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RH12412 - Gestion des Services et des Démons

Contenu du Module

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Systemd

Les systèmes de démarrage antérieurs à Systemd, **SysVinit** et **Upstart**, étaient des systèmes de démarrage **séquentiels**.

Systemd essaie, par contre, de démarrer autant de services en parallèle que possible. Ceci est rendu possible car la majorité d'architectures matérielles modernes sont multi-cœurs. Si un service dépend d'un autre qui n'est pas encore démarré ce premier est mis en attente dans une mémoire

tampon. Qui plus est, les services qui ne sont pas nécessaires au démarrage de la machine, tel cups, ne sont démarrés ultérieurement que si nécessaire. Lors de démarrage, les partitions sont montées en parallèle. Dernièrement, **Systemd** remplace les scripts de démarrage traditionnels avec des binaires compilés, beaucoup plus rapides que leur prédécesseurs.

Au lieu de parler de scripts de démarrage et de niveaux d'exécution, **Systemd** utilise la terminologie **Unités** (*Units*) et **Cibles** (*Targets*). Une Unité peut être :

- **.automount** - active la fonctionnalité d'automount.
- **.device** - expose une périphérique dans systemd.
- **.mount** - contrôle quand et comment les systèmes de fichiers sont montés.
- **.path** - active un service quand il y a un accès à un fichier ou répertoire sous surveillance par le système.
- **.service** - démarre, arrête, redémarre ou recharge un service.
- **.scope** - gère des services.
- **.slice** - regroupe des Unités dans une arborescence afin de limiter des ressources en utilisant des CGroups.
- **.snapshot** - un état sauvegardé du gestionnaire Systemd.
- **.socket** - permet aux Unités d'utiliser des sockets pour la communication inter-processus.
- **.swap** - encapsule une périphérique ou un fichier swap.
- **.timer** - déclenche l'activation d'autres Unités en utilisant des minuteurs de Systemd.
- **.target** - regroupe des Unités multiples afin qu'elles puissent être démarrées en même temps. Par exemple **network.target** regroupe toutes les Unités nécessaires pour démarrer toutes les interfaces réseaux en même temps.

Une Cible est en quelque sorte une **grande étape** dans le démarrage du système :

- **halt.target** - arrête le système.
 - **poweroff.target** - arrête le système et coupe le courant.
 - **shutdown.target** - arrête le système.
 - **rescue.target** - démarre le système en mode single-user (seul root peut s'y connecter). Tous les systèmes de fichiers sont montés mais le réseau n'est pas démarré.
 - **emergency.target** - démarre le système en mode single-user (seul root peut s'y connecter). Uniquement le système de fichiers racine est monté en mode lecture seule. Le réseau n'est pas démarré.
 - **multi-user.target** - démarre le système en mode multi-utilisateur avec tous les systèmes de fichiers montés et le service network démarré.
 - **graphical.target** - démarre le système en multi-user.target puis démarre l'interface graphique.
 - **hibernate.target** - sauvegarde l'état courant sur disque et arrête le système. Quand le système est démarré, l'état est restauré.
 - **reboot.target** - redémarre le système.
-

Systemd utilise des Cibles d'une manière similaire à ce que **SysVinit** utilise des niveaux d'exécution. Pour rendre la transition plus facile, il existe des **Cibles** qui “simulent” les niveaux d'exécution de **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 - La Commande **systemctl**

Pour visualiser la liste des Unités, il convient d'utiliser la commande **systemctl** avec l'option **list-units** :

```
[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-pci	0000:00-0000:00:01.1-ata2-host2-target2:0:0-2:0:0:0-block-sr0.device	loaded
active	plugged	QEMU_DVD-ROM	
	sys-devices-pci	0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0:0-block-sda-sda1.device	loaded
active	plugged	QEMU_HARDDISK 1	
	sys-devices-pci	0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0:0-block-sda-sda2.device	loaded
active	plugged	QEMU_HARDDISK 2	
	sys-devices-pci	0000:00-0000:00:05.0-0000:01:01.0-virtio2-host0-target0:0:0-0:0:0:0-block-sda.device	loaded
active	plugged	QEMU_HARDDISK	
	sys-devices-pci	0000:00-0000:00:12.0-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		loaded

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-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	loaded
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 System	
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.service	
run-credentials-systemd\x2dtmpfiles\x2dsetup\x2ddev.service.mount	loaded
active mounted /run/credentials/systemd-tmpfiles-setup-dev.service	
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 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-cl.scope		loaded
active running	Session cl 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		

Pour consulter la liste des Unités inactifs, utilisez la commande suivante :

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

not-found inactive dead	fcoe.service
getty@tty1.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	iscsi-starter.service
iscsid.service	
loaded inactive dead	Open-iSCSI
iscsiuio.service	
loaded inactive dead	iSCSI UserSpace I/O driver
ldconfig.service	
loaded inactive dead	Rebuild Dynamic Linker Cache
logrotate.service	

```
loaded    inactive dead    Rotate log files
  low-memory-monitor.service
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]
```

Les points noirs au début de certaines lignes dans la sortie ci-dessus sont en réalité des points blancs à l'écran. Ces points impliquent que le service, la cible ou l'unité spécifié n'a pas été trouvé sur le système. Par exemple :

```
[root@redhat9 ~]# systemctl status network
```

Unit network.service could not be found.

Pour consulter la liste des Unités ainsi que leurs statuts, utilisez la commande suivante :

```
[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-cl.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]

```

Pour visualiser les Unités d'un type spécifique, il convient d'utiliser l'option **-t** :

```

[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.

```

Dans la colonne STATE on voit les mots **static** et **generated**.

- STATE = static
 - Ceci implique que l'Unité ne peut ni être démarrée, ni être arrêtée par l'administrateur. Le démarrage et l'arrêt d'une telle Unité est effectué par le système. En règle générale, les Unités dont le STATE est static sont des dépendances d'autres Unité
- STATE = generated
 - Ceci implique que le fichier a été généré automatiquement en utilisant les informations dans le fichier **/etc/fstab** lors du démarrage du système. Dans le cas d'un point de montage, l'exécutable responsable de la génération du fichier est **/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

```

Il existe aussi d'autres exécutables responsables de la génération d'autres fichiers :

```

[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
```

Les options de la commande **systemctl** sont :

```
[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
                     preset configuration
lines 1-55
```

LAB #2 - Fichiers de Configuration

2.1 - Fichiers de Configuration par Défaut

Les fichiers de configuration des Cibles et fichiers de configuration des Unités installés par des paquets se trouvent dans le répertoire **/usr/lib/systemd/system** :

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

Certains fichiers de configuration sont créés à la volée dans le répertoire **/run/systemd/system** lors du runtime puis ils sont détruits quand le système n'en a plus besoin :

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

Les fichiers de configuration des Unités créés par les utilisateurs doivent être mis dans le répertoire **/usr/lib/systemd/user** :

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



Important : De cette façon les fichiers dans **/usr/lib/systemd/user** surchargent les fichiers dans le répertoire **/run/systemd/system** qui surchargent les fichiers dans le répertoire **/usr/lib/systemd/system**.

Prenons le cas du service **sshd** qui est configuré par le fichier **/usr/lib/systemd/system/sshd.service** :

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

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

Dans le fichier on peut noter la présence des lignes suivantes dans la section **[Unit]** :

- **Description=OpenSSH server daemon,**
 - Cette directive est utilisée pour donner une courte description des fonctionnalités de l'Unité,
- **Documentation=man:sshd(8) man:sshd_config(5),**
 - Cette directive stipule les chapitres des manuels et les URLs contenant de l'information en relation avec l'Unité,
- **After=network.target sshd-keygen.target,**
 - Cette directive indique les cibles qui devraient être atteintes et les Unités qui devraient être démarrées avant l'Unité sshd. Par contre, cette directive ne spécifie pas une dépendance,
- **Wants=sshd-keygen.target,**
 - Cette directive stipule une dépendance douce. Autrement dit, Systemd essaiera de démarrer l'Unité **sshd-keygen.target** mais si ce démarrage est en échec, l'Unité sshd sera démarré.

Dans le fichier on peut aussi noter la présence des lignes suivantes dans la section **[Service]** :

- **Type=notify,**
 - Cette directive indique que le service informera Systemd quand son démarrage a terminé,
- **ExecStart=/usr/sbin/sshd -D \$OPTIONS,**
 - Cette directive définit l'exécutable à lancer,
- **ExecReload=/bin/kill -HUP \$MAINPID,**

- Cette directive indique la commande nécessaire pour redémarrer le service,
- **KillMode=process**,
 - Cette directive indique comment les processus du service doivent être arrêtés. La valeur de **process** implique l'utilisation de SIGTERM suivi par SIGHUP,
- **Restart=on-failure**,
 - Cette ligne indique que le service doit être re-démarré en cas d'arrêt de celui-ci.
- **RestartSec=42s**,
 - Cette directive stipule le temps d'attente entre l'arrêt du service et le redémarrage par Systemd,

Dernièrement on note la présence de la ligne suivante dans la section **[Install]** :

- **WantedBy=multi-user.target**,
 - Cette directive indique la Cible dans laquelle le service doit être démarré. La présence de cette directive crée un lien symbolique dans le répertoire **/etc/systemd/system/multi-user.target.wants** qui pointe vers ce fichier.

Pour consulter **l'ensemble** des directives de configuration ainsi que leurs valeurs d'une Unité, il convient d'utiliser la commande **systemctl show** en spécifiant l'Unité concernée :

```
[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
```

Pour consulter la liste des dépendances d'une Unité, il convient d'utiliser **systemctl list-dependencies** en spécifiant l'Unité concernée :

```
[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-pcrmachine.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 - Surchargement des Fichiers de Configuration par Défaut

Les fichiers de configuration par défaut peuvent aussi être surchargés par des fichiers dans d'autres répertoires :

```
[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 - La Commande systemd-analyze

Pour avoir une évaluation du temps de démarrage, il convient d'utiliser la commande suivante :

```
[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.
```

L'option **blame** de la commande systemd-analyze permet de voir le temps de démarrage de chaque Unité afin de pouvoir se concentrer sur les plus lentes :

```
[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\x2d0:0:0:0\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\x2d0:0:0:0\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-target0:0:0-0:0:0:0-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 firewallld.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-udev.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
```

L'option **critical-chain** de la commande **systemd-analyze** permet de voir l'enchaînement des événements qui amènent au chargement de l'Unité qui est passée en 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
```

Les options de la commande **systemd-analyze** sont :

```
[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

timestamp TIMESTAMP...	events
timespan SPAN...	Validate a timestamp
security [UNIT...]	Validate a time span
inspect-elf FILE...	Analyze security of unit
	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 - Les Cibles Systemd

Chaque Cible est décrite par un fichier de configuration :

```
[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
```

Dans ce fichier on peut noter la présence des lignes suivantes :

- **Requires=multi-user.target,**
 - Cette ligne indique que le **graphical.target** ne peut pas être atteint si le **multi-user.target** n'a pas été atteint au préalable,
- **After=multi-user.target rescue.service rescue.target display-manager.service,**
 - Cette ligne indique le **multi-user.target** et **rescue.target** doivent d'abord être atteints et que les services **rescue.service** et **display-manager.service** doivent d'abord être démarrés,
- **Conflicts=rescue.service rescue.target,**
 - Cette ligne indique la Cible et le service en conflits avec le **graphical.target**,
- **Wants=display-manager.service,**
 - Cette ligne indique quel service doit être démarré.

4.1 - Contrôler les dépendances d'une Cible

Les dépendances d'une Cible peuvent être consultées en utilisant la commande **systemctl list-dependencies** :

```
[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
● |—libstoragemgmt.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
● | | |-- iscsiui.socket
○ | |-- multipathd.socket
● | | |-- sssd-kcm.socket
● | | |-- systemd-coredump.socket
● | | |-- systemd-initctl.socket
● | | |-- systemd-journald-dev-log.socket
● | | |-- systemd-journald.socket
● | | |-- systemd-udev-control.socket
● | | |-- systemd-udev-kernel.socket
● | |-- sysinit.target
● | | |-- dev-hugepages.mount
lines 1-55
```

Les points noirs au début de chaque ligne dans la sortie ci-dessus peuvent être de trois couleurs différentes :

- **Vert** implique que le service, la cible ou l'unité est activé et démarré.
- **Blanc** implique que le service, la cible ou l'unité est inactif.
- **Rouge** implique que le service, la cible ou l'unité n'a pas démarré à cause d'une erreur fatale.

Pour visualiser les Unités en état d'erreur fatale, utilisez la commande **systemctl -failed** :

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

Les dépendances sont créés sous la forme de liens symboliques dans les répertoires **/etc/systemd/system/multi-user.target.wants** et **/usr/lib/systemd/system/multi-user.target.wants** :

```
[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/smartd.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/sss.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 - La Cible par Défaut

Consulter la Cible par Défaut

Pour consulter la cible par défaut, il convient d'utiliser la commande **systemctl get-default** :

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

La Cible par défaut est représentée par le lien symbolique **/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
```

Modifier la Cible par Défaut

Pour modifier la Cible par défaut avec une prise en compte lors du **prochain** démarrage, il convient d'utiliser la commande **systemctl set-default** :

```
[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
```

Modifier la Cible en Cours

Il est possible de modifier la cible actuellement en cours en utilisant la commande **systemctl isolate** :

```
[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 - Gestion des Services

5.1 - Gestion des Instances Uniques

Commencez par installer le paquet **httpd** :

```
[root@redhat9 ~]# dnf install httpd
Updating Subscription Management repositories.
Last metadata expiration check: 1:59:56 ago on Thu 26 Sep 2024 12:57:02 PM CEST.
Dependencies resolved.
```

Package	Architecture	Size	Version
Repository			
Installing:			
httpd	x86_64		2.4.57-11.el9_4.1
rhel-9-for-x86_64-appstream-rpms		51 k	
Installing dependencies:			
apr	x86_64		1.7.0-12.el9_3

rhel-9-for-x86_64-appstream-rpms		126 k	
apr-util	x86_64		1.6.1-23.el9
rhel-9-for-x86_64-appstream-rpms		97 k	
apr-util-bdb	x86_64		1.6.1-23.el9
rhel-9-for-x86_64-appstream-rpms		14 k	
httpd-core	x86_64		2.4.57-11.el9_4.1
rhel-9-for-x86_64-appstream-rpms		1.5 M	
httpd-filesystem	noarch		2.4.57-11.el9_4.1
rhel-9-for-x86_64-appstream-rpms		14 k	
httpd-tools	x86_64		2.4.57-11.el9_4.1
rhel-9-for-x86_64-appstream-rpms		86 k	
redhat-logos-httpd	noarch		90.4-2.el9
rhel-9-for-x86_64-appstream-rpms		18 k	
Installing weak dependencies:			
apr-util-openssl	x86_64		1.6.1-23.el9
rhel-9-for-x86_64-appstream-rpms		17 k	
mod_http2	x86_64		2.0.26-2.el9_4
rhel-9-for-x86_64-appstream-rpms		167 k	
mod_lua	x86_64		2.4.57-11.el9_4.1
rhel-9-for-x86_64-appstream-rpms		60 k	

Transaction Summary

=====
=====
Install 11 Packages

Total download size: 2.2 M

Installed size: 6.0 M

Is this ok [y/N]: y

Downloading Packages:

(1/11): apr-util-bdb-1.6.1-23.el9.x86_64.rpm

28 kB/s | 14 kB 00:00

(2/11): apr-util-openssl-1.6.1-23.el9.x86_64.rpm

31 kB/s | 17 kB 00:00

```
(3/11): apr-util-1.6.1-23.el9.x86_64.rpm
165 kB/s | 97 kB      00:00
(4/11): redhat-logos-httpd-90.4-2.el9.noarch.rpm
69 kB/s | 18 kB      00:00
(5/11): apr-1.7.0-12.el9_3.x86_64.rpm
374 kB/s | 126 kB    00:00
(6/11): mod_http2-2.0.26-2.el9_4.x86_64.rpm
435 kB/s | 167 kB    00:00
(7/11): httpd-core-2.4.57-11.el9_4.1.x86_64.rpm
2.9 MB/s | 1.5 MB    00:00
(8/11): httpd-filesystem-2.4.57-11.el9_4.1.noarch.rpm
31 kB/s | 14 kB      00:00
(9/11): httpd-2.4.57-11.el9_4.1.x86_64.rpm
63 kB/s | 51 kB      00:00
(10/11): httpd-tools-2.4.57-11.el9_4.1.x86_64.rpm
297 kB/s | 86 kB     00:00
(11/11): mod_lua-2.4.57-11.el9_4.1.x86_64.rpm
154 kB/s | 60 kB     00:00
```

```
-----
-----
Total
1.2 MB/s | 2.2 MB     00:01
Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction
  Preparing           :
1/1
  Installing           : apr-1.7.0-12.el9_3.x86_64
1/11
  Installing           : apr-util-bdb-1.6.1-23.el9.x86_64
2/11
  Installing           : apr-util-openssl-1.6.1-23.el9.x86_64
```

```
3/11
  Installing      : apr-util-1.6.1-23.el9.x86_64
4/11
  Installing      : httpd-tools-2.4.57-11.el9_4.1.x86_64
5/11
  Running scriptlet: httpd-filesystem-2.4.57-11.el9_4.1.noarch
6/11
  Installing      : httpd-filesystem-2.4.57-11.el9_4.1.noarch
6/11
  Installing      : httpd-core-2.4.57-11.el9_4.1.x86_64
7/11
  Installing      : mod_lua-2.4.57-11.el9_4.1.x86_64
8/11
  Installing      : redhat-logos-httpd-90.4-2.el9.noarch
9/11
  Installing      : mod_http2-2.0.26-2.el9_4.x86_64
10/11
  Installing      : httpd-2.4.57-11.el9_4.1.x86_64
11/11
  Running scriptlet: httpd-2.4.57-11.el9_4.1.x86_64
11/11
  Verifying       : apr-util-1.6.1-23.el9.x86_64
1/11
  Verifying       : apr-util-bdb-1.6.1-23.el9.x86_64
2/11
  Verifying       : apr-util-openssl-1.6.1-23.el9.x86_64
3/11
  Verifying       : redhat-logos-httpd-90.4-2.el9.noarch
4/11
  Verifying       : apr-1.7.0-12.el9_3.x86_64
5/11
  Verifying       : mod_http2-2.0.26-2.el9_4.x86_64
6/11
  Verifying       : httpd-2.4.57-11.el9_4.1.x86_64
```

```
7/11
  Verifying      : httpd-core-2.4.57-11.el9_4.1.x86_64
8/11
  Verifying      : httpd-filesystem-2.4.57-11.el9_4.1.noarch
9/11
  Verifying      : httpd-tools-2.4.57-11.el9_4.1.x86_64
10/11
  Verifying      : mod_lua-2.4.57-11.el9_4.1.x86_64
11/11
Installed products updated.

Installed:
  apr-1.7.0-12.el9_3.x86_64          apr-util-1.6.1-23.el9.x86_64          apr-util-
bdb-1.6.1-23.el9.x86_64          apr-util-openssl-1.6.1-23.el9.x86_64    httpd-2.4.57-11.el9_4.1.x86_64
  httpd-core-2.4.57-11.el9_4.1.x86_64  httpd-filesystem-2.4.57-11.el9_4.1.noarch  httpd-
tools-2.4.57-11.el9_4.1.x86_64    mod_http2-2.0.26-2.el9_4.x86_64          mod_lua-2.4.57-11.el9_4.1.x86_64
  redhat-logos-httpd-90.4-2.el9.noarch

Complete!
```

Pour obtenir le détail sur un service donné, il convient d'utiliser la commande **systemctl status** :

```
[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)
```

Dans le cas du service httpd ci-dessus, on peut constater que le statut est **disabled**. Le statut peut être une de 2 valeurs :

- **disabled** - le service ne démarrera pas lors du prochain démarrage du système.
- **enabled** - le service démarrera lors du prochain démarrage du système.

Il est possible de vérifier le statut en utilisant le commande **systemctl is-enabled** :

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

Pour rendre le statut **enabled**, il convient d'utiliser la commande **systemctl enable** :

```
[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)
```

Dans le cas du service httpd ci-dessus, on peut maintenant constater que l'état est **inactive (dead)**. L'état peut être une de 7 valeurs :

- **inactive (dead)** - le service est arrêté.
- **active(running)** - le service est démarré avec un ou plusieurs processus.
- **active(exited)** - le service a terminé une configuration unique.
- **active(waiting)** - le service est démarré mais en attente d'un évènement.
- **activating** - le service est en cours d'activation.
- **deactivating** - le service est en cours de désactivation.
- **failed** - le service a rencontré une erreur fatale.

Il est possible de vérifier l'état en utilisant la commande **systemctl is-active** :

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

Pour rendre l'état **active(running)**, utilisez la commande suivante :

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

Vérifiez ensuite l'état du 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.
```

Pour arrêter une Unité de service, utilisez la commande suivante :

```
[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.
```

Pour désactiver un service au prochain démarrage du système, utilisez l'option **disable** :

```
[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 - Gestion d'Instances Multiples

Systemd permet l'utilisation des gabarits (templates) des fichiers de configuration des Unités. De cette façon il est possible de faire coexister deux ou plusieurs instances du même service. Un gabarit est reconnaissable par le caractère @ qui est placé juste avant le point dans le nom du fichier :

```
[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
```

Une instance créée à partir de ce gabarit devrait avoir un nom sous la forme suivante :

```
httpd@<nom_instance>.service
```

Dans ce fichier on peut constater l'utilisation d'un **identifiant** sous la forme de **%i**. Les identifiants sont de deux types - un dit **échappé** où les caractères non-ASCII alphanumérique sont remplacés par **escapes** de type langage C et l'autre non-échappé :

- **%n** : est remplacé par le nom complet échappé de l'Unité.
- **%N** : est remplacé par le nom complet non-échappé de l'Unité.
- **%p** : est remplacé par le préfixe échappé de l'Unité, c'est-à-dire la partie **avant** le caractère @.
- **%P** : est remplacé par le préfixe non-échappé de l'Unité, c'est-à-dire la partie **avant** le caractère @.
- **%i** : est remplacé par le nom de l'instance échappé de l'Unité, c'est-à-dire la partie **après** le caractère @ et **avant** le point.
- **%I** : est remplacé par le nom de l'instance non-échappé de l'Unité, c'est-à-dire la partie **après** le caractère @ et **avant** le point.
- **%f** : est remplacé par le préfixe non-échappé ou le nom de l'instance non-échappé préfixé par le caractère /.
- **%c** : est remplacé par le CGroup de l'Unité sans le chemin /sys/fs/cgroup/systemd/.
- **%u** : est remplacé par le nom de l'utilisateur responsable de l'exécution de l'Unité.
- **%U** : est remplacé par l'UID de l'utilisateur responsable de l'exécution de l'Unité.
- **%H** : est remplacé par le nom d'hôte sur lequel est exécuté l'Unité.
- **%%** : est remplacé par le caractère %.

Créez maintenant deux copies du fichier **/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
```

Créez deux copies du fichier **/etc/httpd/conf/httpd.conf** :

```
[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
```

Editez la directive **Listen** du fichier **/etc/httpd/conf/instance01.conf** et ajoutez la directive **PidFile** :

```
[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', where as '/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]
```

Editez la directive **Listen** du fichier **/etc/httpd/conf/instance02.conf** et ajoutez la directive **PidFile** :

```
[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', where as '/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]
```

Démarrez les deux 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 - Interdire la Modification du Statut d'un Service

Il est possible d'interdire la modification en utilisant la commande **systemctl mask**:

```
[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.
```

Pour autoriser de nouveau les modifications, il convient d'utiliser la commande **systemctl unmask** :

```
[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.
```