Red Hat Enterprise Linux 9

Upgrading from RHEL 8 to RHEL 9

Instructions for an in-place upgrade from Red Hat Enterprise Linux 8 to Red Hat Enterprise Linux 9

Last Updated: 2023-03-27

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Legal Notice

Abstract

This document provides instructions on how to perform an in-place upgrade from Red Hat Enterprise Linux 8 to Red Hat Enterprise Linux 9 using the Leapp utility. During the in-place upgrade, the existing RHEL 8 operating system is replaced by a RHEL 9 version.

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MAKING OPEN SOURCE MORE INCLUSIVE

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

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

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1. View the documentation in the **Multi-page HTML** format and ensure that you see the **Feedback** button in the upper right corner after the page fully loads.
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1. Log in to the Bugzilla website.
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3. Enter a descriptive title in the **Summary** field.
4. Enter your suggestion for improvement in the **Description** field. Include links to the relevant parts of the documentation.
5. Click **Submit Bug**.

KEY MIGRATION TERMINOLOGY

While the following migration terms are commonly used in the software industry, these definitions are specific to Red Hat Enterprise Linux (RHEL).

Update

Sometimes called a software patch, an update is an addition to the current version of the application, operating system, or software that you are running. A software update addresses any issues or bugs to provide a better experience of working with the technology. In RHEL, an update relates to a minor release, for example, updating from RHEL 8.1 to 8.2.

Upgrade

An upgrade is when you replace the application, operating system, or software that you are currently running with a newer version. Typically, you first back up your data according to instructions from Red Hat. When you upgrade RHEL, you have two options:

- **In-place upgrade:** During an in-place upgrade, you replace the earlier version with the new version without removing the earlier version first. The installed applications and utilities, along with the configurations and preferences, are incorporated into the new version.
- **Clean install:** A clean install removes all traces of the previously installed operating system, system data, configurations, and applications and installs the latest version of the operating system. A clean install is ideal if you do not need any of the previous data or applications on your systems or if you are developing a new project that does not rely on prior builds.

Operating system conversion

A conversion is when you convert your operating system from a different Linux distribution to Red Hat Enterprise Linux. Typically, you first back up your data according to instructions from Red Hat.

Migration

Typically, a migration indicates a change of platform: software or hardware. Moving from Windows to Linux is a migration. Moving a user from one laptop to another or a company from one server to another is a migration. However, most migrations also involve upgrades, and sometimes the terms are used interchangeably.

- **Migration to RHEL:** Conversion of an existing operating system to RHEL
- **Migration across RHEL:** Upgrade from one version of RHEL to another

CHAPTER 1. SUPPORTED UPGRADE PATHS

The in-place upgrade replaces the RHEL 8 operating system on your system with a RHEL 9 version.

IMPORTANT

It is not possible to perform an in-place upgrade directly from RHEL 7 to RHEL 9. However, you can perform an in-place upgrade from RHEL 7 to RHEL 8 and then perform a second in-place upgrade to RHEL 9. For more information, see Upgrading from RHEL 7 to RHEL 8.

Currently, it is possible to perform an in-place upgrade from the following source RHEL 8 minor versions to the following target RHEL 9 minor versions:

Table 1.1. Supported upgrade paths

Product variant	Source OS version	Target OS version
RHEL	RHEL 8.7	RHEL 9.0
RHEL for SAP	RHEL 8.6	RHEL 9.0

For more information on supported upgrade paths, see Supported in-place upgrade paths for Red Hat Enterprise Linux.

CHAPTER 2. PLANNING AN UPGRADE

An in-place upgrade is the recommended and supported way to upgrade your system to the next major version of RHEL.

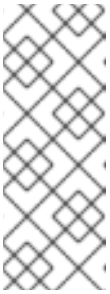
You should consider the following before upgrading to RHEL 9:

- **Operating system** - The operating system is upgradable by the **Leapp** utility under the following conditions:
  - The source OS version is installed on a system with one of the following supported architectures:
    - 64-bit Intel, AMD, and ARM
    - IBM POWER (little endian)
    - 64-bit IBM Z
      For more information, see Red Hat certified hardware .
  - Minimum hardware requirements for RHEL 9 met
  - Access to up-to-date RHEL 8.7 and RHEL 9.0 content provided; see Preparing a RHEL 8 system for the upgrade, step 1 for details.
- **Applications** - You can migrate applications installed on your system using **Leapp**. However, in certain cases, you have to create custom actors, which specify actions to be performed by **Leapp** during the upgrade, for example, reconfiguring an application or installing a specific hardware driver. For more information, see Handling the migration of your custom and third-party applications. Note that custom actors are unsupported by Red Hat.

IMPORTANT

SHA1 has been deprecated in RHEL 9. If your system contains any packages with **RSA/SHA1** signatures, the upgrade is inhibited. Before upgrading, either remove these packages or contact the vendor for packages with **RSA/SHA256** signatures. For more information, see SHA-1 deprecation in Red Hat Enterprise Linux 9.

- **Security** - You should evaluate this aspect before the upgrade and take additional steps when the upgrade process completes. Consider especially the following:
  - Before the upgrade, define the security standard your system has to comply with and understand the security changes in RHEL 9 .
  - During the upgrade process, the **Leapp** utility sets SELinux mode to permissive.
  - In-place upgrades of systems in FIPS mode are not supported.

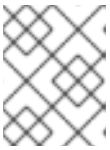


NOTE

Turning FIPS off, upgrading from RHEL 8 to 9, and then turning FIPS on is not supported by Red Hat. To be FIPS-compliant, all cryptographic keys must be used only by the FIPS-validated cryptographic modules. Therefore, turning FIPS on after the upgrade cannot be supported without regenerating cryptographic keys. Note that Red Hat does not track every created cryptographic key and therefore, cannot automate this task.

  - After the upgrade is finished, re-evaluate and re-apply your security policies. For information about applying and updating security policies, see Applying security policies.

- **Storage and file systems**- You should always back up your system prior to upgrading. For example, you can use the Relax-and-Recover (ReaR) utility, LVM snapshots, RAID splitting, or a virtual machine snapshot.



NOTE

File systems formats are intact. As a consequence, file systems have the same limitations as when they were originally created.

- **High Availability** - If you are using the High Availability add-on, follow the Recommended Practices for Applying Software Updates to a RHEL High Availability or Resilient Storage Cluster Knowledgebase article.

- **Downtime** - The upgrade process can take from several minutes to several hours.

- **Satellite** - If you manage your hosts through Satellite, you can upgrade multiple hosts simultaneously from RHEL 8 to RHEL 9 using the Satellite web UI. For more information, see Upgrading Hosts from RHEL 7 to RHEL 8 .

- **SAP HANA** - If you are using SAP HANA, follow the How to in-place upgrade SAP environments from RHEL 8 to RHEL 9 guide instead. Note that the upgrade path for RHEL with SAP HANA might differ.

- **Public clouds** - The in-place upgrade is supported for on-demand Pay-As-You-Go (PAYG) instances on Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform with Red Hat Update Infrastructure (RHUI) . The in-place upgrade is also supported for Bring Your Own Subscription instances on all public clouds that use RHSM for a RHEL subscription.

- **Language** - All **Leapp** reports, logs, and other generated documentation are in English, regardless of the language configuration.

- **Bootloader** - It is not possible to switch the bootloader from BIOS to UEFI on RHEL 8 or RHEL 9. If your RHEL 8 system uses BIOS and you want your RHEL 9 system to use UEFI, perform a fresh install of RHEL 9 instead of an in-place upgrade. For more information, see Is it possible to switch the BIOS boot to UEFI boot on preinstalled Red Hat Enterprise Linux machine?

- **Known limitations** - Notable known limitations of **Leapp** currently include:

  - Encryption of the whole disk or a partition, or file-system encryption currently cannot be used on a system targeted for an in-place upgrade.

  - No network-based multipath and no kind of network storage mount can be used as a system partition (for example, iSCSI, or NFS).

- The in-place upgrade is currently unsupported for on-demand PAYG instances on the remaining Public Clouds (Huawei Cloud, Alibaba Cloud) that use Red Hat Update Infrastructure but not Red Hat Subscription Manager (RHSM) for a RHEL subscription.

See also Known Issues.

You can use **Red Hat Insights** to determine which of the systems you have registered to Insights is on a supported upgrade path to RHEL 9. To do so, navigate to the respective Advisor recommendation in Insights, enable the recommendation under the *Actions* drop-down menu, and inspect the list under the *Affected systems* heading. Note that the Advisor recommendation considers only the RHEL 8 minor version and does not perform a pre-upgrade assessment of the system. See also Advisor Service Recommendations.

CHAPTER 3. PREPARING FOR THE UPGRADE

To prevent issues after the upgrade and to ensure that your system is ready to be upgraded to the next major version of RHEL, complete all necessary preparation steps before upgrading.

You must perform the preparation steps described in Preparing a RHEL 8 system for the upgrade on all systems. In addition, on systems that are registered to Satellite Server, you must also perform the preparation steps described in Preparing a Satellite-registered system for the upgrade .

3.1. PREPARING A RHEL 8 SYSTEM FOR THE UPGRADE

This procedure describes the steps that are necessary before performing an in-place upgrade to RHEL 9 by using the **Leapp** utility.

If you do not plan to use Red Hat Subscription Manager (RHSM) during the upgrade process, follow instructions in Upgrading to RHEL 9 without Red Hat Subscription Manager .

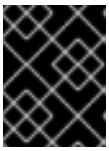
Prerequisites

- The system meets conditions listed in Planning an upgrade.

Procedure

1. If you previously performed an in-place upgrade from RHEL 7 to RHEL 8, remove the **/root/tmp_leapp_py3** directory if it is present on your system:

```
# rm -rf /root/tmp_leapp_py3
```



IMPORTANT

If the **/root/tmp_leapp_py3** directory is present on your system when you perform the upgrade, the system might break following the upgrade.

2. Ensure your system has been successfully registered to the Red Hat Content Delivery Network (CDN) or Red Hat Satellite by using the Red Hat Subscription Manager.

3. If you have registered your system to Satellite Server, complete the steps in Preparing a Satellite-registered system for the upgrade to ensure that your system meets the requirements for the upgrade.

4. Verify that you have the Red Hat Enterprise Linux Server subscription attached. For example:

```
# subscription-manager list --installed
+-------------------------------------------+
    Installed Product Status
+-------------------------------------------+
Product Name:   Red Hat Enterprise Linux x86_64
Product ID:     479
Version:        8.6
Arch:           x86_64
Status:         Subscribed
```

5. Ensure you have appropriate repositories enabled. The following command enables the Base and AppStream repositories for the 64-bit Intel architecture; for other architectures, see RHEL 8 repositories.

```
# subscription-manager repos --enable rhel-8-for-x86_64-baseos-rpms --enable rhel-8-for-x86_64-appstream-rpms
```

NOTE

Optionally, you can enable the CodeReady Linux Builder (also known as Optional) or Supplementary repositories. For more information about repository IDs, see RHEL 8 repositories. For more information about the content of these repositories, see the Package manifest.

6. For systems subscribed using RHSM, lock the system to RHEL 8.7:

```
# subscription-manager release --set 8.7
```

7. Optional: If you want to use custom repositories, configure them per instructions in Configuring custom repositories.

8. If you use the **dnf versionlock** plugin to lock packages to a specific version, clear the lock by running:

```
# dnf versionlock clear
```

   See How to restrict dnf to install or upgrade a package to a fixed specific package version? for more information.

9. If you are upgrading by using Red Hat Update Infrastructure (RHUI) on a public cloud, enable required RHUI repositories and install required RHUI packages to ensure your system is ready for upgrade:

   a. For AWS:

```
# dnf config-manager --set-enabled rhui-client-config-server-8
# dnf -y install rh-amazon-rhui-client-ha leapp-rhui-aws
```

   b. For Microsoft Azure:

```
# dnf config-manager --set-enabled rhui-microsoft-azure-rhel8
# dnf -y install rhui-azure-rhel8 leapp-rhui-azure
```

   c. For Google Cloud Platform, follow the Leapp RHUI packages for Google Cloud Platform (GCP) Knowledgebase article.

10. Update all packages to the latest RHEL 8 version:

```
# dnf update
```

11. Reboot the system:

```
# reboot
```

12. Install the **Leapp** utility:

```
# dnf install leapp-upgrade
```

Note that currently you need version 0.15.0 or later of the **leapp** package and version 0.17.0 or later of the **leapp-repository** package, which contains the **leapp-upgrade-el8toel9** RPM package.

NOTE

If your system does not have internet access, download the following packages from the Red Hat Customer Portal :

- **leapp**
- **leapp-deps**
- **python3-leapp**
- **leapp-upgrade-el8toel9**
- **leapp-upgrade-el8toel9-deps**

13. Ensure you have access to the latest version of additional required data files, including RPM package changes, RPM repository mapping, and unsupported drivers and devices.

    a. If you are using RHSM for the upgrade, the system has access to cloud.redhat.com, and you have not downloaded an earlier version of the required data files, no further action is required from you. The data files are automatically downloaded from cloud.redhat.com.

    b. If you are accessing Red Hat CDN using a proxy server, define the **$LEAPP_PROXY_HOST** environment variable to access the latest version of required data files.

    c. If needed, download the data files attached to the Knowledgebase article Leapp utility metadata in-place upgrades of RHEL for disconnected upgrades and place them in the **/etc/leapp/files/** directory. Note that currently you need data files from the **leapp-data19.tar.gz** archive or later. This is necessary for a successful upgrade in the following scenarios:

        i. You are upgrading on a public cloud by using RHUI. If you do not have a Red Hat subscription or Red Hat Customer Portal account, create a no-cost RHEL developer subscription so that you can access the Knowledgebase article and download required data packages. For more information, see How do I get a no-cost Red Hat Enterprise Linux Developer Subscription or renew it?

        ii. Your system does not have internet access.

        iii. You are using RHSM for the upgrade and you previously downloaded an older version of the required data files but did not perform the upgrade, for example to create automated scripts. You can also delete your older version of the data files to start the automatic download of the latest file version.

14. Temporarily disable antivirus software to prevent the upgrade from failing.

15. Ensure that any configuration management system does not interfere with the in-place upgrade process:

- If you use a configuration management system with a client-server architecture, such as **Puppet**, **Salt**, or **Chef**, disable the system before running the **leapp preupgrade** command. Do not enable the configuration management system until after the upgrade is complete to prevent issues during the upgrade.

- If you use a configuration management system with agentless architecture, such as **Ansible**, do not execute the configuration and deployment file, such as an Ansible playbook, during the in-place upgrade as described in Performing the upgrade from RHEL 8 to RHEL 9 . Automation of the pre-upgrade and upgrade process by using a configuration management system is not supported by Red Hat. For more information, see Using configuration management systems to automate parts of the Leapp pre-upgrade and upgrade process on Red Hat Enterprise Linux.

16. Ensure your system does not use more than one Network Interface Card (NIC) with a name based on the prefix used by the kernel (**eth**). For instructions on how to migrate to another naming scheme before an in-place upgrade to RHEL 9, see How to perform an in-place upgrade to RHEL 8 when using kernel NIC names on RHEL 7. The process for migrating naming schemes is the same for both the RHEL 7 to RHEL 8 upgrade and the RHEL 8 to RHEL 9 upgrade.

17. If your NSS database was created in RHEL 7 or earlier, verify that the database has been converted from the DBM database format to SQLite. For more information, see Updating NSS databases from DBM to SQLite.

18. RHEL 9 does not support the legacy **network-scripts** package, which was deprecated in RHEL 8. Before upgrading, move your custom network scripts and write a NetworkManager dispatcher script that executes your existing custom scripts. For more information, see Migrating custom network scripts to NetworkManager dispatcher scripts.

19. Ensure you have a full system backup or a virtual machine snapshot. You should be able to get your system to the pre-upgrade state if you follow standard disaster recovery procedures within your environment. For example, you can use the Relax-and-Recover (ReaR) utility. For more information, see the ReaR documentation and What is Relax and Recover (ReaR) and how can I use it for disaster recovery?. Alternatively, you can use LVM snapshots, or RAID splitting. In case of upgrading a virtual machine, you can create a snapshot of the whole VM.

3.2. PREPARING A SATELLITE-REGISTERED SYSTEM FOR THE UPGRADE

This procedure describes the steps that are necessary to prepare a system that is registered to Satellite for the upgrade to RHEL 9. There steps are performed on the Satellite Server.

IMPORTANT

Users on Satellite systems must complete the preparatory steps described both in this procedure and in Preparing a RHEL 8 system for the upgrade .

Prerequisites

- You have administrative privileges for the Satellite Server.

Procedure

1. Verify that Satellite is on a version in full or maintenance support. For more information, see Red Hat Satellite Product Life Cycle .

2. Import a subscription manifest with RHEL 9 repositories into Satellite Server. For more information, see the Managing Subscriptions chapter in the Content Management Guide for the particular version of Red Hat Satellite , for example, for version 6.10.

3. Enable and synchronize all required RHEL 8 and RHEL 9 repositories on the Satellite Server with the latest updates for RHEL 8.7 and RHEL 9.0.

NOTE

For RHEL 9 repositories, make sure to enable version 9.0 of each repository. If you have enabled only the RHEL 9 version of the repositories, the in-place upgrade is inhibited.

For example, for the Intel architecture without an Extended Update Support (EUS) subscription, enable at minimum the following repositories:

- Red Hat Enterprise Linux 8 for x86_64 - AppStream (RPMs)
  rhel-8-for-x86_64-appstream-rpms

  x86_64 8 or 8.7

- Red Hat Enterprise Linux 8 for x86_64 - BaseOS (RPMs)
  rhel-8-for-x86_64-baseos-rpms

  x86_64 8 or 8.7

- Red Hat Enterprise Linux 9 for x86_64 - AppStream (RPMs)
  rhel-9-for-x86_64-appstream-rpms

  x86_64 9.0

- Red Hat Enterprise Linux 9 for x86_64 - BaseOS (RPMs)
  rhel-9-for-x86_64-baseos-rpms

  x86_64 9.0

  For other architectures, see RHEL 8 repositories and RHEL 9 repositories.

  For more information, see the *Importing Content* chapter in the *Content Management Guide* for the particular version of Red Hat Satellite , for example, for version 6.10.

4. Attach the content host to a Content View containing the required RHEL 8 and RHEL 9 repositories.
   For more information, see the *Managing Content Views* chapter in the *Content Management Guide* for the particular version of Red Hat Satellite , for example, for version 6.10.

Verification

- Verify that the latest RHEL 8 repositories have been enabled on Satellite Server. For example, to verify repositories in the Library lifecycle environment:

```
# hammer repository list --search 'content_label ~ rhel-9' --content-view
<content_view_name> --organization <organization> --lifecycle-environment Library
```

Replace *<content_view_name>* with the name of the content view and *<organization>* with the organization.

CHAPTER 4. REVIEWING THE PRE-UPGRADE REPORT

To assess upgradability of your system, start the pre-upgrade process by the **leapp preupgrade** command. During this phase, the **Leapp** utility collects data about the system, assesses upgradability, and generates a pre-upgrade report.

The pre-upgrade report is available both in the **/var/log/leapp/leapp-report.txt** file and in the web console. The report summarizes potential problems and proposes recommended solutions. The report also helps you decide whether it is possible or advisable to proceed with the upgrade.

In certain configurations, **Leapp** generates true/false questions to determine how to proceed. All questions are stored in **/var/log/leapp/answerfile** and in the pre-upgrade report in the **Missing required answers in the answer file** message. **Leapp** inhibits the upgrade if you do not provide answers to all the questions.

You have two options when assessing upgradability in the pre-upgrade phase:

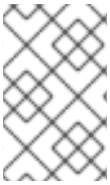
a. Review the pre-upgrade report in the generated **leapp-report.txt** file and manually resolve reported problems using the command-line interface.

b. Use the web console to review the report, apply automated remediations where available, and fix remaining problems using the suggested remediation hints.

IMPORTANT

During the pre-upgrade phase, **Leapp** neither simulates the whole in-place upgrade process nor downloads all RPM packages.

Reviewing a pre-upgrade report is useful also if you decide or need to redeploy a RHEL 8 system without the in-place upgrade process.



NOTE

You can process the pre-upgrade report using your own custom scripts, for example, to compare results from multiple reports across different environments. For more information, see Automating your Red Hat Enterprise Linux pre-upgrade report workflow .

4.1. ASSESSING UPGRADABILITY FROM THE COMMAND LINE

Identify potential upgrade problems during the pre-upgrade phase using the command-line interface.

Prerequisites

- The steps listed in Preparing for the upgrade have been completed.

Procedure

1. On your RHEL 8 system, perform the pre-upgrade phase:

```
# leapp preupgrade --target 9.0
```

   - If you are going to use custom repositories from the **/etc/yum.repos.d/** directory for the upgrade, enable the selected repositories as follows:

```
# leapp preupgrade --enablerepo <repository_id1> --enablerepo <repository_id2> ...
```

- If you are going to upgrade without RHSM or using RHUI, add the **--no-rhsm** option.
- If you have an Extended Upgrade Support (EUS), Advanced Update Support (AUS), or Update Services for SAP Solutions (E4S) subscription, add the **--channel *channel*** option. Replace *channel* with the channel, for example **eus**, **aus**, or **e4s**. Note that SAP HANA customers should perform the in-place upgrade using the How to in-place upgrade SAP environments from RHEL 8 to RHEL 9 guide.

2. Provide answers to each question required by **Leapp** by either of the following methods:
   - Execute the **leapp answer** command, specifying the question you are responding to and your confirmed answer.

     ```
     # leapp answer --section <question_section>.<field_name>=<answer>
     ```

     For example, to confirm a **True** response to the question **Are all VDO devices, if any, successfully converted to LVM management?**, execute the following command:

     ```
     # leapp answer --section check_vdo.confirm=True
     ```

   - Manually edit the **/var/log/leapp/answerfile** file, uncomment the last line of the file by deleting the **#** symbol, and confirm your answer as **True** or **False**; see Leapp answerfile.
3. Examine the report in the **/var/log/leapp/leapp-report.txt** file, and manually resolve all the reported problems before proceeding with the in-place upgrade.

4.2. ASSESSING UPGRADABILITY AND APPLYING AUTOMATED REMEDIATIONS THROUGH THE WEB CONSOLE

Identify potential problems in the pre-upgrade phase and how to apply automated remediations using the web console.

Prerequisites

- The steps listed in Preparing for the upgrade have been completed.

Procedure

1. Install the **cockpit-leapp** plug-in:

   ```
   # dnf install cockpit-leapp
   ```

2. Navigate to the web console in your browser and log in as **root** or as a user configured in the **/etc/sudoers** file. See Managing systems using the RHEL 8 web console for more information about the web console.
3. On your RHEL 8 system, perform the pre-upgrade phase either from the command-line interface or from the web console terminal:

   ```
   # leapp preupgrade --target 9.0
   ```

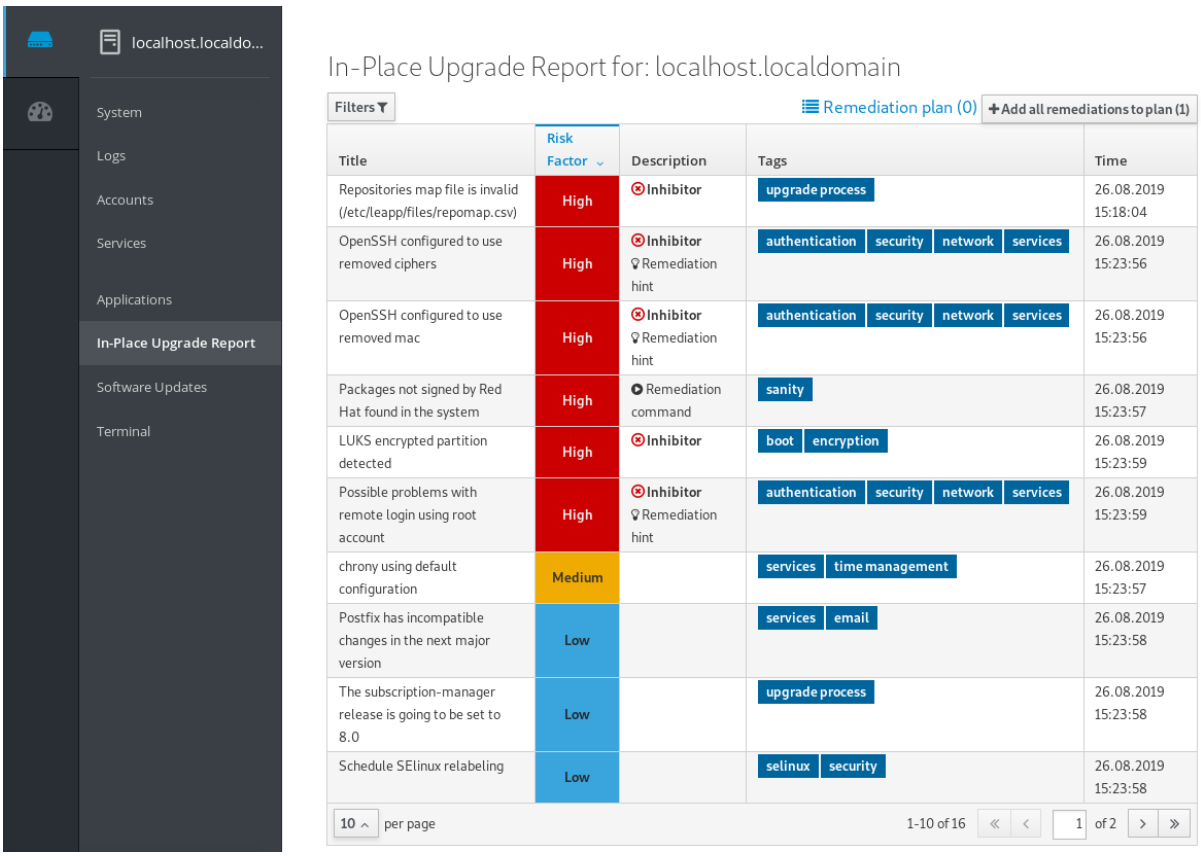
- If you are going to use custom repositories from the **/etc/yum.repos.d/** directory for the upgrade, enable the selected repositories as follows:

```
# leapp preupgrade --target 9.0 --enablerepo <repository_id1> --enablerepo
<repository_id2> ...
```

- If you are going to upgrade without RHSM or using RHUI, add the **--no-rhsm** option.
- If you have an Extended Upgrade Support (EUS), Advanced Update Support (AUS), or Update Services for SAP Solutions (E4S) subscription, add the **--channel *channel*** option. Replace *channel* with the channel, for example **eus**, **aus**, or **e4s**. Note that SAP HANA customers should perform the in-place upgrade using the How to in-place upgrade SAP environments from RHEL 8 to RHEL 9 guide.

4. In the web console, select **In-place Upgrade Report** from the left menu.

Figure 4.1. In-place upgrade report in the web console



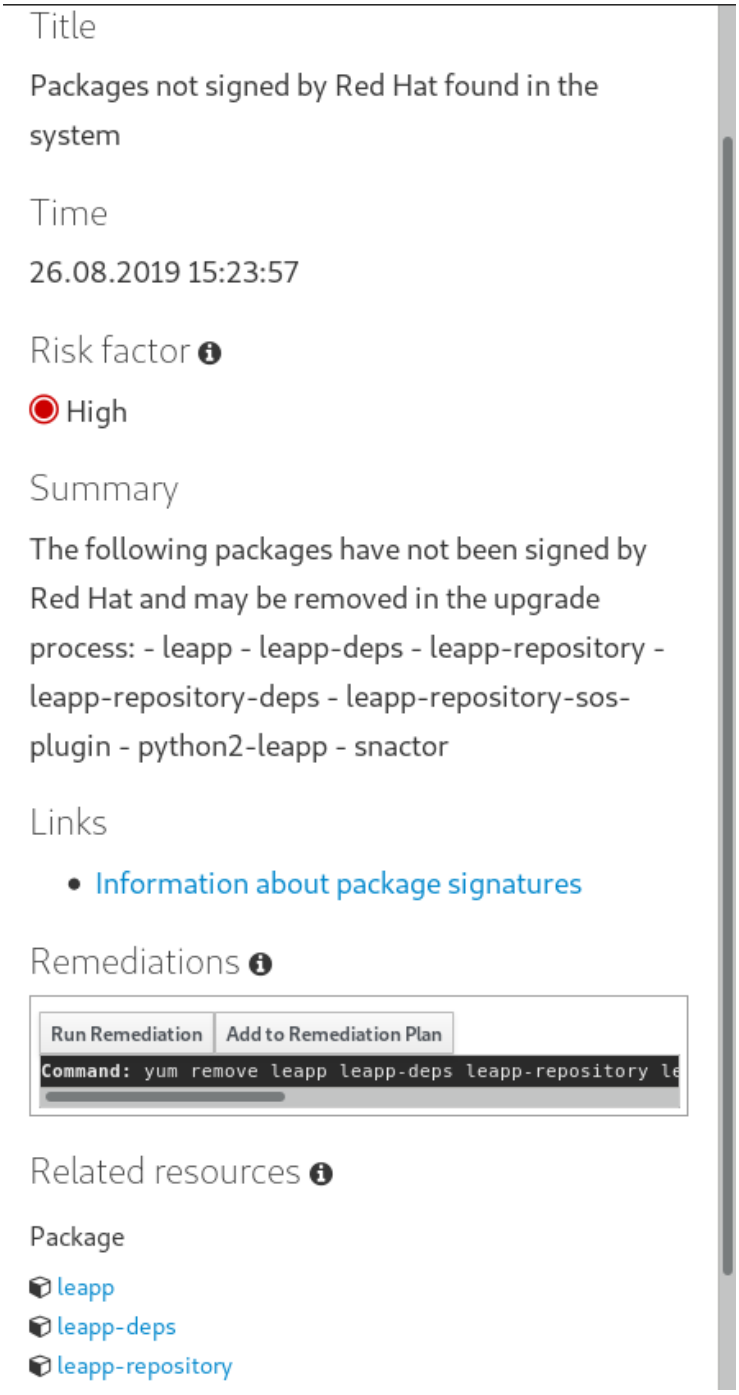
The report table provides an overview of the problems found, their risk assessment, and remediations (if available).

- Risk factor:
  - High - very likely to result in a deteriorated system state
  - Medium - can impact both the system and applications
  - Low - should not impact the system but can have an impact on applications
  - Info - informational with no expected impact to the system or applications

- Inhibitor - will inhibit (hard stop) the upgrade process, otherwise the system could become unbootable, inaccessible, or dysfunctional
- Remediation - an actionable solution to a reported problem:
  - Remediation command - can be executed directly through the web console
  - Remediation hint - instructions on how to resolve the problem manually

5. Examine the content of the report. You can sort the table by clicking a header. To open a detail pane, click a selected row.

Figure 4.2. Detail pane



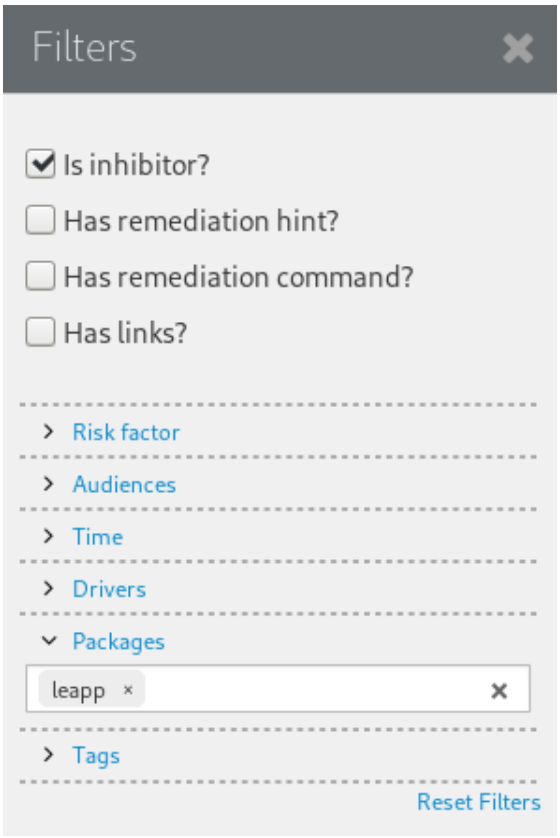
The detail pane displays the following additional information:

- Summary of the problem and links to Knowledgebase articles describing the problem in more detail

- Remediations - you can run or schedule an automated remediation (if available), and see its results when applied
- Affected system resources: packages, repositories, files (configuration, data), disks, volumes

6. Optionally filter the results. Click the **Filters** button in the top left corner above the report and apply a filter based on your preferences. Filter categories are applied in conjunction with one another.

Figure 4.3. Filters



7. Select issues for which you want to apply an automated remediation. You have two options:

   a. Choose individual items by clicking the **Add to Remediation Plan** button in the detail pane. Alternatively, you can execute individual remediations directly by clicking **Run Remediation** in the detail pane.

   b. Select all items for which a remediation is available by clicking the **Add all remediations to plan** button in the top right corner above the report.

8. Review and answer questions required by **Leapp** in the web console. Each unanswered question appears as a **Missing required answers in the answer file** title in the Upgrade Report. Select a title to answer the question:

   a. To confirm the default **True** answer, select **Add to Remediation Plan** to execute the remediation later or **Run Remediation** to execute the remediation immediately.

   b. To select the non-default answer instead, perform either of the following:

      i. Execute the **leapp answer** command, specifying the question you are responding to and your confirmed answer.

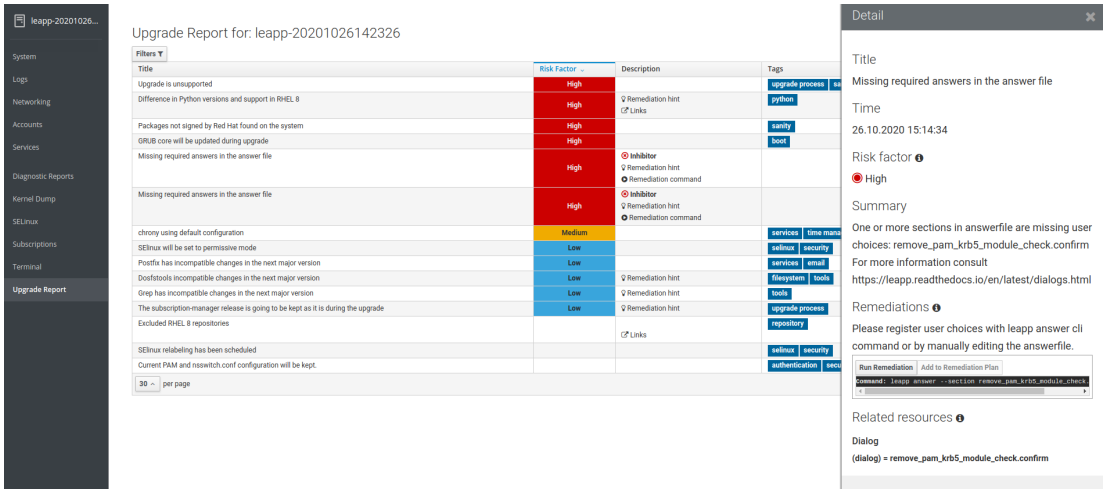
```
# leapp answer --section <question_section>.<field_name>=<answer>
```

For example, to confirm a **True** response to the question **Are all VDO devices, if any, successfully converted to LVM management?**, execute the following command:

```
# leapp answer --section check_vdo.confirm=True
```

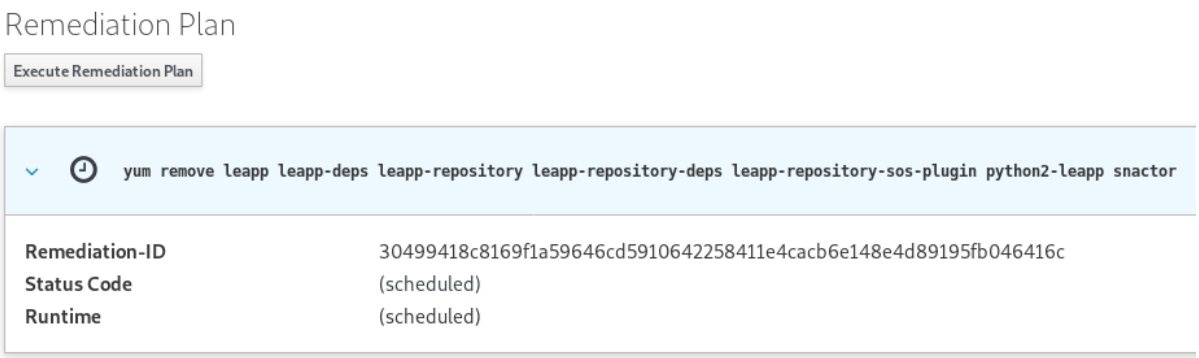
ii. Manually edit the **/var/log/leapp/answerfile** file, uncomment the last line of the file by deleting the **#** symbol, and confirm your answer as **True** or **False**; see Leapp answerfile example.

Figure 4.4. Missing unanswered Leapp question



9. Open the remediation plan by clicking the **Remediation plan** link in the top right corner above the report. The remediation plan provides a list of all executed or scheduled remediations.

Figure 4.5. Remediation plan



10. Process all scheduled remediations by clicking **Execute Remediation Plan**. The following information is displayed for each remediation entry:

- A unique ID of the remediation
- Exit status of the command
- Elapsed time of the executed remediation
- Standard output
- Standard error

11. After executing selected remediations, generate the pre-upgrade report again by using the **leapp preupgrade** command, examine the new report, and take additional remediation steps if needed.

CHAPTER 5. PERFORMING THE UPGRADE FROM RHEL 8 TO RHEL 9

This procedure lists steps required to perform the upgradefrom RHEL 8 to RHEL 9 using the **Leapp** utility.

Prerequisites

- The steps listed in Preparing for the upgrade have been completed, including a full system backup.
- The steps listed in Reviewing the pre-upgrade report have been completed and all reported issues resolved.

Procedure

1. On your RHEL 8 system, start the upgrade process:

```
# leapp upgrade --target 9.0
```

   - If you are going to use custom repositories from the **/etc/yum.repos.d/** directory for the upgrade, enable the selected repositories as follows:

```
# leapp upgrade --target 9.0 --enablerepo <repository_id1> --enablerepo
<repository_id2> ...
```

   - If you are going to upgrade without RHSM or using RHUI, add the **--no-rhsm** option.
   - If you have an Extended Upgrade Support (EUS), Advanced Update Support (AUS), or Update Services for SAP Solutions (E4S) subscription, add the **--channel *channel*** option. Replace *channel* with the value you used with the **leapp preupgrade** command, for example **eus**, **aus**, or **e4s**. Note that you must use the same value with the **--channel** option in both the **leapp preupgrade** and **leapp upgrade** commands.

2. At the beginning of the upgrade process, **Leapp** performs the pre-upgrade phase described in Reviewing the pre-upgrade report.
   - If the system is upgradable, **Leapp** downloads necessary data and prepares an RPM transaction for the upgrade.
   - If your system does not meet the parameters for a reliable upgrade, **Leapp** terminates the upgrade process and provides a record describing the issue and a recommended solution in the **/var/log/leapp/leapp-report.txt** file. For more information, see Troubleshooting.

3. Manually reboot the system:

```
# reboot
```

   In this phase, the system boots into a RHEL 9-based initial RAM disk image, initramfs. **Leapp** upgrades all packages and automatically reboots to the RHEL 9 system.

   Alternatively, you can run the **leapp upgrade** command with the **--reboot** option and skip this manual step.

If a failure occurs, investigate logs and known issues as described in Troubleshooting.

4. Log in to the RHEL 9 system and verify its state as described in Verifying the post-upgrade state of the RHEL 9 system.

5. Complete post-upgrade tasks as described in Performing post-upgrade tasks. Especially, re-evaluate and re-apply your security policies.

CHAPTER 6. VERIFYING THE POST-UPGRADE STATE OF THE RHEL 9 SYSTEM

This procedure lists verification steps recommended to perform after an in-place upgrade to RHEL 9.

Prerequisites

- The system has been upgraded following the steps described in Performing the upgrade from RHEL 8 to RHEL 9 and you have been able to log in to RHEL 9.

Procedure

After the upgrade completes, determine whether the system is in the required state, at least:

- Verify that the current OS version is RHEL 9:

```
# cat /etc/redhat-release
Red Hat Enterprise Linux release 9.0 (Plow)
```

- Check the OS kernel version:

```
# uname -r
5.14.0-70.10.1.el9_0.x86_64
```

  Note that **.el9** is important and the version should not be earlier than 5.14.0.

- If you are using the Red Hat Subscription Manager:
  - Verify that the correct product is installed:

```
# subscription-manager list --installed
+-------------------------------------------+
    Installed Product Status
+-------------------------------------------+
Product Name: Red Hat Enterprise Linux for x86_64
Product ID:   479
Version:      9.0
Arch:         x86_64
Status:       Subscribed
```

  - Verify that the release version is set to 9.0 immediately after the upgrade:

```
# subscription-manager release
Release: 9.0
```

- Verify that network services are operational, for example, try to connect to a server using SSH.
- Check the post-upgrade status of your applications. In some cases, you may need to perform migration and configuration changes manually. For example, to migrate your databases, follow instructions in Configuring and using database servers.

CHAPTER 7. PERFORMING POST-UPGRADE TASKS

This procedure lists major tasks recommended to perform after an in-place upgrade to RHEL 9.

Prerequisites

- The system has been upgraded following the steps described in Performing the upgrade from RHEL 8 to RHEL 9 and you have been able to log in to RHEL 9.
- The status of the in-place upgrade has been verified following the steps described in Verifying the post-upgrade status of the RHEL 9 system.

Procedure

After performing the upgrade, complete the following tasks:

1. Remove any remaining **Leapp** packages from the exclude list in the **/etc/dnf/dnf.conf** configuration file, including the **snactor** package, which is a tool for upgrade extension development. During the in-place upgrade, **Leapp** packages that were installed with the **Leapp** utility are automatically added to the exclude list to prevent critical files from being removed or updated. After the in-place upgrade, these **Leapp** packages must be removed from the exclude list before they can be removed from the system.
   - To manually remove packages from the exclude list, edit the **/etc/dnf/dnf.conf** configuration file and remove the desired **Leapp** packages from the exclude list.
   - To remove all packages from the exclude list:

     ```
     # dnf config-manager --save --setopt exclude=''
     ```

2. Remove remaining RHEL 8 packages, including remaining **Leapp** packages.
   a. Locate remaining RHEL 8 packages:

      ```
      # rpm -qa | grep -e '\.el[78]' | grep -vE '^(gpg-pubkey|libmodulemd|katello-ca-consumer)' | sort
      ```

   b. Remove remaining RHEL 8 packages, including the old kernel package, from your RHEL 9 system.
   c. Remove remaining **Leapp** dependency packages:

      ```
      # dnf remove leapp-deps-el9 leapp-repository-deps-el9
      ```

3. Disable DNF repositories whose packages are not RHEL 9-compatible. Repositories managed by RHSM are handled automatically. To disable these repositories:

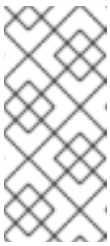
   ```
   # dnf config-manager --set-disabled <repository_id>
   ```

   Replace *repository_id* with the repository ID.

4. Ensure your system remains supported after the in-place upgrade. With the general availability of RHEL 9.1, ensure that your system is updated to either RHEL 9.1 or to RHEL 9.0 Extended Update Support (EUS).
   a. Update the system to RHEL 9.1:

i. Unset Red Hat Subscription Manager to consume the latest RHEL 9.1 content:

```
# subscription-manager release --unset
```



NOTE

If you manage your system with RHUI, use the following command instead:

```
# rhui-set-release --unset
```

ii. Update your system to the latest RHEL 9.1 version:

```
# dnf update
```

b. Ensure that your system is updated to RHEL 9.0 EUS.
If you used the **--channel** option to set the EUS channel during the in-place upgrade, you do not need to take further steps. Otherwise, update the system to RHEL 9.0 EUS:

i. Enable RHEL 9 EUS repositories:

```
# subscription-manager repos --enable repository_id1 --enable repository_id2 …
```

Replace *repository_id** with IDs of EUS repositories available with your subscription.

Enable at least the BaseOS and AppStream repositories. For example, on the Intel 64 architecture:

```
# subscription-manager repos --enable  rhel-9-for-x86_64-baseos-eus-rpms --enable rhel-9-for-x86_64-appstream-eus-rpms
```

ii. Update your system to the latest RHEL 9.0 EUS version:

```
# dnf update
```

5. Re-evaluate and re-apply your security policies. Especially, change the SELinux mode to enforcing. For details, see Applying security policies.

CHAPTER 8. APPLYING SECURITY POLICIES

During the in-place upgrade process, the SELinux policy must be switched to permissive mode. Furthermore, security profiles might contain changes between major releases. This section guides you when securing your upgraded RHEL systems and covers details for pre-upgrade steps of security-related components.

8.1. CHANGING SELINUX MODE TO ENFORCING

During the in-place upgrade process, the **Leapp** utility sets SELinux mode to permissive. When the system is successfully upgraded, you have to manually change SELinux mode to enforcing.

Prerequisites

- The system has been upgraded and you have performed the verification steps described in Verifying the post-upgrade state of the RHEL 9 system .

Procedure

1. Ensure that there are no SELinux denials, for example, by using the **ausearch** utility:

```
# ausearch -m AVC,USER_AVC -ts boot
```

   Note that the previous step covers only the most common scenario. To check for all possible SELinux denials, see the Identifying SELinux denials section in the Using SELinux title, which provides a complete procedure.

2. Open the **/etc/selinux/config** file in a text editor of your choice, for example:

```
# vi /etc/selinux/config
```

3. Configure the **SELINUX=enforcing** option:

```
# This file controls the state of SELinux on the system.
# SELINUX= can take one of these three values:
#       enforcing - SELinux security policy is enforced.
#       permissive - SELinux prints warnings instead of enforcing.
#       disabled - No SELinux policy is loaded.
SELINUX=enforcing
# SELINUXTYPE= can take one of these two values:
#       targeted - Targeted processes are protected,
#       mls - Multi Level Security protection.
SELINUXTYPE=targeted
```

4. Save the change, and restart the system:

```
# reboot
```

Verification

1. After the system restarts, confirm that the **getenforce** command returns **Enforcing**:

```
$ getenforce
Enforcing
```

Additional resources

- Troubleshooting problems related to SELinux
- Changing SELinux states and modes

8.2. 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.

The in-place upgrade process preserves the cryptographic policy you used in RHEL 8. For example, if you used the **DEFAULT** cryptographic policy in RHEL 8, your system upgraded to RHEL 9 also uses **DEFAULT**. Note that specific settings in predefined policies differ, and RHEL 9 cryptographic policies contain more strict and more secure default values. For example, the RHEL 9 **DEFAULT** cryptographic policy restricts SHA-1 usage for signatures and the **LEGACY** policy no longer allows DH and RSA ciphers with less than 2048 bits. See the Strong crypto defaults section in the Security hardening document for more information. Custom cryptographic policies are preserved across the in-place upgrade.

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

```
$ update-crypto-policies --show
DEFAULT
```

For example, the following command switches the system-wide crypto policy level to **FUTURE**, which should withstand any near-term future attacks:

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

If your scenario requires the use of SHA-1 for verifying existing or third-party cryptographic signatures, you can enable it by entering the following command:

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

Alternatively, you can switch the system-wide crypto policies to the **LEGACY** policy. However, **LEGACY** also enables many other algorithms that are not secure.

WARNING

Enabling the **SHA** subpolicy makes your system more vulnerable than the default RHEL 9 settings. Switching to the **LEGACY** policy is even less secure, and you should use it with caution.

You can also customize system-wide cryptographic policies. For details, see the Customizing system-wide cryptographic policies with policy modifiers and Creating and setting a custom system-wide cryptographic policy sections. If you use a custom cryptographic policy, consider reviewing and updating the policy to mitigate threats brought by advances in cryptography and computer hardware.

Additional resources

- Using system-wide cryptographic policies
- **update-crypto-policies(8)** man page.

8.3. UPGRADING A SYSTEM HARDENED TO A SECURITY BASELINE

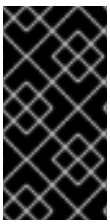
To get a fully hardened system after a successful upgrade to RHEL 9, you can use automated remediation provided by the OpenSCAP suite. OpenSCAP remediations align your system with security baselines, such as PCI-DSS, OSPP, or ACSC Essential Eight. The configuration compliance recommendations differ among major versions of RHEL due to the evolution of the security offering.

When upgrading a hardened RHEL 8 system, the **Leapp** tool does *not* provide direct means to retain the full hardening. Depending on the changes in the component configuration, the system might diverge from the recommendations for the RHEL 9 during the upgrade.

NOTE

You cannot use the same SCAP content for scanning RHEL 8 and RHEL 9. Update the management platforms if the compliance of the system is managed by tools such as Red Hat Satellite or Red Hat Insights.

As an alternative to automated remediations, you can make the changes manually by following an OpenSCAP-generated report. For information on generating a compliance report, see Scanning the system for security compliance and vulnerabilities.



IMPORTANT

Automated remediations support RHEL systems in the default configuration. Because the system configuration has been altered after the upgrade, running automated remediations might not make the system fully compliant with the required security profile. You might need to fix some requirements manually.

The following example procedure hardens your system settings according to the PCI-DSS profile.

Prerequisites

- The **scap-security-guide** package is installed on your RHEL 9 system.

Procedure

1. Find the appropriate security compliance data stream **.xml** file:

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

See the Viewing compliance profiles section for more information.

2. Remediate the system according to the selected profile from the appropriate data stream:

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

You can replace the **pci-dss** value in the **--profile** argument with the ID of the profile according to which you want to harden your system. For a full list of profiles supported in RHEL 9, see SCAP security profiles supported in RHEL .

WARNING

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.

3. Restart your system:

```
# reboot
```

Verification

1. Verify that the system is compliant with the profile, and save the results in an HTML file:

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

Additional resources

- **scap-security-guide(8)** and **oscap(8)** man pages
- Scanning the system for security compliance and vulnerabilities
- Red Hat Insights Security Policy
- Red Hat Satellite Security Policy

8.4. VERIFYING USBGUARD POLICIES

With the USBGuard software framework, you can protect your systems against intrusive USB devices by using lists of permitted and forbidden devices based on the USB device authorization feature in the kernel.

Prerequisites

- You have created a rule set for USB devices that reflected the requirements of your scenario before the upgrade.
- The **usbguard** service is installed and running on your RHEL 9 system.

Procedure

1. Back up your *.conf files stored in the **/etc/usbguard/** directory.
2. Use the **usbguard generate-policy** to generate a new policy file. Note that the command generates rules for the currently present USB devices only.
3. Compare the newly generated rules against the rules in the previous policy:
   a. If you identify differences in the rules for the devices that were present when you generated the new policy and the pre-upgrade rules for the same devices, modify the original rules correspondingly also for devices that might be inserted later.
   b. If there are no differences between the newly generated and the pre-upgrade rules, you can use the policy files created in RHEL 8 without any modification.

Additional resources

- Protecting systems against intrusive USB devices .

8.5. UPDATING FAPOLICYD DATABASES

The **fapolicyd** software framework controls the execution of applications based on a user-defined policy.

In rare cases, a problem with the **fapolicyd** trust database format can occur. To rebuild the database:

1. Stop the service:

```
# systemctl stop fapolicyd
```

2. Delete the database:

```
# fapolicyd-cli --delete-db
```

3. Start the service:

```
# systemctl start fapolicyd
```

If you added custom trust files to the trust database, update them either individually by using the **fapolicyd-cli -f update *<FILE>*** command or altogether by using **fapolicyd-cli -f update**. To apply the changes, use either the **fapolicyd-cli --update** command or restart the **fapolicyd** service.

Additionally, custom binaries might require a rebuild for the new RHEL version. Perform any such updates before you update the fapolicyd database.

Additional resources

- Blocking and allowing applications using fapolicyd

8.6. UPDATING NSS DATABASES FROM DBM TO SQLITE

Many applications automatically convert the NSS database format from DBM to SQLite after you set the **NSS_DEFAULT_DB_TYPE** environment variable to the **sql** value on the system. You can ensure that all databases are converted by using the **certutil** tool.

NOTE

Convert your NSS databases stored in the DBM format before you upgrade to RHEL 9. In other words, perform the following steps on RHEL systems (6, 7, and 8) from which you want to upgrade to RHEL 9.

Prerequisites

- The **nss-tools** package is installed on your system.

Procedure

1. Set **NSS_DEFAULT_DB_TYPE** to **sql** on the system:

```
# export NSS_DEFAULT_DB_TYPE=sql
```

2. Use the conversion command in every directory[1] that contains NSS database files in the DBM format, for example:

```
# certutil -K -X -d /etc/ipsec.d/
```

Note that you have to provide a password or a path to a password file as a value of the **-f** option if your database file is password-protected, for example:

```
# certutil -K -X -f /etc/ipsec.d/nsspassword -d /etc/ipsec.d/
```

Additional resources

- **certutil(1)** man page.

8.7. MIGRATING CYRUS SASL DATABASES FROM THE BERKELEY DB FORMAT TO GDBM

The RHEL 9 **cyrus-sasl** package is built without the **libdb** dependency, and the **sasldb** plugin uses the GDBM database format instead of Berkeley DB.

Prerequisites

- The **cyrus-sasl-lib** package is installed on your system.

Procedure

- To migrate your existing Simple Authentication and Security Layer (SASL) databases stored in the old Berkeley DB format, use the **cyrusbdb2current** tool with the following syntax:

```
# cyrusbdb2current <sasldb_path> <new_path>
```

Additional resources

- **cyrusbdb2current(1)** man page

[1] RHEL contains a system-wide NSS database in the **/etc/pki/nssdb** directory. Other locations depend on applications you use. For example, Libreswan stores its database in the **/etc/ipsec.d/** directory and Firefox uses the **/home/<username>/.mozilla/firefox/** directory.

CHAPTER 9. TROUBLESHOOTING

You can refer to the following tips to troubleshoot upgrading from RHEL 8 to RHEL 9.

9.1. TROUBLESHOOTING RESOURCES

You can refer to the following troubleshooting resources.

Console output

By default, only error and critical log level messages are printed to the console output by the **Leapp** utility. To change the log level, use the **--verbose** or **--debug** options with the **leapp upgrade** command.

- In *verbose* mode, **Leapp** prints info, warning, error, and critical messages.
- In *debug* mode, **Leapp** prints debug, info, warning, error, and critical messages.

Logs

- The **/var/log/leapp/leapp-upgrade.log** file lists issues found during the initramfs phase.
- The **/var/log/leapp/dnf-debugdata/** directory contains transaction debug data. This directory is present only if the **leapp upgrade** command is executed with the **--debug** option.
- The **/var/log/leapp/answerfile** contains questions required to be answered by **Leapp**.
- The **journalctl** utility provides complete logs.

Reports

- The **/var/log/leapp/leapp-report.txt** file lists issues found during the pre-upgrade phase. The report is also available in the web console, see Assessing upgradability and applying automated remediations through the web console.
- The **/var/log/leapp/leapp-report.json** file lists issues found during the pre-upgrade phase in a machine-readable format, which enables you to process the report using custom scripts. For more information, see Automating your Red Hat Enterprise Linux pre-upgrade report workflow .

9.2. TROUBLESHOOTING TIPS

You can refer to the following troubleshooting tips.

Pre-upgrade phase

- Verify that your system meets all conditions listed in Planning an upgrade.
- Make sure you have followed all steps described in Preparing for the upgrade for example, your system does not use more than one Network Interface Card (NIC) with a name based on the prefix used by the kernel (**eth**).
- Make sure you have answered all questions required by **Leapp** in the **/var/log/leapp/answerfile** file. If any answers are missing, **Leapp** inhibits the upgrade. For example:
  - Are there no VDO devices on the system?

- Make sure you have resolved all problems identified in the pre-upgrade report, located at **/var/log/leapp/leapp-report.txt**. To achieve this, you can also use the web console, as described in Assessing upgradability and applying automated remediations through the web console .

Example 9.1. Leapp answerfile

The following is an example of an unedited **/var/log/leapp/answerfile** file that has one unanswered question:

```
[check_vdo]
# Title:            None
# Reason:           Confirmation
# ============================== check_vdo.confirm
==============================
# Label:            Are all VDO devices, if any, successfully converted to LVM management?
# Description:      Enter True if no VDO devices are present on the system or all VDO devices on
the system have been successfully converted to LVM management. Entering True will circumvent
check of failures and undetermined devices. Recognized VDO devices that have not been
converted to LVM management can still block the upgrade despite the answer.All VDO devices
must be converted to LVM management before upgrading.
# Reason:           To maximize safety all block devices on a system that meet the criteria as
possible VDO devices are checked to verify that, if VDOs, they have been converted to LVM
management. If the devices are not converted and the upgrade proceeds the data on unconverted
VDO devices will be inaccessible. In order to perform checking the 'vdo' package must be
installed. If the 'vdo' package is not installed and there are any doubts the 'vdo' package should be
installed and the upgrade process re-run to check for unconverted VDO devices. If the check of
any device fails for any reason an upgrade inhibiting report is generated. This may be problematic
if devices are dynamically removed from the system subsequent to having been identified during
device discovery. If it is certain that all VDO devices have been successfully converted to LVM
management this dialog may be answered in the affirmative which will circumvent block device
checking.
# Type:             bool
# Default:          None
# Available choices: True/False
# Unanswered question. Uncomment the following line with your answer
# confirm =
```

The **Label** field specifies the question that requires an answer. In this example, the question is **Are all VDO devices, if any, successfully converted to LVM management?**

To answer the question, uncomment the last line and enter an answer of **True** or **False**. In this example, the selected answer is **True**:

```
[check_vdo]
...
# Available choices: True/False
# Unanswered question. Uncomment the following line with your answer
confirm = True
```

Download phase

- If a problem occurs during downloading RPM packages, examine transaction debug data located in the **/var/log/leapp/dnf-debugdata/** directory.

NOTE

The **/var/log/leapp/dnf-debugdata/** directory is empty or does not exist if no transaction debug data was produced. This might occur when the required repositories are not available.

Initramfs phase

- During this phase, potential failures redirect you to the Dracut shell. Check the Journal log:

```
# journalctl
```

  Alternatively, restart the system from the Dracut shell using the **reboot** command and check the **/var/log/leapp/leapp-upgrade.log** file.

Post-upgrade phase

- If your system seems to be successfully upgraded but booted with the old RHEL 8 kernel, restart the system and check the kernel version of the default entry in GRUB.
- Make sure you have followed the recommended steps in Verifying the post-upgrade state of the RHEL 9 system.
- If your application or a service stops working or behaves incorrectly after you have switched SELinux to enforcing mode, search for denials using the **ausearch**, **journalctl**, or **dmesg** utilities:

```
# ausearch -m AVC,USER_AVC -ts boot
# journalctl -t setroubleshoot
# dmesg | grep -i -e selinux -e type=1400
```

  The most common problems are caused by incorrect labeling. See Troubleshooting problems related to SELinux for more details.

9.3. KNOWN ISSUES

The following are Known Issues you may encounter when upgrading from RHEL 8 to RHEL 9.

- Network teaming currently does not work when the in-place upgrade is performed while Network Manager is disabled or not installed.
- If you use an HTTP proxy, Red Hat Subscription Manager must be configured to use such a proxy, or the **subscription-manager** command must be executed with the **--proxy <hostname>** option. Otherwise, an execution of the **subscription-manager** command fails. If you use the **--proxy** option instead of the configuration change, the upgrade process fails because **Leapp** is unable to detect the proxy. To prevent this problem from occurring, manually edit the **rhsm.conf** file as described in How to configure HTTP Proxy for Red Hat Subscription Management. (BZ#1689294)
- If your RHEL 8 system uses a device driver that is provided by Red Hat but is not available in RHEL 9, **Leapp** inhibits the upgrade. However, if the RHEL 8 system uses a third-party device driver that **Leapp** does not have data for in the **/etc/leapp/files/device_driver_deprecation_data.json** file, **Leapp** does not detect such a driver and proceeds with the upgrade. Consequently, the system might fail to boot after the upgrade.

- If the name of a third-party package (not signed by Red Hat) installed on your system is the same as the name of a package provided by Red Hat, the in-place upgrade fails. To work around this problem, choose one of the following options prior to upgrading:

  a. Remove the third-party package

  b. Replace the third-party package with the package provided by Red Hat

- In RHEL 8, you can manage Virtual Data Optimizer (VDO) volumes using either the VDO manager or the Logical Volume Manager (LVM). In RHEL 9, it is only possible to manage VDO volumes using LVM. To continue using VDO-managed volumes on RHEL 9, import those volumes to LVM-managed VDO volumes before the upgrade. For more information, see Importing existing VDO volumes to LVM .

- The in-place upgrade fails on systems with Software Redundant Array of Independent Disks (RAID). (BZ#1957192)

- During the in-place upgrade, the **Leapp** utility usually preserves the network interface controller (NIC) names between RHEL 8 and RHEL 9. However, on some systems, for example systems with network bonding, the NIC names might need to be updated between RHEL 8 and RHEL 9. On those systems, set the **LEAPP_NO_NETWORK_RENAMING=1** environment variable, perform the in-place upgrade, and then verify that your network is working as expected. If needed, manually update the network configuration. (BZ#1919382)

- The in-place upgrade might be stopped before the upgrade is performed because the **Leapp** utility incorrectly detects that there is not enough free disk space. If your system contains partitions formatted with the XFS filesystem without ftype attributes, you can work around this issue by changing the default size in the **LEAPP_OVL_SIZE** environment variable to account for, at minimum, the specified missing disk space inside the container. It is recommended to increase the default size to greater than the specified missing disk space to prevent repeated error messages. For example, if the **Leapp** utility detects that an additional 400 MB is needed, increase the default size from 2048 MB to at least 2500 MB.

  NOTE

  This workaround can require a large amount of free space in the **/var** partition.

  If this workaround does not resolve the issue, or if your system does not contain these partitions without ftype attributes, contact Red Hat support. (BZ#1832730)

- The in-place upgrade breaks networking on IBM Z with RoCE Express adapters. RHEL 9.0 uses Predictable Interface Names for RoCE Express adapters. These are different from the names available in the RHEL 8.6 distribution. Therefore, existing networking configurations of RoCE Express adapters will break with the RHEL 9.0 release if you perform an in-place upgrade from RHEL 8 to RHEL 9.

- RHEL 8.7 introduced new features that are not available in the RHEL 9.0 release. Consequently, the system or applications might be broken if any of such features are required. To work around these problems, either update the system setup to be compatible with RHEL 9.0, or, after upgrading to RHEL 9.0, manually update the system to RHEL 9.1, which contains the missing features.

9.4. OBTAINING SUPPORT

To open a support case, select *RHEL 8* as the product, and provide a **sosreport** from your system.

- To generate a **sosreport** on your system, run:

```
# sosreport
```

Note that you can leave the case ID empty.

For details on generating a sosreport, see the solution What is an sosreport and how to create one in Red Hat Enterprise Linux?.

For more information on opening and managing a support case on the Customer Portal, see the article How do I open and manage a support case on the Customer Portal? .

CHAPTER 10. RELATED INFORMATION

You can refer to the following instructional materials:

- Red Hat Enterprise Linux technology capabilities and limits
- Supported in-place upgrade paths for Red Hat Enterprise Linux
- Considerations in adopting RHEL 9
- Customizing your Red Hat Enterprise Linux in-place upgrade
- Automating your Red Hat Enterprise Linux pre-upgrade report workflow
- Using configuration management systems to automate parts of the Leapp pre-upgrade and upgrade process on Red Hat Enterprise Linux
- Leapp utility metadata in-place upgrades of RHEL for disconnected upgrades
- Upgrading from RHEL 7 to RHEL 8
- How to convert from CentOS or Oracle Linux to RHEL
- How to in-place upgrade SAP environments from RHEL 8 to RHEL 9
- Red Hat Insights Documentation

APPENDIX A. RHEL 8 REPOSITORIES

Before the upgrade, ensure you have appropriate repositories enabled as described in step 4 of the procedure in Preparing a RHEL 8 system for the upgrade .

If you plan to use Red Hat Subscription Manager during the upgrade, you **must enable** the following repositories before the upgrade by using the **subscription-manager repos --enable *repository_id*** command:

Table A.1. RHEL 8 repositories

Architecture	Repository	Repository ID
64-bit Intel and AMD	Base	**rhel-8-for-x86_64-baseos-rpms**
	AppStream	**rhel-8-for-x86_64-appstream-rpms**
64-bit ARM	Base	**rhel-8-for-aarch64-baseos-rpms**
	Extras	**rhel-8-for-aarch64-appstream-rpms**
IBM POWER (little endian)	Base	**rhel-8-for-ppc64le-baseos-rpms**
	AppStream	**rhel-8-for-ppc64le-appstream-rpmss**
IBM Z	Base	**rhel-8-for-s390x-baseos-rpms**
	AppStream	**rhel-8-for-s390x-appstream-rpms**

You **can enable** the following repositories before the upgrade by using the **subscription-manager repos --enable *repository_id*** command:

Table A.2. Voluntary RHEL 8 repositories

Architecture	Repository	Repository ID
64-bit Intel and AMD	Code Ready Linux Builder	**codeready-builder-for-rhel-8-x86_64-rpms**
	Supplementary	**rhel-8-for-x86_64-supplementary-rpms**
64-bit ARM	Code Ready Linux Builder	**codeready-builder-for-rhel-8-aarch64-rpms**
	Supplementary	**rhel-8-for-aarch64-supplementary-rpms**
IBM POWER (little endian)	Code Ready Linux Builder	**codeready-builder-for-rhel-8-ppc64le-rpms**

Architecture	Repository	Repository ID
	Supplementary	**rhel-8-for-ppc64le-supplementary-rpms**
IBM Z	Code Ready Linux Builder	**codeready-builder-for-rhel-8-s390x-rpms**
	Supplementary	**rhel-8-for-s390x-supplementary-rpms**

NOTE

If you have enabled a RHEL 8 Code Ready Linux Builder or a RHEL 8 Supplementary repository before an in-place upgrade, **Leapp** enables the RHEL 8 CodeReady Linux Builder or the RHEL 8 Supplementary repositories, respectively. For more information, see the Package manifest.

If you decide to use custom repositories, enable them per instructions in Configuring custom repositories.

APPENDIX B. RHEL 9 REPOSITORIES

If your system is registered to the Red Hat Content Delivery Network (CDN) using the Red Hat Subscription Manager (RHSM), RHEL 9 repositories are automatically enabled during the in-place upgrade. However, on systems registered to Red Hat Satellite using RHSM, you must manually enable and synchronize both RHEL 8 and RHEL 9 repositories before running the pre-upgrade report.

NOTE

Make sure to enable version 9.0 of each repository. If you have enabled only the RHEL 9 version of the repositories, the in-place upgrade is inhibited.

If you plan to use Red Hat Satellite during the upgrade, you **must enable and synchronize** at least the following RHEL 9 repositories before the upgrade using either the Satellite web UI or the **hammer repository-set enable** and **hammer product synchronize** commands:

Table B.1. RHEL 9 repositories

Architecture	Repository	Repository ID	Repository name	Release version
64-bit Intel and AMD	BaseOS	**rhel-9-for-x86_64-baseos-rpms**	Red Hat Enterprise Linux 9 for x86_64 - BaseOS (RPMs)	x86_64 9.0
	AppStream	**rhel-9-for-x86_64-appstream-rpms**	Red Hat Enterprise Linux 9 for x86_64 - AppStream (RPMs)	x86_64 9.0
64-bit ARM	BaseOS	**rhel-9-for-aarch64-baseos-rpms**	Red Hat Enterprise Linux 9 for ARM 64 - BaseOS (RPMs)	aarch64 9.0
	AppStream	**rhel-9-for-aarch64-appstream-rpms**	Red Hat Enterprise Linux 9 for ARM 64 - AppStream (RPMs)	aarch64 9.0
IBM Power (little endian)	BaseOS	**rhel-9-for-ppc64le-baseos-rpms**	Red Hat Enterprise Linux 9 for Power, little endian - BaseOS (RPMs)	ppc64le 9.0

Architecture	Repository	Repository ID	Repository name	Release version
	AppStream	**rhel-9-for-ppc64le-appstream-rpms**	Red Hat Enterprise Linux 9 for Power, little endian - AppStream (RPMs)	ppc64le 9.0
IBM Z	BaseOS	**rhel-9-for-s390x-baseos-rpms**	Red Hat Enterprise Linux 9 for IBM z Systems - BaseOS (RPMs)	s390x 9.0
	AppStream	**rhel-9-for-s390x-appstream-rpms**	Red Hat Enterprise Linux 9 for IBM z Systems - AppStream (RPMs)	s390x 9.0