Managing software with the DNF tool

Managing content in the RPM repositories by using the DNF software management tool
Red Hat Enterprise Linux 9 Managing software with the DNF tool

Managing content in the RPM repositories by using the DNF software management tool
Abstract

Find, install, and utilize content distributed through the RPM repositories by using the DNF tool. Learn how to work with packages, modules, streams, and profiles.
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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.
PROVIDING FEEDBACK ON RED HAT DOCUMENTATION

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

Submitting feedback through Jira (account required)

1. Log in to the Jira website.
2. Click Create in the top navigation bar
3. Enter a descriptive title in the Summary field.
4. Enter your suggestion for improvement in the Description field. Include links to the relevant parts of the documentation.
5. Click Create at the bottom of the dialogue.
CHAPTER 1. SOFTWARE MANAGEMENT TOOLS IN RED HAT ENTERPRISE LINUX 9

In Red Hat Enterprise Linux (RHEL) 9, use the DNF utility to manage software. For compatibility reasons with previous major RHEL versions, you can still use the yum command. However, in RHEL 9, yum is an alias for dnf which provides a certain level of compatibility with yum.

NOTE

Although RHEL 8 and RHEL 9 are based on DNF, they are compatible with YUM used in RHEL 7.
CHAPTER 2. DISTRIBUTION OF CONTENT IN RHEL 9

In the following sections, learn how the software is distributed in Red Hat Enterprise Linux 9:

- Content distribution between repositories
- Application Streams
- Modules
- Module streams
- Module profiles

2.1. REPOSITORIES

Red Hat Enterprise Linux (RHEL) distributes content through different repositories, for example:

**BaseOS**
Content in the BaseOS repository consists of the core set of the underlying operating system functionality that provides the foundation for all installations. This content is available in the RPM format and is subject to support terms similar to those in earlier releases of RHEL.

**AppStream**
Content in the AppStream repository includes additional user-space applications, runtime languages, and databases in support of the varied workloads and use cases.

**IMPORTANT**
Both the BaseOS and AppStream content sets are required by RHEL and are available in all RHEL subscriptions.

**CodeReady Linux Builder**
The CodeReady Linux Builder repository is available with all RHEL subscriptions. It provides additional packages for use by developers. Red Hat does not support packages included in the CodeReady Linux Builder repository.

**Additional resources**
- Package manifest

2.2. APPLICATION STREAMS

Red Hat provides multiple versions of user-space components as Application Streams, and they are updated more frequently than the core operating system packages. This provides more flexibility to customize Red Hat Enterprise Linux (RHEL) without impacting the underlying stability of the platform or specific deployments.

Application Streams are available in the following formats:

- RPM format
- Modules, which are an extension to the RPM format
Software Collections

RHEL 9 improves Application Streams experience by providing initial Application Stream versions as RPMs, which you can install by using the `dnf install` command.

Starting with RHEL 9.1, Red Hat provides additional Application Stream versions as modules with a shorter life cycle.

**IMPORTANT**

Each Application Stream has its own life cycle, and it can be the same or shorter than the life cycle of RHEL 9. See [Red Hat Enterprise Linux Application Streams Life Cycle](#).

Always determine which version of an Application Stream you want to install, and make sure to review the RHEL Application Stream life cycle first.

Additional resources

- [Red Hat Enterprise Linux 9: Application Compatibility Guide](#)
- Package manifest
- [Red Hat Enterprise Linux Application Streams Life Cycle](#)

### 2.3. MODULES

A module is a set of RPM packages that represent a component. A typical module contains the following package types:

- Packages with an application
- Packages with the application-specific dependency libraries
- Packages with documentation for the application
- Packages with helper utilities

### 2.4. MODULE STREAMS

Module streams are filters that can be imagined as virtual repositories in the AppStream physical repository. Module streams versions of the AppStream components. Each of the streams receives updates independently, and they can depend on other module streams.

Module streams can be active or inactive. Active streams give the system access to the RPM packages within the particular module stream, allowing the installation of the respective component version.

A stream is active in the following cases:

- If an administrator explicitly enables it.
- If the stream is a dependency of an enabled module.
- If the stream is the default stream. Each module can have a default stream but in Red Hat Enterprise Linux 9, no default streams are defined. If required, you can configure default streams as described in [Defining custom default module streams and profiles](#).
Only one stream of a particular module can be active at a given point in time. Therefore, only packages from a particular stream are available.

Prior to selecting a particular stream for a runtime user application or a developer application, consider the following:

- Required functionality and which component versions support that functionality
- Compatibility with your application or use case
- The life cycle of the Application Stream and your update plan

For a list of all available modules and streams, see the Package manifest. For per-component changes, see the Release Notes.

Additional resources

- Modular dependencies and stream changes

### 2.5. MODULE PROFILES

A module profile is a list of recommended packages to be installed together for a particular use case such as for a server, client, development, minimal install, or other. These package lists can contain packages outside the module stream, usually from the BaseOS repository or the dependencies of the stream.

Installing packages by using a profile is a one-time action provided for the user’s convenience. It is also possible to install packages by using multiple profiles of the same module stream without any further preparatory steps.

Each module stream can have any number of profiles, including none. For any given module stream, some of its profiles can be marked as default and are then used for profile installation actions if you did not explicitly specify a profile. However, the existence of a default profile for a module stream is not required.

Example 2.1. nodejs module profiles

The nodejs module, which provides the Node.js runtime environment, offers the following profiles for installation:

```
# dnf module list nodejs
Name  Stream Profiles Summary
nodejs 18     common [d], development, minimal, s2i Javascript runtime
       Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled
```

In this example, the following profiles are available:

- **common**: The production-ready packages. This is the default profile ([d]).
- **development**: The production-ready packages, including the Node.js development headers.
- **minimal**: The smallest set of packages that provides the Node.js runtime environment.
- **s2i**: Packages necessary for creating Node.js Source-to-Image (S2I) Linux containers.
CHAPTER 3. CONFIGURING DNF

The configuration of DNF and related utilities is stored in the [main] section of the /etc/dnf/dnf.conf file.

In the following sections, learn how to configure DNF by using the /etc/dnf/dnf.conf configuration file:

- View the current DNF configurations
- Set DNF [main] options
- Manage, enable and disable DNF plug-ins

3.1. VIEWING THE CURRENT DNF CONFIGURATIONS

The [main] section in the /etc/dnf/dnf.conf file contains only the settings that have been explicitly set. However, you can display all settings of the [main] section, including the ones that have not been set and which, therefore, use their default values.

Procedure

- Display the global DNF configuration:
  
  ```
  # dnf config-manager --dump
  ```

Additional resources

- dnf.conf(5) man page

3.2. SETTING DNF MAIN OPTIONS

The /etc/dnf/dnf.conf file contains one [main] section. The key-value pairs in this section affect how DNF operates and treats repositories.

Procedure

1. Edit the /etc/dnf/dnf.conf file.
2. Update the [main] section according to your requirements.
3. Save the changes.

Additional resources

- The [main] OPTIONS and OPTIONS FOR BOTH [main] AND REPO sections in the dnf.conf(5) man page.

3.3. MANAGING DNF PLUG-INS

Every installed plug-in can have its own configuration file in the /etc/dnf/plugins/ directory. Name plug-in configuration files in this directory <plug-in_name>.conf. By default, plug-ins are typically enabled. To disable a plug-in in one of these configuration files, add the following to the file:
### 3.4. ENABLING AND DISABLING DNF PLUG-INS

In the DNF tool, plug-ins are loaded by default. However, you can influence which plug-ins DNF loads.

**WARNING**

Disable all plug-ins only for diagnosing a potential problem. DNF requires certain plug-ins, such as `product-id` and `subscription-manager`, and disabling them causes Red Hat Enterprise Linux to not be able to install or update software from the Content Delivery Network (CDN).

#### Procedure

- Use one of the following methods to influence how DNF uses plug-ins:
  - To enable or disable loading of DNF plug-ins globally, add the `plugins` parameter to the `[main]` section of the `/etc/dnf/dnf.conf` file.
    - Set `plugins=1` (default) to enable loading of all DNF plug-ins.
    - Set `plugins=0` to disable loading of all DNF plug-ins.
  - To disable a particular plug-in, add `enabled=False` to the `[main]` section in the `/etc/dnf/plugins/<plug-in_name>.conf` file.
  - To disable all DNF plug-ins for a particular command, append the `--noplugins` option to the command. For example, to disable DNF plug-ins for a single update command, enter:
    ```bash
    # dnf --noplugins update
    ```
  - To disable certain DNF plug-ins for a single command, append the `--disableplugin=<plugin-name>` option to the command. For example, to disable a certain DNF plug-in for a single update command, enter:
    ```bash
    # dnf update --disableplugin=<plugin_name>
    ```
  - To enable certain DNF plug-ins for a single command, append the `--enableplugin=<plugin-name>` option to the command. For example, to enable a certain DNF plug-in for a single update command, enter:
    ```bash
    # dnf update --enableplugin=<plugin_name>
    ```
CHAPTER 4. SEARCHING FOR RHEL 9 CONTENT

In the following sections, learn how to locate and examine content in the AppStream and BaseOS repositories in Red Hat Enterprise Linux 9 by using **DNF**:

- Search for packages providing desired content.
- List installed and available packages.
- List enabled and disabled repositories.
- Display information about installed and available packages.
- List installed and available package groups.
- List available modules and find out details about them.
- Specify global expressions in *dnf* input.

4.1. SEARCHING FOR SOFTWARE PACKAGES

To identify which package provides the software you require, you can use DNF to search the repositories.

**Procedure**

- Depending on your scenario, use one of the following options to search the repository:
  - To search for a term in the name or summary of packages, enter:
    
    ```
    $ dnf search <term>
    ```
  - To search for a term in the name, summary, or description of packages, enter:
    
    ```
    $ dnf search --all <term>
    ```
    Note that searching additionally in the description by using the *--all* option is slower than a normal search operation.
  - To search for a package name and list the package name and its version in the output, enter:
    
    ```
    $ dnf repoquery <package_name>
    ```
  - To search for which package provides a file, specify the file name or the path to the file:
    
    ```
    $ dnf provides <file_name>
    ```

4.2. LISTING SOFTWARE PACKAGES

You can use DNF to display a list of packages and their versions that are available in the repositories. If required, you can filter this list and, for example, only list packages for which updates are available.
Procedure

- List the latest versions of all available packages, including architectures, version numbers, and the repository they were installed from:

  ```
  $ dnf list --all
  ...
  zlib.x86_64         1.2.11-39.el9   @rhel-9-for-x86_64-baseos-rpms
  zlib.i686           1.2.11-39.el9   rhel-9-for-x86_64-baseos-rpms
  zlib-devel.i686     2.11-39.el9     rhel-9-for-x86_64-appstream-rpms
  zlib-devel.x86_64   1.2.11-39.el9   rhel-9-for-x86_64-appstream-rpms
  ...
  ```

  The `@` sign in front of a repository indicates that the package in this line is currently installed.

  Alternatively, to display all available packages, including version numbers and architectures, enter:

  ```
  $ dnf repoquery
  ...
  zlib-0:1.2.11-35.el9_1.i686
  zlib-0:1.2.11-35.el9_1.x86_64
  zlib-0:1.2.11-39.el9.i686
  zlib-0:1.2.11-39.el9.x86_64
  zlib-devel-0:1.2.11-39.el9.i686
  zlib-devel-0:1.2.11-39.el9.x86_64
  ...
  ```

  Optionally, you can filter the output by using other options instead of `--all`, for example:

  - Use `--installed` to list only installed packages.
  - Use `--available` to list all available packages.
  - Use `--upgrades` to list packages for which newer versions are available.

  **NOTE**

  You can filter the results by appending global expressions as arguments. For more details, see [Specifying global expressions in DNF input](#).

4.3. LISTING REPOSITORIES

To get an overview of repositories that are enabled and disabled on your system, you can list them.

Procedure

1. List all enabled repositories on your system:

   ```
   $ dnf repolist
   ```

   To display only certain repositories, append one of the following options to the command:

   - Append `--disabled` to list only disabled repositories.
2. Optional: List additional information about the repositories:

```
$ dnf repoinfo <repository_name>
```

**NOTE**
You can filter the results by using global expressions. For details, see Specifying global expressions in DNF input.

### 4.4. DISPLAYING PACKAGE INFORMATION

You can query DNF repositories to display further details about a package, such as the following:

- Version
- Release
- Architecture
- Package size
- Description

**Procedure**

1. Display information about one or more available packages:

```
$ dnf info <package_name>
```

This command displays the information for the currently installed package and, if available, its newer versions that are in the repository. Alternatively, use the following command to display the information for all packages with the specified name in the repository:

```
$ dnf repoquery --info <package_name>
```

**NOTE**
You can filter the results by appending global expressions as arguments. For details, see Specifying global expressions in DNF input.

### 4.5. LISTING PACKAGE GROUPS AND PACKAGES THEY PROVIDE

Package groups bundle multiple packages, and you can use package groups to install all packages assigned to a group in a single step. However, before the installation, you must identify the name of the required package group.

**Procedure**

1. List both installed and available groups:

```
$ dnf group list
```
Note that you can filter the results by appending the `--installed` and `--available` option to the `dnf group list` command. By using the `--hidden` option, you can display hidden groups in the output.

2. List mandatory, optional, and default packages contained in a particular group:

   ```bash
   $ dnf group info "<group_name>"
   ```

   **NOTE**

   You can filter the results by appending global expressions as arguments. For more details, see [Specifying global expressions in DNF input](#).

3. Optional: View the number of installed and available groups:

   ```bash
   $ dnf group summary
   ```

### 4.6. LISTING AVAILABLE MODULES AND THEIR CONTENTS

By searching for modules and displaying information about them with DNF, you can identify which modules are available in the repositories and select the appropriate stream before you install a module.

**Procedure**

1. List the module information in one of the following ways:

   - List all available modules:
     ```bash
     $ dnf module list
     Name       Stream  Profiles                           Summary
     ...        ...
     nodejs    18       common [d], development, minimal, s2i  Javascript runtime
     postgresql 15      client, server                        PostgreSQL server and client module
     ...        ...
     Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled
     ```

   Use the `dnf module list <module_name>` command to list the same information but only for a specific module.

   - Search for which module provides a certain package:

     ```bash
     $ dnf module provides <package_name>
     ```

     For example, to display which module and profiles provide the `npm` package, enter:

     ```bash
     # dnf module provides npm
     npm-1:8.19.2-1.18.10.0.3.module+el9.1.0+16866+0fab0697.x86_64
     Module     : nodejs:18:9010020221009220316:rhel9:x86_64
     Profiles   : common development s2i
     Repo       : rhel-9-for-x86_64-appstream-rpms
     Summary    : Javascript runtime
     ```
2. Use one of these methods to list module details:

- List all details about a module, including a description, list of all profiles, and a list of all packages the module provides:

  
  ```
  $ dnf module info <module_name>
  ```

  For example, to display details about the `nodejs` package, enter:

  ```
  $ dnf module info nodejs
  Name             : nodejs
  Stream           : 18
  Version          : 9010020221009220316
  Context          : rhel9
  Architecture     : x86_64
  Profiles         : common [d], development, minimal, s2i
  Default profiles : common
  Repo             : rhel-9-for-x86_64-appstream-rpms
  Summary          : Javascript runtime
  Description      : Node.js is a platform built on Chrome’s JavaScript runtime...
  Requires         : platform:[el9]
  Artifacts        : nodejs-1:18.10.0-3.module+el9.1.0+16866+0fab0697.src
  : nodejs-1:18.10.0-3.module+el9.1.0+16866+0fab0697.x86_64
  : npm-1:8.19.2-1.18.10.0.3.module+el9.1.0+16866+0fab0697.x86_64
  ...
  ```

- List which packages each module profile installs:

  ```
  $ dnf module info --profile <module_name>
  ```

  For example, to display this information for the `nodejs` module, enter:

  ```
  $ dnf module info --profile nodejs
  Name        : nodejs:18:9010020221009220316:rhel9:x86_64
  common      : nodejs
  : npm
devolution : nodejs
  : nodejs-devel
  : npm
  minimal     : nodejs
  s2i         : nodejs
  : nodejs-nodemon
  : npm
  ...
  ```

**Additional resources**

- Modules
- Module streams
- Module profiles

**4.7. SPECIFYING GLOBAL EXPRESSIONS IN DNF INPUT**
You can filter the results of **dnf** commands by appending one or more global expressions as arguments.

**Procedure**

- Use one of the following methods if you use global expressions in **dnf** commands:
  - Enclose the entire global expression in single or double quotation marks:
    ```bash
    # dnf provides "*/<file_name>"
    ```
    Note that you must precede `<file_name>` either by `/` for an absolute path or `*/` to use a wildcard if the full path is unknown.
  - Escape the wildcard characters by preceding them with a backslash (`\`) character:
    ```bash
    # dnf provides \*/<file_name>
    ```
CHAPTER 5. INSTALLING RHEL 9 CONTENT

In the following sections, learn how to install content in Red Hat Enterprise Linux 9:

- Install a package, package group, or sets of packages provided by modules, streams, and profiles.
- Define default module streams and profiles.

5.1. INSTALLING PACKAGES

If a software is not part of the default installation, you can manually install it. DNF automatically resolves and installs dependencies.

Prerequisites

- Optional: You know the name of the package you want to install.
- If the package you want to install is provided by a module stream, the respective module stream is enabled.

Procedure

- Use one of the following methods to install packages:
  - To install packages from the repositories, enter:
    ```bash
    # dnf install <package_name_1> <package_name_2> ...
    ```
    If you install packages on a system that supports multiple architectures, such as `i686` and `x86_64`, you can specify the architecture of the package by appending it to the package name:
    ```bash
    # dnf install <package_name>.<architecture>
    ```
  - To install a package if you only know the path to the file the package provides but not the package name, you can use this path to install the corresponding package:
    ```bash
    # dnf install <path_to_file>
    ```
  - To install a local RPM file, enter:
    ```bash
    # dnf install <path_to_RPM_file>
    ```
    If the package has dependencies, specify the paths to these RPM files as well. Otherwise, DNF downloads the dependencies from the repositories or fails if they are not available in the repositories.

Additional resources

- Installing modular content

5.2. INSTALLING PACKAGE GROUPS
Prerequisites

- You know the name or ID of the group you want to install.

Procedure

- Install a package group:

  ```bash
  # dnf group install <group_name_or_ID>
  ```

5.3. INSTALLING MODULAR CONTENT

For certain software, Red Hat provides modules. You can use modules to install a specific version (stream) and set of packages (profiles).

Procedure

1. List modules that provide the package you want to install:

   ```bash
   # dnf module list <module_name>
   ```

   For example, to list the details about the nodejs module, enter:

   ```bash
   # dnf module list nodejs
   ```

<table>
<thead>
<tr>
<th>Name</th>
<th>Stream</th>
<th>Profiles</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>nodejs</td>
<td>18</td>
<td>common [d], development, minimal, s2i</td>
<td>Javascript runtime</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td>common [d], development, minimal, s2i</td>
<td>Javascript runtime</td>
</tr>
</tbody>
</table>

   Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled

2. Install a module:

   ```bash
   # dnf module install <module_name>:<stream>/<profile>
   ```

   If a default profile for a stream is defined, you can omit `/<profile>` in the command to install this default profile of the stream.

   **NOTE**

   In Red Hat Enterprise Linux 9, no default module streams are predefined. However, if you specify the stream during the module installation as shown, you do not have to manually enable the stream in advance.

   For example, to install the default profile (common) from stream 18 of the nodejs module, enter:

   ```bash
   # dnf module install nodejs:18
   ```
<table>
<thead>
<tr>
<th>Package</th>
<th>Architecture</th>
<th>Version</th>
<th>Repository</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>nodejs</td>
<td>x86_64</td>
<td>...</td>
<td>rhel-9-for-x86_64-appstream-rpms</td>
<td>12 M</td>
</tr>
<tr>
<td>npm</td>
<td>x86_64</td>
<td>...</td>
<td>rhel-9-for-x86_64-appstream-rpms</td>
<td>2.5 M</td>
</tr>
<tr>
<td>nodejs-docs</td>
<td>noarch</td>
<td>..</td>
<td>rhel-9-for-x86_64-appstream-rpms</td>
<td>7.6 M</td>
</tr>
<tr>
<td>nodejs-full-i18n</td>
<td>x86_64</td>
<td>..</td>
<td>rhel-9-for-x86_64-appstream-rpms</td>
<td>8.4 M</td>
</tr>
</tbody>
</table>

Installing weak dependencies:

<table>
<thead>
<tr>
<th>Package</th>
<th>Architecture</th>
<th>Version</th>
<th>Repository</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>nodejs-docs</td>
<td>noarch</td>
<td>..</td>
<td>rhel-9-for-x86_64-appstream-rpms</td>
<td>7.6 M</td>
</tr>
<tr>
<td>nodejs-full-i18n</td>
<td>x86_64</td>
<td>..</td>
<td>rhel-9-for-x86_64-appstream-rpms</td>
<td>8.4 M</td>
</tr>
</tbody>
</table>

Installing module profiles:

<table>
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<th>Architecture</th>
<th>Version</th>
<th>Repository</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>nodejs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Enabling module streams:

<table>
<thead>
<tr>
<th>Package</th>
<th>Architecture</th>
<th>Version</th>
<th>Repository</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>nodejs</td>
<td></td>
<td>18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Verification

- Verify that the correct module stream is enabled ([e]) and the required profile was installed ([i]):

```bash
# dnf module list nodejs
```

Updating Subscription Management repositories.

Last metadata expiration check: 0:33:24 ago on Mon 24 Jul 2023 04:59:01 PM CEST.

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Stream</th>
<th>Profiles</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>nodejs</td>
<td>18</td>
<td>[e] common [d] [i], development, minimal, s2i</td>
<td>Javascript runtime</td>
</tr>
</tbody>
</table>

Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled

Additional resources

- Modules
- Module streams
- Module profiles

5.4. DEFINING CUSTOM DEFAULT MODULE STREAMS AND PROFILES

Red Hat Enterprise Linux 9 does not define default streams in the AppStream repository. However, you can configure a default module stream and default module profile. In this case, you can omit this information when you install the default stream and profile of a module.

Procedure

1. Use the `dnf module list <module_name>` command to display the available streams and their profiles, for example:

```
# dnf module list nodejs
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Stream</th>
<th>Profiles</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>nodejs</td>
<td>18</td>
<td>common [d], development, minimal, s2i</td>
<td>Javascript runtime</td>
</tr>
</tbody>
</table>

In this example, `nodejs:18` is not set as the default stream, and the default profile in this stream is `common`. 

20
2. Create a YAML file in the /etc/dnf/modules.defaults.d/ directory to define the default stream and profile for a module. For example, create the /etc/dnf/modules.defaults.d/nodejs.yaml file with the following content to define 18 as the default stream and minimal as the default profile for the nodejs module:

```yaml
document: modulemd-defaults
version: 1
data:
  module: nodejs
  stream: "18"
  profiles:
    '18': [minimal]
```

Verification

- Use the `dnf module list <module_name>` command to verify the new default stream and profile settings, for example:

```
# dnf module list nodejs
Name    Stream  Profiles                                Summary
nodejs  18 [d]  common, development, minimal [d], s2i  Javascript runtime
```

Additional resources

- Modules
- Module streams
- Module profiles
CHAPTER 6. UPDATING RHEL 9 CONTENT

With DNF you can check if your system has any pending updates. You can list packages that need updating and choose to update a single package, multiple packages, or all packages at once. If any of the packages you choose to update have dependencies, they are updated as well.

In the following sections, learn how to update content in Red Hat Enterprise Linux 9 by using DNF:

- Check the available updates.
- Update a single package, package group, or all packages and their dependencies.
- Apply security updates.

6.1. CHECKING FOR UPDATES

To check the available updates for packages installed on your system by using the `dnf check-update` command, complete the following steps.

Procedure

- Run the following command to see which packages installed on your system have available updates:

  ```
  # dnf check-update
  ```

  The output returns the list of packages and their dependencies that have an update available.

6.2. UPDATING PACKAGES

To update a single package, a package group, or all packages and their dependencies by using the `dnf upgrade` command, complete the following steps.

Procedure

- To update all packages and their dependencies, use:

  ```
  # dnf upgrade
  ```

- To update a single package, use:

  ```
  # dnf upgrade package-name
  ```

  Replace `package-name` with the name of the package.

- To update a package group, use:

  ```
  # dnf group upgrade group-name
  ```

  Replace `group-name` with the name of the package group.
6.3. UPDATING SECURITY-RELATED PACKAGES

To update security-related packages by using the `dnf upgrade` or `dnf upgrade-minimal` command, complete the following steps.

Procedure

- To upgrade to the latest available packages that have security errata, use:

  ```shell
  # dnf upgrade --security
  ```

- To upgrade to the last security errata packages, use:

  ```shell
  # dnf upgrade-minimal --security
  ```
CHAPTER 7. AUTOMATING SOFTWARE UPDATES IN RHEL 9

To check and download package updates automatically and regularly, you can use the DNF Automatic tool that is provided by the dnf-automatic package.

DNF Automatic is an alternative command-line interface to DNF that is suited for automatic and regular execution by using systemd timers, cron jobs, and other such tools.

DNF Automatic synchronizes package metadata as needed, checks for updates available, and then performs one of the following actions depending on how you configure the tool:

- Exit
- Download updated packages
- Download and apply the updates

The outcome of the operation is then reported by a selected mechanism, such as the standard output or email.

In the following sections, learn how to automate software updates in Red Hat Enterprise Linux 9:

- Install the DNF Automatic tool.
- Enable the DNF Automatic tool.
- Examine the DNF Automatic configuration file and its sections.
- Examine the dnf-automatic systemd timer units.

7.1. INSTALLING DNF AUTOMATIC

To install the DNF Automatic tool on your system, complete the following steps.

Procedure

- Install the dnf-automatic package:

  ```
  # dnf install dnf-automatic
  ```

Verification

- Verify the successful installation by confirming the presence of the dnf-automatic package:

  ```
  # rpm -qi dnf-automatic
  ```

7.2. DNF AUTOMATIC CONFIGURATION FILE

By default, DNF Automatic uses /etc/dnf/automatic.conf as its configuration file to define its behavior.

The configuration file is separated into the following topical sections:

- [commands] section
  Sets the mode of operation of DNF Automatic.
**[emitters] section**
Defines how the results of DNF Automatic are reported.

**[command_email] section**
Provides the email emitter configuration for an external command used to send email.

**[email] section**
Provides the email emitter configuration.

**[base] section**
Overrides settings from the main configuration file of DNF.

With the default settings of the `/etc/dnf/automatic.conf` file, DNF Automatic checks for available updates, downloads them, and reports the results as standard output.

---

**WARNING**
Settings of the operation mode from the `[commands]` section are overridden by settings used by a systemd timer unit for all timer units except `dnf-automatic.timer`.

---

Additional resources

- DNF Automatic documentation
- `dnf-automatic(8)` man page
- Overview of the systemd timer units included in the dnf-automatic package

### 7.3. ENABLING DNF AUTOMATIC

To run DNF Automatic, you must always enable and start a specific systemd timer unit. You can use one of the timer units provided in the `dnf-automatic` package, or you can write your own timer unit depending on your needs.

To enable DNF Automatic on your system, complete the following steps.

**Prerequisites**

- You specified the behavior of DNF Automatic by modifying the `/etc/dnf/automatic.conf` configuration file.

**Procedure**

- To select, enable, and start a systemd timer unit that downloads available updates, use:

```
# systemctl enable dnf-automatic-download.timer
# systemctl start dnf-automatic-download.timer
```
To select, enable, and start a systemd timer unit that downloads and installs available updates, use:

```
# systemctl enable dnf-automatic-install.timer
# systemctl start dnf-automatic-install.timer
```

To select, enable, and start a systemd timer unit that reports available updates, use:

```
# systemctl enable dnf-automatic-notifyonly.timer
# systemctl start dnf-automatic-notifyonly.timer
```

To select, enable, and start a systemd timer unit that downloads, downloads and installs, or reports available updates, use:

```
# systemctl enable dnf-automatic.timer
# systemctl start dnf-automatic.timer
```

Optionally, select, enable, and start a systemd timer unit in one command by using the `--now` option. For example:

```
# systemctl enable --now dnf-automatic-download.timer
```

**NOTE**

You can also run DNF Automatic by executing the `/usr/bin/dnf-automatic` file directly from the command line or from a custom script.

**Verification**

- Verify that the timer is enabled:

  ```
  # systemctl status <systemd timer unit>
  ```

**Additional resources**

- [dnf-automatic(8) man page](#)
- Overview of the systemd timer units included in the dnf-automatic package
- DNF Automatic configuration file

**7.4. OVERVIEW OF THE SYSTEMD TIMER UNITS INCLUDED IN THE DNF-AUTOMATIC PACKAGE**

The systemd timer units take precedence and override the settings in the `/etc/dnf/automatic.conf` configuration file when downloading and applying updates.
For example if you set `download_updates = yes` in the `/etc/dnf/automatic.conf` configuration file, but you have activated the `dnf-automatic-notifyonly.timer` unit, the packages will not be downloaded.

The `dnf-automatic` package includes the following systemd timer units:

**Table 7.1. systemd timers included in the `dnf-automatic` package**

<table>
<thead>
<tr>
<th>Timer unit</th>
<th>Function</th>
<th>Overrides settings in the <code>/etc/dnf/automatic.conf</code> file?</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>dnf-automatic-download.timer</code></td>
<td>Downloads packages to cache and makes them available for updating.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Note: This timer unit does not install the updated packages. To perform the installation, you must run the <code>dnf update</code> command.</td>
<td></td>
</tr>
<tr>
<td><code>dnf-automatic-install.timer</code></td>
<td>Downloads and installs updated packages.</td>
<td>Yes</td>
</tr>
<tr>
<td><code>dnf-automatic-notifyonly.timer</code></td>
<td>Downloads only repository data to keep the repository cache up-to-date and notifies you about available updates.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Note: This timer unit does not download or install the updated packages.</td>
<td></td>
</tr>
<tr>
<td><code>dnf-automatic.timer</code></td>
<td>The behavior of this timer when downloading and applying updates is specified by the settings in the <code>/etc/dnf/automatic.conf</code> configuration file.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Default behavior is the same as for the <code>dnf-automatic-download.timer</code> unit: it downloads packages, but does not install them.</td>
<td></td>
</tr>
</tbody>
</table>

**Additional resources**

- `dnf-automatic(8)` man page
- DNF Automatic configuration file
CHAPTER 8. REMOVING RHEL 9 CONTENT

In the following sections, learn how to remove content in Red Hat Enterprise Linux 9 by using DNF:

- Remove a package.
- Remove a package group.
- Remove content installed from a module stream or a profile.
  - Remove packages from a selected profile.
  - Remove all packages from a selected module stream.

8.1. REMOVING INSTALLED PACKAGES

To remove packages installed on your system by using the `dnf remove` command, complete the following steps.

Procedure

- To remove a particular package and all unused dependent packages, use:

  ```
  # dnf remove package-name
  ```
  
  Replace `package-name` with the name of the package.

- To remove multiple packages and their unused dependencies simultaneously, use:

  ```
  # dnf remove package-name-1 package-name-2
  ```
  
  Replace `package-name-1` and `package-name-2` with the names of the packages.

NOTE

The `dnf` command removes a package together with any other dependent packages.

8.2. REMOVING PACKAGE GROUPS

To remove a package group either by the group name or the groupID by using the `dnf group remove` command, complete the following steps.

Procedure

- To remove a package group by the group name, use:

  ```
  # dnf group remove group-name
  ```
  
  Replace `group-name` with the full name of the group.

- To remove a package group by the groupID, use:

  ```
  # dnf group remove groupID
  ```
Replace $\textit{groupId}$ with the ID of the group.

8.3. REMOVING INSTALLED MODULAR CONTENT

When removing installed modular content, you can remove packages from either a selected profile or the whole stream.

![IMPORTANT]

**IMPORTANT**

DNF will try to remove all packages with a name corresponding to the packages installed with a profile or a stream, including their dependent packages. Always check the list of packages to be removed before you proceed, especially if you have enabled custom repositories on your system.

8.3.1. Removing packages from an installed profile

When you remove packages installed with a profile, all packages with a name corresponding to the packages installed by the profile are removed. This includes their dependencies, with the exception of packages required by a different profile.

To remove packages from a selected profile, complete the following steps.

**Prerequisites**

- The selected profile has been installed by using the `dnf module install module-name:stream/profile` command or as a default profile by using the `dnf install module-name:stream` command.
- You understand modular dependency resolution.

**Procedure**

1. Uninstall packages belonging to the selected profile:

   ```
   # dnf module remove module-name:stream/profile
   ```

   Replace $\textit{module-name}$, $\textit{stream}$, and $\textit{profile}$ with the module, stream, and profile you want to uninstall.

   Alternatively, uninstall packages from all installed profiles within a stream:

   ```
   # dnf module remove module-name:stream
   ```

   These operations will not remove packages from the stream that do not belong to any of the profiles.

2. Check the list of packages under **Removing** and **Removing unused dependencies** before you proceed with the removal transaction.

To remove all packages from a selected stream, follow instructions in Section 8.3.2 "Removing all packages from a module stream".

**Example 8.1. Removing packages from a selected profile**
The following is an example of how to remove packages and their dependencies that belong to the **development** profile of the **nodejs:18** module stream.

**NOTE**

The outputs in this example have been edited for brevity. Actual outputs might contain more information than shown here.

1. Install the **nodejs:18** module stream, including all available profiles:

   ```
   # dnf module install nodejs:18/*
   (...
   Dependencies resolved.
   ===========================
   Package Architecture Version
   Repository Size
   ===========================
   Installing group/module packages:
   nodejs x86_64 1:18.7.0-1.module+el9.1.0+16284+4fdefb2f
            rhel-AppStream 12 M
   nodejs-devel x86_64 1:18.7.0-1.module+el9.1.0+16284+4fdefb2f
            rhel-AppStream 202 k
   nodejs-nodemon noarch 2.0.15-1.module+el9.1.0+15718+e52ec601
            rhel-AppStream 762 k
   npm x86_64 1:8.15.0-1.18.7.0.1.module+el9.1.0+16284+4fdefb2f
            rhel-AppStream 2.2 M
   Installing dependencies:
   brotli x86_64 1.0.9-6.el9
            rhel-AppStream 314 k
   brotli-devel x86_64 1.0.9-6.el9
            rhel-AppStream 36 k
   ...
   Installing weak dependencies:
   nodejs-docs noarch 1:18.7.0-1.module+el9.1.0+16284+4fdefb2f
            rhel-AppStream 7.2 M
   nodejs-full-i18n x86_64 1:18.7.0-1.module+el9.1.0+16284+4fdefb2f
            rhel-AppStream 8.2 M
   Installing module profiles:
   nodejs/common
   nodejs/development
   nodejs/minimal
   nodejs/s2i
   Transaction Summary
   ===========================
   Install 31 Packages
   Total download size: 36 M
   Installed size: 165 M
   Is this ok [y/N]: y
   (...
   Complete!
   ```
2. Inspect the installed profiles:

```
$ dnf module info nodejs
...
Name     : nodejs
Stream   : 18 [e] [a]
Version  : 9010020221009220316
Context  : rhel9
Architecture : x86_64
Profiles     : common [d] [i], development [i], minimal [i], s2i [i]
Default profiles : common
Repo       : rhel-AppStream
...
```

All profiles are installed as indicated in the output.

3. Remove packages from the **development** profile and their dependencies:

```
# dnf module remove nodejs:18/development
(...)
Dependencies resolved.
========================================================================
Package          Architecture Version
Repository       Size
========================================================================
Removing:
nodejs-devel     x86_64         1:18.7.0-1.module+el9.1.0+16284+4fdefb2f
@rhel-AppStream  950 k
Removing unused dependencies:
brotli           x86_64         1.0.9-6.el9
@rhel-AppStream  754 k
brotli-devel     x86_64         1.0.9-6.el9
@rhel-AppStream  55 k
...
Disabling module profiles:
nodejs/development
```

Transaction Summary

```
Remove  26 Packages
Freed space: 8.3 M
Is this ok [y/N]: y
```

4. Inspect the installed profiles after the removal:

```
$ dnf module info nodejs
...
Name     : nodejs
Stream   : 18 [e] [a]
Version  : 9010020221009220316
```
8.3.2. Removing all packages from a module stream

When you remove packages installed with a module stream, all packages with a name corresponding to the packages installed by the stream are removed. This includes their dependencies, with the exception of packages required by other modules.

To remove all packages from a selected module stream, complete the following steps.

Prerequisites

- The module stream has been enabled and at least some packages from the stream have been installed.
- You understand modular dependency resolution.

Procedure

1. Remove all packages from a selected stream:

   ```bash
   # dnf module remove --all module-name:stream
   ```

   Replace `module-name` and `stream` with the module and stream you want to uninstall.

2. Check the list of packages under Removing: and Removing unused dependencies: before you proceed with the removal transaction.

3. Optionally, reset or disable the stream.

If you want to remove only packages from a selected profile, follow instructions in Section 8.3.1, "Removing packages from an installed profile".

Example 8.2. Removing packages from the whole stream

The following is an example of how to remove all packages from the `nodejs:18` module stream.

**NOTE**

The outputs in this example have been edited for brevity. Actual outputs might contain more information than shown here.

1. Install the `nodejs:18` module stream, including all available profiles:
# dnf module install nodejs:18/

(...)

Dependencies resolved.

===

Package  Architecture  Version
Repository  Size

===

Installing group/module packages:

nodejs  x86_64  1:18.10.0-3.module+el9.1.0+16866+0fab0697
         rhel-AppStream  13 M
nodejs-devel  x86_64  1:18.10.0-3.module+el9.1.0+16866+0fab0697
            rhel-AppStream  203 k
nodejs-nodemon  noarch  2.0.15-1.module+el9.1.0+15718+e52ec601
              rhel-AppStream  762 k
npm  x86_64  1:8.19.2-1.18.10.0.3.module+el9.1.0+16866+0fab0697
         rhel-AppStream  2.2 M

Installing dependencies:

brotli  x86_64  1.0.9-6.el9
        rhel-AppStream  314 k
brotli-devel  x86_64  1.0.9-6.el9
            rhel-AppStream  36 k

... Installing weak dependencies:

nodejs-docs  noarch  1:18.10.0-3.module+el9.1.0+16866+0fab0697
          rhel-AppStream  7.3 M
nodejs-full-i18n  x86_64  1:18.10.0-3.module+el9.1.0+16866+0fab0697
             rhel-AppStream  8.2 M

Installing module profiles:

nodejs/common
nodejs/development
nodejs/minimal
nodejs/s2i

Enabling module streams:

nodejs  18

Transaction Summary

===

Install  31 Packages

Total download size: 37 M
Installed size: 167 M

Is this ok [y/N]: y

2. Remove all packages from the nodejs:18 module stream:

# dnf module remove --all nodejs:18

(...)

Dependencies resolved.

===

Package  Architecture  Version
Repository  Size

===
Removing:
nodejs       x86_64       1:18.10.0-3.module+el9.1.0+16866+0fab0697
    @rhel-AppStream  43 M
nodejs-devel x86_64       1:18.10.0-3.module+el9.1.0+16866+0fab0697
    @rhel-AppStream  953 k
nodejs-docs  noarch       1:18.10.0-3.module+el9.1.0+16866+0fab0697
    @rhel-AppStream  78 M
nodejs-full-i18n x86_64     1:18.10.0-3.module+el9.1.0+16866+0fab0697
    @rhel-AppStream  29 M
nodejs-nodemon noarch      2.0.15-1.module+el9.1.0+15718+e52ec601
    @rhel-AppStream  2.0 M
nodejs-packaging noarch    2021.06-4.module+el9.1.0+15718+e52ec601
    @rhel-AppStream  41 k
npm           x86_64       1:8.19.2-1.18.10.0.3.module+el9.1.0+16866+0fab0697
    @rhel-AppStream  6.9 M
Removing unused dependencies:
brotli       x86_64       1.0.9-6.el9
    @rhel-AppStream  754 k
brotli-devel x86_64       1.0.9-6.el9
    @rhel-AppStream  55 k
... 
Disabling module profiles:
nodejs/common
nodejs/development
nodejs/minimal
nodejs/s2i

Transaction Summary

Remove  31 Packages

Freed space: 167 M
Is this ok [y/N]: y

3. Inspect the nodejs module after the removal:

$ dnf module info nodejs
...
Name         : nodejs
Stream       : 18 [e] [a]
Version      : 9010020221009220316
Context      : rhel9
Architecture : x86_64
Profiles      : common [d], development, minimal, s2i
Default profiles : common
...
Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled, [a]ctive

No Node.js module stream is currently installed.
Additional resources

- Resetting module streams
- Disabling all streams of a module

8.4. ADDITIONAL RESOURCES

- Commands for removing content in RHEL 9
CHAPTER 9. HANDLING PACKAGE MANAGEMENT HISTORY

With the `dnf history` command, you can review the following information:

- Timeline of DNF transactions
- Dates and times the transactions occurred
- Number of packages affected by the transactions
- Whether the transactions succeeded or were aborted
- If the RPM database was changed between the transactions

You can also use the `dnf history` command to undo or redo the transactions.

In the following sections, learn how to handle package management history by using the `dnf history` command:

- List the latest transactions, the latest operations for a selected package, and details of a particular transaction.
- Revert DNF transactions by using the `dnf history undo` and `dnf history rollback` commands:
  - Revert a single DNF transaction.
  - Revert all DNF transactions performed between the specified transaction and the last transaction.
- Repeat selected or last transactions.

9.1. LISTING TRANSACTIONS

To list the latest DNF transactions, the latest operations for a selected package, and details of a particular transaction, complete the following steps.

Procedure

- To display a list of all the latest DNF transactions, use:

  ```
  # dnf history
  ```

  **NOTE**

  The **Action(s)** column in the output displays which type of action was performed during a transaction, for example, Install (I), Upgrade (U), Remove (E), and other actions. The **Altered** column displays the number of actions performed during the transaction. The number of actions can also be followed by the result of the transaction. For more information about the values of the **Action(s)** and **Altered** columns, see the `dnf(8)` man page.

- To display a list of all the latest operations for a selected package, use:

  ```
  # dnf history list package-name
  ```
Replace package-name with the name of the package.

- To display details of a particular transaction, use:

  ```
  # dnf history info transactionID
  ```

  Replace transactionID with the ID of the transaction.

  **NOTE**

  You can filter the command output by appending global expressions. For more details, see Specifying global expressions in `dnf` input.

Additional resources

- `dnf(8)` man page

### 9.2. REVERTING DNF TRANSACTIONS

In RHEL 9, you can revert DNF transactions in two ways:

- Revert a single DNF transaction by using the `dnf history undo` command.
- Revert all DNF transactions performed between the specified transaction and the last transaction by using the `dnf history rollback` command.

**IMPORTANT**

Use the `dnf history undo` and `dnf history rollback` commands with caution. Downgrading RHEL packages, especially `selinux`, `selinux-policy-*`, `kernel`, `glibc` (dependencies of `glibc` such as `gcc`) packages, to an older version is not supported. Therefore, downgrading a system to a minor version (for example, from RHEL 9.1 to RHEL 9.0) is not recommended as it might leave the system in an undesired state.

#### 9.2.1. Reverting a single DNF transaction by using dnf history undo

You can revert steps performed within a single transaction by using the `dnf history undo` command.

If the transaction installed a new package, `dnf history undo` uninstalls it. If the transaction uninstalled a package, `dnf history undo` installs it back. The `dnf history undo` command also attempts to downgrade all updated packages to their previous versions if the older packages are still available.

**NOTE**

If an older package version is not available, the downgrade by using the `dnf history undo` command fails.

To revert a single transaction by using the `dnf history undo` command, complete the following steps.

**Procedure**

1. Identify the ID of a transaction you want to revert:
# dnf history

2. Optional: Verify that this is the transaction you want to revert by displaying its details:

```bash
# dnf history info transaction_id
```

Replace `transaction_id` with the ID of a transaction you want to revert.

3. Revert the transaction:

```bash
# dnf history undo transaction_id
```

Replace `transaction_id` with the ID of a transaction you want to revert.

---

**Example 9.1. Reverting a single DNF transaction by using the `dnf history undo` command**

The following is an example of how to revert the installation transaction of the `unzip` package by using the `dnf history undo` command.

1. Install the `unzip` package:

```bash
# dnf install unzip
```

Dependencies resolved.

```
Package          Architecture      Version          Repository      Size
========================================================================
==
Installing: unzip            x86_64            6.0-56.el9       rhel            186 k
```

Transaction Summary

```
==
Install  1 Package

Total download size: 186 k
Installed size: 392 k
Is this ok [y/N]: y
```

2. Identify the transaction ID that you want to revert:

```bash
# dnf history
```

```
ID | Command line     | Date and time     | Action(s) | Altered
-----------------------------------------
13 | install zip      | 2022-11-03 10:49  | Install   |    1
12 | install unzip    | 2022-11-03 10:49  | Install   |    1
```

3. Revert the transaction:

```bash
# dnf history undo 12
```
9.2.2. Reverting multiple DNF transactions by using dnf history rollback

You can revert all DNF transactions performed between a specified transaction and the last transaction by using the `dnf history rollback` command. Note that the transaction specified by the transaction ID will remain unchanged.

To revert multiple transactions by using the `dnf history rollback` command, complete the following steps.

Procedure

1. Identify the transaction ID of the state you want to revert to:

   ```
   # dnf history
   ```

2. Revert specified transactions:

   ```
   # dnf history rollback transaction_id
   ```

   Replace `transaction_id` with the transaction ID of the state you want to revert to.

   Alternatively, to revert all transactions in the transaction history, use the transaction ID 1:

   ```
   # dnf history rollback 1
   ```

Example 9.2. Reverting multiple DNF transactions by using the `dnf history rollback` command

The following is an example of how to roll back two installation transactions of the `unzip` and `zip` packages by using the `dnf history rollback` command.

1. Install the `unzip` package:

   ```
   # dnf install unzip
   Dependencies resolved.

   Package       Architecture Version Repository Size
   ===============================
   Installing:   unzip       x86_64   6.0-56.el9   rhel   186 k

   Transaction Summary
   ===============================

   Install 1 Package

   Total download size: 186 k
   Installed size: 392 k
   Is this ok [y/N]: y
   ```

2. Install the `wget` package:

   ```
   # dnf install wget
   ```
Dependencies resolved.

Package | Architecture | Version | Repository | Size
--- | --- | --- | --- | ---
Installing:
wget | x86_64 | 1.21.1-7.el9 | rhel | 794 k

Transaction Summary

Install 1 Package

Total download size: 794 k
Installed size: 3.1 M
Is this ok [y/N]: y

3. Identify the transaction ID of the state you want to revert to:

```
# dnf history
ID | Command line     | Date and time     | Action(s) | Altered
--- | --- | --- | --- | ---
14 | install wget     | 2022-11-03 10:49 | Install | 1
13 | install unzip    | 2022-11-03 10:49 | Install | 1
12 | install vim-X11  | 2022-11-03 10:20 | Install | 171 EE
```

4. Revert the last two transactions:

```
# dnf history rollback 12
```

This action uninstalls the `wget` and `unzip` packages but leaves the `vim-X11` package installed.

9.3. REPEATING TRANSACTIONS

You can repeat steps performed during a transaction by using the `dnf history redo` command.

To repeat a selected transaction or the last DNF transaction, complete the following steps.

**Procedure**

- To repeat a particular transaction, use:

  ```
  # dnf history redo transactionID
  ```

  Replace `transactionID` with the ID of the transaction.

- To repeat the last transaction, use:

  ```
  # dnf history redo last
  ```
CHAPTER 10. MANAGING CUSTOM SOFTWARE REPOSITORIES

You can configure a repository in the /etc/dnf/dnf.conf file or in a .repo file in the /etc/yum.repos.d/ directory.

The configuration information for DNF and related utilities are stored in the /etc/dnf/dnf.conf file. This file contains the [main] section and can contain one or more [repository] sections, which allow you to set repository-specific options. The values you define in individual [repository] sections of the /etc/dnf/dnf.conf file override values set in the [main] section.

However, it is recommended to define individual repositories in new or existing .repo files in the /etc/yum.repos.d/ directory.

In the following sections, learn how to manage custom software repositories by using DNF:

- Set the [repository] section options.
- Define a new DNF repository.
- Enable a DNF repository added to your system.
- Disable a DNF repository added to your system.

10.1. SETTING DNF REPOSITORY OPTIONS

The /etc/dnf/dnf.conf configuration file contains the [repository] sections, where repository is a unique repository ID. The [repository] sections allow you to define individual DNF repositories.

**NOTE**

Do not give custom repositories names used by the Red Hat repositories to avoid conflicts.

For a complete list of available [repository] options, see the [repository] OPTIONS section of the dnf.conf(5) man page.

10.2. ADDING A DNF REPOSITORY

To define a new repository, you can either:

- Add a [repository] section to the /etc/dnf/dnf.conf file.
- Add a [repository] section to a .repo file in the /etc/yum.repos.d/ directory.
  
  Installed RPMs or software management tools, for example, Subscription Manager, can provide their own .repo file.

**NOTE**

Define your repositories in a .repo file instead of /etc/dnf/dnf.conf because all files with the .repo file extension in this directory are read by dnf.
To add a DNF repository to your system by using the `dnf config-manager` command, complete the following steps.

**Procedure**

- Add a repository to your system:

  ```
  # dnf config-manager --add-repo repository_URL
  ```

  Replace `repository_url` with URL pointing to the repository.

**WARNING**

Obtaining and installing software packages from unverified or untrusted sources other than Red Hat certificate-based **Content Delivery Network (CDN)** is a potential security risk, and can lead to security, stability, compatibility, and maintainability issues.

### 10.3. ENABLING A DNF REPOSITORY

To enable a DNF repository added to your system by using the `dnf config-manager` command, complete the following steps.

**Procedure**

- Enable a repository:

  ```
  # dnf config-manager --enable repositoryID
  ```

  Replace `repositoryID` with the unique repository ID.

**Additional resources**

Listing repositories

### 10.4. DISABLING A DNF REPOSITORY

To disable a DNF repository added to your system by using the `dnf config-manager` command, complete the following steps.

**Procedure**

- Disable a repository:

  ```
  # dnf config-manager --disable repositoryID
  ```

  Replace `repositoryID` with the unique repository ID.
Additional resources

Listing repositories
CHAPTER 11. MANAGING VERSIONS OF APPLICATION STREAM CONTENT

Content in the AppStream repository can be available in multiple versions, corresponding to module streams.

In the following sections, learn operations you must perform when changing existing enabled module streams:

- Modular dependency rules.
- Interaction of modular and non-modular dependencies.
- Reset modules to their initial state.
- Completely disable a module and all its streams.

11.1. MODULAR DEPENDENCIES AND STREAM CHANGES

Traditionally, packages providing content depend on further packages, and usually specify the desired dependency versions. For packages contained in modules, this mechanism applies as well, but the grouping of packages and their particular versions into modules and streams provides further constraints. Additionally, module streams can declare dependencies on streams of other modules, independent of the packages contained and provided by them.

After any operations with packages or modules, the whole dependency tree of all underlying installed packages must satisfy all the conditions that the packages declare. Additionally, all module stream dependencies must be satisfied.

As a result:

- Enabling a module stream can require enabling further module streams.
- Installing a module stream profile or installing packages from a stream can require enabling further module streams and installing further packages.
- Disabling a module stream can require disabling other module streams. No packages will be removed automatically.
- Removing a package can require removing further packages. If these packages were provided by modules, the module streams remain enabled in preparation for further installation, even if no packages from these streams are installed any more. This mirrors the behavior of an unused DNF repository.

11.2. INTERACTION OF MODULAR AND NON-MODULAR DEPENDENCIES

Modular dependencies are an additional layer on top of regular RPM dependencies. Modular dependencies behave similarly to hypothetical dependencies between repositories. This means that installing different packages requires resolution of both the RPM dependencies and the modular dependencies.

The system will always retain the module and stream choices, unless explicitly instructed to change them. A modular package will receive updates contained in the currently enabled stream of the module that provides this package, but will not upgrade to a version contained in a different stream.
11.3. RESETTING MODULE STREAMS

Resetting a module is an action that returns all of its streams to their initial state - neither enabled nor disabled. If the module has a configured default stream, this stream becomes active as a result of resetting the module.

To reset a module stream to its initial state by using the `dnf module reset` command, complete the following steps.

**Procedure**

- Reset the module state:

  ```
  # dnf module reset module-name
  ```

  The module is returned to the initial state. Information about an enabled stream and installed profiles is erased but no installed content is removed.

11.4. DISABLING ALL STREAMS OF A MODULE

Modules that have a default stream will always have one stream active. In situations where the content from all the module streams must not be accessible, it is possible to disable the whole module.

To disable all streams of a module by using the `dnf module disable` command, complete the following steps.

**Prerequisites**

- You understand the concept of an active module stream.

**Procedure**

- Disable the module:

  ```
  # dnf module disable module-name
  ```

  The `dnf` command asks for confirmation and then disables the module with all its streams. All of the module streams become inactive. No installed content is removed.

11.5. SWITCHING TO A LATER STREAM

When you switch to a later module stream, all respective packages are replaced with their later versions.

**IMPORTANT**

Back up your data and follow migration instructions specific to the component.

**Prerequisites**

- The system is fully updated.

**Procedure**
Switch the installed component to the new version and select the module (component) and stream (version):

```
# dnf module switch-to module:stream
```

Optional: Switch the installed component to the new version and select also the profile to be installed or updated:

```
# dnf module switch-to module:stream/profile
```

Example 11.1. Switching from non-modular content to a module stream

The following is an example of how to switch from non-modular PHP 8.0 to modular PHP 8.1.

**NOTE**

The outputs in this example have been edited for brevity. Actual outputs might contain more information than shown here.

1. Verify that the `php-common` package with PHP 8.0 is installed:

```
$ rpm -q php-common
php-common-8.0.27-1.el9_1.x86_64
```

2. Switch from the non-modular PHP 8.0 to modular PHP 8.1:

```
# dnf module switch-to php:8.1
... Dependencies resolved.
```

```
Package    Arch    Version                                      Repository     Size
========================================================================
==
Upgrading:
php-common x86_64 8.1.14-1.module+el9.2.0+17911+b059dfc2 rhel-AppStream 687 k
Enabling module streams:
php                8.1
```

Transaction Summary

```
Upgrade  1 Package
Total download size: 687 k
Is this ok [y/N]: y
Downloading Packages:
... Upgraded:
    php-common-8.1.14-1.module+el9.2.0+17911+b059dfc2.x86_64
Complete!
```
3. Verify that the **php:8.1** module stream is enabled:

```bash
$ dnf module list php
...  
Name  Stream     Profiles                                     Summary
php   8.1 [e]     common [d], devel, minimal                  PHP scripting language
Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled
```

4. Check the installed version of the **php-common** package:

```bash
$ rpm -q php-common
php-common-8.1.14-1.module+el9.2.0+17911+b059dfe2.x86_64
```

**Example 11.2. Switching from an earlier to a later module stream**

The following is an example of how to switch from the **nodejs:18** module stream to the **nodejs:20** stream.

**NOTE**

The outputs in this example have been edited for brevity. Actual outputs might contain more information than shown here.

1. Verify that the **nodejs:18** module stream is installed:

```bash
$ dnf module list nodejs
...  
Name  Stream     Profiles                                     Summary
nodejs 18 [e]     common [d] [i], development, minimal, s2i Javascript runtime
nodejs 20 common [d], development, minimal, s2i Javascript runtime
Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled
```

2. Switch to the later **nodejs:20** module stream:

```bash
# dnf module switch-to nodejs:20
...  
Dependencies resolved.
```

---

<table>
<thead>
<tr>
<th>Package</th>
<th>Arch</th>
<th>Version</th>
<th>Repository</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>nodejs</td>
<td>x86_64</td>
<td>1:20.5.1-1.module+el9.3.0+19646+9a702805</td>
<td>rhel-AppStream</td>
<td>14 M</td>
</tr>
<tr>
<td>nodejs-docs</td>
<td>noarch</td>
<td>1:20.5.1-1.module+el9.3.0+19646+9a702805</td>
<td>rhel-AppStream</td>
<td>8.0 M</td>
</tr>
<tr>
<td>nodejs-full-i18n</td>
<td>x86_64</td>
<td>1:20.5.1-1.module+el9.3.0+19646+9a702805</td>
<td>rhel-AppStream</td>
<td></td>
</tr>
</tbody>
</table>
Switching module streams:
nodejs 18 -> 20

Transaction Summary
========================================================================
================
Upgrade  4 Packages

Total download size: 33 M
Is this ok [y/N]: y
Downloading Packages: ...

Upgraded:
nodejs-1:20.5.1-1.module+el9.3.0+19646+9a702805.x86_64
nodejs-docs-1:20.5.1-1.module+el9.3.0+19646+9a702805.noarch
nodejs-full-i18n-1:20.5.1-1.module+el9.3.0+19646+9a702805.x86_64
npm-1:9.8.0-1.20.5.1.1.module+el9.3.0+19646+9a702805.x86_64

Complete!

3. Verify that the nodejs:20 module stream is enabled:

$ dnf module list nodejs ...
  rhel-AppStream
  Name    Stream   Profiles                           Summary
  nodejs  18       common [d], development, minimal, s2i Javascript runtime
  nodejs  20 [e]   common [d] [i], development, minimal, s2i Javascript runtime

  Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled

4. Check the installed version of nodejs:

$ rpm -q nodejs
  nodejs-20.5.1-1.module+el9.3.0+19646+9a702805.x86_64
APPENDIX A. DNF COMMANDS LIST

In the following sections, examine DNF commands for listing, installing, and removing content in Red Hat Enterprise Linux 9.

A.1. COMMANDS FOR LISTING CONTENT IN RHEL 9

The following are the commonly used DNF commands for finding content and its details in Red Hat Enterprise Linux 9:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>dnf search term</code></td>
<td>Search for a package by using term related to the package.</td>
</tr>
<tr>
<td><code>dnf repoquery package</code></td>
<td>Search for enabled DNF repositories for a selected package and its version.</td>
</tr>
<tr>
<td><code>dnf list</code></td>
<td>List information about all installed and available packages.</td>
</tr>
<tr>
<td><code>dnf list --installed</code></td>
<td>List all packages installed on your system.</td>
</tr>
<tr>
<td><code>dnf repoquery --installed</code></td>
<td>List all packages installed on your system.</td>
</tr>
<tr>
<td><code>dnf list --available</code></td>
<td>List all packages in all enabled repositories that are available to install.</td>
</tr>
<tr>
<td><code>dnf repoquery</code></td>
<td></td>
</tr>
<tr>
<td><code>dnf repolist</code></td>
<td>List all enabled repositories on your system.</td>
</tr>
<tr>
<td><code>dnf repolist --disabled</code></td>
<td>List all disabled repositories on your system.</td>
</tr>
<tr>
<td><code>dnf repolist --all</code></td>
<td>List both enabled and disabled repositories.</td>
</tr>
<tr>
<td><code>dnf repoinfo</code></td>
<td>List additional information about the repositories.</td>
</tr>
<tr>
<td><code>dnf info package-name</code></td>
<td>Display details of an available package.</td>
</tr>
<tr>
<td><code>dnf repoquery --info package_name</code></td>
<td>Display details of a package installed on your system.</td>
</tr>
<tr>
<td><code>dnf repoquery --info --installed package_name</code></td>
<td></td>
</tr>
<tr>
<td><code>dnf module list</code></td>
<td>List modules and their current status.</td>
</tr>
<tr>
<td><code>dnf module info module-name</code></td>
<td>Display details of a module.</td>
</tr>
<tr>
<td><code>dnf module list module-name</code></td>
<td>Display the current status of a module.</td>
</tr>
</tbody>
</table>
### Command and Description

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>dnf module info --profile module-name</code></td>
<td>Display packages associated with available profiles of a selected module.</td>
</tr>
<tr>
<td><code>dnf module info --profile module-name:stream</code></td>
<td>Display packages associated with available profiles of a module by using a specified stream.</td>
</tr>
<tr>
<td><code>dnf module provides package</code></td>
<td>Determine which modules, streams, and profiles provide a package. Note that if the package is available outside any modules, the output of this command is empty.</td>
</tr>
<tr>
<td><code>dnf group summary</code></td>
<td>View the number of installed and available groups.</td>
</tr>
<tr>
<td><code>dnf group list</code></td>
<td>List all installed and available groups.</td>
</tr>
<tr>
<td><code>dnf group info group-name</code></td>
<td>List mandatory and optional packages included in a particular group.</td>
</tr>
</tbody>
</table>

### A.2. COMMANDS FOR INSTALLING CONTENT IN RHEL 9

The following are the commonly used **DNF** commands for installing content in Red Hat Enterprise Linux 9:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>dnf install package-name</code></td>
<td>Install a package.</td>
</tr>
<tr>
<td></td>
<td>If the package is provided by a module stream, <strong>dnf</strong> resolves the required module stream and enables it automatically while installing this package. This also happens recursively for all package dependencies. If more module streams satisfy the requirement, the default ones are used.</td>
</tr>
<tr>
<td><code>dnf install package-name-1 package-name-2</code></td>
<td>Install multiple packages and their dependencies simultaneously.</td>
</tr>
<tr>
<td><code>dnf install package-name.arch</code></td>
<td>Specify the architecture of the package by appending it to the package name when installing packages on a <strong>multilib</strong> system (AMD64, Intel 64 machine).</td>
</tr>
<tr>
<td><code>dnf install /usr/sbin/binary-file</code></td>
<td>Install a binary by using the path to the binary as an argument.</td>
</tr>
</tbody>
</table>
Command | Description
--- | ---
dnf install /path/ | Install a previously downloaded package from a local directory.
dnf install package-url | Install a remote package by using a package URL.
dnf module enable module-name:stream | Install a default profile from a specific module stream.
| Note that running this command does not install any RPM packages.
dnf module install module-name:stream | Install a selected profile by using a specific stream.
dnf install @module-name:stream | Install a default profile from a specific module stream.
| Note that running this command also enables the specified stream.
dnf module install module-name:stream/profile | Install a selected profile by using a specific stream.
dnf install @module-name:stream/profile | Install a selected profile by using a specific stream.
dnf group install group-name | Install a package group by a group name.
dnf group install groupID | Install a package group by the groupID.

A.3. COMMANDS FOR REMOVING CONTENT IN RHEL 9

The following are the commonly used DNF commands for removing content in Red Hat Enterprise Linux 9:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
</table>
dnf remove package-name | Remove a particular package and all dependent packages.
dnf remove package-name-1 package-name-2 | Remove multiple packages and their unused dependencies simultaneously.
dnf group remove group-name | Remove a package group by the group name.
dnf group remove groupID | Remove a package group by the groupID.
dnf module remove --all module-name:stream | Remove all packages from the specified stream.
| Note that running this command can remove critical packages from your system.
### Command

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dnf module remove <em>module-name:stream/profile</em></td>
<td>Remove packages from an installed profile.</td>
</tr>
<tr>
<td>dnf module remove <em>module-name:stream</em></td>
<td>Remove packages from all installed profiles within the specified stream.</td>
</tr>
<tr>
<td>dnf module reset <em>module-name</em></td>
<td>Reset a module to the initial state. Note that running this command does not remove packages from the specified module.</td>
</tr>
<tr>
<td>dnf module disable <em>module-name</em></td>
<td>Disable a module and all its streams. Note that running this command does not remove packages from the specified module.</td>
</tr>
</tbody>
</table>