Oracle Linux 10

Managing the System With systemd

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Contents

Preface

Oracle Linux 10: System Management with systemd describes how to use systemd to manage core system configuration, services, timer units, and resource usage.

Documentation License

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

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1 About systemd

systemd is the system initialization and service manager in Oracle Linux. The systemd daemon is the first process that starts after a system boots and is the final process that's running when the system shuts down. systemd controls the final stages of booting and prepares the system for use. It also speeds up booting by loading services concurrently.

> **Tip:**
>
> See for a hands-on tutorial and video demonstrations on working with systemd in Oracle Linux.

For more information about system boot, see Oracle Linux 10: Managing Kernels and System Boot

systemd Configuration

systemd reads its configuration from files in the following directories, in order of priority:

- `$HOME/.config/systemd/`: User specific systemd configuration entries.
- `/etc/systemd/`: System-wide systemd configuration customization.
- `/run/systemd/`: Runtime systemd configuration.
- `/usr/lib/systemd`: Base systemd configuration provided by packages.

Systemd configuration customization is stored in the `/etc/systemd` directory. For example, you could copy the `/usr/lib/systemd/system.conf` to `/etc/systemd/system.conf` file and edit it to control how systemd handles system initialization.

The systemd daemon starts services during the boot process by reading the symbolic link `/etc/systemd/system/default.target`. The following example shows the value of `/etc/systemd/system/default.target` on a system configured to boot to a multiuser mode without a graphical user interface, a target called `multi-user.target`:

```
sudo ls -l /etc/systemd/system/default.target
```

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

> **Note:**
>
> You can use a kernel boot parameter to override the default system target. See Oracle Linux 10: Managing Kernels and System Boot for information about setting kernel boot parameters.

systemd Units

`systemd` organizes the different types of resources it manages into units. Most units are configured in unit configuration files that enable you to configure these units according to system needs. In addition to the files, you can also use `systemd` runtime commands to configure the units.

To display all the types of units available in systemd, use the following command:

```
sudo systemctl -t help


Available unit types:
service
mount
swap
socket
target
device
automount
timer
path
slice
scope
```

The following list describes some system units that you can manage on an Oracle Linux system by using `systemd`:

Services
Service unit configuration files have the file name format *service_name*`.service`, for example `sshd.service`, `crond.service`, and `httpd.service`.
Service units start and control daemons and the processes of which the daemons consist.
The following example shows how you might start the `systemd` service unit for the Apache HTTP server, `httpd.service`:

```
sudo systemctl start httpd.service
```

See Service Management for more information.

Targets
Target unit configuration files have the file name format *target_name*`.target`, for example `graphical.target`.
Targets are similar to runlevels. A system reaches different targets during the boot process as resources get configured. For example, a system reaches `network-pre.target` before it reaches the target `network-online.target`.
Many target units have dependencies. For example, the activation of `graphical.target` (for a graphical session) fails unless `multi-user.target` (for multiuser system) is also active.
See Targets for more information.

File System Mount Points
Mount unit configuration files have the file name format *mount_point_name*`.mount`.

Mount units enable you to mount file systems at boot time. For example, you can run the following command to mount the temporary file system (`tmpfs`) on `/tmp` at boot time:

```
sudo systemctl enable tmp.mount
```

Devices
Device unit configuration files have the file name format *device_unit_name*.`device`.
Device units are named after the `/sys` and `/dev` paths they control. For example, the device `/dev/sda5` is exposed in systemd as `dev-sda5.device`.
Device units enable you to implement device-based activation.

Sockets
Socket unit configuration files have the file name format *socket_unit_name*.`socket`.
Each "*.`socket`" file needs a corresponding "*.`service`" file to configure the service to start on incoming traffic on the socket.
Socket units enable you to implement socket-based activation.

Timers
Timer unit configuration files have the file name format *timer_unit_name*.`timer`.
Each "*.`timer`" file needs a corresponding "*.`service`" file to configure the service to start at a configured timer event. A `Unit` configuration entry can be used to specify a service that's named differently to the timer unit, if required.
Timer units can control when service units are run and can act as an alternative to using the cron daemon. Timer units can be configured for calendar time events, monotonic time events, and can be run asynchronously.
See Working with Timers for more information.

Paths to `systemd` unit configuration files vary depending on their purpose and whether `systemd` is running in 'user' or 'system' mode. For example, configuration for units that are installed from packages might be available in `/usr/lib/systemd/system` or in `/usr/local/lib/systemd/system`, while a user mode configuration unit is likely to be stored in `$HOME/.config/systemd/user`. See the `systemd.unit(5)` manual page for more information.

2
systemd Utilities

systemd provides several command line utilities you can use to view and change the system.

Utility	Purpose	Manual Page
systemctl	Manage units and change the system state.	systemctl(1)
timedatectl	View and change time and date settings on the system.	timedatectl(1)
localectl	View and change language and keyboard settings on the system.	localectl(1)

systemctl System State Commands

Some systemctl subcommands control the state of the system. Each of these system commands activate a related target.

For more information, see the systemctl(1) manual page.

Command	Description	Target
systemctl halt	Stop all running software, stop the kernel, and leave the hardware powered on.	halt.target
systemctl hibernate	Save the contents of system memory to disk and power off the hardware.	hibernate.target
systemctl hybrid-sleep	Save the contents of system memory to disk and leave the hardware powered on.	hybrid-sleep.target
systemctl poweroff	Halt and power off the system.	poweroff.target
systemctl reboot	Reboot the system.	reboot.target
systemctl suspend	Power off most hardware in the system while preserving power to memory.	suspend.target

Running systemctl on a Remote System

You can run systemctl commands on a remote system where the sshd service is running. Include the -H option and the hostname with the systemctl command to control the system remotely.

For more information see the systemctl(1) manual page.

The following example shows how to check the status of the crond service on a remote system.

- Run the following command: `systemctl -H 10.0.0.2 status crond`

  The remote system returns results similar to the following:

  ```
  ● crond.service - Command Scheduler
       Loaded: loaded (/usr/lib/systemd/system/crond.service; enabled;
  preset: enabled)
       Active: active (running) since Thu 2025-01-09 09:38:06 GMT; 7min ago
     Main PID: 2399
        Tasks: 1 (limit: 99824)
       Memory: 1.0M (available: 14.8G)
          CPU: 9ms
       CGroup: /system.slice/crond.service
               └─2399 /usr/sbin/crond -n
  ```

  Note that to run systemd commands that require root access, the system must allow authentication for the root account over SSH. For example, you might run `systemctl -H root@10.0.0.2 restart httpd`.

Configuring System Date and Time Settings

System time is based on the POSIX time standard, where time is measured as the number of seconds that have elapsed from 00:00:00 Coordinated Universal Time (UTC), Thursday, January 1, 1970. A day is defined as 86400 seconds and leap seconds are subtracted automatically.

Date and time representation on a system can be set to match a specific timezone. To list the available timezones, run:

```
timedatectl list-timezones
```

To set the system timezone to match a value returned from the available timezones, you can run:

```
timedatectl set-timezone America/Los_Angeles
```

Substitute *America/Los_Angeles* with a valid timezone entry.

This command sets a symbolic link from `/etc/localtime` to point to the appropriate zone information file in `/usr/share/zoneinfo/`. The setting takes effect immediately. Some long running processes that use `/etc/localtime` to detect the current system timezone might not detect a change in system timezone until the process is restarted.

Note that timezones are largely used for display purposes or to handle user input. Changing timezone doesn't change the time for the system clock. You can change the presentation for system time in any console by setting the `TZ` environment variable. For example, to see the current time in Tokyo, you can run:

```
TZ="Asia/Tokyo" date
```

You can check the system's current date and time configuration by running the `timedatectl` command on its own:

```
timedatectl
```

```
               Local time: Wed 2021-07-17 00:50:58
EDT
           Universal time: Wed 2021-07-17 04:50:58
UTC
                 RTC time: Wed 2021-07-17
04:50:55
                Time zone: America/New_York (EDT,
-0400)
System clock synchronized:
yes
              NTP service:
active
          RTC in local TZ: no
```

To set system time manually, use the `timedatectl set-time` command:

```
sudo timedatectl set-time "2021-07-17 01:59:59"
```

This command sets the current system time based on the time specified assuming the currently set system timezone. The command also updates the system Real Time Clock (RTC).

> **Tip:**
>
> See Set System Host Names and Locale on Oracle Linux for a hands-on tutorial that describes how to use tools to configure system parameters such as date, time, and locale.

Consider configuring the system to use network time synchronization for more accurate time-keeping. Using network time synchronization is important especially when setting up high-availability or when using network-based file systems.

> **Tip:**
>
> See Configure Chrony on Oracle Linux for a hands-on tutorial on setting up and configuring the `chronyd` service.

If you configure an NTP service, enable NTP by running the following command:

```
sudo timedatectl set-ntp true
```

This command enables and starts the `chronyd` service, if available.

Configuring System Language (Locale) and Keyboard Settings

System-wide preferences for language and keyboard are stored in the locale configuration file (`/etc/locale.conf`). You can query and change these settings as needed using `localectl` command. Note that the `systemd` process reads the locale configuration file at boot and applies these settings to every system-wide service, user interface, and user profile, unless they're overridden by other programs or users. For more information about configuring these system-wide settings, see:

- Changing the Language Setting
- Changing the Keyboard Layout

> **Note:**
>
> System-wide preferences for language and keyboard are also configurable during installation. For details on how to configure these settings at installation, see Oracle Linux 10: Installing Oracle Linux.

Changing the Language Setting

The system locale language setting defines the language in which text appears in the Linux user interfaces (text-based and graphical). For more information on how to configure language locale options on the system, see the `locale` manual page.

To query and change the language setting on the system, follow these steps:

1. To check the current language locale set on the system, type:

   ```
   localectl status
   ```

   For example, the following system language locale output indicates: English (en) as the language, US as the country code, and UTF-8 as the codeset.

   ```
    System Locale: LANG=en_US.UTF-8
   ```

2. To list all possible language locales available on the system, type:

   ```
   localectl list-locales
   ```

   To search the output for a specific language locale, use the `grep` command. For example, to list all possible English locales available for configuration, type:

```
localectl list-locales | grep en
```

3. To set the default language locale on the system, type:

   ```
   sudo localectl set-locale LANG=locale_name
   ```

   Where:

   - *locale_name* is replaced with the name retrieved earlier from the `list-locales` output.

   For example, to set British English as the system language locale, type:

   ```
   sudo localectl set-locale LANG=en_GB.utf8
   ```

   > **Note:**
   >
   > Locale options are typically listed in the following format: `LANGUAGE_COUNTRY.CODESET[@MODIFIERS]`. The `LANGUAGE` is an ISO 639 language code, for example, `en` for English and `COUNTRY` is an ISO 3166 country code. The two letter country code in this example is `GB` for Great Britain and the United Kingdom. The `CODESET` is the character set or encoding, for example, `utf-8`.

Installing Language Locales Individually

A langpack is a metapackage that consists of dependencies that provide support for a specified language. The dependencies include packages for locales, fonts, and other functionality for using a language on a system.

For a particular language, one of the dependencies the langpack installs is `glibc-langpack-<locale_code>`. To reduce storage space required for languages, you can choose to install only the individual glibc locale langpack packages (`glibc-langpack-<locale_code>`).

1. To list all language packs already installed on the system and all language packs available on the `ol10_appstream` repository, type:

   ```
   sudo dnf list langpacks-*
   ```

   For example, the following shows that this system has Spanish, French, Japanese, and Russian language packs installed followed by a truncated list of language packs available on `ol10_appstream`.

   ```
   sudo dnf list langpacks-*
   Last metadata expiration check: 16:24:05 ago on Wed 08 Jan 2025 05:36:12
   PM GMT.
   Installed Packages
   langpacks-core-en.noarch              4.1-2.el10
   @ol10_appstream
   langpacks-en.noarch                   4.1-2.el10
   @ol10_appstream
   langpacks-fonts-en.noarch             4.1-2.el10
   @ol10_appstream
   Available Packages
   langpacks-af.noarch                   4.1-2.el10
   ol10_appstream
   langpacks-am.noarch                   4.1-2.el10
   ol10_appstream
   ```

```
langpacks-ar.noarch                     4.1-2.el10
ol10_appstream
langpacks-as.noarch                     4.1-2.el10
ol10_appstream
...
```

2. Use dnf to install a language pack. For example, the following installs the Japanese language pack:

   ```
   sudo dnf install langpacks-ja.noarch
   ```

3. To list all installed and all available glibc Langpack packages, run the following command:

   ```
   sudo dnf list glibc-langpack*
   ```

4. To install a glibc language pack, run the following command:

   ```
   sudo dnf install glibc-langpack-language_code
   ```

   In the previous command, *language_code* is the language code you want to install. For example, the following example installs Japanese.

   ```
   sudo dnf install glibc-langpack-ja.x86_64
   ```

Changing the Keyboard Layout

The keyboard layout settings enable you to specify a keymap locale for the Linux user interfaces (text-based and graphical). Keymaps are managed using the `localectl` command. For more information on how to use the `localectl` command line utility to change keyboard system settings, see the`localectl` manual page.

To query and change the keyboard layout settings on the system, follow these steps:

1. To check the current keyboard layout configuration on the system, type:

   ```
   localectl status
   ```

   For example, the following keyboard layout output indicates a US country code for the virtual console keymap and a US country code for the X11 layout.

   ```
   System Locale: LANG=en_US.UTF-8
   VC Keymap: us
   X11 Layout: us
   ```

2. To list all possible keyboard layout configurations available, type:

   ```
   localectl list-keymaps
   ```

   To search the output for a specific keymap name, use the `grep` command. For example, to list British compatible keyboard layouts, type:

   ```
   localectl list-keymaps | grep gb
   ```

3. To set the default keyboard layout on the system, type:

   ```
   sudo localectl set-keymap keymap_name
   ```

   Where:

- *keymap_name* is replaced with the name of the keymap retrieved earlier from the `list-keymaps` output.

Note that the keymap name change applies to both the virtual console and the X11 layout settings. If you want the X11 layout to differ from the virtual console keymap, use the `--no-convert` option, for example:

```
sudo localectl --no-convert set-x11-keymap keymap_name
```

The *no-convert* option retains the previous x11 keyboard layout setting.

3 Targets

By using targets, you can control `systemd` so that it starts only the services that are required for a specific purpose. For example, you set the default target to `multi-user.target` on a production server so that the graphical user interface isn't used when the system boots. In a case where you need to troubleshoot or perform diagnostics, you might consider setting the target to `rescue.target`, where only `root` logs onto the system to run the minimum number of services.

Each run level defines the services that `systemd` stops or starts. As an example, `systemd` starts network services for `multi-user.target` and the X Window System for `graphical.target`, and stops both services for `rescue.target`.

Table 3-1 shows the commonly used system-state targets and the equivalent runlevel targets.

Table 3-1 System-State Targets and Equivalent Runlevel Targets

System-State Targets	Equivalent Runlevel Targets	Description
`graphical.target`	`runlevel5.target`	Set up a multiuser system with networking and display manager.

`multi-user.target`	`runlevel2.target`
	`runlevel3.target`
	`runlevel4.target`
		Set up a nongraphical multiuser system with networking.

`poweroff.target`	`runlevel0.target`	Shut down and power off the system.
`reboot.target`	`runlevel6.target`	Shut down and reboot the system.
`rescue.target`	`runlevel1.target`	Set up a rescue shell.

Note that `runlevel*` targets are implemented as symbolic links.

For more information, see the `systemd.target(5)` manual page.

Displaying Default and Active System-State Targets

To display the default system-state target, use the `systemctl get-default` command:

```
systemctl get-default
```

```
graphical.target
```

To display the active targets on a system, use the `systemctl list-units --type target` command:

```
systemctl list-units --type target [--all]


UNIT                     LOAD   ACTIVE SUB    DESCRIPTION
basic.target             loaded active active Basic System
cryptsetup.target        loaded active active Local Encrypted Volumes
getty.target             loaded active active Login Prompts
graphical.target         loaded active active Graphical Interface
local-fs-pre.target      loaded active active Local File Systems (Pre)
local-fs.target          loaded active active Local File Systems
multi-user.target        loaded active active Multi-User System
network-online.target    loaded active active Network is Online
network-pre.target       loaded active active Network (Pre)
network.target           loaded active active Network
nfs-client.target        loaded active active NFS client services
nss-user-lookup.target   loaded active active User and Group Name Lookups
paths.target             loaded active active Paths
remote-fs-pre.target     loaded active active Remote File Systems (Pre)
remote-fs.target         loaded active active Remote File Systems
rpc_pipefs.target        loaded active active rpc_pipefs.target
rpcbind.target           loaded active active RPC Port Mapper
slices.target            loaded active active Slices
sockets.target           loaded active active Sockets
sound.target             loaded active active Sound Card
sshd-keygen.target       loaded active active sshd-keygen.target
swap.target              loaded active active Swap
sysinit.target           loaded active active System Initialization
timers.target            loaded active active Timers

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

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

The output for a system with the `graphical` target active shows that this target depends on other active targets, including `network` and `sound` for networking and sound functionality.

Use the `--all` option to include inactive targets in the list.

For more information, see the `systemctl(1)` and `systemd.target(5)` manual pages.

Changing Default and Active System-State Targets

Use the `systemctl set-default` command to change the default system-state target:

```
sudo 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
```

> **Note:**
>
> This command changes the target to which the default target is linked, but doesn't change the state of the system.

To change the current active system target, use the `systemctl isolate` command, for example:

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

For more information, see the `systemctl(1)` manual page.

4

Service Management

Services in an Oracle Linux system are managed by the `systemctl` *`subcommand`* command.

Examples of subcommands are `enable`, `disable`, `stop`, `start`, `restart`, `reload`, and `status`.

For more information, see the `systemctl(1)` manual page.

Starting and Stopping Services

To start a service, use the `systemctl start` command:

```
sudo systemctl start sshd
```

To stop a service, use the `systemctl stop` command:

```
sudo systemctl stop sshd
```

Changing the state of a service only lasts while the system remains at the same state. If you stop a service and then change the system-state target to one in which the service is configured to run (for example, by rebooting the system), the service restarts. Similarly, starting a service doesn't enable the service to start following a reboot. See Enabling and Disabling Services.

Enabling and Disabling Services

You can use the `systemctl` command to enable or disable a service from starting when the system boots, for example:

```
sudo systemctl enable httpd
```

```
Created symlink /etc/systemd/system/multi-user.target.wants/httpd.service
→ /usr/lib/systemd/system/httpd.service.
```

The `enable` command activates a service by creating a symbolic link for the lowest-level system-state target at which the service starts. In the previous example, the command creates the symbolic link `httpd.service` for the `multi-user` target.

> **Note:**
>
> To start the service at the same time you enable it, include the `--now` option in the command. For example: `sudo systemctl enable --now httpd`

Disabling a service removes the symbolic link:

```
sudo systemctl disable httpd
```

```
Removed /etc/systemd/system/multi-user.target.wants/httpd.service.
```

To check whether a service is enabled, use `is-enabled` subcommand as shown in the following examples:

```
systemctl is-enabled httpd
```

```
disabled
```

```
systemctl is-enabled sshd
```

```
enabled
```

After running the `systemctl disable` command, the service can still be started or stopped by user accounts, scripts, and other processes. However, if you need to ensure that the service might be started inadvertently, for example, by a conflicting service, then use the `systemctl mask` command as follows:

```
sudo systemctl mask httpd
```

```
Created symlink from '/etc/systemd/system/multi-user.target.wants/
httpd.service' to '/dev/null'
```

The `mask` command sets the service reference to `/dev/null`. If you try to start a service that has been masked, you will receive an error as shown in the following example:

```
sudo systemctl start httpd
```

```
Failed to start httpd.service: Unit is masked.
```

To relink the service reference back to the matching service unit configuration file, use the `systemctl unmask` command:

```
sudo systemctl unmask httpd
```

For more information, see the `systemctl(1)` manual page.

Displaying the Status of Services

To check whether a service is running, use the `is-active` subcommand. The output would either be *active*) or *inactive*, as shown in the following examples:

```
systemctl is-active httpd
```

```
active
```

```
systemctl is-active sshd
```

```
inactive
```

The `status` subcommand provides a detailed summary of the status of a service, including a tree that displays the tasks in the control group (`CGroup`) that the service implements:

```
systemctl status httpd
```

```
httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; vendor
preset: disabled)
   Active: active (running) since ...
     Docs: man:httpd.service(8)
 Main PID: 11832 (httpd)
   Status: "Started, listening on: port 80"
    Tasks: 213 (limit: 26213)
   Memory: 32.5M
   CGroup: /system.slice/httpd.service
           ├─11832 /usr/sbin/httpd -DFOREGROUND
           ├─11833 /usr/sbin/httpd -DFOREGROUND
           ├─11834 /usr/sbin/httpd -DFOREGROUND
           ├─11835 /usr/sbin/httpd -DFOREGROUND
           └─11836 /usr/sbin/httpd -DFOREGROUND

Jul 17 00:14:32 Unknown systemd[1]: Starting The Apache HTTP Server...
Jul 17 00:14:32 Unknown httpd[11832]: Server configured, listening on: port 80
Jul 17 00:14:32 Unknown systemd[1]: Started The Apache HTTP Server.
```

A `cgroup` is a collection of processes that are bound together so that you can control their access to system resources. In the example, the `cgroup` for the `httpd` service is `httpd.service`, which is in the `system` slice.

Slices divide the `cgroups` on a system into different categories. To display the slice and `cgroup` hierarchy, use the `systemd-cgls` command:

```
systemd-cgls
```

```
Control group /:
-.slice
├─user.slice
│ └─user-1000.slice
│   ├─user@1000.service
│   │ └─init.scope
│   │   ├─6488 /usr/lib/systemd/systemd --user
│   │   └─6492 (sd-pam)
│   └─session-7.scope
│     ├─6484 sshd: root [priv]
│     ├─6498 sshd: root@pts/0
│     ├─6499 -bash
│     ├─6524 sudo systemd-cgls
│     ├─6526 systemd-cgls
│     └─6527 less
├─init.scope
│ └─1 /usr/lib/systemd/systemd --switched-root --system --deserialize 16
└─system.slice
  ├─rngd.service
  │ └─1266 /sbin/rngd -f --fill-watermark=0
  ├─irqbalance.service
  │ └─1247 /usr/sbin/irqbalance --foreground
  ├─libstoragemgmt.service
  │ └─1201 /usr/bin/lsmd -d
  ├─systemd-udevd.service
  │ └─1060 /usr/lib/systemd/systemd-udevd
  ├─polkit.service
  │ └─1241 /usr/lib/polkit-1/polkitd --no-debug
  ├─chronyd.service
  │ └─1249 /usr/sbin/chronyd
  ├─auditd.service
  │ ├─1152 /sbin/auditd
  │ └─1154 /usr/sbin/sedispatch
  ├─tuned.service
  │ └─1382 /usr/libexec/platform-python -Es /usr/sbin/tuned -l -P
  ├─systemd-journald.service
  │ └─1027 /usr/lib/systemd/systemd-journald
  ├─atd.service
  │ └─1812 /usr/sbin/atd -f
  ├─sshd.service
  │ └─1781 /usr/sbin/sshd
```

The `system.slice` contains services and other system processes. `user.slice` contains user processes, which run within transient cgroups called *scopes*. In the example, the processes for the user with ID 1000 are running in the scope `session-7.scope` under the slice `/user.slice/user-1000.slice`.

You can use the `systemctl` command to limit the CPU, I/O, memory, and other resources that are available to the processes in service and scope cgroups. See Controlling Access to System Resources.

For more information, see the `systemctl(1)` and `systemd-cgls(1)` manual pages. Also see About Control Groups.

Controlling Access to System Resources

Use the `systemctl` command to control a cgroup's access to system resources, for example:

```
sudo systemctl [--runtime] set-property httpd CPUShares=512 MemoryLimit=1G
```

`CPUShare` controls access to CPU resources. As the default value is 1024, a value of 512 halves the access to CPU time that the processes in the `cgroup` have. Similarly, `MemoryLimit` controls the maximum amount of memory that the `cgroup` can use.

> **Note:**
>
> You don't need to specify the `.service` extension to the name of a service.
>
> If you specify the `--runtime` option, the setting doesn't persist across system reboots.

Alternatively, you can change the resource settings for a service under the `[Service]` heading in the service's configuration file in `/usr/lib/systemd/system`. After editing the file, make `systemd` reload its configuration files and then restart the service:

```
sudo systemctl daemon-reload
sudo systemctl restart service
```

You can run general commands within scopes and use `systemctl` to control the access that these transient cgroups have to system resources. To run a command within in a scope, use the `systemd-run` command:

```
sudo systemd-run --scope --unit=group_name [--slice=slice_name]
```

If you don't want to create the group under the default `system` slice, you can specify another slice or the name of a new slice. The following example runs a command named `mymonitor` in `mymon.scope` under `myslice.slice`:

```
sudo systemd-run --scope --unit=mymon --slice=myslice mymonitor
```

```
Running as unit mymon.scope.
```

> **Note:**
>
> If you don't specify the `--scope` option, the control group is a created as a service rather than as a scope.

You can then use `systemctl` to control the access that a scope has to system resources in the same way as for a service. However, unlike a service, you must specify the `.scope` extension, for example:

```
sudo systemctl --runtime set-property mymon.scope CPUShares=256
```

For more information see About Control Groups and the `systemctl(1)`, `systemd-cgls(1)`, and `systemd.resource-control(5)` manual pages.

Creating a User-Based systemd Service

In addition to the system-wide `systemd` files, `systemd` enables you to create user-based services that you can run from a user level without requiring root access and privileges. These user-based services are under user control and are configurable independent of system services.

The following are some distinguishing features of user-based `systemd` services:

- User-based `systemd` services are linked with a specific user account.
- They're created under the associated user's home directory in `$HOME/.config/systemd/user/`.
- After these services are enabled, they start when the associated user logs in. This behavior differs from that of enabled `systemd` services which start when the system boots.

To create a user based service:

1. Create the service's unit file in the `$HOME/.config/systemd/user` directory, for example:

   ```
   touch $HOME/.config/systemd/user/myservice.service
   ```

2. Open the unit file and specify the values to the options you want to use, such as `Description`, `ExecStart`, `WantedBy`, and so on.

   For reference, see Configurable Options in Service Unit Files and the `systemd.service(5)` and `systemd.unit(5)` manual pages.

3. Enable the service to start automatically when you log in.

   ```
   systemctl --user enable myservice.service
   ```

> **Note:**
>
> When you log out, the service is stopped unless the root user has enabled processes to continue to run for the user.
>
> See for more information.

4. Start the service.

```
systemctl --user start myservice.service
```

5. Verify that the service is running.

```
systemctl --user status myservice.service
```

Changing systemd Service Unit Files

To change the configuration of `systemd` services, copy the files with `.service`, `.target`, `.mount` and `.socket` extensions from `/usr/lib/systemd/system` to `/etc/systemd/system`.

After you have copied the files, you can edit the versions in `/etc/systemd/system`. The files in `/etc/systemd/system` take precedence over the versions in `/usr/lib/systemd/system`. Files in `/etc/systemd/system` aren't overwritten when you update a package that touches files in `/usr/lib/systemd/system`.

To revert to the default `systemd` configuration for a particular service, you can either rename or delete the copies in `/etc/systemd/system`.

Another approach for changing the configuration of a service is to create a drop-in file. With this approach, you can preserve the original unit while changing specific parameters of the unit.

Create drop-in files in `/etc/systemd/system/unit_name.d/`, where the `unit_name.d` directory is an existing unit, then give the drop-in files a `.conf` file extension. For example: `/etc/systemd/system/unit_name.d/name_of_drop-in.conf`. `systemd` reads the `.conf` file and applies the settings to the original unit.

The following sections describe the different parts of a service unit file that you can edit and customize for a system.

About Service Unit Files

Services run based on their corresponding service unit files. A service unit file typically contains the following sections, with each section having its respective defined options that determine how a specific service runs:

`[Unit]`
Contains information about the service.

`[UnitType]:`
Contains options that are specific to the unit type of the file. For example, in a service unit file this section is titled `[Service]` and contains options that are specific to units of the service type, such as `ExecStart` or `StandardOutput`.

Only those unit types that offer options specific to their type have such a section.

[Install]
Contains installation information for the specific unit. The information in this section is used by the `systemctl enable` and `systemctl disable` commands.

A service unit file might contain the following configurations for a service.

```
[Unit]
Description=A test service used to develop a service unit file template

[Service]
Type=simple
StandardOutput=journal
ExecStart=/usr/lib/systemd/helloworld.sh

[Install]
WantedBy=default.target
```

Configurable Options in Service Unit Files describes some commonly used configured options available under each section. A complete list is also available in the `systemd.service(5)` and `systemd.unit(5)` manual pages.

Configurable Options in Service Unit Files

Each of the following lists deals with a separate section of the service unit file.

Description of Options Under [Unit] Section

The following list provides a general overview of the commonly used configurable options available in the `[Unit]` section of service unit file:

Description
Provides information about the service. The information is displayed when you run the `systemctl status` command on the unit.

Documentation
Contains a space-separated list of URIs referencing documentation for this unit or its configuration.

After
Configures the unit to only run after the units listed in the option finish starting up.
In the following example, if the file *var3*`.service` has the following entry, then it's only started after units *var1*`.service` and *var2*`.service` have started:

```
After=var1.service var2.service
```

Requires
Configures a unit to have requirement dependencies on other units. If a unit is activated, those listed in its `Requires` option are also activated.

Wants
A less stringent version of the `Requires` option. For example, a specific unit can be activated even if one of those listed in its `Wants` option fails to start.

Description of Options Under [Service] Section

This following list gives a general overview of the commonly used configurable options available in the `[Service]` section of a service unit file.

`Type`
Configures the process start-up type for the service unit.
By default, this parameter's value is `simple`, which indicates that the service's main process is that which is started by the `ExecStart` parameter.
Typically, if a service's type is `simple`, then the definition can be omitted from the file.

`StandardOutput`
Configures the how the service's events are logged. For example, consider a service unit file has the following entry:

```
StandardOutput=journal
```

In the example, the value `journal` indicates that the events are recorded in the journal, which can be viewed by using the `journalctl` command.

`ExecStart`
Specifies the full path and command that starts the service, for example, `/usr/bin/npm start`.

`ExecStop`
Specifies the commands to run to stop the service started through `ExecStart`.

`ExecReload`
Specifies the commands to run to trigger a configuration reload in the service.

`Restart`
Configures whether the service is to be restarted when the service process exits, is stopped, or when a timeout is reached.

> **Note:**
>
> This option doesn't apply when the process is stopped cleanly by a `systemd` operation, for example a `systemctl stop` or `systemctl restart`. In these cases, the service isn't restarted by this configuration option.

`RemainAfterExit`
A Boolean value that configures whether the service is to be considered active even when all of its processes have exited. The default value is `no`.

Description of Options Under [Install] Section

This following list gives a general overview of the commonly used configurable options available in the `[Install]` section of service unit file.

`Alias`
A space-separated list of names for a unit.
At installation time, `systemctl enable` creates symlinks from these names to the unit filename.

Aliases are only effective when the unit is enabled.

RequiredBy
Configures the service to be required by other units.
For example, consider a unit file *var1*.service that has the following configuration added to it:

```
RequiredBy=var2.service var3.service
```

When *var1*.service is enabled, both *var2*.service and *var3*.service are granted a Requires dependency upon *var1*.service. This dependency is defined by a symbolic link that's created in the .requires folder of each dependent service (*var2*.service and var3.service) that points to the *var1*.service system unit file.

WantedBy
Specifies a list of units that are to be granted a wants dependency upon the service whose file you're editing.
For example, consider a unit file *var1*.service that has the following configuration added to it:

```
WantedBy=var2.service var3.service
```

When *var1*.service is enabled, both *var2*.service and *var3*.service are granted a Wants dependency upon *var1*.service. This dependency is defined by a symbolic link that's created in the ".wants" folder of each dependent service (*var2*.service and var3.service) that points to the system unit file for *var1*.service .

Also
Lists additional units to install or remove when the unit is installed or removed.

DefaultInstance
The DefaultInstance option applies to template unit files only.
Template unit files enable the creation of multiple units from a single configuration file. The DefaultInstance option specifies the instance for which the unit is enabled if the template is enabled without any explicitly set instance.

Creating a Unit Drop-In File

You can use the systemctl edit command to automatically generate a systemd unit drop-in or unit file for any existing systemd unit. You can use the drop-in file to override base configuration for a unit or to extend the requirements for a unit file.

1. Run the systemctl edit <unit> command to automatically generate a systemd drop-in file and to open the file in the system default editor.

   For example, to edit the cockpit.socket unit to change the port that the Cockpit web console listens on, you can do the following:

   ```
   sudo systemctl edit cockpit.socket --drop-in=listen.conf
   ```

   The --drop-in option lets you specify the file name that's used for the drop-in file. If you don't specify this option, the default file name is set to override.conf.

The system text editor opens and you can add the lines to override the default configuration:

```
[Socket]
ListenStream=
ListenStream=443
```

> **Note:**
>
> More configuration outside of systemd is required if you change the default listener port for Cockpit. For example, you might need to change SELinux contexts and firewall configuration.

2. Save the drop-in file or exit.

   If you save the changes to the drop-in file, the file is automatically installed into `/etc/systemd/system/<unit>.d/<drop-in.file>`. If you exit out of the editor without saving changes, the file isn't created and no further updates are required.

3. Reload the systemd daemon configuration.

   ```
   sudo systemctl daemon-reload
   ```

4. Restart the systemd unit that you have updated.

   For example, to restart the `cockpit.socket` that's used in this example, run:

   ```
   sudo systemctl restart cockpit.socket
   ```

5 Working with Timers

Timer unit files are a type of `systemd` file that the `systemctl` utility uses to schedule tasks, similar to the `cron` utility that uses `crontab` and other `cron` jobs for the same purpose. Note that the cron daemon runs as a service within systemd, so timer units are preferred because they remove a layer of added processing and offer much more utility and more granular configuration than is available in the cron service.

Typically, packages that use specific services to function in the system include their own `systemd` timer unit files. Thus, when these packages are installed with Oracle Linux, the timer unit files are automatically included. You can display with the timer files in the system with the following command:

```
systemctl list-unit-files --type=timer
```

> **Note:**
>
> The list of timer files might differ depending on where Oracle Linux is running, such as in an instance in Oracle Cloud Infrastructure, a physical system, and so on.

Each timer unit file contains parameter settings that manage the schedule of a task. For example, the schedule for running `dnf-makecache.service` is set in the `dnf-makecache.timer` file. The file contains the following settings:

```
systemctl cat dnf-makecache.timer
```

```
# /usr/lib/systemd/system/dnf-makecache.timer
[Unit]
Description=dnf makecache --timer
ConditionKernelCommandLine=!rd.live.image
# See comment in dnf-makecache.service
ConditionPathExists=!/run/ostree-booted
Wants=network-online.target

[Timer]
OnBootSec=10min
OnUnitInactiveSec=1h
RandomizedDelaySec=60m
Unit=dnf-makecache.service

[Install]
WantedBy=timers.target
```

The schedule information is specified under the `[Timer]` section. In the sample configuration, the `dnf-makecache.service` service is set to automatically run 10 minutes after the system is booted. The service then goes into idle mode for an hour, as specified by the `OnUnitInactiveSec` parameter. At the end of the hour, the service runs again. This cycle continues every hour indefinitely.

The `RandomizedDelaySec` setting provides a value limit for how much a run can be delayed beyond its schedule. In the example, the service is allowed to run one minute later than its schedule at the latest. This parameter is useful for preventing too many jobs that start at the same time on a specified schedule, which would otherwise risk overloading the resources.

`OnCalendar` is another useful parameter for task scheduling. Suppose that the parameter is set as follows:

```
OnCalendar=*:00/10
```

The `*:00` indicates every hour at the top of the hour, while the `/10` setting indicates 10 minutes. Therefore, the job is set to run hourly, at ten minutes past the top of the hour.

For a complete list of `systemd` timer unit file parameters for scheduling a job, see the `systemd.timer(5)` manual pages.

> **Tip:**
>
> For a tutorial on how to use `systemd` in Oracle Linux, including how to configure `systemd` timer unit files, see .

Using Timer Units to Control Service Unit Runtime

Timer units can be configured to control when service units run. You can use timer units instead of configuring the `cron` daemon for time-based events. Timer units can be more complicated to configure than creating a crontab entry. However, timer units are more configurable and the services that they control can be configured for better logging and deeper integration with `systemd` architecture.

Timer units are started, enabled, and stopped similarly to service units. For example, to enable and start a timer unit immediately, type:

```
sudo systemctl enable --now myscript.timer
```

To list all existing timers on the system, to see when they last ran, and when they're next configured to run, type:

```
systemctl list-timers
```

For more information about system timers, see the `systemd.timer(5)` and `systemd.time(7)` manual pages.

Configuring a Realtime Timer Unit

Realtime timers activate on a calendar event, similar to events in a crontab. The option `OnCalendar` specifies when the timer runs a service.

- If needed, create a `.service` file that defines the service to be triggered by the timer unit. In the following procedure, the sample service is `/etc/systemd/system/update.service` which is a service unit that runs an update script.

  For more information about creating service units, see Creating a User-Based systemd Service.
- Decide the time and frequency for running the service. In this procedure, the timer is configured to run the service every 2 hours from Monday to Friday.

This task shows you how to create a system timer to trigger a service to run based on a calendar event. The definition of the calendar event is similar to entries that you put in a cron job.

1. Create the `/etc/systemd/system/update.timer` with the following content:

   ```
   [Unit]
   Description="Run the update.service every two hours from Mon to Fri."

   [Timer]
   OnCalendar=Mon..Fri 00/2
   Unit=update.service

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

   `OnCalendar` can use a straightforward setting such as `OnCalendar=weekly` or can use more complex definitions that are more detailed. However, the format for defining settings is constant, as follows:

   ```
   DayofWeek Year-Month-Day Hour:Minute:Second
   ```

   The following definition means "the first 4 days of each month at 12:00 o'clock noon, but only if that day is either a Monday or a Tuesday":

   ```
   OnCalendar=Mon,Tue *-*-01..04 12:00:00
   ```

   For other ways to define `OnCalendar` and for more timer options that you can configure in the system timer file, see the `systemd.timer(5)` and `systemd.time(7)` manual pages.
2. Check that all the files related to this timer are configured correctly.

   ```
   systemd-analyze verify /etc/systemd/system/update.*
   ```

   Any detected errors are reported on the screen.
3. Start the timer.

   ```
   sudo systemctl start update.timer
   ```

This command starts the timer for the current session only.

4. Ensure that the timer starts when the system is booted.

```
sudo systemctl enable update.timer
```

Configuring a Monotonic Timer Unit

Monotonic timers activate after a time span relative to a varying starting point, such as a boot event, or when a particular `systemd` unit becomes active. These timer units stop if the computer is temporarily suspended or shut down. Monotonic timers are configured by using the `On`*`Type`*`Sec` option, where *Type* is the name of the event to which the timer is related. Common monotonic timers include `OnBootSec` and `OnUnitActiveSec`.

- If needed, create a `.service` file that defines the service to be triggered by the timer unit. In the following procedure, the sample service is `/etc/systemd/system/update.service` which is a service unit that runs an update script.

  For more information about creating service units, see Creating a User-Based systemd Service.
- Decide the time and frequency for running the service. In this procedure, the timer is configured to run the service 10 minutes after a system boot, and every 2 hours from when the service is last activated.

This task shows you how to create a system timer to trigger a service to run at specific events, which are when the system boots or after 2 hours have lapsed from the timer's activation.

1. Create the `/etc/systemd/system/update.timer` with the following content:

```
[Unit]
Description="Run the update.service every two hours from Mon to Fri."

[Timer]
OnBootSec=10min
OnUnitActiveSec=2h
Unit=update.service

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

   For more timer options that you can configure in the system timer, see the `systemd.timer(5)` and `systemd.time(7)` manual pages.

2. Check that all the files related to this timer are configured correctly.

```
systemd-analyze verify /etc/systemd/system/update.*
```

   Any detected errors are reported on the screen.

3. Start the timer.

```
sudo systemctl start update.timer
```

   This command starts the timer for the current session only.

4. Ensure that the timer starts when the system is booted.

```
sudo systemctl enable update.timer
```

Running a Transient Timer Unit

Transient timers are temporary timers that are valid only for the current session. These timers can be created to run a program or script directly without requiring service or timer units to be configured within `systemd`. These units are generated by using the `systemd-run` command. See the `systemd-run(1)` manual page for more information.

The parameter options that you would add to the *`unit-file`*`.timer` file also serve as arguments when you use `systemd-run` command to run a transient timer unit.

The following examples show how to use `systemd-run` to activate transient timers.

- Run `update.service` after 2 hours have elapsed.

  ```
  sudo systemd-run --on-active="2h" --unit update.service
  ```

- Create `~/tmp/myfile` after 1 hour.

  ```
  sudo systemd-run --on-active="1h" /bin/touch ~/tmp/myfile
  ```

- Run `~/myscripts/update.sh` 5 minutes after the service manager is started. Use this syntax to run a service after the service manager has started at user login.

  ```
  sudo systemd-run --on-startup="5m" ~/myscripts/update.sh
  ```

- Run `myjob.service` 10 minutes after system boot.

  ```
  sudo systemd-run --on-boot="10m" --unit myjob.service
  ```

- Run `report.service` at the end of the day.

  ```
  sudo systemd-run --on-calendar="17:00:00"
  ```

6 System Logging

systemd has its own logging system called the journal. The journal is handled by the `systemd-journald` service unit. Although it's possible to run another system logging service, it's not necessary as the systemd journal provides a complete system logging service that can be used to audit and review activity on the system.

The systemd journal stores log data in a binary format, making it more efficient than traditional text-based logging systems. The journal conforms to standard syslog severity codes or priorities to mark the importance of a message, and syslog facilities to describe the subsystems and services that generate messages as defined in RFC 5424. See the `systemd-journald.service(8)` manual page for more information.

Journal configuration is controlled by editing the `/etc/systemd/journald.conf` file. The preferred approach to updating journal configuration is to use systemd drop-in configuration to make changes. See Adding Persistent Journal Storage for an example of creating a drop-in configuration file. Also see the `journald.conf(5)` manual page for more information about configuration options.

Use `journalctl` to view and manage system logs. `journalctl` is a utility used to query and display log messages from the systemd journal. See Viewing and Filtering Log Messages for more information. You can also use `journalctl` to manage certain journal runtime behavior. For example, you can use the `--disk-usage` option to view how much disk space the journal is using. You can also use the `--rotate` option to force log rotation, and the `--vacuum-size` or `--vacuum-time` to limit how much data is stored in the rotated journal files. See the `journalctl(1)` manual page for more information.

Viewing and Filtering Log Messages

To view and filter log messages in the journal, you can use the `journalctl` command.

To view all log messages, run:

```
journalctl
```

When run without any options, the `journalctl` command displays all log messages.

You can also run the `journalctl --grep` command to return only lines that match a specified string or regular expression. If the string specified is all in lowercase, the match is treated as case-insensitive. If you need a case-sensitive match on a lowercase string, you can override this behavior with the `--case-sensitive` option.

You can apply other filters to log messages to limit output by specifying various filtering options, including:

- `-S`, `--since`: Show only lines in the log after a specified date, time, or duration. For example, you can run any of the following commands:

  ```
  journalctl --since today
  journalctl --since "1 hour ago"
  journalctl --since "2025-01-15 18:10:20"
  ```

- `-U`, `--until`: Show only lines in the log before a specified date, time, or duration. For example, you can run:

  ```
  journalctl --until "10 minutes ago"
  ```

- `-f`, `--follow`: Follow the journal as it's being updated and display new entries as they're added. Use the `Ctrl-c` keyboard sequence to exit the log.
- `-n`, `--lines`: Show only the most recent n lines.
- `-b`, `--boot`: Show only the lines from the specified boot. If set to `0`, log lines from the most recent boot are shown. If set to `-1`, log lines from the previous boot are used. Note that you need persistent storage for journald enabled to retain logs from previous boots. See Adding Persistent Journal Storage.
- `-u`, `--unit`: Filter by unit name. For example, you can run:
- ```
  journalctl -u cockpit.socket
  journalctl -u cockpit.service
  ```
- `-t`, `--identifier`: Filter by syslog identifier. For example, you can run:

  ```
  journalctl -t sudo
  ```

- `-p`, `--priority`: Filter by syslog priority. For example you can run:
- ```
  journalctl -p crit
  ```
- `-x`, `--catalog`: Include extra explanation texts from the message catalog, if available. These explanations can make log output dense, but can also be helpful in finding resolutions for issues that might appear in the log.

You can combine any of the filtering options to narrow the returned log information to exactly what you need. For example, to see all systemd's log activity for the current date until and hour ago, and to include explanatory messages, run:

```
journalctl --since "today" -U "1 hour ago" -t systemd -x
```

Adding Persistent Journal Storage

Add persistent journal storage if you want log entries to persist across reboots, for greater historical reference and for deeper auditing purposes.

By default, the systemd journal is stored in volatile storage under `/run/log/journal`. This storage is wiped at reboot. To create persistent journal storage, that's preserved after reboot, you can create the appropriate directory structure, set the correct permissions and edit the journald configuration.

1. Create the persistent storage directory in `/var/log/journal`.

   ```
   sudo mkdir /var/log/journal
   ```

2. Set the appropriate permissions and configure the directory for systemd-journald access.

   ```
   sudo systemd-tmpfiles --create --prefix /var/log/journal
   ```

3. Optionally, create a systemd journald drop-in configuration file in `/etc/systemd/journald.conf.d/` and set the Storage parameter to persistent.

   Creating a systemd journald drop-in configuration can help make it clearer that the configuration is set to use persistent storage. This step is optional because, by default, the storage is set to 'auto' and journald switches to persistent if the /var/log/journal directory exists.

   ```
   sudo mkdir /etc/systemd/journald.conf.d
   cat > /etc/systemd/journald.conf.d/00-storage.conf << EOF
   [Journal]
   Storage=persistent
   EOF
   ```

4. Restart the systemd-journald service and flush the journal to force it to switch from volatile to persistent storage.

   ```
   sudo systemctl restart systemd-journald
   sudo journalctl --flush
   ```

5. Validate that the journal has switched to persistent storage.

   You can check the `/var/log/journal` directory to ensure that it's populated with data.

   ```
   sudo ls /var/log/journal
   ```

   Also check the journal path that's configured in the journal:

   ```
   journalctl -F JOURNAL_PATH
   ```

7

Core Dumps

Core dumps contain crash information for userspace applications and services running on Oracle Linux. They can be generated on demand by using a debugger, or the `systemd-coredump` service can be configured to generate them automatically in the event of a process stopping prematurely.

Core dumps contain a log summary of the crash event that typically includes the process ID, owner, termination signal, and a stack trace. For more information, see the `systemd-coredump(8)` manual pages.

The `coredumpctl` command can be used to review core dumps that have been written to the system journal or saved as a file. For more information, see the `coredumpctl(1)` manual pages.

Enabling Core Dumps

Core dumps aren't enabled by default, so you must configure Systemd to generate them.

1. Create the `/etc/systemd/system.conf.d/10-enable-coredumps.conf` configuration file and add the following content:

   ```
   [Manager]
   DumpCore=yes
   DefaultLimitCORE=infinity
   ```

2. Restart the `systemd` daemon to apply the change without restarting Oracle Linux:

   ```
   sudo systemctl daemon-reload
   ```

Configuring Core Dumps

1. To adjust the scope of the data captured in Systemd core dumps and define where Systemd stores them, change the `/etc/systemd/coredump.conf` configuration file.

   For more information, see the `coredump.conf(5)` manual pages.

2. Before running the `coredumpctl` command, remove any core dump size limits that apply to the current shell session:

   ```
   sudo ulimit -c unlimited
   ```

   For more information about the `ulimit` command, see the `ulimit(1)` manual pages.

Analyzing Core Dumps

- Use the `coredumpctl` command to list the core dumps that are available on the system:

  ```
  coredumpctl list
  ```

- To review more information about the core dumps stored for a particular application, specify the executable as an option:

  ```
  coredumpctl list executable-path
  ```

- To review all the core dumps that are stored for a failed process on the system, specify the process ID instead:

  ```
  coredumpctl list process-id
  ```

Exporting Core Dumps

1. To export the core dump for bug reporting purposes, specify the process ID and output file when you run the `coredumpctl dump` command:

   ```
   coredumpctl dump process-id -o output-file
   ```

2. Optionally, you can export an SOS report with extra information about the system.
3. On the same system or a different one, install the `gdb` package and then step through a core dump with the GNU Debugger by using the `coredumpctl debug` command:

   ```
   sudo dnf install gdb
   ```

   ```
   coredumpctl debug process-id
   ```

For more information about the `coredumpctl` command, see the `coredumpctl(1)` manual pages.

8 About Control Groups

Control groups, usually referred to as `cgroups`, are an Oracle Linux kernel feature that enables processes (`PIDs`) to be organized into hierarchical groups for resource allocation. For example, if you have identified 3 sets of processes that need to be allocated CPU time in a ratio of 150:100:50, you can create 3 `cgroups`, each with a CPU weight corresponding to one of the 3 values in the ratio, and then assign the appropriate processes to each `cgroup`.

By default, `systemd` creates a `cgroup` for the following:

- Each `systemd` service set up on the host.

  For example, a server might have control group `NetworkManager.service` to group processes owned by the `NetworkManager` service, and control group `firewalld.service` to group processes owned by the `firewalld` service, and so on.

- Each user (`UID`) on the host.

The `cgroup` functionality is mounted as a virtual file system under `/sys/fs/cgroup`. Each cgroup has a corresponding folder within `/sys/fs/cgroup` file system. For example, the `cgroups` created by `systemd` for the services it manages can be seen by running the command `ls -l /sys/fs/cgroup/system.slice | grep ".service"` as shown in the following sample code block:

```
ls -l /sys/fs/cgroup/system.slice | grep ".service"
...root root 0 Mar 22 10:47 atd.service
...root root 0 Mar 22 10:47 auditd.service
...root root 0 Mar 22 10:47 chronyd.service
...root root 0 Mar 22 10:47 crond.service
...root root 0 Mar 22 10:47 dbus-broker.service
...root root 0 Mar 22 10:47 dtprobed.service
...root root 0 Mar 22 10:47 firewalld.service
...root root 0 Mar 22 10:47 httpd.service
...
```

You can also create custom `cgroups` by creating folders under the `/sys/fs/cgroup` virtual file system and assigning process IDs (`PIDs`) to different `cgroups` according to the system needs. However, the recommended practice is to use `systemd` to configure `cgroups` instead of creating the `cgroups` manually under `/sys/fs/cgroup`. See Using systemd to Manage cgroups v2 for the recommended method of managing `cgroups` through `systemd`.

> **Note:**
>
> **Use `systemd` to configure `cgroups`.**
>
> Although the recommended method for configuring using `systemd` to manage cgroups, this topic also covers the manual creation of `cgroup` folders in the `/sys/fs/cgroup` file system. However, this coverage is mainly to provide background knowledge of the kernel `cgroup` feature to which `systemd` provides access.

Oracle Linux uses the control groups version 2 (`cgroups v2`) implementation. These groups provide a single control group hierarchy against which all resource controllers are mounted. In this hierarchy, you can obtain better proper coordination of resource uses across different resource controllers. This version is an improvement over `cgroups v1` whose over flexibility prevented proper coordination of resource use among the system consumers.

Note that `cgroups v1` is deprecated and is not available on Oracle Linux 10. The `cgroups v2` functionality is enabled and mounted by default.

For more information about control groups, see the `cgroups(7)` and `sysfs(5)` manual pages.

About Control Groups and systemd

Control groups can be used by the `systemd` system and service manager for resource management. `Systemd` uses these groups to organize units and services that consume resources. For more information about `systemd`, see About systemd.

`Systemd` provides different unit types, three of which are for resource control purposes:

- **Service**: A process or a group of processes whose settings are based on a unit configuration file. Services encompass specified processes in a "collection" so that `systemd` can start or stop the processes as one set. Service names follow the format *name*`.service`.
- **Scope**: A group of externally created processes, such as user sessions, containers, virtual machines, and so on. Similar to services, scopes encapsulate these created processes and are started or stopped by the arbitrary processes and then registered by `systemd` at runtime. Scope names follow the format *name*`.scope`.
- **Slice**: A group of hierarchically organized units in which services and scopes are located. Thus, slices themselves don't contain processes. Rather, the scopes and services in a slice define the processes. Every name of a slice unit corresponds to the path to a location in the hierarchy. Root slices, typically `user.slice` for all user-based processes and `system.slice` for system-based processes, are automatically created in the hierarchy. Parent slices exist immediately below the root slice and follow the format *parent-name*`.slice`. These root slices can then have subslices on multiple levels.

The service, the scope, and the slice units directly map to objects in the control group hierarchy. When these units are activated, they map directly to control group paths that are built from the unit names. To display the mapping between the `systemd` resource unit types and control groups, type:

```
sudo systemd-cgls
```

```
Working directory /sys/fs/cgroup:
├─user.slice (#1243)
│ → trusted.invocation_id: 50ce3909b2644f919ee420adc39edb4b
│ ├─user-1001.slice (#4167)
│ │ → trusted.invocation_id: 02e80a960d4549a7a9c69ce0fb546c26
│ │ ├─session-2.scope (#4405)
│ │ │ ├─2417 sshd: alice [priv]
│ │ │ ├─2430 sshd: alice@pts/0
│ │ │ ├─2431 -bash
│ │ │ ├─2689 sudo systemd-cgls
│ │ │ ├─2691 systemd-cgls
│ │ │ └─2692 less
...
│   └─user@984.service … (#3827)
│     → trusted.delegate: 1
│     → trusted.invocation_id: 09b47ce9f3124239b75814114353f3f2
│     └─init.scope (#3861)
│       ├─2058 /usr/lib/systemd/systemd --user
│       └─2099 (sd-pam)
├─init.scope (#19)
│ └─1 /usr/lib/systemd/systemd --switched-root --system --deserialize 17
└─system.slice (#53)
...
  ├─chronyd.service (#2467)
  │ → trusted.invocation_id: c0f77aaa9c7844e6bef6a6898ae4dd56
  │ └─1358 /usr/sbin/chronyd -F 2
  ├─auditd.service (#2331)
  │ → trusted.invocation_id: 756808add6a348609316c9e8c1801846
  │ └─1310 /sbin/auditd
  ├─tuned.service (#3079)
  │ → trusted.invocation_id: 2c358135fc46464d862b05550338d4f4
  │ └─1415 /usr/bin/python3 -Es /usr/sbin/tuned -l -P
  ├─systemd-journald.service (#1651)
  │ → trusted.invocation_id: 7cb7ccb14e044a899aadf47bbb583ada
  │ └─977 /usr/lib/systemd/systemd-journald
  ├─atd.service (#3623)
  │ → trusted.invocation_id: 597a7a4e5646468db407801b8562d869
  │ └─1915 /usr/sbin/atd -f
  ├─sshd.service (#3419)
  │ → trusted.invocation_id: 490504a683fc4311ab0fbeb0864a1a34
  │ └─1871 sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups
...
```

For an example of how to use `systemd` commands such as `systemctl` to manage resources, see Controlling Access to System Resources. For further technical details, see the `systemctl(1)`, `systemd-cgls(1)`, and `systemd.resource-control(5)` manual pages.

Using systemd to Manage cgroups v2

The preferred method of managing resource allocation with `cgroups v2` is to use the control group functionality provided by `systemd`.

> **Note:**
>
> For information on enabling `cgroups v2` functionality on the system, see Oracle Linux 10: Managing Kernels and System Boot

By default, `systemd` creates a `cgroup` folder for each `systemd` service set up on the host. `systemd` names these folders using the format *servicename*`.service`, where *servicename* is the name of the service associated with the folder.

To see a list of the `cgroup` folders `systemd` creates for the services, run the `ls` command on the **`system.slice`** branch of the `cgroup` file system as shown in the following sample code block:

```
ls /sys/fs/cgroup/system.slice/
...                     ...                           ...
app_service1.service    cgroup.subtree_control        httpd.service
app_service2.service    chronyd.service               ...
...                     crond.service                 ...
cgroup.controllers      dbus-broker.service           ...
cgroup.events           dtprobed.service              ...
cgroup.freeze           firewalld.service             ...
...                     gssproxy.service              ...
...                     ...                           ...
```

In the preceding command block:

- The folders *app_service1*`.service` and *app_service2*`.service` represent custom application services that might run on the system.

In addition to service control groups, `systemd` also creates a `cgroup` folder for each user on the host. To see the `cgroups` created for each user you can run the `ls` command on the **`user.slice`** branch of the `cgroup` file system as shown in the following sample code block:

```
ls /sys/fs/cgroup/user.slice/
cgroup.controllers      cgroup.subtree_control        user-1001.slice
cgroup.events           cgroup.threads                user-982.slice
cgroup.freeze           cgroup.type                   ...
...                     ...                           ...
...                     ...                           ...
...                     ...                           ...
```

In the preceding code block:

- Each user `cgroup` folder is named using the format `user-`*UID*`.slice`. So, control group `user-1001.slice` is for a user whose `UID` is 1001, for example.

`systemd` provides high-level access to the `cgroups` and kernel resource controller features so you don't have to access the file system directly. For example, to set the CPU weight of a service called *app_service1*`.service`, run the `systemctl set-property` command as follows:

```
sudo systemctl set-property app_service1.service CPUWeight=150
```

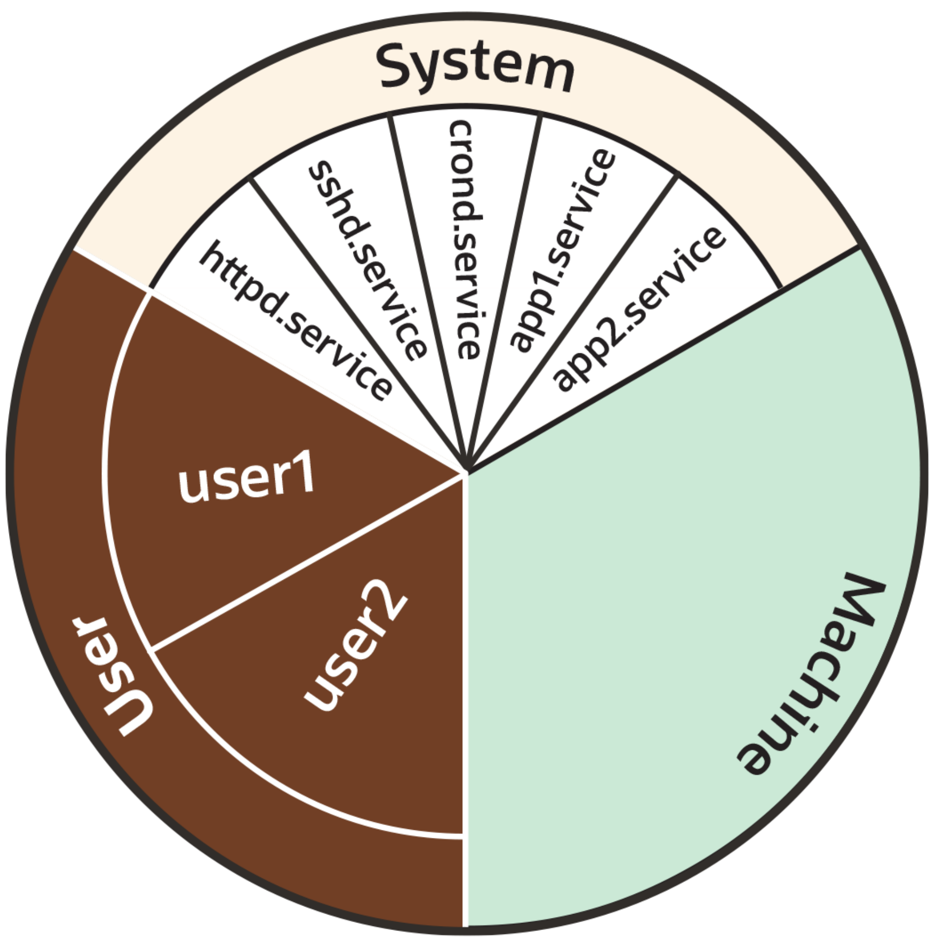
Thus, `systemd` enables you to manage resource distribution at an application level, rather than the process PID level used when configuring `cgroups` without using `systemd` functionality.

About Slices and Resource Allocation in systemd

This section looks at the way `systemd` initially divides each of the default kernel controllers, for example `CPU`, `memory` and `blkio`, into portions called "slices" as illustrated by the following example pie chart:

> **Note:**
>
> You can also create custom slices for resource distribution, as shown in section Setting Resource Controller Options and Creating Custom Slices.

Figure 8-1 Pie chart illustrating distribution in a resource controller, such as CPU or Memory



As the preceding pie chart shows, by default each resource controller is divided equally between the following 3 slices:

- System (`system.slice`).
- User (`user.slice`).
- Machine (`machine.slice`).

The following list looks at each slice more closely. For the purposes of discussion, the examples in the list focus on the CPU controller.

System (`system.slice`)
This resource slice is used for managing resource allocation amongst daemons and service units.
As shown in the preceding example pie chart, the system slice is divided into further sub-slices. For example, in the case of CPU resources, we might have sub-slice allocations within the system slice that include the following:

- `httpd.service` (`CPUWeight`=100)
- `sshd.service` (`CPUWeight` =100)
- `crond.service` (`CPUWeight` =100)
- *app1*.`service` (`CPUWeight` =100)
- *app2*.`service` (`CPUWeight` =100)

In the preceding list, *app1*.`service` and *app2*.`service` represent custom application services that might run on the system.

User (`user.slice`)
This resource slice is used for managing resource allocation amongst user sessions. A single slice is created for each `UID` irrespective of how many logins the associated user has active on the server. Continuing with our pie chart example, the sub-slices might be as follows:

- *user1* (`CPUWeight`=100, `UID`=982)
- *user2* (`CPUWeight`=100, `UID`=1001)

Machine (`machine.slice`)
This slice of the resource is used for managing resource allocation amongst hosted virtual machines, such as KVM guests, and Linux Containers. The machine slice is only present on a server if the server is hosting virtual machines or Linux Containers.

> **Note:**
>
> **Share allocations don't set a maximum limit for a resource.**
>
> In the preceding examples, the slice `user.slice` has 2 users: *user1* and *user2*. Each user is allocated an equal share of the CPU resource available to the parent `user.slice`. However, if the processes associated with *user1* are idle, and don't require any CPU resource, then its CPU share is available for allocation to *user2* if needed. In such a situation, *user2* might even be allocated the entire CPU resource apportioned to the parent `user.slice` if it's required by other users.
>
> To cap CPU resource, you would need to set the `CPUQuota` property to the required percentage.

Slices, Services, and Scopes in the cgroup Hierarchy

The pie chart analogy used in the preceding sections is a helpful way to conceptualize the division of resources into slices. However, in terms of structural organization, the control groups are arranged in a hierarchy. You can view the `systemd` control group hierarchy on the system by running the `systemd-cgls` command as follows:

> **Tip:**
>
> To see the entire `cgroup` hierarchy, starting from the root slice `-.slice`, as in the following example, ensure you run `systemd-cgls` from outside of the control group mount point `/sys/fs/cgroup/`. Otherwise, If you run the command from within `/sys/fs/cgroup/`, the output starts from the `cgroup` location from which the command was run. See `systemd-cgls(1)` for more information.

```
systemd-cgls
```

```
Control group /:
-.slice
...
├─user.slice (#1429)
│ → user.invocation_id: 604cf5ef07fa4bb4bb86993bb5ec15e0
│ ├─user-982.slice (#4131)
│ │ → user.invocation_id: 9d0d94d7b8a54bcea2498048911136c8
│ │ ├─session-c1.scope (#4437)
│ │ │ ├─2416 /usr/bin/sudo -u ocarun /usr/libexec/oracle-cloud-agent/plugins/
runcommand/runcommand
│ │ │ └─2494 /usr/libexec/oracle-cloud-agent/plugins/runcommand/runcommand
│ │ └─user@982.service … (#4199)
│ │   → user.delegate: 1
│ │   → user.invocation_id: 37c7aed7aa6e4874980b79616acf0c82
│ │   └─init.scope (#4233)
│ │     ├─2437 /usr/lib/systemd/systemd --user
│ │     └─2445 (sd-pam)
│ └─user-1001.slice (#7225)
│   → user.invocation_id: ce93ad5f5299407e9477964494df63b7
│   ├─session-2.scope (#7463)
│   │ ├─20304 sshd: oracle [priv]
│   │ ├─20404 sshd: oracle@pts/0
│   │ ├─20405 -bash
│   │ ├─20441 systemd-cgls
│   │ └─20442 less
│   └─user@1001.service … (#7293)
│     → user.delegate: 1
│     → user.invocation_id: 70284db060c1476db5f3633e5fda7fba
│     └─init.scope (#7327)
│       ├─20395 /usr/lib/systemd/systemd --user
│       └─20397 (sd-pam)
├─init.scope (#19)
│ └─1 /usr/lib/systemd/systemd --switched-root --system --deserialize 28
```

```
└─system.slice (#53)
 ...
  ├─dbus-broker.service (#2737)
  │ → user.invocation_id: 2bbe054a2c4d49809b16cb9c6552d5a6
  │ ├─1450 /usr/bin/dbus-broker-launch --scope system --audit
  │ └─1457 dbus-broker --log 4 --controller 9 --machine-id
852951209c274cfea35a953ad2964622 --max-bytes 536870912 --max-fds 4096 --max-
matches 131072 --audit
 ...
  ├─chronyd.service (#2805)
  │ → user.invocation_id: e264f67ad6114ad5afbe7929142faa4b
  │ └─1482 /usr/sbin/chronyd -F 2
  ├─auditd.service (#2601)
  │ → user.invocation_id: f7a8286921734949b73849b4642e3277
  │ ├─1421 /sbin/auditd
  │ └─1423 /usr/sbin/sedispatch
  ├─tuned.service (#3349)
  │ → user.invocation_id: fec7f73678754ed687e3910017886c5e
  │ └─1564 /usr/bin/python3 -Es /usr/sbin/tuned -l -P
  ├─systemd-journald.service (#1837)
  │ → user.invocation_id: bf7fb22ba12f44afab3054aab661aedb
  │ └─1068 /usr/lib/systemd/systemd-journald
  ├─atd.service (#3961)
  │ → user.invocation_id: 1c59679265ab492482bfdc9c02f5eec5
  │ └─2146 /usr/sbin/atd -f
  ├─sshd.service (#3757)
  │ → user.invocation_id: 57e195491341431298db233e998fb180
  │ └─2097 sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups
  ├─crond.service (#3995)
  │ → user.invocation_id: 4f5b380a53db4de5adcf23f35d638ff5
  │ └─2150 /usr/sbin/crond -n
  ...
```

The preceding sample output shows how all "`*.slice`" control groups reside under the root slice `-.slice`. Beneath the root slice you can see the `user.slice` and `system.slice` control groups, each with their own child `cgroup` sub-slices.

Examining the `systemd-cgls` command output you can see how, except for root `-.slice` , all processes are on leaf nodes. This arrangement is enforced by `cgroups` v2, in a rule called the "no internal processes" rule. See `cgroups (7)` for more information about the "no internal processes" rule.

The output in the preceding `systemd-cgls` command example also shows how slices can have descendent child control groups that are `systemd` scopes. `systemd` scopes are reviewed in the following section.

systemd Scopes

`systemd` scope is a `systemd` unit type that groups together system service worker processes that have been launched independently of `systemd`. The scope units are transient `cgroups` created programmatically using the bus interfaces of `systemd`.

For example, in the following sample code, the user with `UID` 1001 has run the `systemd-cgls` command, and the output shows `session-2.scope` has been created for processes the user has spawned independently of `systemd` (including the process for the command itself , `21380 sudo systemd-cgls`):

> **Note:**
>
> In the following example, the command has been run from within the control group mount point `/sys/fs/cgroup/`. Hence, instead of the root slice, the output starts from the `cgroup` location from which the command was run.

```
sudo systemd-cgls
```

```
Working directory /sys/fs/cgroup:
...
├─user.slice (#1429)
│ → user.invocation_id: 604cf5ef07fa4bb4bb86993bb5ec15e0
│ → trusted.invocation_id: 604cf5ef07fa4bb4bb86993bb5ec15e0
...
│ └─user-1001.slice (#7225)
│   → user.invocation_id: ce93ad5f5299407e9477964494df63b7
│   → trusted.invocation_id: ce93ad5f5299407e9477964494df63b7
│   ├─session-2.scope (#7463)
│   │ ├─20304 sshd: oracle [priv]
│   │ ├─20404 sshd: oracle@pts/0
│   │ ├─20405 -bash
│   │ ├─21380 sudo systemd-cgls
│   │ ├─21382 systemd-cgls
│   │ └─21383 less
│   └─user@1001.service … (#7293)
│     → user.delegate: 1
│     → trusted.delegate: 1
│     → user.invocation_id: 70284db060c1476db5f3633e5fda7fba
│     → trusted.invocation_id: 70284db060c1476db5f3633e5fda7fba
│     └─init.scope (#7327)
│       ├─20395 /usr/lib/systemd/systemd --user
│       └─20397 (sd-pam)
```

Setting Resource Controller Options and Creating Custom Slices

`systemd` provides the following methods for setting resource controller options, such as `CPUWeight`, `CPUQuota`, and so on, to customize resource allocation on the system:

- Using service unit files.
- Using drop-in files.
- Using the `systemctl set-property` command.

The following sections provide example procedures for using each of these methods to configure resources and slices in the system.

Using Service Unit Files

To set options in a service unit file, perform the following steps:

1. Create file `/etc/systemd/system/myservice1.service` with the following content:

```
[Service]
Type=oneshot
ExecStart=/usr/lib/systemd/generate_load.sh
TimeoutSec=0
StandardOutput=tty
RemainAfterExit=yes

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

2. The service created in the preceding step requires a bash script `/usr/lib/systemd/generate_load.sh`. Create the file with the following content:

```
#!/bin/bash
for i in {1..4};do while : ; do : ; done & done
```

3. Make the script runnable:

```
sudo chmod +x /usr/lib/systemd/generate_load.sh
```

4. Enable and start the service:

```
sudo systemctl enable myservice1 --now
```

5. Run the `systemd-cgls` command and confirm the service `myservice1` is running under `system.slice`:

```
systemd-cgls
```

```
Control group /:
-.slice
...
├─user.slice (#1429)
...
└─system.slice (#53)
  ...
  ├─myservice1.service (#7939)
  │ → user.invocation_id: e227f8f288444fed92a976d391e6a897
  │ ├─22325 /bin/bash /usr/lib/systemd/generate_load.sh
  │ ├─22326 /bin/bash /usr/lib/systemd/generate_load.sh
  │ ├─22327 /bin/bash /usr/lib/systemd/generate_load.sh
  │ └─22328 /bin/bash /usr/lib/systemd/generate_load.sh
  ├─pmie.service (#4369)
  │ → user.invocation_id: 68fcd40071594481936edf0f1d7a8e12
   ...
```

6. Create a custom slice for the service.

Add the line `Slice=my_custom_slice.slice` to the `[Service]` section in the `myservice1.service` file, created in a previous step, as shown in the following code block:

```
[Service]
Slice=my_custom_slice.slice
Type=oneshot
ExecStart=/usr/lib/systemd/generate_load.sh
TimeoutSec=0
StandardOutput=tty
RemainAfterExit=yes

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

> **NOT_SUPPORTED:**
>
> **Use underscores instead of dashes to separate terms in slice names.**
>
> In `systemd`, a dash in a slice name is a special character: in `systemd`, dashes in slice names are used to describe the full `cgroup` path to the slice (starting from the root slice). For example, if you specify a slice name as "`my-custom-slice.slice`", instead of creating a slice of that name, `systemd` creates the following `cgroups` path underneath the root slice: `my.slice/my-custom.slice/my-custom-slice.slice`.

7. After editing the file, ensure `systemd` reloads its configuration files and then restart the service:

```
sudo systemctl daemon-reload
sudo systemctl restart myservice1
```

8. Run the `systemd-cgls` command and confirm the service `myservice1` is now running under custom slice `my_custom_slice`:

```
systemd-cgls
```

```
Control group /:
-.slice
...
├─user.slice (#1429)
...
├─my_custom_slice.slice (#7973)
│ → user.invocation_id: a8a493a8db1342be85e2cdf1e80255f8
│ └─myservice1.service (#8007)
│   → user.invocation_id: 9a4a6171f2844e479d4a0f347aac38ce
│   ├─22385 /bin/bash /usr/lib/systemd/generate_load.sh
│   ├─22386 /bin/bash /usr/lib/systemd/generate_load.sh
│   ├─22387 /bin/bash /usr/lib/systemd/generate_load.sh
│   └─22388 /bin/bash /usr/lib/systemd/generate_load.sh
├─init.scope (#19)
│ └─1 /usr/lib/systemd/systemd --switched-root --system --deserialize 28
└─system.slice (#53)
```

```
├─irqbalance.service (#2907)
│ → user.invocation_id: 00d64c9b9d224f179496a83536dd60bb
│ └─1464 /usr/sbin/irqbalance --foreground
...
```

Using Drop-in Files

To use a drop-in file to configure resources, perform the following steps:

1. Create the directory for your service drop-in file.

   > **Tip:**
   >
   > The "drop-in" directory for drop-in files for a service is at `/etc/systemd/system/`*`service_name`*`.service.d` where *service_name* is the name of the service.

   Continuing with our example with service `myservice1`, we would run the following command:

   ```
   sudo mkdir -p /etc/systemd/system/myservice1.service.d/
   ```

2. Create 2 drop-in files called `00-slice.conf` and `10-CPUSettings.conf` in the `myservice1.service.d` directory created in the preceding step.

   > **Note:**
   >
   > - Multiple drop-in files with different names are applied in **lexicographic** order.
   > - These drop-in files take precedence over the service unit file.

3. Add the following contents to `00-slice.conf`

   ```
   [Service]
   Slice=my_custom_slice2.slice
   MemoryAccounting=yes
   CPUAccounting=yes
   ```

4. And add the following contents to `10-CPUSettings.conf`

   ```
   [Service]
   CPUWeight=200
   ```

5. Create a second service (`myservice2`) and assign it a different `CPUWeight` to that assigned to `myservice1`:

   a. Create file `/etc/systemd/system/myservice2.service` with the following contents:

      ```
      [Service]
      Slice=my_custom_slice2.slice
      Type=oneshot
      ```

```
ExecStart=/usr/lib/systemd/generate_load2.sh
TimeoutSec=0
StandardOutput=tty
RemainAfterExit=yes

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

b. The service created in the preceding step requires a bash script `/usr/lib/systemd/generate_load2.sh`. Create the file with the following content:

```
#!/bin/bash
for i in {1..4};do while : ; do : ; done & done
```

c. Make the script runnable:

```
sudo chmod +x /usr/lib/systemd/generate_load2.sh
```

d. Create a drop in file `/etc/systemd/system/myservice2.service.d/10-CPUSettings.conf` for myservice2 with the following contents:

```
[Service]
CPUWeight=400
```

6. Ensure `systemd` reloads its configuration files, and restart `myservice1`, and also enable and start `myservices2`:

```
sudo systemctl daemon-reload
sudo systemctl restart myservice1
sudo systemctl enable myservice2 --now
```

7. Run the `systemd-cgtop` command to display control groups ordered by their resource usage. You can see from the following sample output how, in addition to the resource usage of each slice, the `systemd-cgtop` command displays resource usage within each slice, so you can use it to confirm the CPU weight has been divided as expected.

```
systemd-cgtop
```

```
Control Group                                      Tasks   %CPU   Memory
Input/s Output/s
/                                                    228  198.8
712.5M        -        -
my_custom_slice2.slice                                 8  198.5
1.8M        -        -
my_custom_slice2.slice/myservice2.service              4  132.8
944.0K        -        -
my_custom_slice2.slice/myservice1.service              4   65.6
976.0K        -        -
user.slice                                            18    0.9
43.9M        -        -
user.slice/user-1001.slice                             6    0.9
13.7M        -        -
user.slice/user-1001.slice/session-2.scope             4    0.9
9.4M        -        -
```

```
system.slice                                           60    0.0
690.8M        -         -
```

Using systemctl set-property

The `systemctl set-property` command places the configuration files under the following location:

```
/etc/systemd/system.control
```

> **Caution:**
>
> You must not manually edit the files systemctl set-property command creates.

> **Note:**
>
> The `systemctl set-property` command doesn't recognize every resource-control property used in the system-unit and drop-in files covered earlier in this topic.

The following procedure shows how you can use the `systemctl set-property` command to configure resource allocation:

1. Continuing with our example, create another service file at location `/etc/systemd/system/myservice3.service` with the following content:

   ```
   [Service]
   Type=oneshot
   ExecStart=/usr/lib/systemd/generate_load3.sh
   TimeoutSec=0
   StandardOutput=tty
   RemainAfterExit=yes
   [Install]
   WantedBy=multi-user.target
   ```

2. Set the slice for the service to be `my_custom_slice2` (the same slice used by the services created in from earlier steps) by adding the following line to the `[Service]` section in the `myservice3.service` file:

   ```
   Slice=my_custom_slice2.slice
   ```

   > **Note:**
   >
   > The slice must be set in the service-unit file because the `systemctl set-property` command doesn't recognize the `Slice` property.

3. The service created in the preceding step requires a bash script `/usr/lib/systemd/generate_load3.sh`. Create the file with the following content:

```
#!/bin/bash
for i in {1..4};do while : ; do : ; done & done
```

4. Make the script runnable:

```
sudo chmod +x /usr/lib/systemd/generate_load3.sh
```

5. Ensure systemd reloads its configuration files, and then enable and start the service:

```
sudo systemctl daemon-reload
sudo systemctl enable myservice3 --now
```

6. Run `systemd-cgtop` to confirm all 3 services, `myservice1`, `myservice2`, and `myservice3`, are all running in the same slice.
7. Use `systemctl set-property` command to set the `CPUWeight` for `myservice3` to 800:

```
sudo systemctl set-property myservice3.service CPUWeight=800
```

8. Confirm that a drop-in file has been created for you under `/etc/systemd/system.control/myservice3.service.d`. However, you must not edit the file:

```
cat /etc/systemd/system.control/myservice3.service.d/50-CPUWeight.conf


# This is a drop-in unit file extension, created via "systemctl set-
property"
# or an equivalent operation. Do not edit.
[Service]
CPUWeight=800
```

9. Ensure `systemd` reloads its configuration files, and restart all the services:

```
sudo systemctl daemon-reload
sudo systemctl restart myservice1
sudo systemctl restart myservice2
sudo systemctl restart myservice3
```

10. Run the `systemd-cgtop` command to confirm the CPU weight has been divided as expected:

```
systemd-cgtop


Control Group                                          Tasks   %CPU
Memory  Input/s Output/s
/                                                        235  200.0
706.1M        -        -
my_custom_slice2.slice                                    12  198.4
2.9M        -        -
my_custom_slice2.slice/myservice3.service                  4  112.7
976.0K        -        -
```

```
my_custom_slice2.slice/myservice2.service                4    56.9
996.0K        -        -
my_custom_slice2.slice/myservice1.service                4    28.8
988.0K        -        -
user.slice                                              18     0.9
44.1M        -        -
user.slice/user-1001.slice                               6     0.9
13.9M        -        -
user.slice/user-1001.slice/session-2.scope               4     0.9
9.5M        -        -
```