check
/usr/sbin/fagenrules: Rules have changed and should be updated
# fagenrules --load
```

11. Check that your custom rule is in the list of **fapolicyd** rules before the rule that prevented the execution:

```
# fapolicyd-cli --list
...
13. allow perm=execute exe=/usr/bin/bash trust=1 : path=/tmp/ls ftype=application/x-
executable trust=0
14. deny_audit perm=execute all : all
...
```

12. Start the **fapolicyd** service:

```
# systemctl start fapolicyd
```

Vérification

1. Check that your custom binary can be now executed, for example:

```
$ /tmp/ls
ls
```

Ressources supplémentaires

- **fapolicyd.rules(5)** and **fapolicyd-cli(1)** man pages.
- The documentation installed with the **fapolicyd** package in the **/usr/share/fapolicyd/sample-rules/README-rules** file.

13.5. ENABLING FAPOLICYD INTEGRITY CHECKS

By default, **fapolicyd** does not perform integrity checking. You can configure **fapolicyd** to perform integrity checks by comparing either file sizes or SHA-256 hashes. You can also set integrity checks by using the Integrity Measurement Architecture (IMA) subsystem.

Conditions préalables

- The **fapolicyd** framework is deployed on your system.

Procédure

1. Open the **/etc/fapolicyd/fapolicyd.conf** file in a text editor of your choice, for example:

```
# vi /etc/fapolicyd/fapolicyd.conf
```

2. Change the value of the **integrity** option from **none** to **sha256**, save the file, and exit the editor:

```
integrity = sha256
```

3. Restart the **fapolicyd** service:

```
# systemctl restart fapolicyd
```

Vérification

1. Back up the file used for the verification:

```
# cp /bin/more /bin/more.bak
```

2. Change the content of the **/bin/more** binary:

```
# cat /bin/less > /bin/more
```

3. Use the changed binary as a regular user:

```
# su example.user
$ /bin/more /etc/redhat-release
bash: /bin/more: Operation not permitted
```

4. Revert the changes:

```
# mv -f /bin/more.bak /bin/more
```

13.6. TROUBLESHOOTING PROBLEMS RELATED TO FAPOLICYD

The following section provides tips for basic troubleshooting of the **fapolicyd** application framework and guidance for adding applications using the **rpm** command.

Installing applications using rpm

- If you install an application using the **rpm** command, you have to perform a manual refresh of the **fapolicyd** RPM database:

  1. Install your *application*:

     ```
     # rpm -i application.rpm
     ```

  2. Refresh the database:

     ```
     # fapolicyd-cli --update
     ```

     If you skip this step, the system can freeze and must be restarted.

Service status

- If **fapolicyd** does not work correctly, check the service status:

  ```
  # systemctl status fapolicyd
  ```

fapolicyd-cli checks and listings

- The **--check-config**, **--check-watch_fs**, and **--check-trustdb** options help you find syntax errors, not-yet-watched file systems, and file mismatches, for example:

  ```
  # fapolicyd-cli --check-config
  Daemon config is OK

  # fapolicyd-cli --check-trustdb
  /etc/selinux/targeted/contexts/files/file_contexts miscompares: size sha256
  /etc/selinux/targeted/policy/policy.31 miscompares: size sha256
  ```

- Use the **--list** option to check the current list of rules and their order:

  ```
  # fapolicyd-cli --list
  ...
  9. allow perm=execute all : trust=1
  10. allow perm=open all : ftype=%languages trust=1
  ```

```
11. deny_audit perm=any all : ftype=%languages
12. allow perm=any all : ftype=text/x-shellscript
13. deny_audit perm=execute all : all
...
```

Debug mode

- Debug mode provides detailed information about matched rules, database status, and more. To switch **fapolicyd** to debug mode:

  1. Stop the **fapolicyd** service:

     ```
     # systemctl stop fapolicyd
     ```

  2. Use debug mode to identify a corresponding rule:

     ```
     # fapolicyd --debug
     ```

     Because the output of the **fapolicyd --debug** command is verbose, you can redirect the error output to a file:

     ```
     # fapolicyd --debug 2> fapolicy.output
     ```

     Alternatively, to limit the output only to entries when **fapolicyd** denies access, use the **--debug-deny** option:

     ```
     # fapolicyd --debug-deny
     ```

Removing the fapolicyd database

- To solve problems related to the **fapolicyd** database, try to remove the database file:

```
# systemctl stop fapolicyd
# fapolicyd-cli --delete-db
```

AVERTISSEMENT

Do not remove the /**var**/**lib**/**fapolicyd**/ directory. The **fapolicyd** framework automatically restores only the database file in this directory.

Dumping the fapolicyd database

- The **fapolicyd** contains entries from all enabled trust sources. You can check the entries after dumping the database:

```
# fapolicyd-cli --dump-db
```

Application pipe

- In rare cases, removing the **fapolicyd** pipe file can solve a lockup:

```
# rm -f /var/run/fapolicyd/fapolicyd.fifo
```

Ressources supplémentaires

- **fapolicyd-cli(1)** man page.

13.7. RESSOURCES SUPPLÉMENTAIRES

- **fapolicyd**-related man pages listed by using the **man -k fapolicyd** command.
- The FOSDEM 2020 fapolicyd presentation.

CHAPITRE 14. PROTECTING SYSTEMS AGAINST INTRUSIVE USB DEVICES

USB devices can be loaded with spyware, malware, or trojans, which can steal your data or damage your system. As a Red Hat Enterprise Linux administrator, you can prevent such USB attacks with **USBGuard**.

14.1. USBGUARD

With the USBGuard software framework, you can protect your systems against intrusive USB devices by using basic lists of permitted and forbidden devices based on the USB device authorization feature in the kernel.

The USBGuard framework provides the following components:

- The system service component with an inter-process communication (IPC) interface for dynamic interaction and policy enforcement
- The command-line interface to interact with a running **usbguard** system service
- The rule language for writing USB device authorization policies
- The C++ API for interacting with the system service component implemented in a shared library

The **usbguard** system service configuration file (**/etc/usbguard/usbguard-daemon.conf**) includes the options to authorize the users and groups to use the IPC interface.

IMPORTANT

The system service provides the USBGuard public IPC interface. In Red Hat Enterprise Linux, the access to this interface is limited to the root user only by default.

Consider setting either the **IPCAccessControlFiles** option (recommended) or the **IPCAllowedUsers** and **IPCAllowedGroups** options to limit access to the IPC interface.

Ensure that you do not leave the Access Control List (ACL) unconfigured as this exposes the IPC interface to all local users and allows them to manipulate the authorization state of USB devices and modify the USBGuard policy.

14.2. INSTALLING USBGUARD

Use this procedure to install and initiate the **USBGuard** framework.

Procédure

1. Install the **usbguard** package:

```
# dnf install usbguard
```

2. Create an initial rule set:

```
# usbguard generate-policy > /etc/usbguard/rules.conf
```

3. Start the **usbguard** daemon and ensure that it starts automatically on boot:

```
# systemctl enable --now usbguard
```

Vérification

1. Verify that the **usbguard** service is running:

```
# systemctl status usbguard
● usbguard.service - USBGuard daemon
   Loaded: loaded (/usr/lib/systemd/system/usbguard.service; enabled; vendor preset:
disabled)
   Active: active (running) since Thu 2019-11-07 09:44:07 CET; 3min 16s ago
     Docs: man:usbguard-daemon(8)
 Main PID: 6122 (usbguard-daemon)
    Tasks: 3 (limit: 11493)
   Memory: 1.2M
   CGroup: /system.slice/usbguard.service
           └─6122 /usr/sbin/usbguard-daemon -f -s -c /etc/usbguard/usbguard-daemon.conf

Nov 07 09:44:06 localhost.localdomain systemd[1]: Starting USBGuard daemon...
Nov 07 09:44:07 localhost.localdomain systemd[1]: Started USBGuard daemon.
```

2. List USB devices recognized by **USBGuard**:

```
# usbguard list-devices
4: allow id 1d6b:0002 serial "0000:02:00.0" name "xHCI Host Controller" hash...
```

Ressources supplémentaires

- **usbguard(1)** and **usbguard-daemon.conf(5)** man pages.

14.3. BLOCKING AND AUTHORIZING A USB DEVICE USING CLI

This procedure outlines how to authorize and block a USB device using the **usbguard** command.

Conditions préalables

- The **usbguard** service is installed and running.

Procédure

1. List USB devices recognized by **USBGuard**:

```
# usbguard list-devices
1: allow id 1d6b:0002 serial "0000:00:06.7" name "EHCI Host Controller" hash
"JDOb0BiktYs2ct3mSQKopnOOV2h9MGYADwhT+oUtF2s=" parent-hash
"4PHGcaDKWtPjKDwYpIRG722cB9SlGz9l9lea93+Gt9c=" via-port "usb1" with-interface
09:00:00
...
6: block id 1b1c:1ab1 serial "000024937962" name "Voyager" hash
"CrXgiaWIf2bZAU+5WkzOE7y0rdSO82XMzubn7HDb95Q=" parent-hash
"JDOb0BiktYs2ct3mSQKopnOOV2h9MGYADwhT+oUtF2s=" via-port "1-3" with-interface
08:06:50
```

2. Authorize the device *6* to interact with the system:

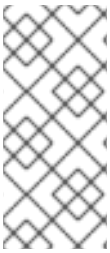
```
# usbguard allow-device 6
```

3. Deauthorize and remove the device *6*:

```
# usbguard reject-device 6
```

4. Deauthorize and retain the device *6*:

```
# usbguard block-device 6
```



NOTE

USBGuard uses the *block* and *reject* terms with the following meanings:

- *block*: do not interact with this device for now.
- *reject*: ignore this device as if it does not exist.

Ressources supplémentaires

- **usbguard(1)** man page.
- Built-in help listed by using the **usbguard --help** command.

14.4. PERMANENTLY BLOCKING AND AUTHORIZING A USB DEVICE

You can permanently block and authorize a USB device using the **-p** option. This adds a device-specific rule to the current policy.

Conditions préalables

- The **usbguard** service is installed and running.

Procédure

1. Configure SELinux to allow the **usbguard** daemon to write rules.
   a. Display the **semanage** Booleans relevant to **usbguard**.

```
# semanage boolean -l | grep usbguard
usbguard_daemon_write_conf     (off  ,  off)  Allow usbguard to daemon write conf
usbguard_daemon_write_rules    (on   ,   on)  Allow usbguard to daemon write rules
```

   b. Optional: If the **usbguard_daemon_write_rules** Boolean is turned off, turn it on.

```
# semanage boolean -m --on usbguard_daemon_write_rules
```

2. List USB devices recognized by **USBGuard**:

```
# usbguard list-devices
1: allow id 1d6b:0002 serial "0000:00:06.7" name "EHCI Host Controller" hash
```

```
"JDOb0BiktYs2ct3mSQKopnOOV2h9MGYADwhT+oUtF2s=" parent-hash
"4PHGcaDKWtPjKDwYpIRG722cB9SlGz9l9lea93+Gt9c=" via-port "usb1" with-interface
09:00:00
...
6: block id 1b1c:1ab1 serial "000024937962" name "Voyager" hash
"CrXgiaWIf2bZAU+5WkzOE7y0rdSO82XMzubn7HDb95Q=" parent-hash
"JDOb0BiktYs2ct3mSQKopnOOV2h9MGYADwhT+oUtF2s=" via-port "1-3" with-interface
08:06:50
```

3. Permanently authorize the device *6* to interact with the system:

```
# usbguard allow-device 6 -p
```

4. Permanently deauthorize and remove the device *6*:

```
# usbguard reject-device 6 -p
```

5. Permanently deauthorize and retain the device *6*:

```
# usbguard block-device 6 -p
```

NOTE

USBGuard uses the terms *block* and *reject* with the following meanings:

- *block*: do not interact with this device for now.
- *reject*: ignore this device as if it does not exist.

Vérification

1. Check that **USBGuard** rules include the changes you made.

```
# usbguard list-rules
```

Ressources supplémentaires

- **usbguard(1)** man page.
- Built-in help listed by using the **usbguard --help** command.

14.5. CREATING A CUSTOM POLICY FOR USB DEVICES

The following procedure contains steps for creating a rule set for USB devices that reflects the requirements of your scenario.

Conditions préalables

- The **usbguard** service is installed and running.
- The **/etc/usbguard/rules.conf** file contains an initial rule set generated by the **usbguard generate-policy** command.

Procédure

1. Create a policy which authorizes the currently connected USB devices, and store the generated rules to the **rules.conf** file:

```
# usbguard generate-policy --no-hashes > ./rules.conf
```

   The **--no-hashes** option does not generate hash attributes for devices. Avoid hash attributes in your configuration settings because they might not be persistent.

2. Edit the **rules.conf** file with a text editor of your choice, for example:

```
# vi ./rules.conf
```

3. Add, remove, or edit the rules as required. For example, the following rule allows only devices with a single mass storage interface to interact with the system:

```
allow with-interface equals { 08:*:* }
```

   See the **usbguard-rules.conf(5)** man page for a detailed rule-language description and more examples.

4. Install the updated policy:

```
# install -m 0600 -o root -g root rules.conf /etc/usbguard/rules.conf
```

5. Restart the **usbguard** daemon to apply your changes:

```
# systemctl restart usbguard
```

Vérification

1. Check that your custom rules are in the active policy, for example:

```
# usbguard list-rules
...
4: allow with-interface 08:*:*
...
```

Ressources supplémentaires

- **usbguard-rules.conf(5)** man page.

14.6. CREATING A STRUCTURED CUSTOM POLICY FOR USB DEVICES

You can organize your custom **USBGuard** policy in several **.conf** files within the **/etc/usbguard/rules.d/** directory. The **usbguard-daemon** then combines the main **rules.conf** file with the **.conf** files within the directory in alphabetical order.

Conditions préalables

- The **usbguard** service is installed and running.

Procédure

1. Create a policy which authorizes the currently connected USB devices, and store the generated rules to a new **.conf** file, for example, ***policy.conf***.

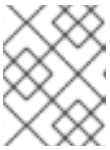
```
# usbguard generate-policy --no-hashes > ./policy.conf
```

The **--no-hashes** option does not generate hash attributes for devices. Avoid hash attributes in your configuration settings because they might not be persistent.

2. Display the ***policy.conf*** file with a text editor of your choice, for example:

```
# vi ./policy.conf
...
allow id 04f2:0833 serial "" name "USB Keyboard" via-port "7-2" with-interface { 03:01:01
03:00:00 } with-connect-type "unknown"
...
```

3. Move selected lines into a separate **.conf** file.



NOTE

The two digits at the beginning of the file name specify the order in which the daemon reads the configuration files.

For example, copy the rules for your keyboards into a new **.conf** file.

```
# grep "USB Keyboard" ./policy.conf > ./10keyboards.conf
```

4. Install the new policy to the **/etc/usbguard/rules.d/** directory.

```
# install -m 0600 -o root -g root 10keyboards.conf /etc/usbguard/rules.d/10keyboards.conf
```

5. Move the rest of the lines to a main **rules.conf** file.

```
# grep -v "USB Keyboard" ./policy.conf > ./rules.conf
```

6. Install the remaining rules.

```
# install -m 0600 -o root -g root rules.conf /etc/usbguard/rules.conf
```

7. Restart the **usbguard** daemon to apply your changes.

```
# systemctl restart usbguard
```

Vérification

1. Display all active **USBGuard** rules.

```
# usbguard list-rules
...
15: allow id 04f2:0833 serial "" name "USB Keyboard" hash
```

```
"kxM/iddRe/WSCocgiuQlVs6Dn0VEza7KiHoDeTz0fyg=" parent-hash
"2i6ZBJfTl5BakXF7Gba84/Cp1gslnNc1DM6vWQpie3s=" via-port "7-2" with-interface {
03:01:01 03:00:00 } with-connect-type "unknown"
...
```

2. Display the contents of the **rules.conf** file and all the **.conf** files in the **/etc/usbguard/rules.d/** directory.

```
# cat /etc/usbguard/rules.conf /etc/usbguard/rules.d/*.conf
```

3. Verify that the active rules contain all the rules from the files and are in the correct order.

Ressources supplémentaires

- **usbguard-rules.conf(5)** man page.

14.7. AUTHORIZING USERS AND GROUPS TO USE THE USBGUARD IPC INTERFACE

Use this procedure to authorize a specific user or a group to use the USBGuard public IPC interface. By default, only the root user can use this interface.

Conditions préalables

- The **usbguard** service is installed and running.
- The **/etc/usbguard/rules.conf** file contains an initial rule set generated by the **usbguard generate-policy** command.

Procédure

1. Edit the **/etc/usbguard/usbguard-daemon.conf** file with a text editor of your choice:

```
# vi /etc/usbguard/usbguard-daemon.conf
```

2. For example, add a line with a rule that allows all users in the **wheel** group to use the IPC interface, and save the file:

```
IPCAllowGroups=wheel
```

3. You can add users or groups also with the **usbguard** command. For example, the following command enables the *joesec* user to have full access to the **Devices** and **Exceptions** sections. Furthermore, *joesec* can list and modify the current policy:

```
# usbguard add-user joesec --devices ALL --policy modify,list --exceptions ALL
```

To remove the granted permissions for the *joesec* user, use the **usbguard remove-user joesec** command.

4. Restart the **usbguard** daemon to apply your changes:

```
# systemctl restart usbguard
```

Ressources supplémentaires

- **usbguard(1)** and **usbguard-rules.conf(5)** man pages.

14.8. LOGGING USBGUARD AUTHORIZATION EVENTS TO THE LINUX AUDIT LOG

Use the following steps to integrate logging of USBguard authorization events to the standard Linux Audit log. By default, the **usbguard** daemon logs events to the **/var/log/usbguard/usbguard-audit.log** file.

Conditions préalables

- The **usbguard** service is installed and running.
- The **auditd** service is running.

Procédure

1. Edit the **usbguard-daemon.conf** file with a text editor of your choice:

```
# vi /etc/usbguard/usbguard-daemon.conf
```

2. Change the **AuditBackend** option from **FileAudit** to **LinuxAudit**:

```
AuditBackend=LinuxAudit
```

3. Restart the **usbguard** daemon to apply the configuration change:

```
# systemctl restart usbguard
```

Vérification

1. Query the **audit** daemon log for a USB authorization event, for example:

```
# ausearch -ts recent -m USER_DEVICE
```

Ressources supplémentaires

- **usbguard-daemon.conf(5)** man page.

14.9. RESSOURCES SUPPLÉMENTAIRES

- **usbguard(1)**, **usbguard-rules.conf(5)**, **usbguard-daemon(8)**, and **usbguard-daemon.conf(5)** man pages.
- USBGuard Homepage.

CHAPITRE 15. CONFIGURING A REMOTE LOGGING SOLUTION

To ensure that logs from various machines in your environment are recorded centrally on a logging server, you can configure the **Rsyslog** application to record logs that fit specific criteria from the client system to the server.

15.1. THE RSYSLOG LOGGING SERVICE

The Rsyslog application, in combination with the **systemd-journald** service, provides local and remote logging support in Red Hat Enterprise Linux. The **rsyslogd** daemon continuously reads **syslog** messages received by the **systemd-journald** service from the Journal. **rsyslogd** then filters and processes these **syslog** events and records them to **rsyslog** log files or forwards them to other services according to its configuration.

The **rsyslogd** daemon also provides extended filtering, encryption protected relaying of messages, input and output modules, and support for transportation using the TCP and UDP protocols.

In **/etc/rsyslog.conf**, which is the main configuration file for **rsyslog**, you can specify the rules according to which **rsyslogd** handles the messages. Generally, you can classify messages by their source and topic (facility) and urgency (priority), and then assign an action that should be performed when a message fits these criteria.

In **/etc/rsyslog.conf**, you can also see a list of log files maintained by **rsyslogd**. Most log files are located in the **/var/log/** directory. Some applications, such as **httpd** and **samba**, store their log files in a subdirectory within **/var/log/**.

Ressources supplémentaires

- The **rsyslogd(8)** and **rsyslog.conf(5)** man pages.
- Documentation installed with the **rsyslog-doc** package in the **/usr/share/doc/rsyslog/html/index.html** file.

15.2. INSTALLING RSYSLOG DOCUMENTATION

The Rsyslog application has extensive online documentation that is available at https://www.rsyslog.com/doc/, but you can also install the **rsyslog-doc** documentation package locally.

Conditions préalables

- You have activated the **AppStream** repository on your system.
- You are authorized to install new packages using **sudo**.

Procédure

- Install the **rsyslog-doc** package:

```
# dnf install rsyslog-doc
```

Vérification

- Open the **/usr/share/doc/rsyslog/html/index.html** file in a browser of your choice, for example:

```
$ firefox /usr/share/doc/rsyslog/html/index.html &
```

15.3. CONFIGURING A SERVER FOR REMOTE LOGGING OVER TCP

The Rsyslog application enables you to both run a logging server and configure individual systems to send their log files to the logging server. To use remote logging through TCP, configure both the server and the client. The server collects and analyzes the logs sent by one or more client systems.

With the Rsyslog application, you can maintain a centralized logging system where log messages are forwarded to a server over the network. To avoid message loss when the server is not available, you can configure an action queue for the forwarding action. This way, messages that failed to be sent are stored locally until the server is reachable again. Note that such queues cannot be configured for connections using the UDP protocol.

The **omfwd** plug-in provides forwarding over UDP or TCP. The default protocol is UDP. Because the plug-in is built in, it does not have to be loaded.

By default, **rsyslog** uses TCP on port **514**.

Conditions préalables

- Rsyslog is installed on the server system.
- You are logged in as **root** on the server.
- The **policycoreutils-python-utils** package is installed for the optional step using the **semanage** command.
- Le service **firewalld** est en cours d'exécution.

Procédure

1. Optional: To use a different port for **rsyslog** traffic, add the **syslogd_port_t** SELinux type to port. For example, enable port **30514**:

```
# semanage port -a -t syslogd_port_t -p tcp 30514
```

2. Optional: To use a different port for **rsyslog** traffic, configure **firewalld** to allow incoming **rsyslog** traffic on that port. For example, allow TCP traffic on port **30514**:

```
# firewall-cmd --zone=<zone-name> --permanent --add-port=30514/tcp
success
# firewall-cmd --reload
```

3. Create a new file in the **/etc/rsyslog.d/** directory named, for example, **remotelog.conf**, and insert the following content:

```
# Define templates before the rules that use them
# Per-Host templates for remote systems
template(name="TmplAuthpriv" type="list") {
    constant(value="/var/log/remote/auth/")
    property(name="hostname")
```

```
    constant(value="/")
    property(name="programname" SecurePath="replace")
    constant(value=".log")
    }

template(name="TmplMsg" type="list") {
    constant(value="/var/log/remote/msg/")
    property(name="hostname")
    constant(value="/")
    property(name="programname" SecurePath="replace")
    constant(value=".log")
    }

# Provides TCP syslog reception
module(load="imtcp")

# Adding this ruleset to process remote messages
ruleset(name="remote1"){
     authpriv.*   action(type="omfile" DynaFile="TmplAuthpriv")
      *.info;mail.none;authpriv.none;cron.none
action(type="omfile" DynaFile="TmplMsg")
}

input(type="imtcp" port="30514" ruleset="remote1")
```

4. Save the changes to the **/etc/rsyslog.d/remotelog.conf** file.
5. Tester la syntaxe du fichier **/etc/rsyslog.conf**:

```
# rsyslogd -N 1
rsyslogd: version 8.1911.0-2.el8, config validation run...
rsyslogd: End of config validation run. Bye.
```

6. Make sure the **rsyslog** service is running and enabled on the logging server:

```
# systemctl status rsyslog
```

7. Restart the **rsyslog** service.

```
# systemctl restart rsyslog
```

8. Optional: If **rsyslog** is not enabled, ensure the **rsyslog** service starts automatically after reboot:

```
# systemctl enable rsyslog
```

Your log server is now configured to receive and store log files from the other systems in your environment.

Ressources supplémentaires

- **rsyslogd(8)**, **rsyslog.conf(5)**, **semanage(8)**, and **firewall-cmd(1)** man pages.
- Documentation installed with the **rsyslog-doc** package in the **/usr/share/doc/rsyslog/html/index.html** file.

15.4. CONFIGURING REMOTE LOGGING TO A SERVER OVER TCP

Follow this procedure to configure a system for forwarding log messages to a server over the TCP protocol. The **omfwd** plug-in provides forwarding over UDP or TCP. The default protocol is UDP. Because the plug-in is built in, you do not have to load it.

Conditions préalables

- The **rsyslog** package is installed on the client systems that should report to the server.
- You have configured the server for remote logging.
- The specified port is permitted in SELinux and open in firewall.
- The system contains the **policycoreutils-python-utils** package, which provides the **semanage** command for adding a non-standard port to the SELinux configuration.

Procédure

1. Create a new file in the **/etc/rsyslog.d/** directory named, for example, **10-remotelog.conf**, and insert the following content:

```
*.* action(type="omfwd"
     queue.type="linkedlist"
     queue.filename="example_fwd"
     action.resumeRetryCount="-1"
     queue.saveOnShutdown="on"
     target="example.com" port="30514" protocol="tcp"
    )
```

   Où ?

   - **queue.type="linkedlist"** enables a LinkedList in-memory queue,
   - **queue.filename** defines a disk storage. The backup files are created with the **example_fwd** prefix in the working directory specified by the preceding global **workDirectory** directive,
   - the **action.resumeRetryCount -1** setting prevents **rsyslog** from dropping messages when retrying to connect if server is not responding,
   - enabled **queue.saveOnShutdown="on"** saves in-memory data if **rsyslog** shuts down,
   - the last line forwards all received messages to the logging server, port specification is optional.
     With this configuration, **rsyslog** sends messages to the server but keeps messages in memory if the remote server is not reachable. A file on disk is created only if **rsyslog** runs out of the configured memory queue space or needs to shut down, which benefits the system performance.

   NOTE

   Rsyslog processes configuration files **/etc/rsyslog.d/** in the lexical order.

2. Restart the **rsyslog** service.

```
# systemctl restart rsyslog
```

Vérification

To verify that the client system sends messages to the server, follow these steps:

1. Sur le système client, envoyez un message de test :

```
# logger test
```

2. Sur le système serveur, affichez le journal **/var/log/messages**, par exemple :

```
# cat /var/log/remote/msg/hostname/root.log
Feb 25 03:53:17 hostname root[6064]: test
```

Where *hostname* is the host name of the client system. Note that the log contains the user name of the user that entered the **logger** command, in this case **root**.

Ressources supplémentaires

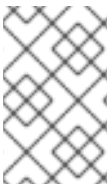
- **rsyslogd(8)** and **rsyslog.conf(5)** man pages.
- Documentation installed with the **rsyslog-doc** package in the **/usr/share/doc/rsyslog/html/index.html** file.

15.5. CONFIGURING TLS-ENCRYPTED REMOTE LOGGING

By default, Rsyslog sends remote-logging communication in the plain text format. If your scenario requires to secure this communication channel, you can encrypt it using TLS.

To use encrypted transport through TLS, configure both the server and the client. The server collects and analyzes the logs sent by one or more client systems.

You can use either the **ossl** network stream driver (OpenSSL) or the **gtls** stream driver (GnuTLS).



NOTE

If you have a separate system with higher security, for example, a system that is not connected to any network or has stricter authorizations, use the separate system as the certifying authority (CA).

Conditions préalables

- You have **root** access to both the client and server systems.
- The **rsyslog** and **rsyslog-openssl** packages are installed on the server and the client systems.
- If you use the **gtls** network stream driver, install the **rsyslog-gnutls** package instead of **rsyslog-openssl**.
- If you generate certificates using the **certtool** command, install the **gnutls-utils** package.
- On your logging server, the following certificates are in the **/etc/pki/ca-trust/source/anchors/** directory and your system configuration is updated by using the **update-ca-trust** command:

- **ca-cert.pem** - a CA certificate that can verify keys and certificates on logging servers and clients.
- **server-cert.pem** - a public key of the logging server.
- **server-key.pem** - a private key of the logging server.

- On your logging clients, the following certificates are in the **/etc/pki/ca-trust/source/anchors/** directory and your system configuration is updated by using **update-ca-trust**:
  - **ca-cert.pem** - a CA certificate that can verify keys and certificates on logging servers and clients.
  - **client-cert.pem** - a public key of a client.
  - **client-key.pem** - a private key of a client.

Procédure

1. Configure the server for receiving encrypted logs from your client systems:
   a. Create a new file in the **/etc/rsyslog.d/** directory named, for example, **securelogser.conf**.
   b. To encrypt the communication, the configuration file must contain paths to certificate files on your server, a selected authentication method, and a stream driver that supports TLS encryption. Add the following lines to the **/etc/rsyslog.d/securelogser.conf** file:

```
# Set certificate files
global(
  DefaultNetstreamDriverCAFile="/etc/pki/ca-trust/source/anchors/ca-cert.pem"
  DefaultNetstreamDriverCertFile="/etc/pki/ca-trust/source/anchors/server-cert.pem"
  DefaultNetstreamDriverKeyFile="/etc/pki/ca-trust/source/anchors/server-key.pem"
)

# TCP listener
module(
  load="imtcp"
  PermittedPeer=["client1.example.com", "client2.example.com"]
  StreamDriver.AuthMode="x509/name"
  StreamDriver.Mode="1"
  StreamDriver.Name="ossl"
)

# Start up listener at port 514
input(
  type="imtcp"
  port="514"
)
```

NOTE

If you prefer the GnuTLS driver, use the **StreamDriver.Name="gtls"** configuration option. See the documentation installed with the **rsyslog-doc** package for more information about less strict authentication modes than **x509/name**.

c. Save the changes to the **/etc/rsyslog.d/securelogser.conf** file.

d. Verify the syntax of the **/etc/rsyslog.conf** file and any files in the **/etc/rsyslog.d/** directory:

```
# rsyslogd -N 1
rsyslogd: version 8.1911.0-2.el8, config validation run (level 1)...
rsyslogd: End of config validation run. Bye.
```

e. Make sure the **rsyslog** service is running and enabled on the logging server:

```
# systemctl status rsyslog
```

f. Redémarrez le service **rsyslog**:

```
# systemctl restart rsyslog
```

g. Optional: If Rsyslog is not enabled, ensure the **rsyslog** service starts automatically after reboot:

```
# systemctl enable rsyslog
```

2. Configure clients for sending encrypted logs to the server:

a. On a client system, create a new file in the **/etc/rsyslog.d/** directory named, for example, **securelogcli.conf**.

b. Add the following lines to the **/etc/rsyslog.d/securelogcli.conf** file:

```
# Set certificate files
global(
  DefaultNetstreamDriverCAFile="/etc/pki/ca-trust/source/anchors/ca-cert.pem"
  DefaultNetstreamDriverCertFile="/etc/pki/ca-trust/source/anchors/client-cert.pem"
  DefaultNetstreamDriverKeyFile="/etc/pki/ca-trust/source/anchors/client-key.pem"
)


# Set up the action for all messages
*.* action(
  type="omfwd"
  StreamDriver="ossl"
  StreamDriverMode="1"
  StreamDriverPermittedPeers="server.example.com"
  StreamDriverAuthMode="x509/name"
  target="server.example.com" port="514" protocol="tcp"
)
```

NOTE

If you prefer the GnuTLS driver, use the **StreamDriver.Name="gtls"** configuration option.

c. Save the changes to the **/etc/rsyslog.d/securelogser.conf** file.

d. Verify the syntax of the `**/etc/rsyslog.conf** file and other files in the **/etc/rsyslog.d/** directory:

```
# rsyslogd -N 1
rsyslogd: version 8.1911.0-2.el8, config validation run (level 1)...
rsyslogd: End of config validation run. Bye.
```

e. Make sure the **rsyslog** service is running and enabled on the logging server:

```
# systemctl status rsyslog
```

f. Redémarrez le service **rsyslog**:

```
# systemctl restart rsyslog
```

g. Optional: If Rsyslog is not enabled, ensure the **rsyslog** service starts automatically after reboot:

```
# systemctl enable rsyslog
```

Vérification

To verify that the client system sends messages to the server, follow these steps:

1. Sur le système client, envoyez un message de test :

```
# logger test
```

2. Sur le système serveur, affichez le journal **/var/log/messages**, par exemple :

```
# cat /var/log/remote/msg/hostname/root.log
Feb 25 03:53:17 hostname root[6064]: test
```

Où ***hostname*** est le nom d'hôte du système client. Notez que le journal contient le nom de l'utilisateur qui a entré la commande logger, dans ce cas **root**.

Ressources supplémentaires

- **certtool(1)**, **openssl(1)**, **update-ca-trust(8)**, **rsyslogd(8)**, and **rsyslog.conf(5)** man pages.
- Documentation installed with the **rsyslog-doc** package at **/usr/share/doc/rsyslog/html/index.html**.
- Using the logging System Role with TLS .

15.6. CONFIGURING A SERVER FOR RECEIVING REMOTE LOGGING INFORMATION OVER UDP

The **Rsyslog** application enables you to configure a system to receive logging information from remote systems. To use remote logging through UDP, configure both the server and the client. The receiving server collects and analyzes the logs sent by one or more client systems. By default, **rsyslog** uses UDP on port **514** to receive log information from remote systems.

Follow this procedure to configure a server for collecting and analyzing logs sent by one or more client systems over the UDP protocol.

Conditions préalables

- Rsyslog is installed on the server system.
- You are logged in as **root** on the server.
- The **policycoreutils-python-utils** package is installed for the optional step using the **semanage** command.
- Le service **firewalld** est en cours d'exécution.

Procédure

1. Optional: To use a different port for **rsyslog** traffic than the default port **514**:
   a. Add the **syslogd_port_t** SELinux type to the SELinux policy configuration, replacing ***portno*** with the port number you want **rsyslog** to use:

```
# semanage port -a -t syslogd_port_t -p udp portno
```

   b. Configure **firewalld** to allow incoming **rsyslog** traffic, replacing ***portno*** with the port number and **zone** with the zone you want **rsyslog** to use:

```
# firewall-cmd --zone=zone --permanent --add-port=portno/udp
success
# firewall-cmd --reload
```

   c. Rechargez les règles du pare-feu :

```
# firewall-cmd --reload
```

2. Create a new **.conf** file in the **/etc/rsyslog.d/** directory, for example, **remotelogserv.conf**, and insert the following content:

```
# Define templates before the rules that use them
# Per-Host templates for remote systems
template(name="TmplAuthpriv" type="list") {
   constant(value="/var/log/remote/auth/")
   property(name="hostname")
   constant(value="/")
   property(name="programname" SecurePath="replace")
   constant(value=".log")
   }

template(name="TmplMsg" type="list") {
   constant(value="/var/log/remote/msg/")
   property(name="hostname")
   constant(value="/")
   property(name="programname" SecurePath="replace")
   constant(value=".log")
   }
```

```
# Provides UDP syslog reception
module(load="imudp")

# This ruleset processes remote messages
ruleset(name="remote1"){
    authpriv.*   action(type="omfile" DynaFile="TmplAuthpriv")
     *.info;mail.none;authpriv.none;cron.none
action(type="omfile" DynaFile="TmplMsg")
}

input(type="imudp" port="514" ruleset="remote1")
```

Where **514** is the port number **rsyslog** uses by default. You can specify a different port instead.

3. Verify the syntax of the **/etc/rsyslog.conf** file and all **.conf** files in the **/etc/rsyslog.d/** directory:

```
# rsyslogd -N 1
rsyslogd: version 8.1911.0-2.el8, config validation run...
```

4. Restart the **rsyslog** service.

```
# systemctl restart rsyslog
```

5. Optional: If **rsyslog** is not enabled, ensure the **rsyslog** service starts automatically after reboot:

```
# systemctl enable rsyslog
```

Ressources supplémentaires

- **rsyslogd(8)** , **rsyslog.conf(5)**, **semanage(8)**, and **firewall-cmd(1)** man pages.
- Documentation installed with the **rsyslog-doc** package in the **/usr/share/doc/rsyslog/html/index.html** file.

15.7. CONFIGURING REMOTE LOGGING TO A SERVER OVER UDP

Follow this procedure to configure a system for forwarding log messages to a server over the UDP protocol. The **omfwd** plug-in provides forwarding over UDP or TCP. The default protocol is UDP. Because the plug-in is built in, you do not have to load it.

Conditions préalables

- The **rsyslog** package is installed on the client systems that should report to the server.
- You have configured the server for remote logging as described in Configuring a server for receiving remote logging information over UDP.

Procédure

1. Create a new **.conf** file in the **/etc/rsyslog.d/** directory, for example, **10-remotelogcli.conf**, and insert the following content:

```
*.* action(type="omfwd"
      queue.type="linkedlist"
```

```
    queue.filename="example_fwd"
    action.resumeRetryCount="-1"
    queue.saveOnShutdown="on"
    target="example.com" port="portno" protocol="udp"
   )
```

Où ?

- **queue.type="linkedlist"** enables a LinkedList in-memory queue.
- **queue.filename** defines a disk storage. The backup files are created with the ***example_fwd*** prefix in the working directory specified by the preceding global **workDirectory** directive.
- The **action.resumeRetryCount -1** setting prevents **rsyslog** from dropping messages when retrying to connect if the server is not responding.
- **enabled queue.saveOnShutdown="on"** saves in-memory data if **rsyslog** shuts down.
- ***portno*** is the port number you want **rsyslog** to use. The default value is **514**.
- The last line forwards all received messages to the logging server, port specification is optional.
  With this configuration, **rsyslog** sends messages to the server but keeps messages in memory if the remote server is not reachable. A file on disk is created only if **rsyslog** runs out of the configured memory queue space or needs to shut down, which benefits the system performance.

NOTE

Rsyslog processes configuration files /**etc**/**rsyslog.d**/ in the lexical order.

2. Restart the **rsyslog** service.

```
# systemctl restart rsyslog
```

3. Optional: If **rsyslog** is not enabled, ensure the **rsyslog** service starts automatically after reboot:

```
# systemctl enable rsyslog
```

Vérification

To verify that the client system sends messages to the server, follow these steps:

1. Sur le système client, envoyez un message de test :

```
# logger test
```

2. On the server system, view the /**var**/**log**/**remote**/**msg**/***hostname***/**root.log** log, for example:

```
# cat /var/log/remote/msg/hostname/root.log
Feb 25 03:53:17 hostname root[6064]: test
```

Where **hostname** is the host name of the client system. Note that the log contains the user name of the user that entered the logger command, in this case **root**.

Ressources supplémentaires

- **rsyslogd(8)** and **rsyslog.conf(5)** man pages.
- Documentation installed with the **rsyslog-doc** package at **/usr/share/doc/rsyslog/html/index.html**.

15.8. LOAD BALANCING HELPER IN RSYSLOG

The **RebindInterval** setting specifies an interval at which the current connection is broken and is re-established. This setting applies to TCP, UDP, and RELP traffic. The load balancers perceive it as a new connection and forward the messages to another physical target system.

The **RebindInterval** setting proves to be helpful in scenarios when a target system has changed its IP address. The Rsyslog application caches the IP address when the connection establishes, therefore, the messages are sent to the same server. If the IP address changes, the UDP packets will be lost until the Rsyslog service restarts. Re-establishing the connection will ensure the IP to be resolved by DNS again.

```
action(type="omfwd" protocol="tcp" RebindInterval="250" target="example.com" port="514" …)

action(type="omfwd" protocol="udp" RebindInterval="250" target="example.com" port="514" …)

action(type="omrelp" RebindInterval="250" target="example.com" port="6514" …)
```

15.9. CONFIGURING RELIABLE REMOTE LOGGING

With the Reliable Event Logging Protocol (RELP), you can send and receive **syslog** messages over TCP with a much reduced risk of message loss. RELP provides reliable delivery of event messages, which makes it useful in environments where message loss is not acceptable. To use RELP, configure the **imrelp** input module, which runs on the server and receives the logs, and the **omrelp** output module, which runs on the client and sends logs to the logging server.

Conditions préalables

- You have installed the **rsyslog**, **librelp**, and **rsyslog-relp** packages on the server and the client systems.
- The specified port is permitted in SELinux and open in the firewall.

Procédure

1. Configure the client system for reliable remote logging:
   a. On the client system, create a new **.conf** file in the **/etc/rsyslog.d/** directory named, for example, **relpclient.conf**, and insert the following content:

      ```
      module(load="omrelp")
      *.* action(type="omrelp" target="_target_IP_" port="_target_port_")
      ```

      Où ?

      - ***target_IP*** is the IP address of the logging server.
      - ***target_port*** is the port of the logging server.

b. Save the changes to the **/etc/rsyslog.d/relpclient.conf** file.

c. Restart the **rsyslog** service.

```
# systemctl restart rsyslog
```

d. Optional: If **rsyslog** is not enabled, ensure the **rsyslog** service starts automatically after reboot:

```
# systemctl enable rsyslog
```

2. Configure the server system for reliable remote logging:

a. On the server system, create a new **.conf** file in the **/etc/rsyslog.d/** directory named, for example, **relpserv.conf**, and insert the following content:

```
ruleset(name="relp"){
*.* action(type="omfile" file="_log_path_")
}


module(load="imrelp")
input(type="imrelp" port="_target_port_" ruleset="relp")
```

Où ?

- ***log_path*** specifies the path for storing messages.
- ***target_port*** is the port of the logging server. Use the same value as in the client configuration file.

b. Save the changes to the **/etc/rsyslog.d/relpserv.conf** file.

c. Restart the **rsyslog** service.

```
# systemctl restart rsyslog
```

d. Optional: If **rsyslog** is not enabled, ensure the **rsyslog** service starts automatically after reboot:

```
# systemctl enable rsyslog
```

Vérification

To verify that the client system sends messages to the server, follow these steps:

1. Sur le système client, envoyez un message de test :

```
# logger test
```

2. On the server system, view the log at the specified ***log_path***, for example:

```
# cat /var/log/remote/msg/hostname/root.log
Feb 25 03:53:17 hostname root[6064]: test
```

Where **hostname** is the host name of the client system. Note that the log contains the user name of the user that entered the logger command, in this case **root**.

Ressources supplémentaires

- **rsyslogd(8)** and **rsyslog.conf(5)** man pages.
- Documentation installed with the **rsyslog-doc** package in the **/usr/share/doc/rsyslog/html/index.html** file.

15.10. SUPPORTED RSYSLOG MODULES

To expand the functionality of the Rsyslog application, you can use specific modules. Modules provide additional inputs (Input Modules), outputs (Output Modules), and other functionalities. A module can also provide additional configuration directives that become available after you load the module.

You can list the input and output modules installed on your system by entering the following command:

```
# ls /usr/lib64/rsyslog/{i,o}m*
```

You can view the list of all available **rsyslog** modules in the **/usr/share/doc/rsyslog/html/configuration/modules/idx_output.html** file after you install the **rsyslog-doc** package.

15.11. CONFIGURING THE NETCONSOLE SERVICE TO LOG KERNEL MESSAGES TO A REMOTE HOST

When logging to disk or using a serial console is not possible, you can use the **netconsole** kernel module and the same-named service to log kernel messages over a network to a remote **rsyslog** service.

Conditions préalables

- A system log service, such as **rsyslog** is installed on the remote host.
- The remote system log service is configured to receive incoming log entries from this host.

Procédure

1. Install the **netconsole-service** package:

```
# dnf install netconsole-service
```

2. Edit the **/etc/sysconfig/netconsole** file and set the **SYSLOGADDR** parameter to the IP address of the remote host:

```
# SYSLOGADDR=192.0.2.1
```

3. Enable and start the **netconsole** service:

```
# systemctl enable --now netconsole
```

Verification steps

- Display the **/var/log/messages** file on the remote system log server.

Ressources supplémentaires

- Configuration d'une solution de journalisation à distance

15.12. RESSOURCES SUPPLÉMENTAIRES

- Documentation installed with the **rsyslog-doc** package in the **/usr/share/doc/rsyslog/html/index.html** file
- **rsyslog.conf(5)** and **rsyslogd(8)** man pages
- Configuring system logging without journald or with minimized journald usage Knowledgebase article
- Negative effects of the RHEL default logging setup on performance and their mitigations Knowledgebase article
- The Using the Logging System Role chapter

CHAPITRE 16. UTILISATION DU RÔLE DE SYSTÈME LOGGING

En tant qu'administrateur système, vous pouvez utiliser le rôle système **logging** pour configurer un hôte RHEL en tant que serveur de journalisation afin de collecter les journaux de nombreux systèmes clients.

16.1. LE RÔLE DU SYSTÈME LOGGING

Avec le rôle de système **logging**, vous pouvez déployer des configurations de journalisation sur des hôtes locaux et distants.

Pour appliquer un rôle de système **logging** à un ou plusieurs systèmes, vous définissez la configuration de la journalisation dans un fichier *playbook*. Un cahier de lecture est une liste d'un ou plusieurs jeux. Les carnets de lecture sont lisibles par l'homme et sont écrits au format YAML. Pour plus d'informations sur les carnets de lecture, voir Travailler avec des carnets de lecture dans la documentation Ansible.

The set of systems that you want to configure according to the playbook is defined in an *inventory file*. For more information about creating and using inventories, see How to build your inventory in Ansible documentation.

Les solutions de journalisation offrent plusieurs façons de lire les journaux et plusieurs sorties de journalisation.

Par exemple, un système d'enregistrement peut recevoir les données suivantes :

- les fichiers locaux,
- **systemd/journal**,
- un autre système d'enregistrement sur le réseau.

En outre, un système d'enregistrement peut avoir les résultats suivants :

- les journaux stockés dans les fichiers locaux du répertoire /**var**/**log**,
- les journaux envoyés à Elasticsearch,
- les journaux transmis à un autre système de journalisation.

Avec le rôle de système **logging**, vous pouvez combiner les entrées et les sorties en fonction de votre scénario. Par exemple, vous pouvez configurer une solution de journalisation qui stocke les entrées provenant de **journal** dans un fichier local, tandis que les entrées lues dans les fichiers sont à la fois transmises à un autre système de journalisation et stockées dans les fichiers journaux locaux.

16.2. LOGGING PARAMÈTRES DU RÔLE DU SYSTÈME

Dans un playbook de rôle système **logging**, vous définissez les entrées dans le paramètre **logging_inputs**, les sorties dans le paramètre **logging_outputs** et les relations entre les entrées et les sorties dans le paramètre **logging_flows**. Le rôle de système **logging** traite ces variables avec des options supplémentaires pour configurer le système de journalisation. Vous pouvez également activer le cryptage ou une gestion automatique des ports.

NOTE

Actuellement, le seul système de journalisation disponible dans le rôle de système **logging** est **Rsyslog**.

- **logging_inputs**: Liste des entrées pour la solution d'enregistrement.
  - **name**: Nom unique de l'entrée. Utilisé dans la liste des entrées **logging_flows**: et dans le nom du fichier généré **config**.
  - **type**: Type de l'élément d'entrée. Le type spécifie un type de tâche qui correspond à un nom de répertoire dans **roles/rsyslog/{tasks,vars}/inputs/**.
    - **basics**: Entrées configurant les entrées à partir du journal **systemd** ou de la prise **unix**.
      - **kernel_message**: Charger **imklog** si la valeur est **true**. La valeur par défaut est **false**.
      - **use_imuxsock**: Utilisez **imuxsock** au lieu de **imjournal**. **false** est la valeur par défaut.
      - **ratelimit_burst**: Nombre maximal de messages pouvant être émis dans le cadre de **ratelimit_interval**. La valeur par défaut est **20000** si **use_imuxsock** est faux. La valeur par défaut est **200** si **use_imuxsock** est vrai.
      - **ratelimit_interval**: Intervalle pour évaluer **ratelimit_burst**. La valeur par défaut est de 600 secondes si **use_imuxsock** est faux. La valeur par défaut est 0 si **use_imuxsock** est vrai. 0 indique que la limitation de débit est désactivée.
      - **persist_state_interval**: L'état du journal est conservé tous les **value** messages. La valeur par défaut est **10** et n'est effective que si **use_imuxsock** est faux.
    - **files**: Entrées configuration des entrées à partir de fichiers locaux.
    - **remote**: Entrées configurant les entrées de l'autre système d'enregistrement sur le réseau.
  - **state**: État du fichier de configuration. **present** ou **absent**. La valeur par défaut est **present**.
- **logging_outputs**: Liste des sorties pour la solution d'enregistrement.
  - **files**: Sorties configurer les sorties vers des fichiers locaux.
  - **forwards**: Sorties Configuration des sorties vers un autre système d'enregistrement.
  - **remote_files**: Sorties configurer les sorties d'un autre système de journalisation vers des fichiers locaux.
- **logging_flows**: Liste des flux qui définissent les relations entre **logging_inputs** et **logging_outputs**. La variable **logging_flows** a les clés suivantes :
  - **name**: Nom unique du flux
  - **inputs**: Liste des valeurs du nom **logging_inputs**
  - **outputs**: Liste des valeurs du nom **logging_outputs**.
- **logging_manage_firewall**: Si la valeur est **true**, la variable utilise le rôle **firewall** pour gérer automatiquement l'accès au port à partir du rôle **logging**.
- **logging_manage_selinux**: Si la valeur est **true**, la variable utilise le rôle **selinux** pour gérer automatiquement l'accès au port à partir du rôle **logging**.

Ressources supplémentaires

- Documentation installée avec le paquetage **rhel-system-roles** dans **/usr/share/ansible/roles/rhel-system-roles.logging/README.html**

16.3. APPLICATION D'UN RÔLE DE SYSTÈME LOCAL LOGGING

Préparer et appliquer un playbook Ansible pour configurer une solution de journalisation sur un ensemble de machines distinctes. Chaque machine enregistre les journaux localement.

Conditions préalables

- Accès et autorisations à un ou plusieurs *managed nodes*, qui sont des systèmes que vous souhaitez configurer avec le rôle de système **logging**.
- Accès et permissions à un *control node*, qui est un système à partir duquel Red Hat Ansible Core configure d'autres systèmes.
  Sur le nœud de contrôle :
  - Les paquets **ansible-core** et **rhel-system-roles** sont installés.

IMPORTANT

RHEL 8.0-8.5 provided access to a separate Ansible repository that contains Ansible Engine 2.9 for automation based on Ansible. Ansible Engine contains command-line utilities such as **ansible**, **ansible-playbook**, connectors such as **docker** and **podman**, and many plugins and modules. For information about how to obtain and install Ansible Engine, see the How to download and install Red Hat Ansible Engine Knowledgebase article.

RHEL 8.6 et 9.0 ont introduit Ansible Core (fourni en tant que paquetage **ansible-core**), qui contient les utilitaires de ligne de commande Ansible, les commandes et un petit ensemble de plugins Ansible intégrés. RHEL fournit ce paquetage par l'intermédiaire du dépôt AppStream, et sa prise en charge est limitée. Pour plus d'informations, consultez l'article de la base de connaissances intitulé Scope of support for the Ansible Core package included in the RHEL 9 and RHEL 8.6 and later AppStream repositories (Portée de la prise en charge du package Ansible Core inclus dans les dépôts AppStream RHEL 9 et RHEL 8.6 et versions ultérieures).

- Un fichier d'inventaire qui répertorie les nœuds gérés.

NOTE

Il n'est pas nécessaire que le paquet **rsyslog** soit installé, car le rôle de système installe **rsyslog** lorsqu'il est déployé.

Procédure

1. Créez un cahier de jeu qui définit le rôle requis :
   a. Créez un nouveau fichier YAML et ouvrez-le dans un éditeur de texte, par exemple :

```
# vi logging-playbook.yml
```

b. Insérer le contenu suivant :

```
---
- name: Deploying basics input and implicit files output
  hosts: all
  roles:
    - rhel-system-roles.logging
  vars:
    logging_inputs:
      - name: system_input
        type: basics
    logging_outputs:
      - name: files_output
        type: files
    logging_flows:
      - name: flow1
        inputs: [system_input]
        outputs: [files_output]
```

2. Exécuter le manuel de jeu sur un inventaire spécifique :

```
# ansible-playbook -i inventory-file /path/to/file/logging-playbook.yml
```

Où ?

- ***inventory-file*** est le fichier d'inventaire.
- ***logging-playbook.yml*** est le manuel de jeu que vous utilisez.

Vérification

1. Tester la syntaxe du fichier **/etc/rsyslog.conf**:

```
# rsyslogd -N 1
rsyslogd: version 8.1911.0-6.el8, config validation run...
rsyslogd: End of config validation run. Bye.
```

2. Vérifiez que le système envoie des messages au journal :

a. Envoyer un message test :

```
# logger test
```

b. Consultez le journal **/var/log/messages**, par exemple :

```
# cat /var/log/messages
Aug  5 13:48:31 hostname root[6778]: test
```

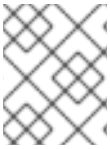
Où `*hostname*` est le nom d'hôte du système client. Notez que le journal contient le nom de l'utilisateur qui a entré la commande de l'enregistreur, dans ce cas **root**.

16.4. FILTRAGE DES JOURNAUX DANS UN SYSTÈME LOCAL LOGGING RÔLE DU SYSTÈME

Vous pouvez déployer une solution de journalisation qui filtre les journaux en fonction du filtre basé sur les propriétés **rsyslog**.

Conditions préalables

- Accès et autorisations à un ou plusieurs *managed nodes*, qui sont des systèmes que vous souhaitez configurer avec le rôle de système **logging**.
- Accès et permissions à un *control node*, qui est un système à partir duquel Red Hat Ansible Core configure d'autres systèmes.
  Sur le nœud de contrôle :
  - Red Hat Ansible Core est installé
  - Le paquet **rhel-system-roles** est installé
  - Un fichier d'inventaire qui répertorie les nœuds gérés.



NOTE

Il n'est pas nécessaire que le paquet **rsyslog** soit installé, car le rôle de système installe **rsyslog** lorsqu'il est déployé.

Procédure

1. Créez un nouveau fichier ***playbook.yml*** avec le contenu suivant :

```
---
- name: Deploying files input and configured files output
  hosts: all
  roles:
    - linux-system-roles.logging
  vars:
    logging_inputs:
      - name: files_input
        type: basics
    logging_outputs:
      - name: files_output0
        type: files
        property: msg
        property_op: contains
        property_value: error
        path: /var/log/errors.log
      - name: files_output1
        type: files
        property: msg
        property_op: "!contains"
        property_value: error
        path: /var/log/others.log
    logging_flows:
      - name: flow0
        inputs: [files_input]
        outputs: [files_output0, files_output1]
```

Avec cette configuration, tous les messages contenant la chaîne ***error*** sont enregistrés dans **/var/log/errors.log**, et tous les autres messages sont enregistrés dans **/var/log/others.log**.

Vous pouvez remplacer la valeur de la propriété ***error*** par la chaîne de caractères par laquelle vous souhaitez filtrer.

Vous pouvez modifier les variables selon vos préférences.

2. Facultatif : Vérifier la syntaxe du playbook.

```
# ansible-playbook --syntax-check playbook.yml
```

3. Exécutez le playbook sur votre fichier d'inventaire :

```
# ansible-playbook -i inventory_file /path/to/file/playbook.yml
```

Vérification

1. Tester la syntaxe du fichier **/etc/rsyslog.conf**:

```
# rsyslogd -N 1
rsyslogd: version 8.1911.0-6.el8, config validation run...
rsyslogd: End of config validation run. Bye.
```

2. Vérifiez que le système envoie au journal les messages contenant la chaîne **error**:

   a. Envoyer un message test :

   ```
   # logger error
   ```

   b. Consultez le journal **/var/log/errors.log**, par exemple :

   ```
   # cat /var/log/errors.log
   Aug  5 13:48:31 hostname root[6778]: error
   ```

   Où ***hostname*** est le nom d'hôte du système client. Notez que le journal contient le nom de l'utilisateur qui a entré la commande logger, dans ce cas **root**.

Ressources supplémentaires

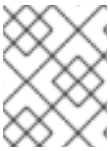
- Documentation installée avec le paquetage **rhel-system-roles** dans **/usr/share/ansible/roles/rhel-system-roles.logging/README.html**

16.5. APPLICATION D'UNE SOLUTION DE JOURNALISATION À DISTANCE À L'AIDE DU RÔLE DE SYSTÈME LOGGING

Suivez ces étapes pour préparer et appliquer un playbook Red Hat Ansible Core afin de configurer une solution de journalisation à distance. Dans ce livre de jeu, un ou plusieurs clients récupèrent les journaux de **systemd-journal** et les transmettent à un serveur distant. Le serveur reçoit des entrées distantes de **remote_rsyslog** et **remote_files** et émet les journaux vers des fichiers locaux dans des répertoires nommés par des noms d'hôtes distants.

Conditions préalables

- Accès et autorisations à un ou plusieurs *managed nodes*, qui sont des systèmes que vous souhaitez configurer avec le rôle de système **logging**.
- Accès et permissions à un *control node*, qui est un système à partir duquel Red Hat Ansible Core configure d'autres systèmes.
  Sur le nœud de contrôle :
  - Les paquets **ansible-core** et **rhel-system-roles** sont installés.
  - Un fichier d'inventaire qui répertorie les nœuds gérés.



NOTE

Il n'est pas nécessaire que le paquet **rsyslog** soit installé, car le rôle de système installe **rsyslog** lorsqu'il est déployé.

Procédure

1. Créez un cahier de jeu qui définit le rôle requis :
   a. Créez un nouveau fichier YAML et ouvrez-le dans un éditeur de texte, par exemple :

```
# vi logging-playbook.yml
```

   b. Insérez le contenu suivant dans le fichier :

```
---
- name: Deploying remote input and remote_files output
  hosts: server
  roles:
    - rhel-system-roles.logging
  vars:
    logging_inputs:
      - name: remote_udp_input
        type: remote
        udp_ports: [ 601 ]
      - name: remote_tcp_input
        type: remote
        tcp_ports: [ 601 ]
    logging_outputs:
      - name: remote_files_output
        type: remote_files
    logging_flows:
      - name: flow_0
        inputs: [remote_udp_input, remote_tcp_input]
        outputs: [remote_files_output]

- name: Deploying basics input and forwards output
  hosts: clients
  roles:
    - rhel-system-roles.logging
  vars:
    logging_inputs:
      - name: basic_input
        type: basics
```

```
    logging_outputs:
      - name: forward_output0
        type: forwards
        severity: info
        target: _host1.example.com_
        udp_port: 601
      - name: forward_output1
        type: forwards
        facility: mail
        target: _host1.example.com_
        tcp_port: 601
    logging_flows:
      - name: flows0
        inputs: [basic_input]
        outputs: [forward_output0, forward_output1]

[basic_input]
[forward_output0, forward_output1]
```

Où ***host1.example.com*** est le serveur de journalisation.

NOTE

Vous pouvez modifier les paramètres du cahier de jeu en fonction de vos besoins.

AVERTISSEMENT

La solution de journalisation ne fonctionne qu'avec les ports définis dans la politique SELinux du serveur ou du système client et ouverts dans le pare-feu. La stratégie SELinux par défaut inclut les ports 601, 514, 6514, 10514 et 20514. Pour utiliser un autre port, modifiez la stratégie SELinux sur les systèmes client et serveur.

2. Créez un fichier d'inventaire qui répertorie vos serveurs et vos clients :

   a. Créez un nouveau fichier et ouvrez-le dans un éditeur de texte, par exemple :

   ```
   # vi inventory.ini
   ```

   b. Insérez le contenu suivant dans le fichier d'inventaire :

   ```
   [servers]
   server ansible_host=host1.example.com
   [clients]
   client ansible_host=host2.example.com
   ```

   Où ?

   - ***host1.example.com*** est le serveur de journalisation.

- ***host2.example.com*** est le client de journalisation.

3. Exécutez le manuel de jeu sur votre inventaire.

```
# ansible-playbook -i /path/to/file/inventory.ini /path/to/file/_logging-playbook.yml
```

Où ?

- ***inventory.ini*** est le fichier d'inventaire.
- ***logging-playbook.yml*** est le cahier de jeu que vous avez créé.

Vérification

1. Sur le système client et le système serveur, testez la syntaxe du fichier **/etc/rsyslog.conf**:

```
# rsyslogd -N 1
rsyslogd: version 8.1911.0-6.el8, config validation run (level 1), master config
/etc/rsyslog.conf
rsyslogd: End of config validation run. Bye.
```

2. Vérifiez que le système client envoie des messages au serveur :

   a. Sur le système client, envoyez un message de test :

```
# logger test
```

   b. Sur le système serveur, affichez le journal **/var/log/messages**, par exemple :

```
# cat /var/log/messages
Aug  5 13:48:31 host2.example.com root[6778]: test
```

   Où ***host2.example.com*** est le nom d'hôte du système client. Notez que le journal contient le nom de l'utilisateur qui a entré la commande logger, dans ce cas **root**.

Ressources supplémentaires

- Préparation d'un nœud de contrôle et de nœuds gérés à l'utilisation des rôles système RHEL
- Documentation installée avec le paquetage **rhel-system-roles** dans **/usr/share/ansible/roles/rhel-system-roles.logging/README.html**
- Article de la base de données RHEL System Roles

16.6. UTILISATION DU RÔLE DE SYSTÈME LOGGING AVEC TLS

Transport Layer Security (TLS) is a cryptographic protocol designed to allow secure communication over the computer network.

As an administrator, you can use the **logging** RHEL System Role to configure a secure transfer of logs using Red Hat Ansible Automation Platform.

16.6.1. Configuration de la journalisation des clients avec TLS

You can use an Ansible playbook with the **logging** System Role to configure logging on RHEL clients and transfer logs to a remote logging system using TLS encryption.

This procedure creates a private key and certificate, and configures TLS on all hosts in the clients group in the Ansible inventory. The TLS protocol encrypts the message transmission for secure transfer of logs over the network.

NOTE

You do not have to call the **certificate** System Role in the playbook to create the certificate. The **logging** System Role calls it automatically.

In order for the CA to be able to sign the created certificate, the managed nodes must be enrolled in an IdM domain.

Conditions préalables

- Vous disposez d'autorisations pour exécuter des playbooks sur les nœuds gérés sur lesquels vous souhaitez configurer TLS.
- Les nœuds gérés sont répertoriés dans le fichier d'inventaire du nœud de contrôle.
- Les paquets **ansible** et **rhel-system-roles** sont installés sur le nœud de contrôle.
- The managed nodes are enrolled in an IdM domain.

Procédure

1. Créer un fichier ***playbook.yml*** avec le contenu suivant :

```
---
- name: Deploying files input and forwards output with certs
  hosts: clients
  roles:
    - rhel-system-roles.logging
  vars:
    logging_certificates:
      - name: logging_cert
        dns: ['localhost', 'www.example.com']
        ca: ipa
    logging_pki_files:
      - ca_cert: /local/path/to/ca_cert.pem
        cert: /local/path/to/logging_cert.pem
        private_key: /local/path/to/logging_cert.pem
    logging_inputs:
      - name: input_name
        type: files
        input_log_path: /var/log/containers/*.log
    logging_outputs:
      - name: output_name
        type: forwards
        target: your_target_host
        tcp_port: 514
        tls: true
        pki_authmode: x509/name
        permitted_server: 'server.example.com'
```

```
logging_flows:
  - name: flow_name
    inputs: [input_name]
    outputs: [output_name]
```

Le playbook utilise les paramètres suivants :

logging_certificates

The value of this parameter is passed on to **certificate_requests** in the **certificate** role and used to create a private key and certificate.

logging_pki_files

Using this parameter, you can configure the paths and other settings that logging uses to find the CA, certificate, and key files used for TLS, specified with one or more of the following sub-parameters: **ca_cert**, **ca_cert_src**, **cert**, **cert_src**, **private_key**, **private_key_src**, and **tls**.

NOTE

If you are using **logging_certificates** to create the files on the target node, do not use **ca_cert_src**, **cert_src**, and **private_key_src**, which are used to copy files not created by **logging_certificates**.

ca_cert

Represents the path to the CA certificate file on the target node. Default path is **/etc/pki/tls/certs/ca.pem** and the file name is set by the user.

cert

Represents the path to the certificate file on the target node. Default path is **/etc/pki/tls/certs/server-cert.pem** and the file name is set by the user.

private_key

Represents the path to the private key file on the target node. Default path is **/etc/pki/tls/private/server-key.pem** and the file name is set by the user.

ca_cert_src

Represents the path to the CA certificate file on the control node which is copied to the target host to the location specified by **ca_cert**. Do not use this if using **logging_certificates**.

cert_src

Represents the path to a certificate file on the control node which is copied to the target host to the location specified by **cert**. Do not use this if using **logging_certificates**.

private_key_src

Represents the path to a private key file on the control node which is copied to the target host to the location specified by **private_key**. Do not use this if using **logging_certificates**.

tls

Setting this parameter to **true** ensures secure transfer of logs over the network. If you do not want a secure wrapper, you can set **tls: false**.

2. Vérifier la syntaxe du playbook :

```
# ansible-playbook --syntax-check playbook.yml
```

3. Exécutez le playbook sur votre fichier d'inventaire :

```
# ansible-playbook -i inventory_file playbook.yml
```

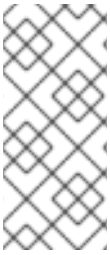
Ressources supplémentaires

- Demande de certificats à l'aide des rôles système RHEL .

16.6.2. Configuration de la journalisation du serveur avec TLS

You can use an Ansible playbook with the **logging** System Role to configure logging on RHEL servers and set them to receive logs from a remote logging system using TLS encryption.

This procedure creates a private key and certificate, and configures TLS on all hosts in the server group in the Ansible inventory.



NOTE

You do not have to call the **certificate** System Role in the playbook to create the certificate. The **logging** System Role calls it automatically.

In order for the CA to be able to sign the created certificate, the managed nodes must be enrolled in an IdM domain.

Conditions préalables

- Vous disposez d'autorisations pour exécuter des playbooks sur les nœuds gérés sur lesquels vous souhaitez configurer TLS.
- Les nœuds gérés sont répertoriés dans le fichier d'inventaire du nœud de contrôle.
- Les paquets **ansible** et **rhel-system-roles** sont installés sur le nœud de contrôle.
- The managed nodes are enrolled in an IdM domain.

Procédure

1. Créer un fichier ***playbook.yml*** avec le contenu suivant :

```
---
- name: Deploying remote input and remote_files output with certs
  hosts: server
  roles:
    - rhel-system-roles.logging
  vars:
    logging_certificates:
      - name: logging_cert
        dns: ['localhost', 'www.example.com']
        ca: ipa
    logging_pki_files:
      - ca_cert: /local/path/to/ca_cert.pem
        cert: /local/path/to/logging_cert.pem
        private_key: /local/path/to/logging_cert.pem
    logging_inputs:
```

```
      - name: input_name
        type: remote
        tcp_ports: 514
        tls: true
        permitted_clients: ['clients.example.com']
    logging_outputs:
      - name: output_name
        type: remote_files
        remote_log_path: /var/log/remote/%FROMHOST%/%PROGRAMNAME:::secpath-
replace%.log
        async_writing: true
        client_count: 20
        io_buffer_size: 8192
    logging_flows:
      - name: flow_name
        inputs: [input_name]
        outputs: [output_name]
```

Le playbook utilise les paramètres suivants :

logging_certificates

The value of this parameter is passed on to **certificate_requests** in the **certificate** role and used to create a private key and certificate.

logging_pki_files

Using this parameter, you can configure the paths and other settings that logging uses to find the CA, certificate, and key files used for TLS, specified with one or more of the following sub-parameters: **ca_cert**, **ca_cert_src**, **cert**, **cert_src**, **private_key**, **private_key_src**, and **tls**.

NOTE

If you are using **logging_certificates** to create the files on the target node, do not use **ca_cert_src**, **cert_src**, and **private_key_src**, which are used to copy files not created by **logging_certificates**.

ca_cert

Represents the path to the CA certificate file on the target node. Default path is **/etc/pki/tls/certs/ca.pem** and the file name is set by the user.

cert

Represents the path to the certificate file on the target node. Default path is **/etc/pki/tls/certs/server-cert.pem** and the file name is set by the user.

private_key

Represents the path to the private key file on the target node. Default path is **/etc/pki/tls/private/server-key.pem** and the file name is set by the user.

ca_cert_src

Represents the path to the CA certificate file on the control node which is copied to the target host to the location specified by **ca_cert**. Do not use this if using **logging_certificates**.

cert_src

Represents the path to a certificate file on the control node which is copied to the target host to the location specified by **cert**. Do not use this if using **logging_certificates**.

private_key_src

Represents the path to a private key file on the control node which is copied to the target host to the location specified by **private_key**. Do not use this if using **logging_certificates**.

tls

Setting this parameter to **true** ensures secure transfer of logs over the network. If you do not want a secure wrapper, you can set **tls: false**.

2. Vérifier la syntaxe du playbook :

```
# ansible-playbook --syntax-check playbook.yml
```

3. Exécutez le playbook sur votre fichier d'inventaire :

```
# ansible-playbook -i inventory_file playbook.yml
```

Ressources supplémentaires

- Demande de certificats à l'aide des rôles système RHEL .

16.7. UTILISATION DES RÔLES DU SYSTÈME LOGGING AVEC RELP

Reliable Event Logging Protocol (RELP) est un protocole de réseau pour l'enregistrement de données et de messages sur le réseau TCP. Il garantit une livraison fiable des messages d'événements et vous pouvez l'utiliser dans des environnements qui ne tolèrent aucune perte de message.

L'émetteur de RELP transfère les entrées de journal sous forme de commandes et le récepteur les accuse réception une fois qu'elles ont été traitées. Pour garantir la cohérence, le RELP enregistre le numéro de transaction de chaque commande transférée afin de permettre la récupération de tout type de message.

Vous pouvez envisager un système de journalisation à distance entre le client RELP et le serveur RELP. Le client RELP transfère les journaux vers le système de journalisation distant et le serveur RELP reçoit tous les journaux envoyés par le système de journalisation distant.

Les administrateurs peuvent utiliser le rôle de système **logging** pour configurer le système de journalisation afin qu'il envoie et reçoive des entrées de journal de manière fiable.

16.7.1. Configuration de la journalisation des clients avec RELP

Vous pouvez utiliser le rôle de système **logging** pour configurer la journalisation dans les systèmes RHEL qui sont journalisés sur une machine locale et peuvent transférer les journaux vers le système de journalisation distant avec RELP en exécutant un livre de jeu Ansible.

Cette procédure configure RELP sur tous les hôtes du groupe **clients** dans l'inventaire Ansible. La configuration de RELP utilise Transport Layer Security (TLS) pour crypter la transmission des messages afin de sécuriser le transfert des journaux sur le réseau.

Conditions préalables

- Vous avez le droit d'exécuter des playbooks sur les nœuds gérés sur lesquels vous souhaitez configurer RELP.
- Les nœuds gérés sont répertoriés dans le fichier d'inventaire du nœud de contrôle.

- Les paquets **ansible** et **rhel-system-roles** sont installés sur le nœud de contrôle.

Procédure

1. Créer un fichier ***playbook.yml*** avec le contenu suivant :

```
---
- name: Deploying basic input and relp output
  hosts: clients
  roles:
    - rhel-system-roles.logging
  vars:
    logging_inputs:
      - name: basic_input
        type: basics
    logging_outputs:
      - name: relp_client
        type: relp
        target: _logging.server.com_
        port: 20514
        tls: true
        ca_cert: _/etc/pki/tls/certs/ca.pem_
        cert: _/etc/pki/tls/certs/client-cert.pem_
        private_key: _/etc/pki/tls/private/client-key.pem_
        pki_authmode: name
        permitted_servers:
          - '*.server.example.com'
    logging_flows:
      - name: _example_flow_
        inputs: [basic_input]
        outputs: [relp_client]
```

Les playbooks utilisent les paramètres suivants :

- **target**: Il s'agit d'un paramètre obligatoire qui spécifie le nom de l'hôte où le système d'enregistrement à distance est exécuté.
- **port**: Numéro de port que le système d'enregistrement à distance écoute.
- **tls**: Assure un transfert sécurisé des journaux sur le réseau. Si vous ne voulez pas d'enveloppe sécurisée, vous pouvez fixer la variable **tls** à **false**. Par défaut, le paramètre **tls** est fixé à true lorsque vous travaillez avec RELP et nécessite des clés/certificats et des triplets {**ca_cert**, **cert**, **private_key**} et/ou {**ca_cert_src**, **cert_src**, **private_key_src**}.
  - Si le triplet {**ca_cert_src**, **cert_src**, **private_key_src**} est défini, les emplacements par défaut **/etc/pki/tls/certs** et **/etc/pki/tls/private** sont utilisés comme destination sur le nœud géré pour transférer des fichiers depuis le nœud de contrôle. Dans ce cas, les noms de fichiers sont identiques aux noms originaux dans le triplet
  - Si le triplet {**ca_cert**, **cert**, **private_key**} est défini, les fichiers sont censés se trouver sur le chemin par défaut avant la configuration de l'enregistrement.
  - Si les deux triplets sont activés, les fichiers sont transférés du chemin local du nœud de contrôle au chemin spécifique du nœud géré.

- **ca_cert**: Représente le chemin d'accès au certificat de l'autorité de certification. Le chemin par défaut est **/etc/pki/tls/certs/ca.pem** et le nom du fichier est défini par l'utilisateur.
- **cert**: Représente le chemin d'accès au certificat. Le chemin par défaut est **/etc/pki/tls/certs/server-cert.pem** et le nom du fichier est défini par l'utilisateur.
- **private_key**: Représente le chemin d'accès à la clé privée. Le chemin par défaut est **/etc/pki/tls/private/server-key.pem** et le nom du fichier est défini par l'utilisateur.
- **ca_cert_src**: Représente le chemin d'accès au fichier CA cert local qui est copié sur l'hôte cible. Si ca_cert est spécifié, il est copié à cet emplacement.
- **cert_src**: Représente le chemin d'accès au fichier local cert qui est copié sur l'hôte cible. Si cert est spécifié, il est copié à l'emplacement.
- **private_key_src**: Représente le chemin d'accès au fichier de la clé locale qui est copié sur l'hôte cible. Si la clé privée est spécifiée, elle est copiée à cet emplacement.
- **pki_authmode**: Accepte le mode d'authentification **name** ou **fingerprint**.
- **permitted_servers**: Liste des serveurs qui seront autorisés par le client de journalisation à se connecter et à envoyer des journaux via TLS.
- **inputs**: Liste des dictionnaires d'entrée de la journalisation.
- **outputs**: Liste des dictionnaires de sortie de la journalisation.

2. Facultatif : Vérifier la syntaxe du playbook.

```
# ansible-playbook --syntax-check playbook.yml
```

3. Exécutez le manuel de jeu :

```
# ansible-playbook -i inventory_file playbook.yml
```

16.7.2. Configuration de la journalisation du serveur avec RELP

Vous pouvez utiliser le rôle de système **logging** pour configurer la journalisation dans les systèmes RHEL en tant que serveur et recevoir les journaux du système de journalisation distant avec RELP en exécutant un livre de jeu Ansible.

Cette procédure configure RELP sur tous les hôtes du groupe **server** dans l'inventaire Ansible. La configuration de RELP utilise TLS pour chiffrer la transmission des messages afin de sécuriser le transfert des journaux sur le réseau.

Conditions préalables

- Vous avez le droit d'exécuter des playbooks sur les nœuds gérés sur lesquels vous souhaitez configurer RELP.
- Les nœuds gérés sont répertoriés dans le fichier d'inventaire du nœud de contrôle.
- Les paquets **ansible** et **rhel-system-roles** sont installés sur le nœud de contrôle.

Procédure

1. Créer un fichier ***playbook.yml*** avec le contenu suivant :

```
---
- name: Deploying remote input and remote_files output
  hosts: server
  roles:
    - rhel-system-roles.logging
  vars:
    logging_inputs:
      - name: relp_server
        type: relp
        port: 20514
        tls: true
        ca_cert: _/etc/pki/tls/certs/ca.pem_
        cert: _/etc/pki/tls/certs/server-cert.pem_
        private_key: _/etc/pki/tls/private/server-key.pem_
        pki_authmode: name
        permitted_clients:
          - '_*example.client.com_'
    logging_outputs:
      - name: _remote_files_output_
        type: _remote_files_
    logging_flows:
      - name: _example_flow_
        inputs: _relp_server_
        outputs: _remote_files_output_
```

Les playbooks utilisent les paramètres suivants :

- **port**: Numéro de port que le système d'enregistrement à distance écoute.
- **tls**: Assure un transfert sécurisé des journaux sur le réseau. Si vous ne voulez pas d'enveloppe sécurisée, vous pouvez fixer la variable **tls** à **false**. Par défaut, le paramètre **tls** est fixé à true lorsque vous travaillez avec RELP et nécessite des clés/certificats et des triplets {**ca_cert**, **cert**, **private_key**} et/ou {**ca_cert_src**, **cert_src**, **private_key_src**}.
  - Si le triplet {**ca_cert_src**, **cert_src**, **private_key_src**} est défini, les emplacements par défaut **/etc/pki/tls/certs** et **/etc/pki/tls/private** sont utilisés comme destination sur le nœud géré pour transférer des fichiers depuis le nœud de contrôle. Dans ce cas, les noms de fichiers sont identiques aux noms originaux dans le triplet
  - Si le triplet {**ca_cert**, **cert**, **private_key**} est défini, les fichiers sont censés se trouver sur le chemin par défaut avant la configuration de l'enregistrement.
  - Si les deux triplets sont activés, les fichiers sont transférés du chemin local du nœud de contrôle au chemin spécifique du nœud géré.
- **ca_cert**: Représente le chemin d'accès au certificat de l'autorité de certification. Le chemin par défaut est **/etc/pki/tls/certs/ca.pem** et le nom du fichier est défini par l'utilisateur.
- **cert**: Représente le chemin d'accès au certificat. Le chemin par défaut est **/etc/pki/tls/certs/server-cert.pem** et le nom du fichier est défini par l'utilisateur.
- **private_key**: Représente le chemin d'accès à la clé privée. Le chemin par défaut est **/etc/pki/tls/private/server-key.pem** et le nom du fichier est défini par l'utilisateur.
- **ca_cert_src**: Représente le chemin d'accès à un fichier CA sur les hôtes invités à l'hôte

- **ca_cert_src**: Représente le chemin d'accès au fichier CA cert local qui est copié sur l'hôte cible. Si ca_cert est spécifié, il est copié à cet emplacement.
- **cert_src**: Représente le chemin d'accès au fichier local cert qui est copié sur l'hôte cible. Si cert est spécifié, il est copié à l'emplacement.
- **private_key_src**: Représente le chemin d'accès au fichier de la clé locale qui est copié sur l'hôte cible. Si la clé privée est spécifiée, elle est copiée à cet emplacement.
- **pki_authmode**: Accepte le mode d'authentification **name** ou **fingerprint**.
- **permitted_clients**: Liste des clients qui seront autorisés par le serveur de journalisation à se connecter et à envoyer des journaux via TLS.
- **inputs**: Liste des dictionnaires d'entrée de la journalisation.
- **outputs**: Liste des dictionnaires de sortie de la journalisation.

2. Facultatif : Vérifier la syntaxe du playbook.

```
# ansible-playbook --syntax-check playbook.yml
```

3. Exécutez le manuel de jeu :

```
# ansible-playbook -i inventory_file playbook.yml
```

16.8. RESSOURCES SUPPLÉMENTAIRES

- Préparation d'un nœud de contrôle et de nœuds gérés à l'utilisation des rôles système RHEL
- Documentation installée avec le paquetage **rhel-system-roles** dans **/usr/share/ansible/roles/rhel-system-roles.logging/README.html**.
- Rôles du système RHEL
- **ansible-playbook(1)** page de manuel.