



Red Hat Enterprise Linux 10

Using systemd unit files to customize and optimize your system

Optimize system performance and extend configuration with systemd

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Abstract

Modify the systemd unit files and extend the default configuration, examine the system boot performance and optimize systemd to shorten the boot time.

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CHAPTER 1. WORKING WITH SYSTEMD UNIT FILES

The **systemd** unit files represent your system resources. As a system administrator, you can perform the following advanced tasks:

- Create custom unit files
- Modify existing unit files
- Work with instantiated units

1.1. INTRODUCTION TO UNIT FILES

A unit file contains configuration directives that describe the unit and define its behavior. Several **systemctl** commands work with unit files in the background. To make finer adjustments, you can edit or create unit files manually.

You can find three main directories where unit files are stored on the system, the **/etc/systemd/system/** directory is reserved for unit files created or customized by the system administrator.

Unit file names take the following form:

```
<unit_name>.<type_extension>
```

Here, *unit_name* stands for the name of the unit and *type_extension* identifies the unit type.

For example, you can find an **sshd.service** as well as an **sshd.socket** unit present on your system.

Unit files can be supplemented with a directory for additional configuration files. For example, to add custom configuration options to **sshd.service**, create the **sshd.service.d/custom.conf** file and insert additional directives there. For more information on configuration directories, see [Modifying existing unit files](#).

The **systemd** system and service manager can also create the **sshd.service.wants/** and **sshd.service.requires/** di. These directories contain symbolic links to unit files that are dependencies of the **sshd** service. **systemd** creates the symbolic links automatically either during installation according to [Install] unit file options or at runtime based on [Unit] options. You can also create these directories and symbolic links manually.

Also, the **sshd.service.wants/** and **sshd.service.requires/** directories can be created. These directories contain symbolic links to unit files that are dependencies of the **sshd** service. The symbolic links are automatically created either during installation according to [Install] unit file options or at runtime based on [Unit] options. It is also possible to create these directories and symbolic links manually. For more details on [Install] and [Unit] options, see the tables below.

Many unit file options can be set by using the **unit specifiers** - wildcard strings that are dynamically replaced with unit parameters when the unit file is loaded. This enables creation of generic unit files that serve as templates for generating instantiated units. See [Working with instantiated units](#).

1.2. SYSTEMD UNIT FILES LOCATIONS

You can find the unit configuration files in one of the following directories:

Table 1.1. systemd unit files locations

Directory	Description
<code>/usr/lib/systemd/system/</code>	systemd unit files distributed with installed RPM packages.
<code>/run/systemd/system/</code>	systemd unit files created at run time. This directory takes precedence over the directory with installed service unit files.
<code>/etc/systemd/system/</code>	systemd unit files created by using the systemctl enable command as well as unit files added for extending a service. This directory takes precedence over the directory with runtime unit files.

The default configuration of **systemd** is defined during the compilation and you can find the configuration in the `/etc/systemd/system.conf` file. By editing this file, you can modify the default configuration by overriding values for **systemd** units globally.

For example, to override the default value of the timeout limit, which is set to 90 seconds, use the **DefaultTimeoutStartSec** parameter to input the required value in seconds.

```
DefaultTimeoutStartSec=required value
```

1.3. UNIT FILE STRUCTURE

Unit files typically consist of three following sections:

The [Unit] section

Contains generic options that are not dependent on the type of the unit. These options provide unit description, specify the unit's behavior, and set dependencies to other units.

For a list of most frequently used [Unit] options, see [Important \[Unit\] section options](#).

The [Unit type] section

Contains type-specific directives, these are grouped under a section named after the unit type. For example, service unit files contain the **[Service]** section.

The [Install] section

Contains information about unit installation used by **systemctl enable** and **disable** commands. For a list of options for the **[Install]** section, see [Important \[Install\] section options](#).

Additional resources

- [Important \[Unit\] section options](#)
- [Important \[Service\] section options](#)
- [Important \[Install\] section options](#)

1.4. IMPORTANT [UNIT] SECTION OPTIONS

The following tables lists important options of the [Unit] section.

Table 1.2. Important [Unit] section options

Option ^[a]	Description
Description	A meaningful description of the unit. This text is displayed for example in the output of the systemctl status command.
Documentation	Provides a list of URIs referencing documentation for the unit.
After ^[b]	Defines the order in which units are started. The unit starts only after the units specified in After are active. Unlike Requires , After does not explicitly activate the specified units. The Before option has the opposite functionality to After .
Requires	Configures dependencies on other units. The units listed in Requires are activated together with the unit. If any of the required units fail to start, the unit is not activated.
Wants	Configures weaker dependencies than Requires . If any of the listed units does not start successfully, it has no impact on the unit activation. This is the recommended way to establish custom unit dependencies.
Conflicts	Configures negative dependencies, an opposite to Requires .
<p>[a] For a complete list of options configurable in the [Unit] section, see the systemd.unit(5) manual page.</p> <p>[b] In most cases, it is sufficient to set only the ordering dependencies with After and Before unit file options. If you also set a requirement dependency with Wants (recommended) or Requires, the ordering dependency still needs to be specified. That is because ordering and requirement dependencies work independently from each other.</p>	

1.5. IMPORTANT [SERVICE] SECTION OPTIONS

The following tables lists important options of the [Service] section.

Table 1.3. Important [Service] section options

Option ^[a]	Description
-----------------------	-------------

Option [a]	Description
Type	<p>Configures the unit process startup type that affects the functionality of ExecStart and related options. One of:</p> <ul style="list-style-type: none"> * simple - The default value. The process started with ExecStart is the main process of the service. * forking - The process started with ExecStart spawns a child process that becomes the main process of the service. The parent process exits when the startup is complete. * oneshot - This type is similar to simple, but the process exits before starting consequent units. * dbus - This type is similar to simple, but consequent units are started only after the main process gains a D-Bus name. * notify - This type is similar to simple, but consequent units are started only after a notification message is sent via the <code>sd_notify()</code> function. * idle - similar to simple, the actual execution of the service binary is delayed until all jobs are finished, which avoids mixing the status output with shell output of services.
ExecStart	<p>Specifies commands or scripts to be executed when the unit is started. ExecStartPre and ExecStartPost specify custom commands to be executed before and after ExecStart. Type=oneshot enables specifying multiple custom commands that are then executed sequentially.</p>
ExecStop	<p>Specifies commands or scripts to be executed when the unit is stopped.</p>
ExecReload	<p>Specifies commands or scripts to be executed when the unit is reloaded.</p>
Restart	<p>With this option enabled, the service is restarted after its process exits, with the exception of a clean stop by the systemctl command.</p>
RemainAfterExit	<p>If set to True, the service is considered active even when all its processes exited. Default is False. This option is especially useful if Type=oneshot is configured.</p>

Option [a]	Description
[a] For a complete list of options configurable in the [Service] section, see the systemd.service(5) manual page.	

1.6. IMPORTANT [INSTALL] SECTION OPTIONS

The following tables lists important options of the [Install] section.

Table 1.4. Important [Install] section options

Option [a]	Description
Alias	Provides a space-separated list of additional names for the unit. Most systemctl commands, excluding systemctl enable , can use aliases instead of the actual unit name.
RequiredBy	A list of units that depend on the unit. When this unit is enabled, the units listed in RequiredBy gain a Require dependency on the unit.
WantedBy	A list of units that weakly depend on the unit. When this unit is enabled, the units listed in WantedBy gain a Want dependency on the unit.
Also	Specifies a list of units to be installed or uninstalled along with the unit.
DefaultInstance	Limited to instantiated units, this option specifies the default instance for which the unit is enabled. See Working with instantiated units .
[a] For a complete list of options configurable in the [Install] section, see the systemd.unit(5) manual page.	

1.7. CREATING CUSTOM UNIT FILES

There are several use cases for creating unit files from scratch: you could run a custom daemon, create a second instance of some existing service as in [Creating a custom unit file by using the second instance of the sshd service](#)

On the other hand, if you intend just to modify or extend the behavior of an existing unit, use the instructions from [Modifying existing unit files](#).

Procedure

1. To create a custom service, prepare the executable file with the service. The file can contain a custom-created script, or an executable delivered by a software provider. If required, prepare a PID file to hold a constant PID for the main process of the custom service. You can also include

environment files to store shell variables for the service. Make sure the source script is executable (by executing the **chmod a+x**) and is not interactive.

2. Create a unit file in the **/etc/systemd/system/** directory and make sure it has correct file permissions. Execute as **root**:

```
# touch /etc/systemd/system/<name>.service

# chmod 664 /etc/systemd/system/<name>.service
```

Replace *<name>* with a name of the service you want to create. Note that the file does not need to be executable.

3. Open the created **<name>.service** file and add the service configuration options. You can use various options depending on the type of service you wish to create, see [Unit file structure](#). The following is an example unit configuration for a network-related service:

```
[Unit]
Description=<service_description>
After=network.target

[Service]
ExecStart=<path_to_executable>
Type=forking
PIDFile=<path_to_pidfile>

[Install]
WantedBy=default.target
```

- *<service_description>* is an informative description that is displayed in journal log files and in the output of the **systemctl status** command.
- The **After** setting ensures that the service is started only after the network is running. Add a space-separated list of other relevant services or targets.
- *path_to_executable* stands for the path to the actual service executable.
- **Type=forking** is used for daemons that make the fork system call. The main process of the service is created with the PID specified in *path_to_pidfile*. Find other startup types in [Important \[Service\] section options](#).
- **WantedBy** states the target or targets that the service should be started under. Think of these targets as a replacement of the older concept of runlevels.

4. Notify **systemd** that a new **<name>.service** file exists:

```
# systemctl daemon-reload

# systemctl start <name>.service
```

**WARNING**

Always execute the **systemctl daemon-reload** command after creating new unit files or modifying existing unit files. Otherwise, the **systemctl start** or **systemctl enable** commands could fail due to a mismatch between states of **systemd** and actual service unit files on disk. Note, that on systems with a large number of units this can take a long time, as the state of each unit has to be serialized and subsequently deserialized during the reload.

1.8. CREATING A CUSTOM UNIT FILE BY USING THE SECOND INSTANCE OF THE SSHD SERVICE

If you need to configure and run multiple instances of a service, you can create copies of the original service configuration files and modify certain parameters to avoid conflicts with the primary instance of the service.

Procedure

To create a second instance of the **sshd** service:

1. Create a copy of the **sshd_config** file that the second daemon will use:

```
# cp /etc/ssh/sshd{,-second}_config
```

2. Edit the **sshd-second_config** file created in the previous step to assign a different port number and PID file to the second daemon:

```
Port 22220
PidFile /var/run/sshd-second.pid
```

See the **sshd_config(5)** manual page for more information about **Port** and **PidFile** options. Make sure the port you choose is not in use by any other service. The PID file does not have to exist before running the service, it is generated automatically on service start.

3. Create a copy of the **systemd** unit file for the **sshd** service:

```
# cp /usr/lib/systemd/system/sshd.service /etc/systemd/system/sshd-second.service
```

4. Alter the created **sshd-second.service**:

- a. Modify the **Description** option:

```
Description=OpenSSH server second instance daemon
```

- b. Add **sshd.service** to services specified in the **After** option, so that the second instance starts only after the first one has already started:

```
After=syslog.target network.target auditd.service sshd.service
```

- c. Remove the **ExecStartPre=/usr/sbin/ssh-keygen** line, the first instance of **sshd** includes key generation.
- d. Add the **-f /etc/ssh/ssh-second_config** parameter to the **sshd** command, so that the alternative configuration file is used:

```
ExecStart=/usr/sbin/sshd -D -f /etc/ssh/ssh-second_config $OPTIONS
```

- e. After the modifications, the **sshd-second.service** unit file contains the following settings:

```
[Unit]
Description=OpenSSH server second instance daemon
After=syslog.target network.target auditd.service sshd.service

[Service]
EnvironmentFile=/etc/sysconfig/ssh
ExecStart=/usr/sbin/sshd -D -f /etc/ssh/ssh-second_config $OPTIONS
ExecReload=/bin/kill -HUP $MAINPID
KillMode=process
Restart=on-failure
RestartSec=42s

[Install]
WantedBy=multi-user.target
```

- 5. If using SELinux, add the port for the second instance of **sshd** to SSH ports, otherwise the second instance of **sshd** will be rejected to bind to the port:

```
# semanage port -a -t ssh_port_t -p tcp 22220
```

- 6. Enable **sshd-second.service** to start automatically on boot:

```
# systemctl enable sshd-second.service
```

- 7. Verify if the **sshd-second.service** is running by using the **systemctl status** command.
- 8. Verify if the port is enabled correctly by connecting to the service:

```
$ ssh -p 22220 user@server
```

Make sure you configure the firewall to allow connections to the second instance of **sshd**.

1.9. FINDING THE SYSTEMD SERVICE DESCRIPTION

You can find descriptive information about the script on the line starting with **#description**. Use this description together with the service name in the **Description** option in the [Unit] section of the unit file. The header might contain similar data on the **#Short-Description** and **#Description** lines.

1.10. FINDING THE SYSTEMD SERVICE DEPENDENCIES

The Linux standard base (LSB) header might contain several directives that form dependencies between services. Most of them are translatable to systemd unit options, see the following table:

Table 1.5. Dependency options from the LSB header

LSB Option	Description	Unit File Equivalent
Provides	Specifies the boot facility name of the service, that can be referenced in other init scripts (with the "\$" prefix). This is no longer needed as unit files refer to other units by their file names.	-
Required-Start	Contains boot facility names of required services. This is translated as an ordering dependency, boot facility names are replaced with unit file names of corresponding services or targets they belong to. For example, in case of postfix , the Required-Start dependency on \$network was translated to the After dependency on network.target.	After, Before
Should-Start	Constitutes weaker dependencies than Required-Start. Failed Should-Start dependencies do not affect the service startup.	After, Before
Required-Stop, Should-Stop	Constitute negative dependencies.	Conflicts

1.11. FINDING DEFAULT TARGETS OF THE SERVICE

The line starting with **#chkconfig** contains three numerical values. The most important is the first number that represents the default runlevels in which the service is started. Map these runlevels to equivalent systemd targets. Then list these targets in the **WantedBy** option in the [Install] section of the unit file. For example, **postfix** was previously started in runlevels 2, 3, 4, and 5, which translates to multiuser.target and graphical.target. Note that the graphical.target depends on multiuser.target, therefore it is not necessary to specify both. You might find information about default and forbidden runlevels also at **#Default-Start** and **#Default-Stop** lines in the LSB header.

The other two values specified on the **#chkconfig** line represent startup and shutdown priorities of the init script. These values are interpreted by **systemd** if it loads the init script, but there is no unit file equivalent.

1.12. FINDING FILES USED BY THE SERVICE

Init scripts require loading a function library from a dedicated directory and allow importing configuration, environment, and PID files. Environment variables are specified on the line starting with **#config** in the init script header, which translates to the **EnvironmentFile** unit file option. The PID file specified on the **#pidfile** init script line is imported to the unit file with the **PIDFile** option.

The key information that is not included in the init script header is the path to the service executable, and potentially some other files required by the service. In previous versions of Red Hat Enterprise Linux, init scripts used a Bash case statement to define the behavior of the service on default actions, such as **start**, **stop**, or **restart**, as well as custom-defined actions. The following excerpt from the **postfix** init script shows the block of code to be executed at service start.

```

conf_check() {
    [ -x /usr/sbin/postfix ] || exit 5
    [ -d /etc/postfix ] || exit 6
    [ -d /var/spool/postfix ] || exit 5
}

make_aliasesdb() {
    if [ "$( /usr/sbin/postconf -h alias_database )" == "hash:/etc/aliases" ]
    then
        # /etc/aliases.db might be used by other MTA, make sure nothing
        # has touched it since our last newaliases call
        [ /etc/aliases -nt /etc/aliases.db ] ||
        [ "$ALIASESDB_STAMP" -nt /etc/aliases.db ] ||
        [ "$ALIASESDB_STAMP" -ot /etc/aliases.db ] || return
        /usr/bin/newaliases
        touch -r /etc/aliases.db "$ALIASESDB_STAMP"
    else
        /usr/bin/newaliases
    fi
}

start() {
    [ "$EUID" != "0" ] && exit 4
    # Check that networking is up.
    [ "${NETWORKING}" = "no" ] && exit 1
    conf_check
    # Start daemons.
    echo -n "Starting postfix: "
    make_aliasesdb >/dev/null 2>&1
    [ -x $CHROOT_UPDATE ] && $CHROOT_UPDATE
    /usr/sbin/postfix start 2>/dev/null 1>&2 && success || failure "$prog start"
    RETVAL=$?
    [ $RETVAL -eq 0 ] && touch $lockfile
    echo
    return $RETVAL
}

```

The extensibility of the init script allowed specifying two custom functions, **conf_check()** and **make_aliasesdb()**, that are called from the **start()** function block. On closer look, several external files and directories are mentioned in the above code: the main service executable **/usr/sbin/postfix**, the **/etc/postfix/** and **/var/spool/postfix/** configuration directories, as well as the **/usr/sbin/postconf/** directory.

systemd supports only the predefined actions, but enables executing custom executables with **ExecStart**, **ExecStartPre**, **ExecStartPost**, **ExecStop**, and **ExecReload** options. The **/usr/sbin/postfix** together with supporting scripts are executed on service start. Converting complex init scripts requires understanding the purpose of every statement in the script. Some of the statements are specific to the operating system version, therefore you do not need to translate them. On the other hand, some adjustments might be needed in the new environment, both in the unit file as well as in the service executable and supporting files.

1.13. MODIFYING EXISTING UNIT FILES

If you want to modify existing unit files proceed to the `/etc/systemd/system/` directory. Note that you should not modify the default unit files, which your system stores in the `/usr/lib/systemd/system/` directory.

Procedure

1. Depending on the extent of the required changes, pick one of the following approaches:
 - Create a directory for supplementary configuration files at `/etc/systemd/system/<unit>.d/`. This method is recommended for most use cases. You can extend the default configuration with additional functionality, while still referring to the original unit file. Changes to the default unit introduced with a package upgrade are therefore applied automatically. See [Extending the default unit configuration](#) for more information.
 - Create a copy of the original unit file from `/usr/lib/systemd/system/` directory in the `/etc/systemd/system/` directory and make changes there. The copy overrides the original file, therefore changes introduced with the package update are not applied. This method is useful for making significant unit changes that should persist regardless of package updates. See [Overriding the default unit configuration](#) for details.
2. To return to the default configuration of the unit, delete custom-created configuration files in the `/etc/systemd/system/` directory.
3. Apply changes to unit files without rebooting the system:

```
# systemctl daemon-reload
```

The **daemon-reload** option reloads all unit files and recreates the entire dependency tree, which is needed to immediately apply any change to a unit file. As an alternative, you can achieve the same result with the following command:

```
# init q
```

4. If the modified unit file belongs to a running service, restart the service:

```
# systemctl restart <name>.service
```

IMPORTANT

To modify properties, such as dependencies or timeouts, of a service that is handled by a SysV initscript, do not modify the initscript itself. Instead, create a **systemd** drop-in configuration file for the service as described in: [Extending the default unit configuration](#) and [Overriding the default unit configuration](#).

Then manage this service in the same way as a normal **systemd** service.

For example, to extend the configuration of the **network** service, do not modify the `/etc/rc.d/init.d/network` initscript file. Instead, create a new directory `/etc/systemd/system/network.service.d/` and a **systemd** drop-in file `/etc/systemd/system/network.service.d/my_config.conf`. Then, put the modified values into the drop-in file. Note: **systemd** knows the **network** service as **network.service**, which is why the created directory must be called **network.service.d**.

1.14. EXTENDING THE DEFAULT UNIT CONFIGURATION

You can extend the default unit file with additional systemd configuration options.

Procedure

1. Create a configuration directory in `/etc/systemd/system/`:

```
# mkdir /etc/systemd/system/<name>.service.d/
```

Replace `<name>` with the name of the service you want to extend. The syntax applies to all unit types.

2. Create a configuration file with the `.conf` suffix:

```
# touch /etc/systemd/system/name.service.d/<config_name>.conf
```

Replace `<config_name>` with the name of the configuration file. This file adheres to the normal unit file structure and you have to specify all directives in the appropriate sections, see [Unit file structure](#).

For example, to add a custom dependency, create a configuration file with the following content:

```
[Unit]
Requires=<new_dependency>
After=<new_dependency>
```

The `<new_dependency>` stands for the unit to be marked as a dependency. Another example is a configuration file that restarts the service after its main process exited, with a delay of 30 seconds:

```
[Service]
Restart=always
RestartSec=30
```

Create small configuration files focused only on one task. Such files can be easily moved or linked to configuration directories of other services.

3. Apply changes to the unit:

```
# systemctl daemon-reload
# systemctl restart <name>.service
```

Example 1.1. Extending the `httpd.service` configuration

To modify the **`httpd.service`** unit so that a custom shell script is automatically executed when starting the Apache service, perform the following steps.

1. Create a directory and a custom configuration file:

```
# mkdir /etc/systemd/system/httpd.service.d/
```

```
# touch /etc/systemd/system/httpd.service.d/custom_script.conf
```

- Specify the script you want to execute after the main service process by inserting the following text to the **custom_script.conf** file:

```
[Service]
ExecStartPost=/usr/local/bin/custom.sh
```

- Apply the unit changes::

```
# systemctl daemon-reload
```

```
# systemctl restart httpd.service
```



NOTE

The configuration files from the **/etc/systemd/system/** configuration directories take precedence over unit files in **/usr/lib/systemd/system/**. Therefore, if the configuration files contain an option that can be specified only once, such as **Description** or **ExecStart**, the default value of this option is overridden. Note that in the output of the **systemd-delta** command, described in [Monitoring overridden units](#), such units are always marked as [EXTENDED], even though in sum, certain options are actually overridden.

1.15. OVERRIDING THE DEFAULT UNIT CONFIGURATION

You can make changes to the unit file configuration that will persist after updating the package that provides the unit file.

Procedure

- Copy the unit file to the **/etc/systemd/system/** directory by entering the following command as **root**:

```
# cp /usr/lib/systemd/system/<name>.service /etc/systemd/system/<name>.service
```

- Open the copied file with a text editor, and make changes.
- Apply unit changes:

```
# systemctl daemon-reload
# systemctl restart <name>.service
```

1.16. CHANGING THE TIMEOUT LIMIT

You can specify a timeout value per service to prevent a malfunctioning service from freezing the system. Otherwise, the default value for timeout is 90 seconds for normal services and 300 seconds for SysV-compatible services.

Procedure

To extend timeout limit for the **httpd** service:

1. Copy the **httpd** unit file to the **/etc/systemd/system/** directory:

```
# cp /usr/lib/systemd/system/httpd.service /etc/systemd/system/httpd.service
```

2. Open the **/etc/systemd/system/httpd.service** file and specify the **TimeoutStartUSec** value in the **[Service]** section:

```
...
[Service]
...
PrivateTmp=true
TimeoutStartSec=10

[Install]
WantedBy=multi-user.target
...
```

3. Reload the **systemd** daemon:

```
# systemctl daemon-reload
```

Verification

- Verify the new timeout value:

```
# systemctl show httpd -p TimeoutStartUSec
```



NOTE

To change the timeout limit globally, input the **DefaultTimeoutStartSec** in the **/etc/systemd/system.conf** file.

1.17. MONITORING OVERRIDDEN UNITS

You can display an overview of overridden or modified unit files by using the **systemd-delta** command.

Procedure

- Display an overview of overridden or modified unit files:

```
# systemd-delta
```

For example, the output of the command can look as follows:

```
[EQUIVALENT] /etc/systemd/system/default.target → /usr/lib/systemd/system/default.target
[OVERRIDDEN] /etc/systemd/system/autofs.service →
/usr/lib/systemd/system/autofs.service

--- /usr/lib/systemd/system/autofs.service    2014-10-16 21:30:39.000000000 -0400
+++ /etc/systemd/system/autofs.service        2014-11-21 10:00:58.513568275 -0500
@@ -8,7 +8,8 @@
EnvironmentFile=-/etc/sysconfig/autofs
```

```

ExecStart=/usr/sbin/automount $OPTIONS --pid-file /run/autofs.pid
ExecReload=/usr/bin/kill -HUP $MAINPID
-TimeoutSec=180
+TimeoutSec=240
+Restart=Always

[Install]
WantedBy=multi-user.target

[MASKED]    /etc/systemd/system/cups.service → /usr/lib/systemd/system/cups.service
[EXTENDED]  /usr/lib/systemd/system/sss.service →
            /etc/systemd/system/sss.service.d/journal.conf

4 overridden configuration files found.

```

1.18. WORKING WITH INSTANTIATED UNITS

You can manage multiple instances of a service by using a single template configuration. You can define a generic template for a unit and generate multiple instances of that unit with specific parameters at runtime. The template is indicated by the at sign (@). Instantiated units can be started from another unit file (using **Requires** or **Wants** options), or with the **systemctl start** command. Instantiated service units are named the following way:

```
<template_name>@<instance_name>.service
```

The *<template_name>* stands for the name of the template configuration file. Replace *<instance_name>* with the name for the unit instance. Several instances can point to the same template file with configuration options common for all instances of the unit. Template unit name has the form of:

```
<unit_name>@.service
```

For example, the following **Wants** setting in a unit file:

```
Wants=getty@ttyA.service getty@ttyB.service
```

first makes systemd search for given service units. If no such units are found, the part between "@" and the type suffix is ignored and **systemd** searches for the **getty@.service** file, reads the configuration from it, and starts the services.

For example, the **getty@.service** template contains the following directives:

```

[Unit]
Description=Getty on %I
...
[Service]
ExecStart=-/sbin/agetty --noclear %I $TERM
...

```

When the **getty@ttyA.service** and **getty@ttyB.service** are instantiated from the above template, **Description=** is resolved as **Getty on ttyA** and **Getty on ttyB**.

1.19. IMPORTANT UNIT SPECIFIERS

You can use the wildcard characters, called **unit specifiers**, in any unit configuration file. Unit specifiers substitute certain unit parameters and are interpreted at runtime.

Table 1.6. Important unit specifiers

Unit Specifier	Meaning	Description
%n	Full unit name	Stands for the full unit name including the type suffix. %N has the same meaning but also replaces the forbidden characters with ASCII codes.
%p	Prefix name	Stands for a unit name with type suffix removed. For instantiated units %p stands for the part of the unit name before the "@" character.
%i	Instance name	Is the part of the instantiated unit name between the "@" character and the type suffix. %I has the same meaning but also replaces the forbidden characters for ASCII codes.
%H	Host name	Stands for the hostname of the running system at the point in time the unit configuration is loaded.
%t	Runtime directory	Represents the runtime directory, which is either /run for the root user, or the value of the <code>XDG_RUNTIME_DIR</code> variable for unprivileged users.

For a complete list of unit specifiers, see the **systemd.unit(5)** man page on your system.

1.20. ADDITIONAL RESOURCES

- [How to set limits for services in RHEL and systemd](#) (Red Hat Knowledgebase)
- [How to write a service unit file which enforces that particular services have to be started](#) (Red Hat Knowledgebase)
- [How to decide what dependencies a systemd service unit definition should have](#) (Red Hat Knowledgebase)

CHAPTER 2. MANAGING SYSTEMD

As a system administrator, you can manage critical aspects of your system with **systemd**. Serving as a system and service manager for Linux operating systems, **systemd** software suite provides tools and services for controlling, reporting, and system initialization. Key features of **systemd** include:

- Parallel start of system services during boot
- On-demand activation of daemons
- Dependency-based service control logic

The basic object that **systemd** manages is a *systemd unit*, a representation of system resources and services. A **systemd** unit consists of a name, type and a configuration file that defines and manages a particular task. You can use unit files to configure system behavior. See the following examples of various systemd unit types:

Service

Controls and manages individual system services.

Target

Represents a group of units that define system states.

Device

Manages hardware devices and their availability.

Mount

Handles file system mounting.

Timer

Schedules tasks to run at specific intervals.

2.1. MANAGING SYSTEM SERVICES WITH SYSTEMCTL

As a system administrator, you can manage system services by using the **systemctl** utility. You can perform various tasks, such as starting, stopping, restarting running services, enabling and disabling services to start at boot, listing available services, and displaying system services statuses.

2.1.1. Listing system services

You can list all currently loaded service units and display the status of all available service units.

Procedure

Use the **systemctl** command to perform any of the following tasks:

- List all currently loaded service units:

```
$ systemctl list-units --type service
UNIT                                LOAD    ACTIVE SUB    DESCRIPTION
abrt-ccpp.service                  loaded active exited Install ABRT coredump hook
abrt-oops.service                  loaded active running ABRT kernel log watcher
abrt-d.service                     loaded active running ABRT Automated Bug Reporting Tool
...
systemd-vconsole-setup.service     loaded active exited Setup Virtual Console
tog-pegasus.service                loaded active running OpenPegasus CIM Server
```


LOAD = Reflects whether the unit definition was properly loaded.
 ACTIVE = The high-level unit activation state, or a generalization of SUB.
 SUB = The low-level unit activation state, values depend on unit type.

46 loaded units listed. Pass --all to see loaded but inactive units, too.
 To show all installed unit files use 'systemctl list-unit-files'

By default, the **systemctl list-units** command displays only active units. For each service unit file, the command provides an overview of the following parameters:

UNIT

The full name of the service unit

LOAD

The load state of the configuration file

ACTIVE or SUB

The current high-level and low-level unit file activation state

DESCRIPTION

A short description of the unit's purpose and functionality

- List **all loaded units regardless of their state** by using the following command with the **--all** or **-a** command line option:

```
$ systemctl list-units --type service --all
```

- List the status (**enabled** or **disabled**) of all available service units:

```
$ systemctl list-unit-files --type service
UNIT FILE          STATE
abrt-ccpp.service  enabled
abrt-oops.service  enabled
abrttd.service     enabled
...
wpa_supplicant.service disabled
ypbind.service     disabled

208 unit files listed.
```

For each service unit, this command displays:

UNIT FILE

The full name of the service unit

STATE

The information whether the service unit is enabled or disabled to start automatically during boot

2.1.2. Displaying system service status

You can inspect any service unit to get detailed information and verify the state of the service, whether it is enabled to start during boot or currently running. You can also view services that are ordered to start after or before a particular service unit.

Procedure

- Display detailed information about a service unit that corresponds to a system service:

```
$ systemctl status <name>.service
```

Replace **<name>** with the name of the service unit you want to inspect (for example, **gdm**).

This command displays the following information:

- The name of the selected service unit followed by a short description
- One or more fields described in [Available service unit information](#)
- The execution of the service unit: if the unit is executed by the **root** user
- The most recent log entries

Table 2.1. Available service unit information

Field	Description
Loaded	Information whether the service unit has been loaded, the absolute path to the unit file, and a note whether the unit is enabled to start during boot.
Active	Information whether the service unit is running followed by a time stamp.
Main PID	The process ID and the name of the corresponding system service.
Status	Additional information about the corresponding system service.
Process	Additional information about related processes.
CGroup	Additional information about related control groups (cgroups).

- Verify that a particular service unit is running:

```
$ systemctl is-active <name>.service
```

- Determine whether a particular service unit is enabled to start during boot:

```
$ systemctl is-enabled <name>.service
```



NOTE

Both **systemctl is-active** and **systemctl is-enabled** commands return an exit status of **0** if the specified service unit is running or enabled.

- Check what services **systemd** orders to start before the specified service unit

```
# systemctl list-dependencies --after <name>.service
```

For example, to view the list of services ordered to start before **gdm**, enter:

```
# systemctl list-dependencies --after gdm.service
gdm.service
├─dbus.socket
├─getty@tty1.service
├─livesys.service
├─plymouth-quit.service
├─system.slice
├─systemd-journald.socket
├─systemd-user-sessions.service
└─basic.target
[output truncated]
```

- Check what services **systemd** orders to start after the specified service unit:

```
# systemctl list-dependencies --before <name>.service
```

For example, to view the list of services **systemd** orders to start after **gdm**, enter:

```
# systemctl list-dependencies --before gdm.service
gdm.service
├─dracut-shutdown.service
├─graphical.target
│   ├──systemd-readahead-done.service
│   ├──systemd-readahead-done.timer
│   └─systemd-update-utmp-runlevel.service
└─shutdown.target
    ├──systemd-reboot.service
    └─final.target
        └─systemd-reboot.service
```

2.1.3. Starting and stopping a systemd unit

You can start system service in the current session by using the **systemctl start** command.

Prerequisites

- You have the Root access.

Procedure

- Start a system service in the current session:

```
# *systemctl start <systemd_unit> *
```

Replace **<systemd_unit>** with the name of the service unit you want to start (for example, **httpd.service**).



NOTE

In **systemd**, positive and negative dependencies between services exist. Starting a particular service may require starting one or more other services (**positive dependency**) or stopping one or more services (**negative dependency**).

When you attempt to start a new service, **systemd** resolves all dependencies automatically, without explicit notification to the user. This means that if you are already running a service, and you attempt to start another service with a negative dependency, the first service is automatically stopped.

For example, if you are running the **sendmail** service, and you attempt to start the **postfix** service, **systemd** first automatically stops **sendmail**, because these two services are conflicting and cannot run on the same port.

Additional resources

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

2.1.4. Stopping a system service

If you want to stop a system service in the current session, use the **systemctl stop** command.

Prerequisites

- You have Root access

Procedure

- Stop a system service:

```
# systemctl stop <name>.service
```

Replace **<name>** with the name of the service unit you want to stop (for example, **bluetooth**).

Additional resources

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

2.1.5. Restarting and Reload a system service

You can restart system service in the current session by using the **restart** command to perform the following actions:

- Stop the selected service unit in the current session and immediately start it again.
- Restart a service unit only if the corresponding service is already running.
- Reload configuration of a system service without interrupting its execution.

Prerequisites

- You have the Root access.

Procedure

- Restart a system service:

```
# systemctl restart <name>.service
```

Replace **<name>** with the name of the service unit you want to restart (for example, **httpd**).

If the selected service unit is not running, this command starts it.

- Restart a service unit only if the corresponding service is already running:

```
# systemctl try-restart <name>.service
```

- Reload the configuration without interrupting service execution:

```
# systemctl reload <name>.service
```



NOTE

System services that do not support this feature, ignore this command. To restart such services, use the **reload-or-restart** and **reload-or-try-restart** commands instead.

Additional resources

- **systemctl(1)** man page on your system
- [Displaying system service status](#)

2.1.6. Enabling a system service to start at boot

You can enable a service to start automatically at boot, these changes apply with the next reboot.

Prerequisites

- You have Root access.

Procedure

- Verify whether the unit is masked:

```
# systemctl status <systemd_unit>
```

- If the unit is masked, unmask it first:

```
# systemctl unmask <systemd_unit>
```

- Enable a service to start at boot time:

```
# systemctl enable <systemd_unit>
```

Replace **<systemd_unit>** with the name of the service unit you want to enable (for example, **httpd**).

Optionally, pass the **--now** option to the command to also start the unit right now.

2.1.7. Disabling a system service to start at boot

You can prevent a service unit from starting automatically at boot time. If you disable a service, it will not start at boot, but you can start it manually. You can also mask a service, so that it cannot be started manually. Masking is a way of disabling a service that makes the service permanently unusable until it is unmasked again.

Prerequisites

- You have Root access.

Procedure

- Disable a service to start at boot:

```
# systemctl disable <name>.service
```

Replace **<name>** with the name of the service unit you want to disable (for example, **bluetooth**). Optionally, pass the **--now** command to also stop the service if it is currently running.

- Optional: To prevent that the unit can be accidentally started by an administrator or as a dependency of other units, mask the service:

```
# systemctl mask <name>.service
```

Additional resources

- **systemctl (1)** man page on your system
- [Displaying system service status](#)
- [Stopping a system service](#)

2.2. BOOTING INTO A TARGET SYSTEM STATE

As a system administrator, you can control the boot process of your system, and define the state you want your system to boot into. This is called a **systemd** target, and it is a set of **systemd** units that your system starts to reach a certain level of functionality. While working with systemd targets, you can view the default target, select a target at runtime, change the default boot target, boot into emergency or rescue target.

2.2.1. Target unit files

Targets in **systemd** are groups of related units that act as synchronization points during the start of your system. Target unit files, which end with the **.target** file extension, represent the **systemd** targets. The purpose of target units is to group together various **systemd** units through a chain of dependencies.

Consider the following example:

- Similarly, the **multi-user.target** unit starts other essential system services such as NetworkManager (**NetworkManager.service**) or D-Bus (**dbus.service**) and activates another target unit named **basic.target**.

You can set the following **systemd** targets as default or current targets:

Table 2.2. Common **systemd targets**

rescue	unit target that pulls in the base system and spawns a rescue shell
multi-user	unit target for setting up a multi-user system
graphical	unit target for setting up a graphical login screen
emergency	unit target that starts an emergency shell on the main console

Additional resources

- **systemd.special(7)** and **systemd.target(5)** man pages on your system

2.2.2. Changing the default target to boot into

The **default.target** symbolic link refers to the **systemd** target that the system should boot into. When the system starts, **systemd** resolves this link and boots into the defined target. You can find the currently selected default target unit in the **/etc/systemd/system/default.target** file. Each target represents a certain level of functionality and is used for grouping other units. Additionally, target units serve as synchronization points during boot. You can change the default target your system boots into. When you set a default target unit, the current target remains unchanged until the next reboot.

Prerequisites

- You have Root access.

Procedure

1. Determine the current default target unit **systemd** uses to start the system:

```
# systemctl get-default
graphical.target
```

2. List the currently loaded targets:

```
# systemctl list-units --type target
```

3. Configure the system to use a different target unit by default:

```
# systemctl set-default <name>.target
```

Replace **<name>** with the name of the target unit you want to use by default.

Example:

```
# systemctl set-default multi-user.target
```

Removed /etc/systemd/system/default.target

Created symlink /etc/systemd/system/default.target -> /usr/lib/systemd/system/multi-user.target

4. Verify the default target unit:

```
# systemctl get-default
multi-user.target
```

5. Optional: Switch to the new default target:

```
# systemctl isolate default.target
```

Alternatively, reboot the system.

Additional resources

- **systemctl(1)**, **systemd.special(7)**, and **bootup(7)** man pages on your system

2.2.3. Changing the current target

On a running system, you can change the target unit in the current boot without reboot. If you switch to a different target, **systemd** starts all services and their dependencies that this target requires, and stops all services that the new target does not enable. Manually switching to a different target is only a temporary operation. When you reboot the host, systemd boots again into the default target.

Procedure

1. Optional: Display the list of targets you can select:

```
# systemctl list-units --type target
```



NOTE

You can only isolate targets that have the **AllowIsolate=yes** option set in the unit files.

2. Change to a different target unit in the current boot:

```
# systemctl isolate <name>.target
```

Replace **<name>** with the name of the target unit you want to use in the current boot.

Example:

```
# systemctl isolate multi-user.target
```


This command starts the target unit named **multi-user** and all dependent units, and immediately stops all other unit.

Additional resources

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

2.2.4. Booting to rescue mode

You can boot to the *rescue mode* that provides a single-user environment for troubleshooting or repair if the system cannot get to a later target, and the regular booting process fails. In rescue mode, the system attempts to mount all local file systems and start certain important system services, but it does not activate network interfaces.

Prerequisites

- You have Root access.

Procedure

- To enter the rescue mode, change the current target in the current session:

```
# systemctl rescue
```

Broadcast message from root@localhost on pts/0 (Fri 2023-03-24 18:23:15 CEST):

The system is going down to rescue mode NOW!



NOTE

This command is similar to **systemctl isolate rescue.target**, but it also sends an informative message to all users that are currently logged into the system.

To prevent **systemd** from sending a message, enter the following command with the **--no-wall** command-line option:

```
# systemctl --no-wall rescue
```

Troubleshooting

If your system is not able to enter the rescue mode, you can boot to *emergency mode*, which provides the most minimal environment possible. In emergency mode, the system mounts the root file system only for reading, does not attempt to mount any other local file systems, does not activate network interfaces, and only starts a few essential services.

2.2.5. Troubleshooting the boot process

As a system administrator, you can select a non-default target at boot time to troubleshoot the boot process. Changing the target at boot time affects only a single boot. You can boot to *emergency mode*, which provides the most minimal environment possible.

Procedure

1. Reboot the system, and interrupt the boot loader menu countdown by pressing any key except the Enter key, which would initiate a normal boot.
2. Move the cursor to the kernel entry that you want to start.
3. Press the E key to edit the current entry.
4. Move to the end of the line that starts with **linux** and press Ctrl+E to jump to the end of the line:

```
linux ($root)/vmlinuz-5.14.0-70.22.1.el9_0.x86_64 root=/dev/mapper/rhel-root ro crash\
kernel=auto resume=/dev/mapper/rhel-swap rd.lvm.lv/swap rhgb quiet
```

5. To choose an alternate boot target, append the **systemd.unit=** parameter to the end of the line that starts with **linux**:

```
linux ($root)/vmlinuz-5.14.0-70.22.1.el9_0.x86_64 root=/dev/mapper/rhel-root ro crash\
kernel=auto resume=/dev/mapper/rhel-swap rd.lvm.lv/swap rhgb quiet
systemd.unit=<name>.target
```

Replace **<name>** with the name of the target unit you want to use. For example, **systemd.unit=emergency.target**

6. Press Ctrl+X to boot with these settings.

2.3. SHUTTING DOWN, SUSPENDING, AND HIBERNATING THE SYSTEM

As a system administrator, you can use different power management options to manage power consumption, perform a proper shutdown to ensure that all data is saved, or restart the system to apply changes and updates.

2.3.1. Scheduling a system shutdown

As a system administrator, you can schedule a delayed shutdown to give users time to save their work and log off the system. Use the **shutdown** command to perform the following operations:

- Shut down the system and power off the machine at a certain time:

```
# shutdown --poweroff hh:mm
```

Where **hh:mm** is the time in the 24-hour time notation. To prevent new logins, the **/run/nologin** file is created 5 minutes before system shutdown.

When you use the time argument, you can notify users logged in to the system of the planned shutdown by specifying an optional *wall message*, for example **shutdown --poweroff 13:59 "Attention. The system will shut down at 13:59"**.

- Shut down and halt the system after a delay, without powering off the machine:

```
# shutdown --halt +m
```

Where **+m** is the delay time in minutes. You can use the **now** keyword as an alias for **+0**.

- Cancel a pending shutdown

```
# shutdown -c
```

Additional resources

- **shutdown(8)** manual page

2.3.2. Shutting down the system using the **systemctl** command

As a system administrator, you can shut down the system and power off the machine or shut down and halt the system without powering off the machine by using the **systemctl** command.

Prerequisites

- Root access

Procedure

Use the **systemctl** command to perform any of the following tasks:

- Shut down the system and power off the machine:

```
# systemctl poweroff
```

- Shut down and halt the system without powering off the machine:

```
# systemctl halt
```



NOTE

By default, running either of these commands causes **systemd** to send an informative message to all users that are currently logged into the system. To prevent **systemd** from sending this message, run the selected command with the **--no-wall** command line option.

2.3.3. Restarting the system

When you restart the system, **systemd** stops all running programs and services, the system shuts down, and then immediately starts again.

Prerequisites

- You have Root access.

Procedure

- Restart the system:

```
# systemctl reboot
```



NOTE

By default, when you use this command, **systemd** sends an informative message to all users that are currently logged into the system. To prevent **systemd** from sending this message, run this command with the **--no-wall** option.

2.3.4. Optimizing power consumption by suspending and hibernating the system

As a system administrator, you can manage power consumption, save energy on your systems, and preserve the current state of your system. To do so, apply one of the following modes:

- Suspend
- Hibernate
- Hybrid Sleep
- Suspend-then-hibernate

Prerequisites

- You have Root access.

Procedure

Choose the appropriate method for power saving:

- **Suspend** Suspending saves the system state in RAM and with the exception of the RAM module, powers off most of the devices in the machine. When you turn the machine back on, the system then restores its state from RAM without having to boot again. Because the system state is saved in RAM and not on the hard disk, restoring the system from suspend mode is significantly faster than from hibernation. However, the suspended system state is also vulnerable to power outages. To suspend the system, run:

```
# systemctl suspend
```

- **Hibernate** Hibernating saves the system state on the hard disk drive and powers off the machine. When you turn the machine back on, the system then restores its state from the saved data without having to boot again. Because the system state is saved on the hard disk and not in RAM, the machine does not have to maintain electrical power to the RAM module. However, as a consequence, restoring the system from hibernation is significantly slower than restoring it from suspend mode. To hibernate the system, run:

```
# systemctl hibernate
```

- **Hybrid sleep** This combines elements of both hibernation and suspending. The system first saves the current state on the the hard disk drive, and enters a low-power state similar to suspending, which allows the system to resume more quickly. The benefit of hybrid sleep is that if the system loses power during the sleep state, it can still recover the previous state from the saved image on the hard disk, similar to hibernation. To hibernate and suspend the system, run:

```
# systemctl hybrid-sleep
```

- **Suspend-then-hibernate** This mode first suspends the system, which results in saving the current system state to RAM and putting the system in a low-power mode. The system

hibernates if it remains suspended for a specific period of time that you can define in the **HibernateDelaySec** parameter. Hibernation saves the system state to the hard disk drive and shuts down the system completely. The suspend-then-hibernate mode provides the benefit of conserving battery power while you are still able to quickly resume work. Additionally, this mode ensures that your data is saved in case of a power failure. Suspend and then hibernate the system:

```
# systemctl suspend-then-hibernate
```

2.3.5. Changing the power button behavior

When you press the power button on your computer, it suspends or shuts down the system by default. You can customize this behavior according to your preferences.

2.3.5.1. Changing the behavior of the power button when pressing the button and GNOME is not running

When you press the power button in a non-graphical **systemd** target, it shuts down the system by default. You can customize this behavior according to your preferences.

Prerequisites

- Administrative access

Procedure

1. Edit the **/etc/systemd/logind.conf** configuration file and set the **HandlePowerKey=poweroff** variable to one of the following options:

poweroff

Shut down the computer.

reboot

Reboot the system.

halt

Initiate a system halt.

kexec

Initiate a **kexec** reboot.

suspend

Suspend the system.

hibernate

Initiate system hibernation.

ignore

Do nothing.

For example, to reboot the system upon pressing the power button, use this setting:

```
HandlePowerKey=reboot
```

2.3.5.2. Changing the behavior of the power button when pressing the button and GNOME is running

On the graphical login screen or in the graphical user session, pressing the power button suspends the machine by default. This happens both in cases when the user presses the power button physically or when pressing a virtual power button from a remote console. You can select a different power button behavior.

Procedure

1. Create a local database for system-wide settings in the **/etc/dconf/db/local.d/01-power** file with the following content:

```
[org/gnome/settings-daemon/plugins/power]
power-button-action=<value>
```

Replace **<value>** with one of the following power button actions:

nothing

Does nothing .

suspend

Suspends the system.

hibernate

Hibernates the system.

interactive

Shows a pop-up query asking the user what to do.

With interactive mode, the system powers off automatically after 60 seconds when pressing the power button. However, you can select a different behavior from the pop-up query.

2. Optional: Override the user's setting, and prevent the user from changing it. Enter the following configuration in the **/etc/dconf/db/local.d/locks/01-power** file:

```
/org/gnome/settings-daemon/plugins/power/power-button-action
```

3. Update the system databases:

```
# dconf update
```

4. Log out and back in again for the system-wide settings to take effect.

CHAPTER 3. OPTIMIZING SYSTEMD TO SHORTEN THE BOOT TIME

As a system administrator, you can optimize performance of your system and shorten the boot time. You can review the services that **systemd** starts during boot and evaluate their necessity. Disabling certain services to start at boot can improve the boot time of your system.

3.1. EXAMINING SYSTEM BOOT PERFORMANCE

To examine system boot performance, you can use the **systemd-analyze** command. By using certain options, you can tune systemd to shorten the boot time.

Prerequisites

- Optional: Before you examine **systemd** to tune the boot time, list all enabled services:

```
$ systemctl list-unit-files --state=enabled
```

Procedure

Choose the information you want to analyze:

- Analyze the information about the time that the last successful boot took:

```
$ systemd-analyze
```

- Analyze the unit initialization time of each **systemd** unit:

```
$ systemd-analyze blame
```

The output lists the units in descending order according to the time they took to initialize during the last successful boot.

- Identify critical units that took the longest time to initialize at the last successful boot:

```
$ systemd-analyze critical-chain
```

The output highlights the units that critically slow down the boot with the red color.

Figure 3.1. The output of the `systemd-analyze critical-chain` command

```
[admin@localhost ~]$ systemd-analyze critical-chain
The time after the unit is active or started is printed after the "@" character.
The time the unit takes to start is printed after the "+" character.

graphical.target @19.706s
├─multi-user.target @19.706s
│   └─tuned.service @5.616s +3.397s
│       └─network.target @5.614s
│           └─wpa_supplicant.service @16.025s +125ms
│               └─dbus.service @2.461s
│                   └─basic.target @2.444s
│                       └─sockets.target @2.444s
│                           └─iscsiuio.socket @2.444s
│                               └─sysinit.target @2.431s
│                                   └─systemd-update-utmp.service @2.419s +10ms
│                                       └─auditd.service @2.292s +126ms
│                                           └─systemd-tmpfiles-setup.service @2.228s +63ms
│                                               └─import-state.service @2.171s +54ms
│                                                   └─local-fs.target @2.168s
│                                                       └─run-user-42.mount @9.536s
│                                                           └─local-fs-pre.target @2.112s
│                                                               └─lvm2-monitor.service @2.087s +25ms
│                                                                   └─dm-event.socket @968ms
│                                                                       └─.mount
│                                                                           └─system.slice
│                                                                               └─.slice

[admin@localhost ~]$
```

Additional resources

- **systemd-analyze (1)** man page on your system

3.2. A GUIDE TO SELECTING SERVICES THAT CAN BE SAFELY DISABLED

You can shorten the boot time of your system by disabling certain services that are enabled on boot by default.

- List enabled services:

```
$ systemctl list-unit-files --state=enabled
```

- Disable a service:

```
# systemctl disable <service_name>
```

Certain services must stay enabled so that your operating system is safe and functions in the way you need.

Refer to the following table as a guide to selecting the services that you can safely disable. The table lists all services enabled by default on a minimal installation of Red Hat Enterprise Linux.

Table 3.1. Services enabled by default on a minimal installation of RHEL

Service name	Can it be disabled?	More information
--------------	---------------------	------------------

Service name	Can it be disabled?	More information
auditd.service	yes	Disable auditd.service only if you do not need audit messages from the kernel. Be aware that if you disable auditd.service , the /var/log/audit/audit.log file is not produced. Consequently, you are not able to retroactively review some commonly-reviewed actions or events, such as user logins, service starts or password changes. Also note that auditd has two parts: a kernel part, and a service itself. By using the systemctl disable auditd command, you only disable the service, but not the kernel part. To disable system auditing in its entirety, set audit=0 on kernel command line.
autovt@.service	no	This service runs only when it is really needed, so it does not need to be disabled.
crond.service	yes	Be aware that no items from crontab will run if you disable crond.service.
dbus-org.fedoraproject.FirewallD1.service	yes	A symlink to firewalld.service
dbus-org.freedesktop.NetworkManager.service	yes	A symlink to NetworkManager.service
dbus-org.freedesktop.nm-dispatcher.service	yes	A symlink to NetworkManager-dispatcher.service
firewalld.service	yes	Disable firewalld.service only if you do not need a firewall.
getty@.service	no	This service runs only when it is really needed, so it does not need to be disabled.
import-state.service	yes	Disable import-state.service only if you do not need to boot from a network storage.
irqbalance.service	yes	Disable irqbalance.service only if you have just one CPU. Do not disable irqbalance.service on systems with multiple CPUs.
kdump.service	yes	Disable kdump.service only if you do not need reports from kernel crashes.

Service name	Can it be disabled?	More information
loadmodules.service	yes	This service is not started unless the /etc/rc.modules or /etc/sysconfig/modules directory exists, which means that it is not started on a minimal RHEL installation.
lvm2-monitor.service	yes	Disable lvm2-monitor.service only if you do not use Logical Volume Manager (LVM).
microcode.service	no	Do not disable the service because it provides updates of the microcode software in the CPU.
NetworkManager-dispatcher.service	yes	Disable NetworkManager-dispatcher.service only if you do not need notifications on network configuration changes (for example in static networks).
NetworkManager-wait-online.service	yes	Disable NetworkManager-wait-online.service only if you do not need working network connection available right after the boot. If the service is enabled, the system does not finish the boot before the network connection is working. This may prolong the boot time significantly.
NetworkManager.service	yes	Disable NetworkManager.service only if you do not need connection to a network.
nis-domainname.service	yes	Disable nis-domainname.service only if you do not use Network Information Service (NIS).
rhsmcertd.service	no	
rngd.service	yes	Disable rngd.service only if you do not need much entropy on your system, or you do not have any sort of hardware generator. Note that the service is necessary in environments that require a lot of good entropy, such as systems used for generation of X.509 certificates (for example the FreeIPA server).
rsyslog.service	yes	Disable rsyslog.service only if you do not need persistent logs, or you set systemd-journald to persistent mode.
selinux-autorelabel-mark.service	yes	Disable selinux-autorelabel-mark.service only if you do not use SELinux.
sshd.service	yes	Disable sshd.service only if you do not need remote logins by OpenSSH server.

Service name	Can it be disabled?	More information
sssd.service	yes	Disable sssd.service only if there are no users who log in the system over the network (for example by using LDAP or Kerberos). Red Hat recommends to disable all sssd-* units if you disable sssd.service .
syslog.service	yes	An alias for rsyslog.service
tuned.service	yes	Disable tuned.service only if you do need to use performance tuning.
lvm2-lvmpolld.socket	yes	Disable lvm2-lvmpolld.socket only if you do not use Logical Volume Manager (LVM).
dnf-makecache.timer	yes	Disable dnf-makecache.timer only if you do not need your package metadata to be updated automatically.
unbound-anchor.timer	yes	Disable unbound-anchor.timer only if you do not need daily updates of the root trust anchor for DNS Security Extensions (DNSSEC). This root trust anchor is used by the Unbound resolver and resolver library for DNSSEC validation.

To find more information about a service, use one of the following commands:

```
$ systemctl cat <service_name>
```

```
$ systemctl help <service_name>
```

The **systemctl cat** command provides the content of the respective **/usr/lib/systemd/system/<service>** service file, as well as all applicable overrides. The applicable overrides include unit file overrides from the **/etc/systemd/system/<service>** file or drop-in files from a corresponding **unit.type.d** directory.

Additional resources

- **systemd.unit(5)** man page on your system
- The **systemd help** command that shows the man page of a particular service

3.3. ADDITIONAL RESOURCES

- **systemctl(1)**, **systemd-delta(1)**, **systemd(1)**, **systemd.directives(7)**, **systemd.unit(5)**, **systemd.service(5)**, **systemd.target(5)** and **systemd.kill(5)** man pages on your system
- [systemd Home Page](#)

