



# Red Hat Enterprise Linux 8

## Upgrading from RHEL 7 to RHEL 8

Instructions for an in-place upgrade from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8



# Red Hat Enterprise Linux 8 Upgrading from RHEL 7 to RHEL 8

---

Instructions for an in-place upgrade from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8

## Legal Notice

Copyright © 2022 Red Hat, Inc.

The text of and illustrations in this document are licensed by Red Hat under a Creative Commons Attribution–Share Alike 3.0 Unported license ("CC-BY-SA"). An explanation of CC-BY-SA is available at

<http://creativecommons.org/licenses/by-sa/3.0/>

. In accordance with CC-BY-SA, if you distribute this document or an adaptation of it, you must provide the URL for the original version.

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

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

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

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

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

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

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

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

All other trademarks are the property of their respective owners.

## Abstract

This document provides instructions on how to perform an in-place upgrade from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8 using the Leapp utility. During the in-place upgrade, the existing RHEL 7 operating system is replaced by a RHEL 8 version.

## Table of Contents

<b>MAKING OPEN SOURCE MORE INCLUSIVE</b>	<b>3</b>
<b>PROVIDING FEEDBACK ON RED HAT DOCUMENTATION</b>	<b>4</b>
<b>KEY MIGRATION TERMINOLOGY</b>	<b>5</b>
<b>CHAPTER 1. SUPPORTED UPGRADE PATHS</b>	<b>6</b>
<b>CHAPTER 2. PLANNING AN UPGRADE</b>	<b>7</b>
<b>CHAPTER 3. PREPARING FOR THE UPGRADE</b>	<b>10</b>
3.1. PREPARING A RHEL 7 SYSTEM FOR THE UPGRADE	10
3.2. PREPARING A SATELLITE SYSTEM FOR THE UPGRADE	13
<b>CHAPTER 4. REVIEWING THE PRE-UPGRADE REPORT</b>	<b>16</b>
4.1. ASSESSING UPGRADABILITY FROM THE COMMAND LINE	16
4.2. ASSESSING UPGRADABILITY AND APPLYING AUTOMATED REMEDIATIONS THROUGH THE WEB CONSOLE	17
<b>CHAPTER 5. PERFORMING THE UPGRADE FROM RHEL 7 TO RHEL 8</b>	<b>23</b>
<b>CHAPTER 6. VERIFYING THE POST-UPGRADE STATE OF THE RHEL 8 SYSTEM</b>	<b>25</b>
<b>CHAPTER 7. PERFORMING POST-UPGRADE TASKS</b>	<b>27</b>
<b>CHAPTER 8. APPLYING SECURITY POLICIES</b>	<b>30</b>
8.1. CHANGING SELINUX MODE TO ENFORCING	30
8.2. SETTING SYSTEM-WIDE CRYPTOGRAPHIC POLICIES	31
8.3. UPGRADING THE SYSTEM HARDENED TO A SECURITY BASELINE	31
<b>CHAPTER 9. TROUBLESHOOTING</b>	<b>34</b>
9.1. TROUBLESHOOTING RESOURCES	34
9.2. TROUBLESHOOTING TIPS	34
9.3. KNOWN ISSUES	36
9.4. KNOWN ISSUES FOR IBM POWER 9 (LITTLE ENDIAN) AND IBM Z (STRUCTURE A)	39
9.5. OBTAINING SUPPORT	40
<b>CHAPTER 10. RELATED INFORMATION</b>	<b>41</b>
<b>APPENDIX A. RHEL 7 REPOSITORIES</b>	<b>42</b>
<b>APPENDIX B. RHEL 8 REPOSITORIES</b>	<b>44</b>



## 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](#).

## PROVIDING FEEDBACK ON RED HAT DOCUMENTATION

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

### Submitting comments on specific passages

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.
2. Use your cursor to highlight the part of the text that you want to comment on.
3. Click the **Add Feedback** button that appears near the highlighted text.
4. Add your feedback and click **Submit**.

### Submitting feedback through Bugzilla (account required)

1. Log in to the [Bugzilla](#) website.
2. Select the correct version from the **Version** menu.
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 7 operating system on your system with a RHEL 8 version.

Currently, it is possible to perform an in-place upgrade from RHEL 7 to the following target RHEL 8 minor versions:

**Table 1.1. Supported upgrade paths**

Architecture and product variant	Source OS version	Target OS version
64-bit Intel, IBM POWER 8 (little endian), and 64-bit IBM Z	RHEL 7.9	RHEL 8.4
		RHEL 8.6 (default)
IBM POWER 9 (little endian) and IBM Z (structure A)	RHEL 7.6	RHEL 8.4
RHEL for SAP	RHEL 7.9	RHEL 8.2
		RHEL 8.6 (default)

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 8:

- **Operating system** - The operating system is upgraded by the **Leapp** utility under the following conditions:
  - The Server variant installed of the **latest available RHEL 7 version** which currently is:
    - **RHEL 7.9** on the 64-bit Intel, IBM POWER 8 (little endian), and 64-bit IBM Z architectures and, when on SAP HANA, on the 64-bit Intel architecture
    - **RHEL 7.6** on architectures that **require kernel version 4.14**: IBM POWER 9 (little endian) or 64-bit IBM Z (Structure A)



### NOTE

The IBM POWER 9 (little endian) and 64-bit IBM Z (Structure A) architectures have reached end of life. The final upgrade path for these architectures is from RHEL 7.6 to RHEL 8.4. Subsequent releases to the in-place upgrade, including new upgrade paths, features, and bug fixes, will not include these architectures.

See [Supported in-place upgrade paths for Red Hat Enterprise Linux](#) for more information.

- Minimum [hardware requirements](#) for RHEL 8 met
- Access to up-to-date RHEL 7.9 and the target OS version (for example, RHEL 8.6) content provided; see [Preparing a RHEL 7 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.
- **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 needs to comply with and understand the [security changes in RHEL 8](#).
  - 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 7 to 8, 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 security policies that have been disabled during the upgrade or newly introduced in RHEL 8, 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 7 to RHEL 8 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 [How to in-place upgrade SAP environments from RHEL 7 to RHEL 8](#) 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 7 or RHEL 8. If your RHEL 7 system uses BIOS and you want your RHEL 8 system to use UEFI, perform a fresh install of RHEL 8 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 8. 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 7 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 7 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 system for the upgrade](#).

### 3.1. PREPARING A RHEL 7 SYSTEM FOR THE UPGRADE

This procedure describes the steps that are necessary before performing an in-place upgrade to RHEL 8 using the **Leapp** utility.

If you do not plan to use Red Hat Subscription Manager during the upgrade process, follow instructions in [Upgrading to RHEL 8 without Red Hat Subscription Manager](#).

#### Prerequisites

- The system meets conditions listed in [Planning an upgrade](#).

#### Procedure

1. Ensure your system has been successfully registered to the Red Hat Content Delivery Network (CDN) or Red Hat Satellite using the Red Hat Subscription Manager.
2. If your system is registered to Satellite Server, complete the steps in [Preparing a Satellite system for the upgrade](#) to ensure that your system meets the requirements for the upgrade.
3. Verify that you have the [Red Hat Enterprise Linux Server subscription](#) attached:

```
# subscription-manager list --installed
+-----+
| Installed Product Status |
+-----+
| Product Name:  Red Hat Enterprise Linux Server |
| Product ID:    69 |
| Version:       7.9 |
| Arch:          x86_64 |
| Status:        Subscribed |
```

You should see *Server* in the product name and *Subscribed* as the status.

4. Ensure you have appropriate repositories enabled. The following commands list repositories for the 64-bit Intel architecture; for other architectures, see [RHEL 7 repositories](#).
  - a. Enable the Base repository:

```
# subscription-manager repos --enable rhel-7-server-rpms
```

- b. Enable the Extras repository where **Leapp** and its dependencies are available:

```
# subscription-manager repos --enable rhel-7-server-extras-rpms
```

**NOTE**

You can also have the Optional or Supplementary repositories enabled; see their list in [RHEL 7 repositories](#). In such a case, **Leapp** enables the [RHEL 8 CodeReady Linux Builder](#) or the [RHEL 8 Supplementary](#) repositories, respectively.

5. Set the Red Hat Subscription Manager to consume the latest RHEL 7 content:

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

6. Optional: If you want to use custom repositories, configure them per instructions in [Configuring custom repositories](#).
7. If you use the **yum-plugin-versionlock** plug-in to lock packages to a specific version, clear the lock by running:

```
# yum versionlock clear
```

See [How to restrict yum to install or upgrade a package to a fixed specific package version?](#) for more information.

8. If you are upgrading 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:

```
# yum-config-manager --enable rhui-client-config-server-7
# yum-config-manager --enable rhel-7-server-rhui-extras-rpms
# yum -y install rh-amazon-rhui-client leapp-rhui-aws
```

- b. For Microsoft Azure:

```
# yum-config-manager --enable rhui-microsoft-azure-rhel7
# yum-config-manager --enable rhui-rhel-7-server-rhui-extras-rpms
# yum -y install rhui-azure-rhel7 leapp-rhui-azure
```

**NOTE**

If you locked the Azure virtual machine (VM) to a minor release, remove the version lock. For more information, see [Switch a RHEL 7.x VM back to non-EUS](#).

- c. For Google Cloud Platform, follow the [Leapp RHUI packages for Google Cloud Platform \(GCP\)](#) Knowledgebase article.
9. If you manage containers in Docker, recreate those containers with the appropriate container images using Podman and then attach any in-use volumes. For more information, see [How do I migrate my Docker containers to Podman prior to moving from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8?](#)
10. Update all packages to the latest RHEL 7 version:

```
# yum update
```

11. Reboot the system:

```
# reboot
```

12. Install the **Leapp** utility:

```
# yum 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-el7toel8** RPM package.

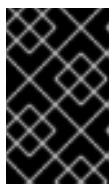


#### NOTE

If your system does not have internet access, download the following packages from the [Red Hat Customer Portal](#):

- **leapp**
- **leapp-deps**
- **python2-leapp**
- **leapp-upgrade-el7toel8**
- **leapp-upgrade-el7toel8-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.



#### IMPORTANT

If you are using RHEL 7.6 for IBM POWER 9 (little endian) or IBM Z (structure A) architectures, follow the [Leapp data snapshots for an in-place upgrade](#) Knowledgebase article instead.

- 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. This also applies to developer subscriptions. If your system is behind a proxy, you can use the **\$LEAPP\_PROXY\_HOST** environment variable to access the data.
- b. 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 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 initiate 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 7 to RHEL 8](#) . Automation of the pre-upgrade and upgrade process 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 8, see [How to perform an in-place upgrade to RHEL 8 when using kernel NIC names on RHEL 7](#).
  17. 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 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 8.



### IMPORTANT

Users on Satellite systems must complete the preparatory steps described both in this procedure and in [Preparing a RHEL 7 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 8 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 7 and RHEL 8 repositories with the latest updates for RHEL 7.9 and the target OS version, for example RHEL 8.6.

**NOTE**

For RHEL 8 repositories, make sure to enable the target OS version of each repository, for example 8.6. If you have enabled only the RHEL 8 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 7 Server (RPMs)  
rhel-7-server-rpms  
  
x86\_64 7Server or x86\_64 7.9
- Red Hat Enterprise Linux 7 Server - Extras (RPMs)  
rhel-7-server-extras-rpms  
  
x86\_64
- Red Hat Enterprise Linux 8 for x86\_64 - AppStream (RPMs)  
rhel-8-for-x86\_64-appstream-rpms  
  
x86\_64 <target\_os\_version>
- Red Hat Enterprise Linux 8 for x86\_64 - BaseOS (RPMs)  
rhel-8-for-x86\_64-baseos-rpms  
  
x86\_64 <target\_os\_version>

Replace *target\_os\_version* with the target OS version, for example 8.6.

For other architectures, see [RHEL 7 repositories](#) and [RHEL 8 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 7 and RHEL 8 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-8' --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:

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

- On your RHEL 7 system, perform the pre-upgrade phase:

```
# leapp preupgrade --target <target_os_version>
```

Replace *target\_os\_version* with the target OS version, for example 8.6. If no target OS version is defined, **Leapp** uses the default target OS version specified in the table 1.1 in [Supported upgrade paths](#).



## NOTE

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 7 to RHEL 8](#) Knowledgebase article.

2. Provide answers to each question required by **Leapp** by either of the following methods:

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

```
# leapp answer --section question_section.confirm=answer
```

For example, to confirm a **True** response to the question **Disable pam\_pkcs11 module in PAM configuration?**, execute the following command:

```
# leapp answer --section remove_pam_pkcs11_module_check.confirm=True
```

- b. Manually edit the `/var/log/leapp/answerfile` file, uncomment the **confirm** line of the file by deleting the `#` symbol, and confirm your answer as **True** or **False**; see [Leapp answerfile](#) in the Troubleshooting tips section.

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:

```
# yum 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 7 web console](#) for more information about the web console.
3. On your RHEL 7 system, perform the pre-upgrade phase either from the command-line interface or from the web console terminal:

```
# leapp preupgrade --target <target_os_version>
```

Replace *target\_os\_version* with the target OS version, for example 8.6. If no target OS version is defined, **Leapp** uses the default target OS version specified in the table 1.1 in [Supported upgrade paths](#).

## NOTE

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 7 to RHEL 8](#) Knowledgebase article.

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

In-Place Upgrade Report for: localhost.localdomain

Filters Remediation plan (0) + Add all remediations to plan (1)

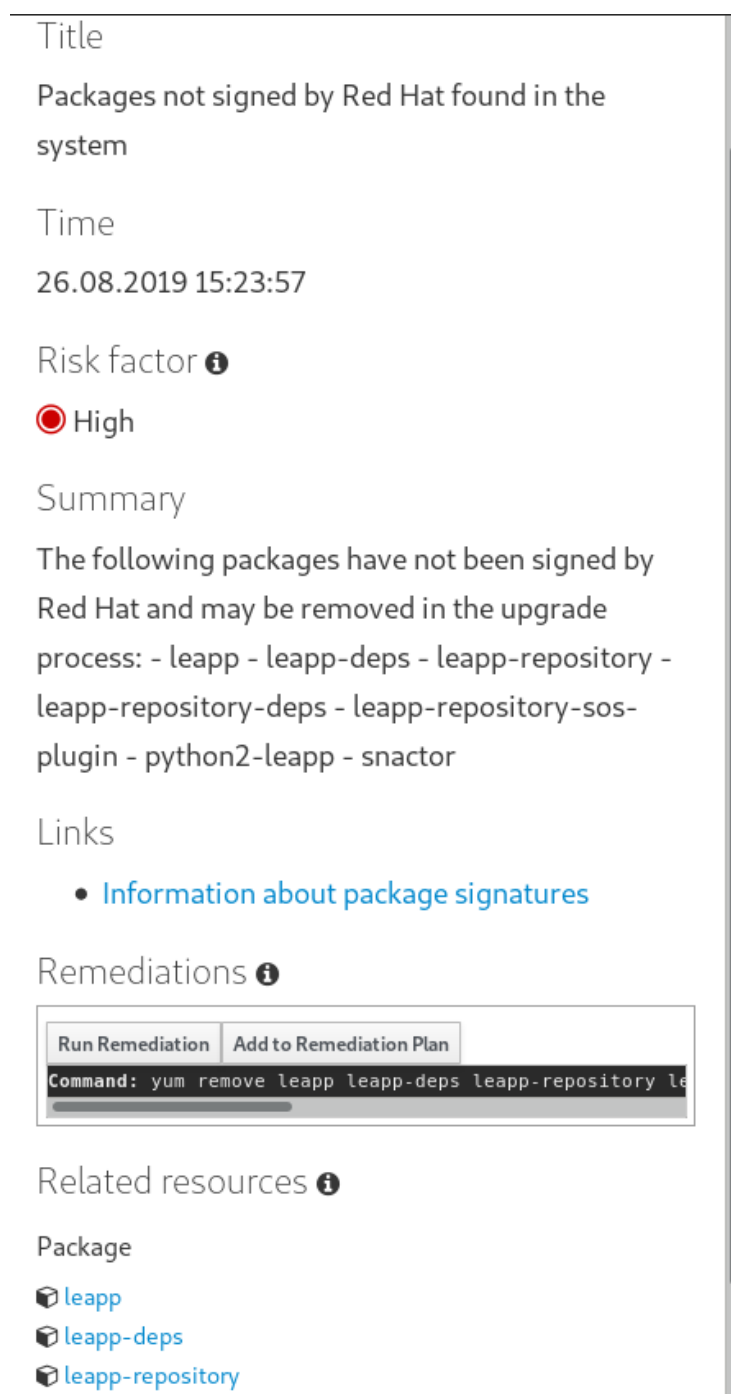
Title	Risk Factor	Description	Tags	Time
Repositories map file is invalid (/etc/leapp/files/repomap.csv)	High	⊘ Inhibitor	upgrade process	26.08.2019 15:18:04
OpenSSH configured to use removed ciphers	High	⊘ Inhibitor 🔍 Remediation hint	authentication security network services	26.08.2019 15:23:56
OpenSSH configured to use removed mac	High	⊘ Inhibitor 🔍 Remediation hint	authentication security network services	26.08.2019 15:23:56
Packages not signed by Red Hat found in the system	High	🔧 Remediation command	sanity	26.08.2019 15:23:57
LUKS encrypted partition detected	High	⊘ Inhibitor	boot encryption	26.08.2019 15:23:59
Possible problems with remote login using root account	High	⊘ Inhibitor 🔍 Remediation hint	authentication security network services	26.08.2019 15:23:59
chrony using default configuration	Medium		services time management	26.08.2019 15:23:57
Postfix has incompatible changes in the next major version	Low		services email	26.08.2019 15:23:58
The subscription-manager release is going to be set to 8.0	Low		upgrade process	26.08.2019 15:23:58
Schedule SELinux relabeling	Low		selinux security	26.08.2019 15:23:58

10 per page 1-10 of 16 1 of 2

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

Filters

☒ Is inhibitor?

☐ Has remediation hint?

☐ Has remediation command?

☐ Has links?

> Risk factor

> Audiences

> Time

> Drivers

▼ Packages

leapp x

> Tags

Reset 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.confirm=answer
```

For example, to confirm a **False** response to the question **Disable pam\_pkcs11 module in PAM configuration?**, execute the following command:

```
# leapp answer --section remove_pam_pkcs11_module_check.confirm=False
```

- ii. Manually edit the `/var/log/leapp/answerfile` file, uncomment the **confirm** line of the file by deleting the **#** symbol, and confirm your answer as **True** or **False**; see [Leapp answerfile example](#) in the Troubleshooting tips section.

Figure 4.4. Missing unanswered Leapp question

leapp-20201026...

System

Logs

Networking

Accounts

Services

Diagnostic Reports

Kernel Dump

SELinux

Subscriptions

Terminal

Upgrade Report

Upgrade Report for: leapp-20201026142336

Filters

Title	Risk Factor	Description	Tags
Upgrade is unsupported	High		upgrade process
Difference in Python versions and support in RHEL 8	High	Remediation hint	python
Packages not signed by Red Hat found on the system	High	Links	python
GRUB core will be updated during upgrade	High		grub
Missing required answers in the answer file	High	Inhibitor	tools
		Remediation hint	
		Remediation command	
Missing required answers in the answer file	High	Inhibitor	
		Remediation hint	
		Remediation command	
chroot using default configuration	Medium		services time machine
SELinux will be set to permissive mode	Low		selinux security
Postfix has incompatible changes in the next major version	Low		services email
Dnf5tools incompatible changes in the next major version	Low	Remediation hint	filesystem tools
Grep has incompatible changes in the next major version	Low	Remediation hint	tools
The subscription-manager release is going to be kept as it is during the upgrade	Low	Remediation hint	upgrade process
Excluded RHEL 8 repositories		Links	repository
SELinux relabeling has been scheduled			selinux security
Current PAM and nsswitch.conf configuration will be kept.			authentication security

30

per page

Title

Missing required answers in the answer file

Time

26.10.2020 15:14:34

Risk factor

High

Summary

One or more sections in answerfile are missing user choices: remove\_pam\_krb5\_module\_check.confirm

For more information consult

<https://leapp.readthedocs.io/en/latest/dialogs.html>

Remediations

Please register user choices with leapp answer cli command or by manually editing the answerfile.

Run Remediation

Add to Remediation Plan

Command:

leapp answer --set=100 remove\_pam\_krb5\_module\_check

Related resources

Dialog

(dialog) = remove\_pam\_krb5\_module\_check.confirm

- 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

### Remediation Plan

Execute Remediation Plan

▼

🕒

yum remove leapp leapp-deps leapp-repository leapp-repository-deps leapp-repository-sos-plugin python2-leapp snactor

Remediation-ID	30499418c8169f1a59646cd5910642258411e4cacb6e148e4d89195fb046416c
Status Code	(scheduled)
Runtime	(scheduled)

- 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
- 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 7 TO RHEL 8

Upgrade to RHEL 8 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 7 system, start the upgrade process:

```
# leapp upgrade --target <target_os_version>
```

Replace *target\_os\_version* with the target OS version, for example 8.6. If no target OS version is defined, **Leapp** uses the default target OS version specified in the table 1.1 in [Supported upgrade paths](#).

### NOTE

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 --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.

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](#).

2. Manually reboot the system:

```
# reboot
```

In this phase, the system boots into a RHEL 8-based initial RAM disk image, `initramfs`. **Leapp** upgrades all packages and automatically reboots to the RHEL 8 system.

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

If a failure occurs, investigate logs as described in [Troubleshooting](#).

3. Log in to the RHEL 8 system and verify its state as described in [Verifying the post-upgrade state of the RHEL 8 system](#).
4. 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 8 SYSTEM

This procedure lists verification steps recommended to perform after an in-place upgrade to RHEL 8.

### Prerequisites

- The system has been upgraded following the steps described in [Performing the upgrade from RHEL 7 to RHEL 8](#) and you have been able to log in to RHEL 8.

### Procedure

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

- Verify that the current OS version is Red Hat Enterprise Linux 8:

```
# cat /etc/redhat-release
Red Hat Enterprise Linux release <target_os_version> (Ootpa)
```

Replace *target\_os\_version* with the target OS version, for example 8.6.

- Check the OS kernel version:

```
# uname -r
4.18.0-305.el<target_os>.x86_64
```

The *target\_os* should be either **8** or the target OS version, for example **8\_6**. Note that **.el8** is important and the version should not be earlier than 4.18.0-305.

- 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: <target_os_version>
Arch: x86_64
Status: Subscribed
```

Replace *target\_os\_version* with the target OS version, for example 8.6.

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

```
# subscription-manager release
Release: <target_os_version>
```

Replace *target\_os\_version* with the target OS version, for example 8.6.

- 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 [RHEL 8 Database servers documentation](#).

## CHAPTER 7. PERFORMING POST-UPGRADE TASKS

This procedure lists major tasks recommended to perform after an in-place upgrade to RHEL 8.

### Prerequisites

- The system has been upgraded following the steps described in [Performing the upgrade from RHEL 7 to RHEL 8](#) and you have been able to log in to RHEL 8.
- The status of the in-place upgrade has been verified following the steps described in [Verifying the post-upgrade status of the RHEL 8 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. 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 7 packages, including remaining **Leapp** packages.

- a. Determine old kernel versions:

```
# cd /lib/modules && ls -d *.el7*
```

- b. Remove weak modules from the old kernel. If you have multiple old kernels, repeat this step for each kernel:

```
# [ -x /usr/sbin/weak-modules ] && /usr/sbin/weak-modules --remove-kernel <version>
```

Replace *version* with the kernel version determined in the previous step, for example:

```
# [ -x /usr/sbin/weak-modules ] && /usr/sbin/weak-modules --remove-kernel 3.10.0-1160.25.1.el7.x86_64
```



### NOTE

Ignore the following error message, which is generated if the kernel package has been previously removed:

```
/usr/sbin/weak-modules: line 1081: cd: /lib/modules/<version>/weak-updates: No such file or directory
```

- c. Remove the old kernel from the bootloader entry. If you have multiple old kernels, repeat this step for each kernel:

```
# /bin/kernel-install remove <version> /lib/modules/<version>/vmlinuz
```

Replace *version* with the kernel version determined in the previous step, for example:

```
# /bin/kernel-install remove 3.10.0-1160.25.1.el7.x86_64 /lib/modules/3.10.0-1160.25.1.el7.x86_64/vmlinuz
```

- d. Locate remaining RHEL 7 packages:

```
# rpm -qa | grep -e '\.el[67]' | grep -vE '^(gpg-pubkey|libmodulemd|katello-ca-consumer)' | sort
```

- e. Remove remaining RHEL 7 packages, including old kernel packages, and the **kernel-workaround** package from your RHEL 8 system.

- f. Remove remaining **Leapp** dependency packages:

```
# dnf remove leapp-deps-el8 leapp-repository-deps-el8
```

- g. Remove any remaining empty directories:

```
# rm -r /lib/modules/*el7*
```

3. Ensure that your system remains supported after the in-place upgrade. With the general availability of RHEL 8.7, ensure that your system is updated to either RHEL 8.7 or RHEL 8.6 Extended Update Support (EUS).

- a. Update the system to RHEL 8.7:

- i. Unset Red Hat Subscription Manager to consume the latest RHEL 8.7 content:

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

- ii. Update your system to the latest RHEL 8.7 version:

```
# yum update
```

- b. Ensure that your system is updated to RHEL 8.6 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 8.6 EUS:

- i. Enable RHEL 8 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-8-for-x86_64-baseos-eus-rpms --enable  
rhel-8-for-x86_64-appstream-eus-rpms
```

- ii. Update your system to the latest RHEL 8.6 EUS version:

```
# yum update
```

4. Re-evaluate and re-apply your security policies. Especially, change the SELinux mode to enforcing. For details, see [Applying security policies](#).

### Verification steps

- Verify that the old kernels have been removed from the bootloader entry:

```
# grubby --info=ALL | grep "\.el7" || echo "Old kernels are not present in the bootloader."
```

## CHAPTER 8. APPLYING SECURITY POLICIES

During the in-place upgrade process, certain security policies must remain disabled. Furthermore, RHEL 8 introduces a new concept of system-wide cryptographic policies and also security profiles might contain changes between major releases. This section guides you when securing your upgraded RHEL systems.

### 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 8 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. SETTING 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.

After a successful installation or an in-place upgrade process, the system-wide cryptographic policy is automatically set to **DEFAULT**. The **DEFAULT** system-wide cryptographic policy level offers secure settings for current threat models.

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
```

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.

#### Additional resources

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

## 8.3. UPGRADING THE SYSTEM HARDENED TO A SECURITY BASELINE

To get a fully hardened system after a successful upgrade to RHEL 8, 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 Red Hat Enterprise Linux due to the evolution of the security offering.

When upgrading a hardened RHEL 7 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 8 during the upgrade.



## NOTE

You cannot use the same SCAP content for scanning RHEL 7 and RHEL 8. Update the management platforms if the compliance of the system is managed by the tools like 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](#).

Follow the procedure to automatically harden your system with the PCI-DSS profile.



## IMPORTANT

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

## Prerequisites

- The **scap-security-guide** package is installed on your RHEL 8 system.

## Procedure

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

```
$ ls /usr/share/xml/scap/ssg/content/
ssg-firefox-cpe-dictionary.xml  ssg-rhel6-ocil.xml
ssg-firefox-cpe-oval.xml      ssg-rhel6-oval.xml
...
ssg-rhel6-ds-1.2.xml          ssg-rhel8-oval.xml
ssg-rhel8-ds.xml             ssg-rhel8-xccdf.xml
...
```

For additional information, see section [Viewing compliance profiles](#).

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-rhel8-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 8, 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-rhel8-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 documentation chapter](#)
- [Red Hat Satellite Security Policy documentation](#)

## CHAPTER 9. TROUBLESHOOTING

You can refer to the following tips to troubleshoot upgrading from RHEL 7 to RHEL 8.

### 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. Example questions:
  - Disable **pam\_pkcs11** module in PAM configuration?

- Disable pam\_krb5 module in PAM configuration?
- Configure PAM and nsswitch.conf with the following authselect call?
- 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:

```
[remove_pam_pkcs11_module_check]
# Title:      None
# Reason:     Confirmation
# ===== remove_pam_pkcs11_module_check.confirm =====
# Label:      Disable pam_pkcs11 module in PAM configuration? If no, the upgrade process will
              be interrupted.
# Description: PAM module pam_pkcs11 is no longer available in RHEL-8 since it was replaced
              by SSSD.
# Type:       bool
# Default:    None
# Available choices: True/False
# Unanswered question. Uncomment the following line with your answer
# confirm =
```

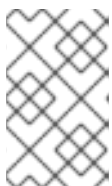
The **Label** field specifies the question that requires an answer. In this example, the question is **Disable pam\_pkcs11 module in PAM configuration?**

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

```
[remove_pam_pkcs11_module_check]
...
# 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 7 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 8 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 7 to RHEL 8.

- 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 7 system uses a device driver that is provided by Red Hat but is not available in RHEL 8, **Leapp** inhibits the upgrade. However, if the RHEL 7 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.
- You cannot perform an in-place upgrade when the **winbind** and **wins** Samba modules are used in the `/etc/nsswitch.conf` file at the moment. The upgrade transaction fails with the following error messages and **Leapp** inhibits the upgrade:

```
upgrade[469]: STDERR:
upgrade[469]: Error in PREIN scriptlet in rpm package unbound-libs
upgrade[469]: Error: Transaction failed
upgrade[469]: Container el8userspace failed with error code 1.
unbound-libs has a PREIN failure
```



To work around this problem, configure the system so that it uses only local providers for the **user**, **groups**, and **hosts** database during the update:

1. Open the system **/etc/nsswitch.conf** configuration file and search for entries that contain the **winbind** or **wins** strings.
  2. If you find such entries, create a backup of **/etc/nsswitch.conf**.
  3. Edit **/etc/nsswitch.conf** and remove **winbind** or **wins** from the entries that contain them.
  4. Perform an in-place upgrade.
  5. After the upgrade, add the **winbind** and **wins** strings to the respective entries in **/etc/nsswitch.conf**, based on your system configuration requirements.  
(BZ#1410154)
- The **Leapp** utility does not change customized authentication configuration during the upgrade process. If you used the deprecated **authconfig** utility to configure authentication on your RHEL 7 system, authentication on RHEL 8 might not work correctly. To ensure that your custom configuration functions properly on the RHEL 8 system, re-configure your RHEL 8 system with the **authselect** utility.



### IMPORTANT

During the in-place upgrade, the deprecated **pam\_krb5** or **pam\_pkcs11** pluggable authentication modules (PAM) are removed. Consequently, if the PAM configuration on your RHEL 7 system contains the **pam\_krb5** or **pam\_pkcs11** modules and if these modules have the **required** or **requisite** control values, performing the in-place upgrade might result in locking you out of the system. To work around this problem, reconfigure your RHEL 7 system to not use **pam\_krb5** or **pam\_pkcs11** before you start the upgrade process.

- 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
- Due to security reasons, support for single-DES (DES) and triple-DES (3DES) encryption types has been removed from RHEL 8. RHEL 7 Identity Management (IdM), however, still supports 3DES encryption.

Upgrading an IdM environment from RHEL 7 to RHEL 8 is possible because both versions of RHEL prefer stronger AES encryption types by default:

Version of IdM	Default encryption types	Additional supported encryption types
RHEL 7	<b>aes256-cts</b> <b>aes128-cts</b>	<b>camellia256-cts</b> <b>camellia128-cts</b> <b>des3-hmac</b> <b>arcfour-hmac</b>

Version of IdM	Default encryption types	Additional supported encryption types
RHEL 8	<b>aes256-cts</b> <b>aes128-cts</b>	<b>aes256-sha2</b> <b>aes128-sha2</b> <b>camellia256-cts</b> <b>camellia128-cts</b> <b>arcfour-hmac</b> <sup>[a]</sup>
<p>[a] RC4 encryption has been deprecated and disabled by default in RHEL 8, as it is considered less secure than the newer AES-128 and AES-256 encryption types. For more information on enabling RC4 support for compatibility with legacy Active Directory environments, see <a href="#">Ensuring support for common encryption types in AD and RHEL</a>.</p>		

If you manually configured a non-IdM Kerberos Distribution Center (KDC), any services, or any users to **only** use DES or 3DES encryption, you might experience service interruptions after updating to the latest Kerberos packages in RHEL 8, such as:

- Kerberos authentication errors
- **unknown enctype** encryption errors
- KDCs with DES-encrypted Database Master Keys (**K/M**) fail to start

Red Hat recommends you do not use DES or 3DES encryption in your environment. For more information on re-keying Kerberos principals to use stronger encryption types, see [Retiring DES](#) from MIT Kerberos Documentation.

- The in-place upgrade fails on systems with Software Redundant Array of Independent Disks (RAID). (BZ#[1957192](#))
- Systems with a disabled GRUB bootloader specification, such as systems using Puppet, cannot create new initramfs for newer kernels. To work around this problem, manually remove packages and the old kernel from the bootloader entry as described in [Performing post-upgrade tasks](#). (BZ#[1955099](#))
- The Relax-and-Recover (ReaR) utility is not available on the IBM Z architecture. As a result, IBM Z systems cannot be completely remediated by the OpenSCAP suite and might not be fully compliant with security baselines. (BZ#[1958939](#))
- During the in-place upgrade, the **Leapp** utility usually preserves the network interface controller (NIC) names between RHEL 7 and RHEL 8. However, on some systems, for example systems with network bonding, the NIC names might need to be updated between RHEL 7 and RHEL 8. 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 inhibited 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](#))

## 9.4. KNOWN ISSUES FOR IBM POWER 9 (LITTLE ENDIAN) AND IBM Z (STRUCTURE A)

The IBM POWER 9 (little endian) and 64-bit IBM Z (Structure A) architectures have reached end of life. The final upgrade path for these architectures is from RHEL 7.6 to RHEL 8.4. Subsequent releases to the in-place upgrade do not include these architectures. As a result, known issues that are resolved in later releases of the in-place upgrade are not resolved for these architectures.

The following known issues affect only IBM POWER 9 (little endian) and 64-bit IBM-Z (Structure A) architectures:

- During an in-place upgrade, the **docker** package is removed without a warning. If you use containers in RHEL, migrate to Podman prior to upgrading to RHEL 8. For instructions, see [How do I migrate my Docker containers to Podman prior to moving from Red Hat Enterprise Linux 7 to Red Hat Enterprise Linux 8?](#) (BZ#[1858711](#))
- During the pre-upgrade process, users might be required to answer true/false questions before they can proceed with the upgrade. If the pre-upgrade report was run prior to the release of the latest version of **Leapp**, the report might have incorrectly reported that all true/false questions had been answered and that it was safe to proceed with the upgrade. If you ran the pre-upgrade report prior to November 9, 2021, complete the following steps to prevent serious issues with the upgrade:
  1. Update all **Leapp**-related packages.
  2. Remove the **/var/log/leapp/answerfile** and **/var/log/leapp/answerfile.userchoices** files:
 

```
# rm -f /var/log/leapp/answerfile /var/log/leapp/answerfile.userchoices
```
  3. Run the **leapp preupgrade** command and answer any true/false questions again. (BZ#[2014015](#))
- On systems with the NSFD service running on NFS servers, a non-existent NFS partition might be incorrectly detected during the in-place upgrade, inhibiting the upgrade. To prevent this issue, stop the NSFD service before running the in-place upgrade:

```
# systemctl stop /proc/fs/nfsd
```

(BZ#[2036069](#))

## 9.5. OBTAINING SUPPORT

To open a support case, select *RHEL 7* 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 8](#)
- [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 6 to RHEL 7](#)
- [Upgrading from RHEL 6 to RHEL 8](#)
- [How to convert from CentOS or Oracle Linux to RHEL](#)
- [Upgrading Hosts from RHEL 7 to RHEL 8 in Red Hat Satellite](#)
- [How to in-place upgrade SAP environments from RHEL 7 to RHEL 8](#)
- [Red Hat Insights Documentation](#)

## APPENDIX A. RHEL 7 REPOSITORIES

Before the upgrade, ensure you have appropriate repositories enabled as described in step 4 of the procedure in [Preparing a RHEL 7 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:

Architecture	Repository	Repository ID
64-bit Intel	Base	<b>rhel-7-server-rpms</b>
	Extras	<b>rhel-7-server-extras-rpms</b>
IBM POWER8 (little endian)	Base	<b>rhel-7-for-power-le-rpms</b>
	Extras	<b>rhel-7-for-power-le-extras-rpms</b>
IBM POWER9 (little endian)	Base	<b>rhel-7-for-power-9-rpms</b>
	Extras	<b>rhel-7-for-power-9-extras-rpms</b>
IBM Z	Base	<b>rhel-7-for-system-z-rpms</b>
	Extras	<b>rhel-7-for-system-z-extras-rpms</b>
IBM Z (Structure A)	Base	<b>rhel-7-for-system-z-a-rpms</b>
	Extras	<b>rhel-7-for-system-z-a-extras-rpms</b>

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

Architecture	Repository	Repository ID
64-bit Intel	Optional	<b>rhel-7-server-optional-rpms</b>
	Supplementary	<b>rhel-7-server-supplementary-rpms</b>
IBM POWER8 (little endian)	Optional	<b>rhel-7-for-power-le-optional-rpms</b>
	Supplementary	<b>rhel-7-for-power-le-supplementary-rpms</b>
IBM POWER9 (little endian)	Optional	<b>rhel-7-for-power-9-optional-rpms</b>
	Supplementary	<b>rhel-7-for-power-9-supplementary-rpms</b>

Architecture	Repository	Repository ID
IBM Z	Optional	<b>rhel-7-for-system-z-optional-rpms</b>
	Supplementary	<b>rhel-7-for-system-z-supplementary-rpms</b>
IBM Z (Structure A)	Optional	<b>rhel-7-for-system-z-a-optional-rpms</b>
	Supplementary	N/A

**NOTE**

If you have enabled a RHEL 7 Optional or a RHEL 7 Supplementary repository before an in-place upgrade, **Leapp** enables the [RHEL 8 CodeReady Linux Builder](#) or [RHEL 8 Supplementary](#) repositories, respectively.

If you decide to use custom repositories, enable them per instructions in [Configuring custom repositories](#).

## APPENDIX B. RHEL 8 REPOSITORIES

If your system is registered to the Red Hat Content Delivery Network (CDN) using the Red Hat Subscription Manager (RHSM), RHEL 8 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 7 and RHEL 8 repositories before running the pre-upgrade report.



### NOTE

Make sure to enable the target OS version of each repository, for example RHEL 8.6. If you have enabled only the RHEL 8 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 8 repositories before the upgrade using either the Satellite web UI or the **hammer repository-set enable** and **hammer product synchronize** commands:



### NOTE

Replace *target\_os\_version* with the target OS version, for example 8.6.

Table B.1. RHEL 8 repositories

Architecture	Repository	Repository ID	Repository name	Release version
64-bit Intel	BaseOS	<b>rhel-8-for-x86_64-baseos-rpms</b>	Red Hat Enterprise Linux 8 for x86_64 - BaseOS (RPMs)	x86_64 < <i>target_os_version</i> >
	Appstream	<b>rhel-8-for-x86_64-appstream-rpms</b>	Red Hat Enterprise Linux 8 for x86_64 - AppStream (RPMs)	x86_64 < <i>target_os_version</i> >
IBM Power8 (little endian)/IBM Power9 (little endian)	BaseOS	<b>rhel-8-for-ppc64le-baseos-rpms</b>	Red Hat Enterprise Linux 8 for Power, little endian - BaseOS (RPMs)	ppc64le < <i>target_os_version</i> >
	Appstream	<b>rhel-8-for-ppc64le-appstream-rpms</b>	Red Hat Enterprise Linux 8 for Power, little endian - AppStream (RPMs)	ppc64le < <i>target_os_version</i> >



Architecture	Repository	Repository ID	Repository name	Release version
IBM Z/IBM Z (Structure A)	BaseOS	<b>rhel-8-for-s390x-baseos-rpms</b>	Red Hat Enterprise Linux 8 for IBM z Systems - BaseOS (RPMs)	s390x < <i>target_os_version</i> >
	Appstream	<b>rhel-8-for-s390x-appstream-rpms</b>	Red Hat Enterprise Linux 8 for IBM z Systems - AppStream (RPMs)	s390x < <i>target_os_version</i> >