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RH12412 - Service and Daemon Management

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Systemd

The boot systems prior to Systemd, **SysVinit** and **Upstart**, were **sequential** boot systems.

Systemd, on the other hand, tries to start as many services in parallel as possible. This is possible because most modern hardware architectures are multi-core. If a service depends on another that has not yet been started, the former is put on hold in a buffer. What's more, services that are not

needed to start at boot time, such as cups, are only started later if necessary. During startup, partitions are mounted in parallel. Recently, **Systemd** has replaced traditional boot scripts with compiled binaries, which are much faster than their predecessors.

Instead of talking about boot scripts and execution levels, **Systemd** uses the terminology **Units** and **Targets**. A Unit can be :

- **.automount** - enables the automount feature.
- **.device** - exposes a device in systemd.
- **.mount** - controls when and how file systems are mounted.
- **.path** - activates a service when there is access to a file or directory monitored by the system.
- **.service** - starts, stops, restarts or reloads a service.
- **scope** - manages services.
- **.slice** - groups Units in a tree to limit resources using CGroups.
- **.snapshot** - a saved state of the Systemd manager.
- **.socket** - allows Units to use sockets for inter-process communication.
- **swap** - encapsulates a device or swap file.
- **.timer** - triggers the activation of other Units using Systemd timers.
- **.target** - groups multiple Units together so that they can be started at the same time. For example **network.target** groups together all the Units needed to start all the network interfaces at the same time.

A Target is a sort of **large step** in booting the system:

- **halt.target** - stops the system.
- **poweroff.target** - stops the system and cuts the power.
- **shutdown.target** - shuts down the system.
- **rescue.target** - starts the system in single-user mode (only root can connect). All file systems are mounted but the network is not booted.
- **emergency.target** - boots the system in single-user mode (only root can connect). Only the root file system is mounted in read-only mode. The network is not started.
- **multi-user.target** - starts the system in multi-user mode with all file systems mounted and the network service started.
- **graphic.target** - starts the system in multi-user.target then starts the graphical interface.
- **hibernate.target** - saves the current state to disk and stops the system. When the system is rebooted, the state is restored.
- **reboot.target** - restarts the system.

Systemd uses Targets in a similar way to how **SysVinit** uses runlevels. To make the transition easier, there are **Targets** which 'simulate' the run levels of **SysVinit** :

```
[root@redhat9 ~]# ls -l /usr/lib/systemd/system/runlevel*
lrwxrwxrwx. 1 root root 15 Jul 18 13:00 /usr/lib/systemd/system/runlevel0.target -> poweroff.target
lrwxrwxrwx. 1 root root 13 Jul 18 13:00 /usr/lib/systemd/system/runlevel1.target -> rescue.target
lrwxrwxrwx. 1 root root 17 Jul 18 13:00 /usr/lib/systemd/system/runlevel2.target -> multi-user.target
lrwxrwxrwx. 1 root root 17 Jul 18 13:00 /usr/lib/systemd/system/runlevel3.target -> multi-user.target
lrwxrwxrwx. 1 root root 17 Jul 18 13:00 /usr/lib/systemd/system/runlevel4.target -> multi-user.target
lrwxrwxrwx. 1 root root 16 Jul 18 13:00 /usr/lib/systemd/system/runlevel5.target -> graphical.target
lrwxrwxrwx. 1 root root 13 Jul 18 13:00 /usr/lib/systemd/system/runlevel6.target -> reboot.target

/usr/lib/systemd/system/runlevel1.target.wants:
total 0

/usr/lib/systemd/system/runlevel2.target.wants:
total 0

/usr/lib/systemd/system/runlevel3.target.wants:
total 0

/usr/lib/systemd/system/runlevel4.target.wants:
total 0

/usr/lib/systemd/system/runlevel5.target.wants:
total 0
```

LAB #1 - The systemctl command

To view the list of Units, use the **systemctl** command with the **list-units** option:

```
[root@redhat9 ~]# systemctl list-units
UNIT                                     LOAD
ACTIVE SUB      DESCRIPTION               >
proc-sys-fs-binfmt_misc.automount        loaded
```

```
active running  Arbitrary Executable File Formats File Syst>
  sys-devices-pci0000:00-0000:00:01.1-ata2-host2-target2:0:0-2:0:0:0-block-sr0.device           loaded
active plugged  QEMU_DVD-ROM
  sys-devices-pci0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0:0-block-sda-sda1.device loaded
active plugged  QEMU_HARDDISK 1
  sys-devices-pci0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0:0-block-sda-sda2.device loaded
active plugged  QEMU_HARDDISK 2
  sys-devices-pci0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0:0-block-sda.device      loaded
active plugged  QEMU_HARDDISK
  sys-devices-pci0000:00-0000:00:12.0-virtio1-net-ens18.device                                loaded
active plugged  Virtio network device
  sys-devices-platform-serial8250-tty-ttyS0.device                                         loaded
active plugged  /sys/devices/platform/serial8250/tty/ttyS0
  sys-devices-platform-serial8250-tty-ttyS1.device                                         loaded
active plugged  /sys/devices/platform/serial8250/tty/ttyS1
  sys-devices-platform-serial8250-tty-ttyS2.device                                         loaded
active plugged  /sys/devices/platform/serial8250/tty/ttyS2
  sys-devices-platform-serial8250-tty-ttyS3.device                                         loaded
active plugged  /sys/devices/platform/serial8250/tty/ttyS3
  sys-devices-virtual-block-dm\x2d0.device                                         loaded
active plugged  /sys/devices/virtual/block/dm-0
  sys-devices-virtual-block-dm\x2d1.device                                         loaded
active plugged  /sys/devices/virtual/block/dm-1
  sys-devices-virtual-misc-rfkill.device                                         loaded
active plugged  /sys/devices/virtual/misc/rfkill
  sys-module-configfs.device                                         loaded
active plugged  /sys/module/configfs
  sys-module-fuse.device                                         loaded
active plugged  /sys/module/fuse
  sys-subsystem-net-devices-ens18.device                                         loaded
active plugged  Virtio network device
  -.mount
active mounted  Root Mount
  boot.mount                                         loaded
```

```
active mounted /boot
  dev-hugepages.mount
                                loaded
active mounted Huge Pages File System
  dev-mqueue.mount
                                loaded
active mounted POSIX Message Queue File System
  proc-sys-fs-binfmt_misc.mount
                                loaded
active mounted Arbitrary Executable File Formats File Syst>
  run-credentials-systemd\x2dsysctl.service.mount
                                loaded
active mounted /run/credentials/systemd-sysctl.service
  run-credentials-systemd\x2dtmpfiles\x2dsetup.service.mount
                                loaded
active mounted /run/credentials/systemd-tmpfiles-setup.ser>
  run-credentials-systemd\x2dtmpfiles\x2dsetup\x2ddev.service.mount
                                loaded
active mounted /run/credentials/systemd-tmpfiles-setup-dev>
  run-user-1000.mount
                                loaded
active mounted /run/user/1000
  run-user-42.mount
                                loaded
active mounted /run/user/42
  sys-fs-fuse-connections.mount
                                loaded
active mounted FUSE Control File System
  sys-kernel-config.mount
                                loaded
active mounted Kernel Configuration File System
  sys-kernel-debug-tracing.mount
                                loaded
active mounted /sys/kernel/debug/tracing
  sys-kernel-debug.mount
                                loaded
active mounted Kernel Debug File System
  sys-kernel-tracing.mount
                                loaded
active mounted Kernel Trace File System >
  cups.path
                                loaded
active running CUPS Scheduler
  systemd-ask-password-plymouth.path
                                loaded
active waiting Forward Password Requests to Plymouth Direc>
  systemd-ask-password-wall.path
                                loaded
active waiting Forward Password Requests to Wall Directory>
  init.scope
                                loaded
```

```
active running  System and Service Manager
  session-4.scope
                                         loaded
active running  Session 4 of User trainee
lines 1-37...skipping...
  UNIT
                                         LOAD
ACTIVE SUB      DESCRIPTION
  proc-sys-fs-binfmt_misc.automount
                                         loaded
active running  Arbitrary Executable File Formats File System Automount Point
  sys-devices-pci0000:00-0000:00:01.1-ata2-host2-target2:0:0-2:0:0:0-block-sr0.device
                                         loaded
active plugged  QEMU_DVD-ROM
  sys-devices-pci0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0:0-block-sda-sd1.device
                                         loaded
active plugged  QEMU_HARDDISK 1
  sys-devices-pci0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0:0-block-sda-sd2.device
                                         loaded
active plugged  QEMU_HARDDISK 2
  sys-devices-pci0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0:0-block-sda.device
                                         loaded
active plugged  QEMU_HARDDISK
  sys-devices-pci0000:00-0000:00:12.0-virtio1-net-ens18.device
                                         loaded
active plugged  Virtio network device
  sys-devices-platform-serial8250-tty-ttyS0.device
                                         loaded
active plugged  /sys/devices/platform/serial8250/tty/ttyS0
  sys-devices-platform-serial8250-tty-ttyS1.device
                                         loaded
active plugged  /sys/devices/platform/serial8250/tty/ttyS1
  sys-devices-platform-serial8250-tty-ttyS2.device
                                         loaded
active plugged  /sys/devices/platform/serial8250/tty/ttyS2
  sys-devices-platform-serial8250-tty-ttyS3.device
                                         loaded
active plugged  /sys/devices/platform/serial8250/tty/ttyS3
  sys-devices-virtual-block-dm\x2d0.device
                                         loaded
active plugged  /sys/devices/virtual/block/dm-0
  sys-devices-virtual-block-dm\x2d1.device
                                         loaded
active plugged  /sys/devices/virtual/block/dm-1
  sys-devices-virtual-misc-rfkill.device
                                         loaded
active plugged  /sys/devices/virtual/misc/rfkill
  sys-module-configfs.device
                                         loaded
active plugged  /sys/module/configfs
```

```
  sys-module-fuse.device                                     loaded
active plugged   /sys/module/fuse
  sys-subsystem-net-devices-ens18.device                   loaded
active plugged   Virtio network device
    -.mount
active mounted   Root Mount
  boot.mount
active mounted   /boot
  dev-hugepages.mount
active mounted   Huge Pages File System
  dev-mqueue.mount
active mounted   POSIX Message Queue File System
  proc-sys-fs-binfmt_misc.mount
active mounted   Arbitrary Executable File Formats File System
  run-credentials-systemd\x2dsysctl.service.mount
active mounted   /run/credentials/systemd-sysctl.service
  run-credentials-systemd\x2dtmpfiles\x2dsetup.service.mount
active mounted   /run/credentials/systemd-tmpfiles-setup.service
  run-credentials-systemd\x2dtmpfiles\x2dsetup\x2ddev.service.mount
active mounted   /run/credentials/systemd-tmpfiles-setup-dev.service
  run-user-1000.mount
active mounted   /run/user/1000
  run-user-42.mount
active mounted   /run/user/42
  sys-fs-fuse-connections.mount
active mounted   FUSE Control File System
  sys-kernel-config.mount
active mounted   Kernel Configuration File System
  sys-kernel-debug-tracing.mount
active mounted   /sys/kernel/debug/tracing
  sys-kernel-debug.mount
active mounted   Kernel Debug File System
  sys-kernel-tracing.mount
active mounted   Kernel Trace File System
```

cups.path	loaded
active running CUPS Scheduler	
systemd-ask-password-plymouth.path	loaded
active waiting Forward Password Requests to Plymouth Directory Watch	
systemd-ask-password-wall.path	loaded
active waiting Forward Password Requests to Wall Directory Watch	
init.scope	loaded
active running System and Service Manager	
session-4.scope	loaded
active running Session 4 of User trainee	
session-c1.scope	loaded
active running Session c1 of User gdm	
accounts-daemon.service	loaded
active running Accounts Service	
atd.service	loaded
active running Deferred execution scheduler	
auditd.service	loaded
active running Security Auditing Service	
avahi-daemon.service	loaded
active running Avahi mDNS/DNS-SD Stack	
colord.service	loaded
active running Manage, Install and Generate Color Profiles	
crond.service	loaded
active running Command Scheduler	
cups.service	loaded
active running CUPS Scheduler	
dbus-broker.service	loaded
active running D-Bus System Message Bus	
dracut-shutdown.service	loaded
active exited Restore /run/initramfs on shutdown	
firewalld.service	loaded
active running firewalld - dynamic firewall daemon	
gdm.service	loaded
active running GNOME Display Manager	

irqbalance.service	loaded
active running irqbalance daemon	
iscsi.service	loaded
active exited Login and scanning of iSCSI devices	
kdump.service	loaded
active exited Crash recovery kernel arming	
kmod-static-nodes.service	loaded
active exited Create List of Static Device Nodes	
libstoragemgmt.service	loaded
active running libstoragemgmt plug-in server daemon	
lvm2-monitor.service	loaded
active exited Monitoring of LVM2 mirrors, snapshots etc. using dmeventd or progress polling	
lines 1-55	

To view the list of inactive units, use the following command:

```
[root@redhat9 ~]# systemctl list-units --all | grep inactive | more
● boot.automount
not-found inactive dead      boot.automount
● home.mount
not-found inactive dead      home.mount
● sysroot.mount
not-found inactive dead      sysroot.mount
tmp.mount
loaded   inactive dead      Temporary Directory /tmp
● var.mount
not-found inactive dead      var.mount
  systemd-ask-password-console.path
loaded   inactive dead      Dispatch Password Requests to Console Directory Watch
  alsa-restore.service
loaded   inactive dead      Save/Restore Sound Card State
  alsa-state.service
loaded   inactive dead      Manage Sound Card State (restore and store)
● auto-cpufreq.service
```

not-found inactive dead ● autofs.service	auto-cpufreq.service
not-found inactive dead blk-availability.service	autofs.service
loaded inactive dead cpupower.service	Availability of block devices
loaded inactive dead dm-event.service	Configure CPU power related settings
loaded inactive dead dnf-makecache.service	Device-mapper event daemon
loaded inactive dead dracut-cmdline.service	dnf makecache
loaded inactive dead dracut-initqueue.service	dracut cmdline hook
loaded inactive dead dracut-mount.service	dracut initqueue hook
loaded inactive dead dracut-pre-mount.service	dracut mount hook
loaded inactive dead dracut-pre-pivot.service	dracut pre-mount hook
loaded inactive dead dracut-pre-trigger.service	dracut pre-pivot and cleanup hook
loaded inactive dead dracut-pre-udev.service	dracut pre-trigger hook
loaded inactive dead dracut-shutdown-onfailure.service	dracut pre-udev hook
loaded inactive dead ● ebttables.service	Service executing upon dracut-shutdown failure to perform cleanup
not-found inactive dead emergency.service	ebtables.service
loaded inactive dead ● fcoe.service	Emergency Shell
not-found inactive dead getty@tty1.service	fcoe.service

```
loaded    inactive dead      Getty on tty1
         initrd-cleanup.service
loaded    inactive dead      Cleaning Up and Shutting Down Daemons
         initrd-parse-etc.service
loaded    inactive dead      Mountpoints Configured in the Real Root
         initrd-switch-root.service
loaded    inactive dead      Switch Root
         initrd-udevadm-cleanup-db.service
loaded    inactive dead      Cleanup udev Database
         insights-client-boot.service
loaded    inactive dead      Run Insights Client at boot
● ip6tables.service
not-found inactive dead    ip6tables.service
● ipset.service
not-found inactive dead    ipset.service
● iptables.service
not-found inactive dead    iptables.service
         iscsi-init.service
loaded    inactive dead      One time configuration for iscsi.service
         iscsi-onboot.service
loaded    inactive dead      Special handling of early boot iSCSI sessions
         iscsi-shutdown.service
loaded    inactive dead      Logout off all iSCSI sessions on shutdown
         iscsi-starter.service
loaded    inactive dead    iscsid.service
         iscsiuio.service
loaded    inactive dead    Open-iSCSI
         ldconfig.service
loaded    inactive dead    iSCSI UserSpace I/O driver
         logrotate.service
loaded    inactive dead    Rebuild Dynamic Linker Cache
         low-memory-monitor.service
loaded    inactive dead    Rotate log files
```

```
loaded    inactive dead      Low Memory Monitor
● lvm2-activation-early.service
not-found inactive dead      lvm2-activation-early.service
  lvm2-lvmpolld.service
loaded    inactive dead      LVM2 poll daemon
  mdmonitor.service
loaded    inactive dead      Software RAID monitoring and management
  microcode.service
loaded    inactive dead      Load CPU microcode update
  mlocate-updatedb.service
loaded    inactive dead      Update a database for mlocate
  modprobe@configfs.service
loaded    inactive dead      Load Kernel Module configfs
  modprobe@drm.service
loaded    inactive dead      Load Kernel Module drm
  modprobe@fuse.service
loaded    inactive dead      Load Kernel Module fuse
  multipathd.service
loaded    inactive dead      Device-Mapper Multipath Device Controller
● network.service
not-found inactive dead      network.service
  nftables.service
loaded    inactive dead      Netfilter Tables
● nslcd.service
not-found inactive dead      nslcd.service
--More--
[q]
```

The black dots at the beginning of some lines in the output above are actually white dots on the screen. These dots imply that the specified service, target or unit has not been found on the system. For example :

```
[root@redhat9 ~]# systemctl status network
Unit network.service could not be found.
```

To view the list of Units and their status, use the following command:

```
[root@redhat9 ~]# systemctl list-unit-files | more
```

UNIT FILE	STATE	PRESET
proc-sys-fs-binfmt_misc.automount	static	-
- .mount	generated	-
boot.mount	generated	-
dev-hugepages.mount	static	-
dev-mqueue.mount	static	-
proc-sys-fs-binfmt_misc.mount	disabled	disabled
run-vmblock\x2dfuse.mount	disabled	disabled
sys-fs-fuse-connections.mount	static	-
sys-kernel-config.mount	static	-
sys-kernel-debug.mount	static	-
sys-kernel-tracing.mount	static	-
tmp.mount	disabled	disabled
cups.path	enabled	enabled
insights-client-results.path	disabled	disabled
ostree-finalize-staged.path	disabled	disabled
systemd-ask-password-console.path	static	-
systemd-ask-password-plymouth.path	static	-
systemd-ask-password-wall.path	static	-
session-4.scope	transient	-
session-c1.scope	transient	-
accounts-daemon.service	enabled	enabled
alsa-restore.service	static	-
alsa-state.service	static	-
arp-ethers.service	disabled	disabled
atd.service	enabled	enabled
auditd.service	enabled	enabled
autovt@.service	alias	-
avahi-daemon.service	enabled	enabled
blk-availability.service	disabled	disabled
bluetooth.service	enabled	enabled

bolt.service	static	-
brltty.service	disabled	disabled
canberra-system-bootup.service	disabled	disabled
canberra-system-shutdown-reboot.service	disabled	disabled
canberra-system-shutdown.service	disabled	disabled
chrony-wait.service	disabled	disabled
chronyd-restricted.service	disabled	disabled
chronyd.service	disabled	enabled
cni-dhcp.service	disabled	disabled
cockpit-motd.service	static	-
cockpit-wsinstance-http.service	static	-
cockpit-wsinstance-https-factory@.service	static	-
cockpit-wsinstance-https@.service	static	-
cockpit.service	static	-
colord.service	static	-
configure-printer@.service	static	-
console-getty.service	disabled	disabled
container-getty@.service	static	-
cpupower.service	disabled	disabled
crond.service	enabled	enabled
cups-browsed.service	disabled	disabled
cups.service	enabled	enabled
dbus-broker.service	enabled	enabled
dbus-daemon.service	disabled	disabled

--More--
[q]

To view Units of a specific type, use the **-t** option:

```
[root@redhat9 ~]# systemctl list-unit-files -t mount
UNIT FILE                      STATE    PRESET
-.mount                         generated -
boot.mount                       generated -
dev-hugepages.mount              static   -
```

```
dev-mqueue.mount           static  -
proc-sys-fs-binfmt_misc.mount disabled disabled
run-vmblock\x2dfuse.mount   disabled disabled
sys-fs-fuse-connections.mount static  -
sys-kernel-config.mount    static  -
sys-kernel-debug.mount     static  -
sys-kernel-tracing.mount  static  -
tmp.mount                  disabled disabled
```

11 unit files listed.

In the STATE column we see the words **static** and **generated**.

- STATE = **static**
 - This means that the Unit cannot be started or stopped by the administrator. Starting and stopping such a Unit is done by the system. As a general rule, Units with STATE = static are dependencies of other Units.
- STATE = **generated**
 - This implies that the file was generated automatically using the information in the **/etc/fstab** file when the system was started. In the case of a mount point, the executable responsible for generating the file is **/lib/systemd/system-generators/systemd-fstab-generator** :

```
[root@redhat9 ~]# ls -l /lib/systemd/system-generators/systemd-fstab-generator
-rwxr-xr-x. 1 root root 57696 Jul 18 13:01 /lib/systemd/system-generators/systemd-fstab-generator
```

There are also other executables responsible for generating other files:

```
[root@redhat9 ~]# ls -l /lib/systemd/system-generators
total 396
-rwxr-xr-x. 1 root root  541 Jul 24 06:08 kdump-dep-generator.sh
-rwxr-xr-x. 1 root root 15832 May 17 18:27 ostree-system-generator
lrwxrwxrwx. 1 root root   31 Aug  8 10:54 podman-system-generator -> ../../libexec/podman/quadlet
-rwxr-xr-x. 1 root root 1005 Feb 19 2024 selinux-autorelabel-generator.sh
-rwxr-xr-x. 1 root root 15624 Jul 18 13:01 systemd-bless-boot-generator
-rwxr-xr-x. 1 root root 40920 Jul 18 13:01 systemd-cryptsetup-generator
-rwxr-xr-x. 1 root root 24312 Jul 18 13:01 systemd-debug-generator
```

```
-rwxr-xr-x. 1 root root 57696 Jul 18 13:01 systemd-fstab-generator  
-rwxr-xr-x. 1 root root 24096 Jul 18 13:01 systemd-getty-generator  
-rwxr-xr-x. 1 root root 36496 Jul 18 13:01 systemd-gpt-auto-generator  
-rwxr-xr-x. 1 root root 16096 Jul 18 13:01 systemd-hibernate-resume-generator  
-rwxr-xr-x. 1 root root 24240 Jul 18 13:01 systemd-integritysetup-generator  
-rwxr-xr-x. 1 root root 15632 Jul 18 13:01 systemd-rc-local-generator  
-rwxr-xr-x. 1 root root 24296 Jul 18 13:01 systemd-run-generator  
-rwxr-xr-x. 1 root root 15824 Jul 18 13:01 systemd-system-update-generator  
-rwxr-xr-x. 1 root root 36424 Jul 18 13:01 systemd-sysv-generator  
-rwxr-xr-x. 1 root root 36872 Jul 18 13:01 systemd-veritysetup-generator
```

The command line switches for the **systemctl** command are :

```
[root@redhat9 ~]# systemctl --help  
systemctl [OPTIONS...] COMMAND ...
```

Query or send control commands to the system manager.

Unit Commands:

list-units [PATTERN...]	List units currently in memory
list-automounts [PATTERN...]	List automount units currently in memory, ordered by path
list-sockets [PATTERN...]	List socket units currently in memory, ordered by address
list-timers [PATTERN...]	List timer units currently in memory, ordered by next elapse
is-active PATTERN...	Check whether units are active
is-failed PATTERN...	Check whether units are failed
status [PATTERN... PID...]	Show runtime status of one or more units
show [PATTERN... JOB...]	Show properties of one or more units/jobs or the manager
cat PATTERN...	Show files and drop-ins of specified units
help PATTERN... PID...	Show manual for one or more units
list-dependencies [UNIT...]	Recursively show units which are required

	or wanted by the units or by which those units are required or wanted
start UNIT...	Start (activate) one or more units
stop UNIT...	Stop (deactivate) one or more units
reload UNIT...	Reload one or more units
restart UNIT...	Start or restart one or more units
try-restart UNIT...	Restart one or more units if active
reload-or-restart UNIT...	Reload one or more units if possible, otherwise start or restart
try-reload-or-restart UNIT...	If active, reload one or more units, if supported, otherwise restart
isolate UNIT	Start one unit and stop all others
kill UNIT...	Send signal to processes of a unit
clean UNIT...	Clean runtime, cache, state, logs or configuration of unit
freeze PATTERN...	Freeze execution of unit processes
thaw PATTERN...	Resume execution of a frozen unit
set-property UNIT PROPERTY=VALUE...	Sets one or more properties of a unit
bind UNIT PATH [PATH]	Bind-mount a path from the host into a unit's namespace
mount-image UNIT PATH [PATH [OPTS]]	Mount an image from the host into a unit's namespace
service-log-level SERVICE [LEVEL]	Get/set logging threshold for service
service-log-target SERVICE [TARGET]	Get/set logging target for service
reset-failed [PATTERN...]	Reset failed state for all, one, or more units

Unit File Commands:

list-unit-files [PATTERN...]	List installed unit files
enable [UNIT... PATH...]	Enable one or more unit files
disable UNIT...	Disable one or more unit files
reenable UNIT...	Reenable one or more unit files
preset UNIT...	Enable/disable one or more unit files based on preset configuration
preset-all	Enable/disable all unit files based on

```
lines 1-55
```

preset configuration

LAB #2 - Configuration files

2.1 - Default Configuration Files

Target configuration files and Unit configuration files installed by packages are located in the **/usr/lib/systemd/system** directory:

```
[root@redhat9 ~]# pkg-config systemd --variable=systemdsystemunitdir  
/usr/lib/systemd/system
```

```
[root@redhat9 ~]# ls -l /usr/lib/systemd/system | more  
total 1584  
-rw-r--r--. 1 root root 729 Feb 24 2022 accounts-daemon.service  
-rw-r--r--. 1 root root 480 Jan 16 2024 alsa-restore.service  
-rw-r--r--. 1 root root 465 Jan 16 2024 alsa-state.service  
-rw-r--r--. 1 root root 275 Aug 10 2021 arp-ethers.service  
-rw-r--r--. 1 root root 274 Apr 4 2022 atd.service  
-rw-r--r--. 1 root root 1771 Nov 8 2023 auditd.service  
lrwxrwxrwx. 1 root root 14 Jul 18 13:00 autovt@.service -> getty@.service  
-rw-r--r--. 1 root root 1044 Nov 8 2023 avahi-daemon.service  
-rw-r--r--. 1 root root 870 Nov 8 2023 avahi-daemon.socket  
-rw-r--r--. 1 root root 964 Jul 18 13:00 basic.target  
drwxr-xr-x. 2 root root 6 Jul 18 13:00 basic.target.wants  
-r--r--r--. 1 root root 384 Feb 3 2024 blk-availability.service  
-rw-r--r--. 1 root root 449 Oct 31 2022 blockdev@.target  
-rw-r--r--. 1 root root 707 Jun 14 2022 bluetooth.service  
-rw-r--r--. 1 root root 435 Oct 31 2022 bluetooth.target  
-rw-r--r--. 1 root root 642 Jan 16 2023 bolt.service  
-rw-r--r--. 1 root root 463 Oct 31 2022 boot-complete.target  
-rw-r--r--. 1 root root 217 Aug 9 2021 brltty.service
```

```
-rw-r--r--. 1 root root 491 Jul 13 2023 canberra-system-bootup.service
-rw-r--r--. 1 root root 509 Jul 13 2023 canberra-system-shutdown-reboot.service
-rw-r--r--. 1 root root 466 Jul 13 2023 canberra-system-shutdown.service
-rw-r--r--. 1 root root 1811 Jan 23 2024 chronyd-restricted.service
-rw-r--r--. 1 root root 1468 Jan 23 2024 chronyd.service
-rw-r--r--. 1 root root 1082 Jan 23 2024 chrony-wait.service
-rw-r--r--. 1 root root 277 Jul 23 09:37 cni-dhcp.service
-rw-r--r--. 1 root root 302 Dec 4 2023 cni-dhcp.socket
-rw-r--r--. 1 root root 222 Apr 2 05:45 cockpit-motd.service
-rw-r--r--. 1 root root 720 Apr 2 05:45 cockpit.service
-rw-r--r--. 1 root root 349 Apr 2 05:45 cockpit.socket
-rw-r--r--. 1 root root 221 Apr 2 05:45 cockpit-wsinstance-http.service
-rw-r--r--. 1 root root 165 Apr 2 05:45 cockpit-wsinstance-https-factory@.service
-rw-r--r--. 1 root root 244 Apr 2 05:45 cockpit-wsinstance-https-factory.socket
-rw-r--r--. 1 root root 215 Apr 2 05:45 cockpit-wsinstance-http.socket
-rw-r--r--. 1 root root 264 Apr 2 05:45 cockpit-wsinstance-https@.service
-rw-r--r--. 1 root root 478 Apr 2 05:45 cockpit-wsinstance-https@.socket
-rw-r--r--. 1 root root 295 Aug 9 2021 colord.service
-rw-r--r--. 1 root root 154 Aug 11 2021 configure-printer@.service
-rw-r--r--. 1 root root 1102 Jul 18 13:00 console-getty.service
-rw-r--r--. 1 root root 1254 Jul 18 13:00 container-getty@.service
-rw-r--r--. 1 root root 294 Sep 13 18:49 cpupower.service
-rw-r--r--. 1 root root 371 Nov 30 2023 crond.service
-rw-r--r--. 1 root root 473 Oct 31 2022 cryptsetup-pre.target
-rw-r--r--. 1 root root 420 Oct 31 2022 cryptsetup.target
lrwxrwxrwx. 1 root root 13 Jul 18 13:00 ctrl-alt-del.target -> reboot.target
-rw-r--r--. 1 root root 234 Jan 7 2021 cups-browsed.service
-rw-r--r--. 1 root root 142 Jun 19 11:00 cups.path
-rw-r--r--. 1 root root 298 Jun 19 11:00 cups.service
drwxr-xr-x. 2 root root 25 Sep 25 12:03 cups.service.d
-rw-r--r--. 1 root root 148 Jun 19 11:00 cups.socket
-rw-r--r--. 1 root root 529 Aug 23 2022 dbus-broker.service
-rw-r--r--. 1 root root 560 Jun 12 2023 dbus-daemon.service
lrwxrwxrwx. 1 root root 25 Jul 18 13:00 dbus-org.freedesktop.hostname1.service -> systemd-hostnamed.service
```

```
lrwxrwxrwx. 1 root root 23 Jul 18 13:00 dbus-org.freedesktop.locale1.service -> systemd-located.service  
lrwxrwxrwx. 1 root root 22 Jul 18 13:00 dbus-org.freedesktop.login1.service -> systemd-logind.service  
--More--  
[q]
```

Some configuration files are created on the fly in the **/run/systemd/system** directory during runtime and then destroyed when the system no longer needs them:

```
[root@redhat9 ~]# ls -l /run/systemd/system/  
total 0
```

Unit configuration files created by users must be placed in the **/usr/lib/systemd/user** directory:

```
[root@redhat9 ~]# pkg-config systemd --variable=systemduserunitdir  
/usr/lib/systemd/user
```

Important: This way the files in **/usr/lib/systemd/user** override the files in the **/run/systemd/system** directory which override the files in the **/usr/lib/systemd/system** directory.

Let's take the case of the **sshd** service, which is configured by the **/usr/lib/systemd/system/sshd.service** file:

```
[root@redhat9 ~]# cat /usr/lib/systemd/system/sshd.service  
[Unit]  
Description=OpenSSH server daemon  
Documentation=man:sshd(8) man:sshd_config(5)  
After=network.target sshd-keygen.target  
Wants=sshd-keygen.target  
  
[Service]  
Type=notify
```

```
EnvironmentFile=-/etc/sysconfig/sshd
ExecStart=/usr/sbin/sshd -D $OPTIONS
ExecReload=/bin/kill -HUP $MAINPID
KillMode=process
Restart=on-failure
RestartSec=42s

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

The file contains the following lines in the **[Unit]** section:

- **Description=OpenSSH server daemon,**
 - This directive is used to give a short description of the Unit's functionality,
- **Documentation=man:sshd(8) man:sshd_config(5),**
 - This directive specifies the manual chapters and URLs containing information relating to the Unit,
- **After=network.target sshd-keygen.target,**
 - This directive specifies targets that should be reached and units that should be started before the sshd unit. However, this directive does not specify a dependency,
- **Wants=sshd-keygen.target,**
 - This directive specifies a soft dependency. In other words, Systemd will try to start the **sshd-keygen.target** unit, but if this fails, the sshd unit will be started regardless.

The file also contains the following lines in the **[Service]** section:

- **Type=notify,**
 - This directive indicates that the service will inform Systemd when it has finished starting,
- **ExecStart=/usr/sbin/sshd -D \$OPTIONS,**
 - This directive specifies the executable to start,
- **ExecReload=/bin/kill -HUP \$MAINPID,**
 - This directive specifies the command needed to restart the service,
- **KillMode=process,**
 - This directive is used to specify how processes in the service should be stopped. The value of **process** implies the use of SIGTERM followed by SIGHUP,

- **Restart=on-failure,**
 - This line indicates that the service must be restarted if it is stopped.
- **RestartSec=42s,**
 - This directive specifies the time to wait between the service being stopped and Systemd restarting it,

Finally, we note the presence of the following line in the **[Install]** section:

- **WantedBy=multi-user.target,**
 - This directive indicates the Target in which the service should be started. The presence of this directive creates a symbolic link in the **/etc/systemd/system/multi-user.target.wants** directory which points to this file.

To view **all** the configuration directives and their values for a Unit, use the **systemctl show** command, specifying the Unit concerned:

```
[root@redhat9 ~]# systemctl show sshd
Type=notify
ExitType=main
Restart=on-failure
NotifyAccess=main
RestartUSec=42s
TimeoutStartUSec=1min 30s
TimeoutStopUSec=1min 30s
TimeoutAbortUSec=1min 30s
TimeoutStartFailureMode=terminate
TimeoutStopFailureMode=terminate
RuntimeMaxUSec=infinity
RuntimeRandomizedExtraUSec=0
WatchdogUSec=0
WatchdogTimestampMonotonic=0
RootDirectoryStartOnly=no
RemainAfterExit=no
GuessMainPID=yes
MainPID=875
ControlPID=0
FileDescriptorStoreMax=0
```

```
NFileDescriptorStore=0
StatusErrno=0
Result=success
ReloadResult=success
CleanResult=success
UID=[not set]
GID=[not set]
NRestarts=0
OOMPolicy=stop
ReloadSignal=1
ExecMainStartTimestamp=Wed 2024-09-25 12:44:53 CEST
ExecMainStartTimestampMonotonic=18089127
ExecMainExitTimestampMonotonic=0
ExecMainPID=875
ExecMainCode=0
ExecMainStatus=0
ExecStart={ path=/usr/sbin/sshd ; argv[]=/usr/sbin/sshd -D $OPTIONS ; ignore_errors=no ; start_time=[n/a] ;
stop_time=[n/a] ; pid=0 ; code=(null) ; status=0/0 }
ExecStartEx={ path=/usr/sbin/sshd ; argv[]=/usr/sbin/sshd -D $OPTIONS ; flags= ; start_time=[n/a] ;
stop_time=[n/a] ; pid=0 ; code=(null) ; status=0/0 }
ExecReload={ path=/bin/kill; argv[]=/bin/kill -HUP $MAINPID; ignore_errors=no; start_time=[n/a]; stop_time=[n/a];
pid=0; code=(null); status=0/0 }
ExecReloadEx={ path=/bin/kill ; argv[]=/bin/kill -HUP $MAINPID ; flags= ; start_time=[n/a] ; stop_time=[n/a] ;
pid=0 ; code=(null) ; status=0/0 }
Slice=system.slice
ControlGroup=/system.slice/sshd.service
ControlGroupId=3690
MemoryCurrent=5275648
MemoryAvailable=infinity
CPUUsageNSec=122370000
TasksCurrent=1
IPIngressBytes=[no data]
IPIngressPackets=[no data]
IPEgressBytes=[no data]
```

```
IPegressPackets=[no data]
IOReadBytes=18446744073709551615
IOReadOperations=18446744073709551615
IOWriteBytes=18446744073709551615
IOWriteOperations=18446744073709551615
lines 1-55
```

To view the list of dependencies for a Unit, use **systemctl list-dependencies** and specify the Unit concerned:

```
[root@redhat9 ~]# systemctl list-dependencies sshd.service
sshd.service
● └─system.slice
● └─sshd-keygen.target
○   ├─sshd-keygen@ecdsa.service
○   ├─sshd-keygen@ed25519.service
○   └─sshd-keygen@rsa.service
● └─sysinit.target
●   ├─dev-hugepages.mount
●   ├─dev-mqueue.mount
●   ├─dracut-shutdown.service
○   ├─iscsi-onboot.service
○   ├─iscsi-starter.service
●   ├─kmod-static-nodes.service
○   ├─ldconfig.service
●   ├─lvm2-lvmpolld.socket
●   ├─lvm2-monitor.service
○   ├─multipathd.service
●   ├─nis-domainname.service
●   ├─plymouth-read-write.service
●   ├─plymouth-start.service
●   ├─proc-sys-fs-binfmt_misc.automount
○   ├─selinux-autorelabel-mark.service
●   ├─sys-fs-fuse-connections.mount
●   └─sys-kernel-config.mount
```

```
● └─sys-kernel-debug.mount
● └─sys-kernel-tracing.mount
○ └─systemd-ask-password-console.path
○ └─systemd-binfmt.service
○ └─systemd-boot-random-seed.service
● └─systemd-boot-update.service
○ └─systemd-firstboot.service
○ └─systemd-hwdb-update.service
○ └─systemd-journal-catalog-update.service
● └─systemd-journal-flush.service
● └─systemd-journald.service
○ └─systemd-machine-id-commit.service
● └─systemd-modules-load.service
● └─systemd-network-generator.service
○ └─systemd-pcramachine.service
○ └─systemd-pcrphase-sysinit.service
○ └─systemd-pcrphase.service
● └─systemd-random-seed.service
○ └─systemd-repart.service
● └─systemd-sysctl.service
○ └─systemd-sysusers.service
● └─systemd-tmpfiles-setup-dev.service
● └─systemd-tmpfiles-setup.service
● └─systemd-udev-trigger.service
● └─systemd-udevd.service
○ └─systemd-update-done.service
● └─systemd-update-utmp.service
● └─cryptsetup.target
● └─integritysetup.target
● └─local-fs.target
●   └─.mount
lines 1-55
```

2.2 - Overriding the Default Configuration Files

Default configuration files can also be overridden by files in other directories:

```
[root@redhat9 ~]# pkg-config systemd --variable=systemdsystemunitpath  
/etc/systemd/system:/etc/systemd/system:/run/systemd/system:/usr/local/lib/systemd/system:/usr/lib/systemd/system  
:/usr/lib/systemd/system:/lib/systemd/system
```

```
[root@redhat9 ~]# ls -l /etc/systemd/system  
total 8  
drwxr-xr-x. 2 root root 65 Oct 19 2023 basic.target.wants  
drwxr-xr-x. 2 root root 31 Oct 19 2023 bluetooth.target.wants  
lrwxrwxrwx. 1 root root 37 Oct 19 2023 ctrl-alt-del.target -> /usr/lib/systemd/system/reboot.target  
lrwxrwxrwx. 1 root root 41 Oct 19 2023 dbus-org.bluez.service -> /usr/lib/systemd/system/bluetooth.service  
lrwxrwxrwx. 1 root root 41 Oct 19 2023 dbus-org.fedoraproject.FirewallD1.service ->  
/usr/lib/systemd/system/firewalld.service  
lrwxrwxrwx. 1 root root 44 Oct 19 2023 dbus-org.freedesktop.Avahi.service -> /usr/lib/systemd/system/avahi-  
daemon.service  
lrwxrwxrwx. 1 root root 44 Oct 19 2023 dbus-org.freedesktop.ModemManager1.service ->  
/usr/lib/systemd/system/ModemManager.service  
lrwxrwxrwx. 1 root root 57 Oct 19 2023 dbus-org.freedesktop.nm-dispatcher.service ->  
/usr/lib/systemd/system/NetworkManager-dispatcher.service  
lrwxrwxrwx. 1 root root 43 Oct 19 2023 dbus.service -> /usr/lib/systemd/system/dbus-broker.service  
lrwxrwxrwx. 1 root root 40 Oct 19 2023 default.target -> /usr/lib/systemd/system/graphical.target  
drwxr-xr-x. 2 root root 45 Oct 19 2023 default.target.wants  
drwxr-xr-x. 2 root root 38 Oct 19 2023 'dev-virtio\x2dports-org.qemu.guest_agent.0.device.wants'  
lrwxrwxrwx. 1 root root 35 Oct 19 2023 display-manager.service -> /usr/lib/systemd/system/gdm.service  
drwxr-xr-x. 2 root root 32 Oct 19 2023 getty.target.wants  
drwxr-xr-x. 2 root root 181 Oct 19 2023 graphical.target.wants  
drwxr-xr-x. 2 root root 36 Oct 19 2023 local-fs.target.wants  
drwxr-xr-x. 2 root root 4096 Oct 19 2023 multi-user.target.wants  
drwxr-xr-x. 2 root root 48 Oct 19 2023 network-online.target.wants  
drwxr-xr-x. 2 root root 26 Oct 19 2023 printer.target.wants
```

```
drwxr-xr-x. 2 root root 27 Oct 19 2023 remote-fs.target.wants
drwxr-xr-x. 2 root root 186 Oct 19 2023 sockets.target.wants
drwxr-xr-x. 2 root root 4096 Sep 25 12:08 sysinit.target.wants
drwxr-xr-x. 2 root root 86 Oct 19 2023 timers.target.wants
drwxr-xr-x. 2 root root 29 Oct 19 2023 vmtoolsd.service.requires
```

LAB #3 - The systemd-analyze command

To consult the system start-up timeline, use the following command:

```
[root@redhat9 ~]# systemd-analyze
Startup finished in 1.309s (kernel) + 4.384s (initrd) + 29.375s (userspace) = 35.069s
graphical.target reached after 29.358s in userspace.
```

The **blame** option in the `systemd-analyze` command allows you to see the boot time of each individual Unit so that you can concentrate on the slowest ones:

```
[root@redhat9 ~]# systemd-analyze blame
15.289s plymouth-quit-wait.service
8.760s dev-disk-by\x2dpartuuid-d00dfc8a\x2d02.device
8.760s dev-disk-by\x2did-scsi\x2d0QEMU_QEMU_HARDDISK_drive\x2dscsi0\x2dpart2.device
8.760s sys-devices-pci0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0:0-block-sda-sda2.device
8.760s dev-disk-by\x2dpath-pci\x2d0000:01:01.0\x2dscsi\x2d0:0:0\x2dpart2.device
8.760s dev-sda2.device
8.662s sys-devices-pci0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0:0-block-sda-sda1.device
8.662s dev-disk-by\x2did-scsi\x2d0QEMU_QEMU_HARDDISK_drive\x2dscsi0\x2dpart1.device
8.662s dev-sda1.device
8.662s dev-disk-by\x2dpath-pci\x2d0000:01:01.0\x2dscsi\x2d0:0:0\x2dpart1.device
8.662s dev-disk-by\x2duuid-6f6c5bb9\x2d30be\x2d4734\x2dbc23\x2d03fed8541616.device
8.662s dev-disk-by\x2dpartuuid-d00dfc8a\x2d01.device
8.629s dev-sda.device
8.629s dev-disk-by\x2dpath-pci\x2d0000:01:01.0\x2dscsi\x2d0:0:0:0.device
8.629s dev-disk-by\x2did-scsi\x2d0QEMU_QEMU_HARDDISK_drive\x2dscsi0.device
```

```
8.629s sys-devices-pci0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0-block-sda.device
8.629s dev-disk-by\x2ddiskseq-1.device
8.589s sys-module-fuse.device
8.578s sys-devices-pci0000:00-0000:00:12.0-virtio1-net-ens18.device
8.578s sys-subsystem-net-devices-ens18.device
8.560s sys-devices-platform-serial8250-tty-ttyS0.device
8.560s dev-ttyS0.device
8.559s sys-devices-platform-serial8250-tty-ttyS2.device
8.559s dev-ttyS2.device
8.558s dev-ttyS1.device
8.558s sys-devices-platform-serial8250-tty-ttyS1.device
8.557s dev-ttyS3.device
8.557s sys-devices-platform-serial8250-tty-ttyS3.device
8.510s sys-module-configfs.device
4.024s initrd-switch-root.service
2.468s firewalld.service
2.157s kdump.service
1.944s systemd-udev-settle.service
1.548s dnf-makecache.service
1.454s NetworkManager-wait-online.service
1.309s udisks2.service
1.294s NetworkManager.service
1.112s power-profiles-daemon.service
1.091s polkit.service
1.015s accounts-daemon.service
953ms ModemManager.service
900ms user@42.service
888ms dracut-initqueue.service
671ms dbus-broker.service
661ms systemd-tmpfiles-setup-dev.service
658ms systemd-udevd.service
561ms lvm2-monitor.service
547ms boot.mount
506ms cups.service
```

```
464ms sshd.service
446ms logrotate.service
382ms systemd-random-seed.service
376ms auditd.service
371ms systemd-tmpfiles-setup.service
324ms systemd-sysctl.service
lines 1-55
```

The **critical-chain** option of the **systemd-analyze** command allows you to see the sequence of events that lead to the loading of the Unit passed as an argument:

```
[root@redhat9 ~]# systemd-analyze critical-chain sshd.service
The time when unit became active or started is printed after the "@" character.
The time the unit took to start is printed after the "+" character.
```

```
sshd.service +464ms
└network.target @12.377s
  └wpa_supplicant.service @25.556s +119ms
    └basic.target @7.432s
      └dbus-broker.service @6.758s +671ms
        └dbus.socket @6.741s
          └sysinit.target @6.737s
            └systemd-update-utmp.service @6.721s +15ms
              └auditd.service @6.333s +376ms
                └systemd-tmpfiles-setup.service @5.951s +371ms
                  └local-fs.target @5.939s
                    └run-user-42.mount @14.616s
                      └local-fs-pre.target @5.379s
                        └systemd-tmpfiles-setup-dev.service @3.398s +661ms
                          └kmod-static-nodes.service @3.243s +49ms
                            └systemd-journald.socket
                              └system.slice
                                └..slice
```

The command line switches for the **systemd-analyze** command are:

```
[root@redhat9 ~]# systemd-analyze --help
systemd-analyze [OPTIONS...] COMMAND ...
```

Profile systemd, show unit dependencies, check unit files.

Commands:

[time]	Print time required to boot the machine
blame	Print list of running units ordered by time to init
critical-chain [UNIT...]	Print a tree of the time critical chain of units
plot	Output SVG graphic showing service initialization
dot [UNIT...]	Output dependency graph in dot(1) format
dump [PATTERN...]	Output state serialization of service manager
cat-config	Show configuration file and drop-ins
unit-files	List files and symlinks for units
unit-paths	List load directories for units
exit-status [STATUS...]	List exit status definitions
capability [CAP...]	List capability definitions
syscall-filter [NAME...]	List syscalls in seccomp filters
filesystems [NAME...]	List known filesystems
condition CONDITION...	Evaluate conditions and asserts
compare-versions VERSION1 [OP] VERSION2	Compare two version strings
verify FILE...	Check unit files for correctness
calendar SPEC...	Validate repetitive calendar time events
timestamp TIMESTAMP...	Validate a timestamp
timespan SPAN...	Validate a time span
security [UNIT...]	Analyze security of unit

```
inspect-elf FILE...          Parse and print ELF package metadata
```

Options:

--recursive-errors=MODE	Control which units are verified
--offline=BOOL	Perform a security review on unit file(s)
--threshold=N	Exit with a non-zero status when overall exposure level is over threshold value
--security-policy=PATH	Use custom JSON security policy instead of built-in one
--json=pretty short off	Generate JSON output of the security analysis table, or plot's raw time data
--no-pager	Do not pipe output into a pager
--no-legend	Disable column headers and hints in plot with either --table or --json=
--system	Operate on system systemd instance
--user	Operate on user systemd instance
--global	Operate on global user configuration
-H --host=[USER@]HOST	Operate on remote host
-M --machine=CONTAINER	Operate on local container
--order	Show only order in the graph
--require	Show only requirement in the graph
--from-pattern=GLOB	Show only origins in the graph
--to-pattern=GLOB	Show only destinations in the graph
--fuzz=SECONDS	Also print services which finished SECONDS

lines 1-55

LAB #4 - Systemd Targets

Each Target is described in a configuration file:

```
[root@redhat9 ~]# cat /usr/lib/systemd/system/graphical.target
# SPDX-License-Identifier: LGPL-2.1-or-later
#
```

```
# This file is part of systemd.
#
# systemd is free software; you can redistribute it and/or modify it
# under the terms of the GNU Lesser General Public License as published by
# the Free Software Foundation; either version 2.1 of the License, or
# (at your option) any later version.

[Unit]
Description=Graphical Interface
Documentation=man:systemd.special(7)
Requires=multi-user.target
Wants=display-manager.service
Conflicts=rescue.service rescue.target
After=multi-user.target rescue.service rescue.target display-manager.service
AllowIsolate=yes
```

The following lines can be found in this file:

- **Requires=multi-user.target,**
 - This line indicates that the **graphical.target** cannot be reached if the **multi-user.target** has not been reached first,
- **After=multi-user.target rescue.service rescue.target display-manager.service,**
 - This line indicates that the **multi-user.target** and **rescue.target** must be reached first and that the **rescue.service** and **display-manager.service** services must be started first,
- **Conflicts=rescue.service rescue.target,**
 - This line indicates the target and service in conflict with the **graphical.target**,
- **Wants=display-manager.service,**
 - This line indicates which service should be started.

4.1 - Checking Target dependencies

The dependencies of a Target can be checked using the **systemctl list-dependencies** command:

```
[root@redhat9 ~]# systemctl list-dependencies multi-user.target
```

```
multi-user.target
●  |-atd.service
●  |-auditd.service
●  |-avahi-daemon.service
●  |-crond.service
●  |-cups.path
●  |-cups.service
●  |-firewalld.service
○  |-insights-client-boot.service
●  |-irqbalance.service
●  |-kdump.service
●  |-libstoragegmt.service
●  |-mcelog.service
○  |-mdmonitor.service
●  |-ModemManager.service
●  |-NetworkManager.service
○  |-ostree-readonly-sysroot-migration.service
●  |-plymouth-quit-wait.service
○  |-plymouth-quit.service
●  |-rhsmcertd.service
●  |-rsyslog.service
○  |-smartd.service
●  |-sshd.service
○  |-sssd.service
●  |-systemd-ask-password-wall.path
●  |-systemd-logind.service
○  |-systemd-update-utmp-runlevel.service
●  |-systemd-user-sessions.service
○  |-tuned.service
○  |-vmtoolsd.service
●  |-basic.target
●  |  |--.mount
○  |  |-low-memory-monitor.service
○  |  |-microcode.service
```

```
● └─paths.target
● └─slices.target
●   └─.slice
●     └─system.slice
● └─sockets.target
●   └─avahi-daemon.socket
●   └─cups.socket
●   └─dbus.socket
●   └─dm-event.socket
●   └─iscsid.socket
●   └─iscsiuio.socket
○ └─multipathd.socket
● └─sssd-kcm.socket
● └─systemd-coredump.socket
● └─systemd-initctl.socket
● └─systemd-journald-dev-log.socket
● └─systemd-journald.socket
● └─systemd-udevd-control.socket
●   └─systemd-udevd-kernel.socket
● └─sysinit.target
●   └─dev-hugepages.mount
lines 1-55
```

The black dots at the start of each line in the output above can be three different colours:

- **Green** implies that the service, target or unit is enabled and started.
- **White** means that the service, target or unit is inactive.
- **Red** means that the service, target or unit has not started due to a fatal error.

To view Units in a fatal error state, use the **systemctl -failed** command:

```
[root@redhat9 ~]# systemctl --failed
UNIT LOAD ACTIVE SUB DESCRIPTION
0 loaded units listed.
```

Dependencies are created as symbolic links in the **/etc/systemd/system/multi-user.target.wants** and **/usr/lib/systemd/system/multi-user.target.wants** directories:

```
[root@redhat9 ~]# ls -l /etc/systemd/system/multi-user.target.wants
total 0
lrwxrwxrwx. 1 root root 35 Oct 19 2023 atd.service -> /usr/lib/systemd/system/atd.service
lrwxrwxrwx. 1 root root 38 Oct 19 2023 auditd.service -> /usr/lib/systemd/system/auditd.service
lrwxrwxrwx. 1 root root 44 Oct 19 2023 avahi-daemon.service -> /usr/lib/systemd/system/avahi-daemon.service
lrwxrwxrwx. 1 root root 37 Oct 19 2023 crond.service -> /usr/lib/systemd/system/crond.service
lrwxrwxrwx. 1 root root 33 Oct 19 2023 cups.path -> /usr/lib/systemd/system/cups.path
lrwxrwxrwx. 1 root root 36 Oct 19 2023 cups.service -> /usr/lib/systemd/system/cups.service
lrwxrwxrwx. 1 root root 41 Oct 19 2023 firewalld.service -> /usr/lib/systemd/system/firewalld.service
lrwxrwxrwx. 1 root root 52 Oct 19 2023 insights-client-boot.service -> /usr/lib/systemd/system/insights-client-boot.service
lrwxrwxrwx. 1 root root 42 Oct 19 2023 irqbalance.service -> /usr/lib/systemd/system/irqbalance.service
lrwxrwxrwx. 1 root root 37 Oct 19 2023 kdump.service -> /usr/lib/systemd/system/kdump.service
lrwxrwxrwx. 1 root root 46 Oct 19 2023 libstoragemgmt.service -> /usr/lib/systemd/system/libstoragemgmt.service
lrwxrwxrwx. 1 root root 38 Oct 19 2023 mcelog.service -> /usr/lib/systemd/system/mcelog.service
lrwxrwxrwx. 1 root root 41 Oct 19 2023 mdmonitor.service -> /usr/lib/systemd/system/mdmonitor.service
lrwxrwxrwx. 1 root root 44 Oct 19 2023 ModemManager.service -> /usr/lib/systemd/system/ModemManager.service
lrwxrwxrwx. 1 root root 46 Oct 19 2023 NetworkManager.service -> /usr/lib/systemd/system/NetworkManager.service
lrwxrwxrwx. 1 root root 40 Oct 19 2023 remote-fs.target -> /usr/lib/systemd/system/remote-fs.target
lrwxrwxrwx. 1 root root 41 Oct 19 2023 rhsmcertd.service -> /usr/lib/systemd/system/rhsmcertd.service
lrwxrwxrwx. 1 root root 39 Oct 19 2023 rsyslog.service -> /usr/lib/systemd/system/rsyslog.service
lrwxrwxrwx. 1 root root 38 Oct 19 2023 smartd.service -> /usr/lib/systemd/system/smard.service
lrwxrwxrwx. 1 root root 36 Oct 19 2023 sshd.service -> /usr/lib/systemd/system/sshd.service
lrwxrwxrwx. 1 root root 36 Oct 19 2023 sssd.service -> /usr/lib/systemd/system/sssd.service
lrwxrwxrwx. 1 root root 37 Oct 19 2023 tuned.service -> /usr/lib/systemd/system/tuned.service
lrwxrwxrwx. 1 root root 40 Oct 19 2023 vmtoolsd.service -> /usr/lib/systemd/system/vmtoolsd.service
```

```
[root@redhat9 ~]# ls -l /usr/lib/systemd/system/multi-user.target.wants
total 0
lrwxrwxrwx. 1 root root 15 Jul 18 13:00 getty.target -> ../getty.target
lrwxrwxrwx. 1 root root 44 May 17 18:27 ostree-readonly-sysroot-migration.service -> ../ostree-readonly-sysroot-
```

```
migration.service
lrwxrwxrwx. 1 root root 24 Jul 14 2023 plymouth-quit.service -> ../plymouth-quit.service
lrwxrwxrwx. 1 root root 29 Jul 14 2023 plymouth-quit-wait.service -> ../plymouth-quit-wait.service
lrwxrwxrwx. 1 root root 33 Jul 18 13:00 systemd-ask-password-wall.path -> ../systemd-ask-password-wall.path
lrwxrwxrwx. 1 root root 25 Jul 18 13:00 systemd-logind.service -> ../systemd-logind.service
lrwxrwxrwx. 1 root root 39 Jul 18 13:00 systemd-update-utmp-runlevel.service -> ../systemd-update-utmp-
runlevel.service
lrwxrwxrwx. 1 root root 32 Jul 18 13:00 systemd-user-sessions.service -> ../systemd-user-sessions.service
```

4.2 - The Default Target

Consulting the Default Target

To view the default target, use the **systemctl get-default** command:

```
[root@redhat9 ~]# systemctl get-default
graphical.target
```

The default target is represented by the symbolic link **/etc/systemd/system/default.target** :

```
[root@redhat9 ~]# ls -l /etc/systemd/system/default.target
lrwxrwxrwx. 1 root root 40 Oct 19 2023 /etc/systemd/system/default.target ->
/usr/lib/systemd/system/graphical.target
```

Modifying the Default Target

To modify the Default Target to be taken into account at the **next** boot, use the **systemctl set-default** command:

```
[root@redhat9 ~]# 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.
```

```
[root@redhat9 ~]# ls -l /etc/systemd/system/default.target
lrwxrwxrwx. 1 root root 41 Sep 26 14:50 /etc/systemd/system/default.target → /usr/lib/systemd/system/multi-
user.target
```

```
[root@redhat9 ~]# systemctl set-default graphical.target
Removed "/etc/systemd/system/default.target".
Created symlink /etc/systemd/system/default.target → /usr/lib/systemd/system/graphical.target.
```

```
[root@redhat9 ~]# ls -l /etc/systemd/system/default.target
lrwxrwxrwx. 1 root root 40 Sep 26 14:51 /etc/systemd/system/default.target →
/usr/lib/systemd/system/graphical.target
```

Modifying the Current Target

The current target can be modified using the **systemctl isolate** command:

```
[root@redhat9 ~]# systemctl isolate rescue

[root@redhat9 ~]# systemctl list-units --type target | egrep "eme|res|gra|mul" | head -1
rescue.target          loaded active active Rescue Mode
[root@redhat9 ~]# runlevel
5 1

[root@redhat9 ~]# who -r
run-level 1 2024-09-26 14:52                         last=5
```

```
[root@redhat9 ~]# systemctl isolate graphical
```

```
[root@redhat9 ~]# systemctl list-units --type target | egrep "eme|res|gra|mul" | head -1
graphical.target        loaded active active Graphical Interface
```

```
[root@redhat9 ~]# runlevel  
1 5  
  
[root@redhat9 ~]# who -r  
run-level 5 2024-09-26 14:55 last=1
```

LAB #5 - Managing Services

5.1 - Managing Single Instances

Start by installing the **httpd** package:

```
[root@redhat9 ~]# dnf install httpd
```

To obtain details of a given service, use the **systemctl status** command:

```
[root@redhat9 ~]# systemctl status httpd.service  
● httpd.service - The Apache HTTP Server  
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; disabled; preset: disabled)  
   Active: inactive (dead)  
     Docs: man:httpd.service(8)
```

In the case of the httpd service above, we can see that the status is **disabled**. The status can be one of 2 values:

- **disabled** - the service will not be started the next time the system is started.
- **enabled** - the service will start the next time the system is started.

You can check the status using the **systemctl is-enabled** command:

```
[root@redhat9 ~]# systemctl is-enabled httpd.service  
disabled
```

To make the status **enabled**, use the **systemctl enable** command:

```
[root@redhat9 ~]# systemctl enable httpd.service
Created symlink /etc/systemd/system/multi-user.target.wants/httpd.service →
/usr/lib/systemd/system/httpd.service.
```

```
[root@redhat9 ~]# systemctl is-enabled httpd.service
enabled
```

```
[root@redhat9 ~]# systemctl status httpd.service
● httpd.service - The Apache HTTP Server
  Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; preset: disabled)
  Active: inactive (dead)
    Docs: man:httpd.service(8)
```

In the case of the httpd service above, we can now see that the state is **inactive (dead)**. The status can be one of 7 values:

- **inactive (dead)** - the service is stopped.
- **active(running)** - the service is started with one or more processes.
- **active(exited)** - the service has completed a single configuration.
- **active(waiting)** - the service is started but waiting for an event.
- **activating** - the service is in the process of being activated.
- **deactivating** - the service is being deactivated.
- **failed** - the service has encountered a fatal error.

You can check the status using the **systemctl is-active** command:

```
[root@redhat9 ~]# systemctl is-active httpd.service
inactive
```

To set the status to **active(running)**, use the following command:

```
[root@redhat9 ~]# systemctl start httpd.service
```

Then check the state of the service:

```
[root@redhat9 ~]# systemctl is-active httpd.service
active

[root@redhat9 ~]# systemctl status httpd.service
● httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; preset: disabled)
   Active: active (running) since Thu 2024-09-26 15:01:28 CEST; 43s ago
     Docs: man:httpd.service(8)
 Main PID: 7187 (httpd)
   Status: "Total requests: 0; Idle/Busy workers 100/0;Requests/sec: 0; Bytes served/sec: 0 B/sec"
    Tasks: 177 (limit: 48800)
   Memory: 40.5M
      CPU: 128ms
     CGroup: /system.slice/httpd.service
             ├─7187 /usr/sbin/httpd -DFOREGROUND
             ├─7188 /usr/sbin/httpd -DFOREGROUND
             ├─7189 /usr/sbin/httpd -DFOREGROUND
             ├─7190 /usr/sbin/httpd -DFOREGROUND
             └─7191 /usr/sbin/httpd -DFOREGROUND

Sep 26 15:01:28 redhat9.ittraining.loc systemd[1]: Starting The Apache HTTP Server...
Sep 26 15:01:28 redhat9.ittraining.loc httpd[7187]: Server configured, listening on: port 80
Sep 26 15:01:28 redhat9.ittraining.loc systemd[1]: Started The Apache HTTP Server.
```

To stop a Service Unit, use the following command :

```
[root@redhat9 ~]# systemctl stop httpd.service

[root@redhat9 ~]# systemctl status httpd.service
○ httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; preset: disabled)
   Active: inactive (dead) since Thu 2024-09-26 15:02:55 CEST; 2s ago
```

```
Duration: 1min 26.084s
Docs: man:httpd.service(8)
Process: 7187 ExecStart=/usr/sbin/httpd $OPTIONS -DFOREGROUND (code=exited, status=0/SUCCESS)
Main PID: 7187 (code=exited, status=0/SUCCESS)
Status: "Total requests: 0; Idle/Busy workers 100/0;Requests/sec: 0; Bytes served/sec: 0 B/sec"
CPU: 178ms
```

```
Sep 26 15:01:28 redhat9.ittraining.loc systemd[1]: Starting The Apache HTTP Server...
Sep 26 15:01:28 redhat9.ittraining.loc httpd[7187]: Server configured, listening on: port 80
Sep 26 15:01:28 redhat9.ittraining.loc systemd[1]: Started The Apache HTTP Server.
Sep 26 15:02:54 redhat9.ittraining.loc systemd[1]: Stopping The Apache HTTP Server...
Sep 26 15:02:55 redhat9.ittraining.loc systemd[1]: httpd.service: Deactivated successfully.
Sep 26 15:02:55 redhat9.ittraining.loc systemd[1]: Stopped The Apache HTTP Server.
```

To deactivate a service the next time the system is started, use the **disable** option:

```
[root@redhat9 ~]# systemctl disable httpd.service
Removed "/etc/systemd/system/multi-user.target.wants/httpd.service".

[root@redhat9 ~]# systemctl status httpd.service
● httpd.service - The Apache HTTP Server
  Loaded: loaded (/usr/lib/systemd/system/httpd.service; disabled; preset: disabled)
  Active: inactive (dead)
    Docs: man:httpd.service(8)
```

```
Sep 26 15:01:28 redhat9.ittraining.loc systemd[1]: Starting The Apache HTTP Server...
Sep 26 15:01:28 redhat9.ittraining.loc httpd[7187]: Server configured, listening on: port 80
Sep 26 15:01:28 redhat9.ittraining.loc systemd[1]: Started The Apache HTTP Server.
Sep 26 15:02:54 redhat9.ittraining.loc systemd[1]: Stopping The Apache HTTP Server...
Sep 26 15:02:55 redhat9.ittraining.loc systemd[1]: httpd.service: Deactivated successfully.
Sep 26 15:02:55 redhat9.ittraining.loc systemd[1]: Stopped The Apache HTTP Server.
```

5.2 - Managing Multiple Instances

Systemd allows the use of templates in Unit configuration files. This allows two or more instances of the same service to co-exist. A template can be recognised by the @ character, which is placed just before the full stop in the file name:

```
[root@redhat9 ~]# cat /usr/lib/systemd/system/httpd@.service
# This is a template for httpd instances.
# See httpd@.service(8) for more information.

[Unit]
Description=The Apache HTTP Server
After=network.target remote-fs.target nss-lookup.target
Documentation=man:httpd@.service(8)

[Service]
Type=notify
Environment=LANG=C
Environment=HTTPD_INSTANCE=%i
ExecStartPre=/bin/mkdir -m 710 -p /run/httpd/instance-%i
ExecStartPre=/bin/chown root.apache /run/httpd/instance-%i
ExecStartPre=/bin/mkdir -m 700 -p /var/lib/httpd/instance-%i
ExecStartPre=/bin/chown apache.apache /var/lib/httpd/instance-%i
ExecStart=/usr/sbin/httpd $OPTIONS -DFOREGROUND -f conf/%i.conf
ExecReload=/usr/sbin/httpd $OPTIONS -k graceful -f conf/%i.conf
# Send SIGWINCH for graceful stop
KillSignal=SIGWINCH
KillMode=mixed
PrivateTmp=true
OOMPolicy=continue

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

An instance created using this template should have a name like :

```
httpd@<instance_name>.service
```

In this file we can see the use of an **identifier** in the form of **%i**. Identifiers are of two types - one called **escaped** where non-ASCII alphanumeric characters are replaced by **escapes** of the C language type and the other not escaped:

- %n: is replaced by the full escaped name of the Unit.
- %N: is replaced by the full name of the Unit.
- %p: is replaced by the escaped prefix of the Unit, i.e. the part **before** the @ character.
- %P : is replaced by the non-escaped prefix of the Unit, i.e. the part **before** the @ character.
- %i: is replaced by the escaped instance name of the Unit, i.e. the part **after** the @ character and **before** the dot.
- %l: is replaced by the name of the non-escaped instance of the Unit, i.e. the part **after** the @ character and **before** the full stop.
- %f: is replaced by the non-escaped prefix or the name of the non-escaped instance prefixed by the / character.
- %c: is replaced by the Unit CGroup without the /sys/fs/cgroup/systemd/ path.
- %u: is replaced by the name of the user responsible for running the Unit.
- %U: is replaced by the UID of the user responsible for running the Unit.
- %H: is replaced by the hostname on which the Unit is running.
- %: is replaced by the % character.

Now create two copies of the file **/usr/lib/systemd/system/httpd@.service** :

```
[root@redhat9 ~]# cp /usr/lib/systemd/system/httpd@.service /usr/lib/systemd/system/httpd@instance01.service  
[root@redhat9 ~]# cp /usr/lib/systemd/system/httpd@.service /usr/lib/systemd/system/httpd@instance02.service
```

Create two copies of the **/etc/httpd/conf/httpd.conf** file:

```
[root@redhat9 ~]# cp /etc/httpd/conf/httpd.conf /etc/httpd/conf/instance01.conf  
[root@redhat9 ~]# cp /etc/httpd/conf/httpd.conf /etc/httpd/conf/instance02.conf
```

Edit the **Listen** directive in **/etc/httpd/conf/instance01.conf** and add the **PidFile** directive:

```
[root@redhat9 ~]# vi /etc/httpd/conf/instance01.conf

[root@redhat9 ~]# more /etc/httpd/conf/instance01.conf
#
# This is the main Apache HTTP server configuration file. It contains the
# configuration directives that give the server its instructions.
# See <URL:http://httpd.apache.org/docs/2.4/> for detailed information.
# In particular, see
# <URL:http://httpd.apache.org/docs/2.4/mod/directives.html>
# for a discussion of each configuration directive.
#
# See the httpd.conf(5) man page for more information on this configuration,
# and httpd.service(8) on using and configuring the httpd service.
#
# Do NOT simply read the instructions in here without understanding
# what they do. They're here only as hints or reminders. If you are unsure
# consult the online docs. You have been warned.
#
# Configuration and logfile names: If the filenames you specify for many
# of the server's control files begin with "/" (or "drive:/\" for Win32), the
# server will use that explicit path. If the filenames do *not* begin
# with "/", the value of ServerRoot is prepended -- so 'log/access_log'
# with ServerRoot set to '/www' will be interpreted by the
# server as '/www/log/access_log', whereas '/log/access_log' will be
# interpreted as '/log/access_log'.

#
# ServerRoot: The top of the directory tree under which the server's
# configuration, error, and log files are kept.
#
# Do not add a slash at the end of the directory path. If you point
# ServerRoot at a non-local disk, be sure to specify a local disk on the
# Mutex directive, if file-based mutexes are used. If you wish to share the
# same ServerRoot for multiple httpd daemons, you will need to change at
```

```
# least PidFile.  
#  
ServerRoot "/etc/httpd"  
  
#  
# Listen: Allows you to bind Apache to specific IP addresses and/or  
# ports, instead of the default. See also the <VirtualHost>  
# directive.  
#  
# Change this to Listen on a specific IP address, but note that if  
# httpd.service is enabled to run at boot time, the address may not be  
# available when the service starts. See the httpd.service(8) man  
# page for more information.  
#  
#Listen 12.34.56.78:80  
Listen 8008  
PidFile /var/run/httpd/instance01.pid  
#  
# Dynamic Shared Object (DSO) Support  
#  
# To be able to use the functionality of a module which was built as a DSO you  
# have to place corresponding 'LoadModule' lines at this location so the  
# directives contained in it are actually available before they are used.  
--More--(19%)  
[q]
```

Edit the **Listen** directive in **/etc/httpd/conf/instance02.conf** and add the **PidFile** directive:

```
[root@redhat9 ~]# vi /etc/httpd/conf/instance02.conf  
  
[root@redhat9 ~]# more /etc/httpd/conf/instance02.conf  
#  
# This is the main Apache HTTP server configuration file. It contains the  
# configuration directives that give the server its instructions.
```

```
# See <URL:http://httpd.apache.org/docs/2.4/> for detailed information.
# In particular, see
# <URL:http://httpd.apache.org/docs/2.4/mod/directives.html>
# for a discussion of each configuration directive.
#
# See the httpd.conf(5) man page for more information on this configuration,
# and httpd.service(8) on using and configuring the httpd service.
#
# Do NOT simply read the instructions in here without understanding
# what they do. They're here only as hints or reminders. If you are unsure
# consult the online docs. You have been warned.
#
# Configuration and logfile names: If the filenames you specify for many
# of the server's control files begin with "/" (or "drive:/\" for Win32), the
# server will use that explicit path. If the filenames do *not* begin
# with "/", the value of ServerRoot is prepended -- so 'log/access_log'
# with ServerRoot set to '/www' will be interpreted by the
# server as '/www/log/access_log', whereas '/log/access_log' will be
# interpreted as '/log/access_log'.
#
# ServerRoot: The top of the directory tree under which the server's
# configuration, error, and log files are kept.
#
# Do not add a slash at the end of the directory path. If you point
# ServerRoot at a non-local disk, be sure to specify a local disk on the
# Mutex directive, if file-based mutexes are used. If you wish to share the
# same ServerRoot for multiple httpd daemons, you will need to change at
# least PidFile.
#
ServerRoot "/etc/httpd"
#
# Listen: Allows you to bind Apache to specific IP addresses and/or
```

```
# ports, instead of the default. See also the <VirtualHost>
# directive.
#
# Change this to Listen on a specific IP address, but note that if
# httpd.service is enabled to run at boot time, the address may not be
# available when the service starts. See the httpd.service(8) man
# page for more information.
#
#Listen 12.34.56.78:80
Listen 8009
PidFile /var/run/httpd/instance02.pid

#
# Dynamic Shared Object (DSO) Support
#
# To be able to use the functionality of a module which was built as a DSO you
# have to place corresponding 'LoadModule' lines at this location so the
# directives contained in it are actually available before they are used.
--More--(19%)
[q]
```

Start both services:

```
[root@redhat9 ~]# systemctl start httpd@instance01.service

[root@redhat9 ~]# systemctl status httpd@instance01.service
● httpd@instance01.service - The Apache HTTP Server
    Loaded: loaded (/usr/lib/systemd/system/httpd@instance01.service; disabled; preset: disabled)
    Active: active (running) since Thu 2024-09-26 15:14:25 CEST; 9s ago
      Docs: man:httpd@.service(8)
   Process: 7424 ExecStartPre=/bin/mkdir -m 710 -p /run/httpd/instance-instance01 (code=exited,
  Status: 0/SUCCESS)
   Process: 7425 ExecStartPre=/bin/chown root.apache /run/httpd/instance-instance01 (code=exited,
  Status: 0/SUCCESS)
```

```
Process: 7426 ExecStartPre=/bin/mkdir -m 700 -p /var/lib/httpd/instance-instance01 (code=exited,
status=0/SUCCESS)
Process: 7427 ExecStartPre=/bin/chown apache.apache /var/lib/httpd/instance-instance01 (code=exited,
status=0/SUCCESS)
Main PID: 7429 (httpd)
Status: "Total requests: 0; Idle/Busy workers 100/0;Requests/sec: 0; Bytes served/sec: 0 B/sec"
Tasks: 177 (limit: 48800)
Memory: 42.1M
CPU: 122ms
CGroup: /system.slice/system-httpd.slice/httpd@instance01.service
└─7429 /usr/sbin/httpd -DFOREGROUND -f conf/instance01.conf
   ├─7430 /usr/sbin/httpd -DFOREGROUND -f conf/instance01.conf
   ├─7431 /usr/sbin/httpd -DFOREGROUND -f conf/instance01.conf
   ├─7432 /usr/sbin/httpd -DFOREGROUND -f conf/instance01.conf
   └─7433 /usr/sbin/httpd -DFOREGROUND -f conf/instance01.conf
```

```
Sep 26 15:14:24 redhat9.ittraining.loc systemd[1]: Starting The Apache HTTP Server...
Sep 26 15:14:25 redhat9.ittraining.loc httpd[7429]: Server configured, listening on: port 8008
Sep 26 15:14:25 redhat9.ittraining.loc systemd[1]: Started The Apache HTTP Server.
```

```
[root@redhat9 ~]# systemctl start httpd@instance02.service
```

```
[root@redhat9 ~]# systemctl status httpd@instance02.service
● httpd@instance02.service - The Apache HTTP Server
  Loaded: loaded (/usr/lib/systemd/system/httpd@instance02.service; disabled; preset: disabled)
  Active: active (running) since Thu 2024-09-26 15:14:43 CEST; 7s ago
    Docs: man:httpd@.service(8)
 Process: 7614 ExecStartPre=/bin/mkdir -m 710 -p /run/httpd/instance-instance02 (code=exited,
status=0/SUCCESS)
 Process: 7615 ExecStartPre=/bin/chown root.apache /run/httpd/instance-instance02 (code=exited,
status=0/SUCCESS)
 Process: 7616 ExecStartPre=/bin/mkdir -m 700 -p /var/lib/httpd/instance-instance02 (code=exited,
status=0/SUCCESS)
 Process: 7617 ExecStartPre=/bin/chown apache.apache /var/lib/httpd/instance-instance02 (code=exited,
```

```
status=0/SUCCESS)
  Main PID: 7618 (httpd)
    Status: "Started, listening on: port 8009"
      Tasks: 177 (limit: 48800)
     Memory: 42.1M
        CPU: 113ms
      CGroup: /system.slice/system-httpd.slice/httpd@instance02.service
              ├─7618 /usr/sbin/httpd -DFOREGROUND -f conf/instance02.conf
              ├─7619 /usr/sbin/httpd -DFOREGROUND -f conf/instance02.conf
              ├─7620 /usr/sbin/httpd -DFOREGROUND -f conf/instance02.conf
              ├─7621 /usr/sbin/httpd -DFOREGROUND -f conf/instance02.conf
              └─7622 /usr/sbin/httpd -DFOREGROUND -f conf/instance02.conf
```

```
Sep 26 15:14:43 redhat9.ittraining.loc systemd[1]: Starting The Apache HTTP Server...
Sep 26 15:14:43 redhat9.ittraining.loc httpd[7618]: Server configured, listening on: port 8009
Sep 26 15:14:43 redhat9.ittraining.loc systemd[1]: Started The Apache HTTP Server.
```

5.3 - Prohibiting Service Status Changes

It is possible to prohibit service status changes using the **systemctl mask** command:

```
[root@redhat9 ~]# systemctl status httpd.service
● httpd.service - The Apache HTTP Server
  Loaded: loaded (/usr/lib/systemd/system/httpd.service; disabled; preset: disabled)
  Active: inactive (dead)
    Docs: man:httpd.service(8)

Sep 26 15:01:28 redhat9.ittraining.loc systemd[1]: Starting The Apache HTTP Server...
Sep 26 15:01:28 redhat9.ittraining.loc httpd[7187]: Server configured, listening on: port 80
Sep 26 15:01:28 redhat9.ittraining.loc systemd[1]: Started The Apache HTTP Server.
Sep 26 15:02:54 redhat9.ittraining.loc systemd[1]: Stopping The Apache HTTP Server...
Sep 26 15:02:55 redhat9.ittraining.loc systemd[1]: httpd.service: Deactivated successfully.
Sep 26 15:02:55 redhat9.ittraining.loc systemd[1]: Stopped The Apache HTTP Server.
```

```
[root@redhat9 ~]# systemctl mask httpd.service
Created symlink /etc/systemd/system/httpd.service → /dev/null.

[root@redhat9 ~]# systemctl enable httpd.service
Failed to enable unit: Unit file /etc/systemd/system/httpd.service is masked.

[root@redhat9 ~]# systemctl start httpd.service
Failed to start httpd.service: Unit httpd.service is masked.
```

To authorise changes again, use the **systemctl unmask** command:

```
[root@redhat9 ~]# systemctl unmask httpd.service
Removed "/etc/systemd/system/httpd.service".

[root@redhat9 ~]# systemctl enable httpd.service
Created symlink /etc/systemd/system/multi-user.target.wants/httpd.service →
/usr/lib/systemd/system/httpd.service.

[root@redhat9 ~]# systemctl start httpd.service

[root@redhat9 ~]# systemctl status httpd.service
● httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; preset: disabled)
   Active: active (running) since Thu 2024-09-26 15:17:38 CEST; 18s ago
     Docs: man:httpd.service(8)
 Main PID: 7896 (httpd)
    Status: "Total requests: 0; Idle/Busy workers 100/0;Requests/sec: 0; Bytes served/sec: 0 B/sec"
      Tasks: 177 (limit: 48800)
     Memory: 40.1M
        CPU: 99ms
      CGroup: /system.slice/httpd.service
              └─7896 /usr/sbin/httpd -DFOREGROUND
                  ├─7897 /usr/sbin/httpd -DFOREGROUND
                  ├─7898 /usr/sbin/httpd -DFOREGROUND
```

```
|--7899 /usr/sbin/httpd -DFOREGROUND
|   |--7900 /usr/sbin/httpd -DFOREGROUND
```

```
Sep 26 15:17:38 redhat9.ittraining.loc systemd[1]: Starting The Apache HTTP Server...
Sep 26 15:17:38 redhat9.ittraining.loc httpd[7896]: Server configured, listening on: port 80
Sep 26 15:17:38 redhat9.ittraining.loc systemd[1]: Started The Apache HTTP Server.
```

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