Understanding systemd

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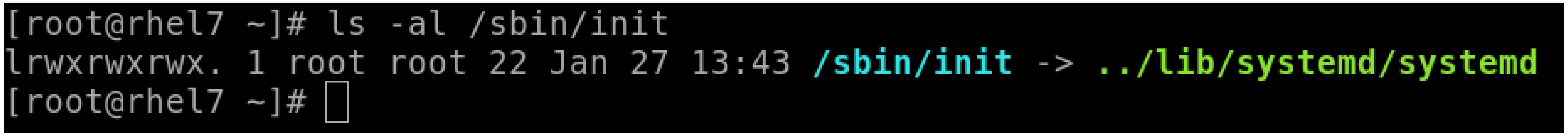
What is systemd?

- Replaces init
  - Literally!



```
[root@rhel7 ~]# ls -al /sbin/init
lrwxrwxrwx. 1 root root 22 Jan 27 13:43 /sbin/init -> ../lib/systemd/systemd
[root@rhel7 ~]# 
```

- First process to start and last to stop
- Parent process of all other processes
- Manages services ***and*** other resources

What was init again?

- init – System V UNIX origins in 1970s
- Process for starting system:
  - BIOS/UEFI → Bootloader → Kernel → init
- init is the parent of all processes
- Creates processes from scripts stored in /etc/inittab
- “Modern” init scripts are stored in /etc/init.d and called from /etc/rc*

Why replace System V init?

- init scripts!
  - Old, poorly maintained
  - Lack of standardization
  - Difficult / impossible to analyze (by humans and/or computers)
- Single threaded
- Unable to represent complex relationships

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/etc/init.d/httpd
(taken from RHEL 6.5, comments removed)

```
. /etc/rc.d/init.d/functions
if [ -f /etc/sysconfig/httpd ]; then
        . /etc/sysconfig/httpd
fi
HTTPD_LANG=${HTTPD_LANG-"C"}
INITLOG_ARGS=""
apachectl=/usr/sbin/apachectl
httpd=${HTTPD-/usr/sbin/httpd}
prog=httpd
pidfile=${PIDFILE-/var/run/httpd/httpd.pid}
lockfile=${LOCKFILE-/var/lock/subsys/httpd}
RETVAL=0
STOP_TIMEOUT=${STOP_TIMEOUT-10}
start() {
        echo -n $"Starting $prog: "
        LANG=$HTTPD_LANG daemon --pidfile=${pidfile} $httpd $OPTIONS
        RETVAL=$?
        echo
        [ $RETVAL = 0 ] && touch ${lockfile}
        return $RETVAL
}
stop() {
        echo -n $"Stopping $prog: "
        killproc -p ${pidfile} -d ${STOP_TIMEOUT} $httpd
        RETVAL=$?
        echo
        [ $RETVAL = 0 ] && rm -f ${lockfile} ${pidfile}
}
```

/etc/init.d/httpd

(continued)

```
reload() {
    echo -n $"Reloading $prog: "
    if ! LANG=$HTTPD_LANG $httpd $OPTIONS -t >&/dev/null; then
        RETVAL=6
        echo $"not reloading due to configuration syntax error"
        failure $"not reloading $httpd due to configuration syntax error"
    else
        LSB=1 killproc -p ${pidfile} $httpd -HUP
        RETVAL=$?
        if [ $RETVAL -eq 7 ]; then
            failure $"httpd shutdown"
        fi
    fi
    echo
}

case "$1" in
  start)
        start
        ;;
  stop)
        stop
        ;;
  status)
        status -p ${pidfile} $httpd
        RETVAL=$?
        ;;
```

/etc/init.d/httpd

(still continued…)

```
 restart)
        stop
        start
        ;;
  condrestart|try-restart)
        if status -p ${pidfile} $httpd >&/dev/null; then
                stop
                start
        fi
        ;;
  force-reload|reload)
        reload
        ;;
  graceful|help|configtest|fullstatus)
        $apachectl $@
        RETVAL=$?
        ;;
  *)
        echo $"Usage: $prog {start|stop|restart|condrestart|try-restart|force-reload|reload|status|fullstatus|graceful|help|
configtest}"
        RETVAL=2
esac
exit $RETVAL
```

systemd: httpd.service

```
[Unit]
Description=The Apache HTTP Server
After=remote-fs.target nss-lookup.target

[Service]
Type=notify
EnvironmentFile=/etc/sysconfig/httpd
ExecStart=/usr/sbin/httpd $OPTIONS -DFOREGROUND
ExecReload=/usr/sbin/httpd $OPTIONS -k graceful
ExecStop=/usr/sbin/httpd $OPTIONS -k graceful-stop

KillSignal=SIGCONT
PrivateTmp=true

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

So long, and thanks for all the fish

RIP
Sys V
init
1970-2011

systemd -

System & Service Manager

systemd Overview

- Controls More than Services
- Dependency Control
- Tracks and Restarts Services
- Service Activation
- Faster Start Up and Shutdown
- Improved Resource Management
- Better Logging, Debugging and Profiling
- Backwards compatible
- Easier to learn

systemd Units

Controls more than services, it controls all resources on the system - referred to as units.

Examples of Units:

Services	Sockets	Mounts
Targets	Swap	and more...

Units are defined using Unit Files

- Naming convention is name.unit_type

systemd Unit Files

- Maintainer files: /usr/lib/systemd/system
- Administrator files: /etc/systemd/system
- Non-persistent, runtime data: /run/systemd
- Drop-ins: /etc/systemd/system/[name.type].d/*.conf

Note: unit files under /etc will take precedence over /usr

Don't forget `systemctl daemon-reload` when modifying units.

Common Unit File Options

Description=Unit description

Documentation=Documentation links

Requires=Additional units required

Before/After=Unit must start Before/After

Wants=Weaker Requires

Conflicts=Units cannot co-exist

WantedBy/RequiredBy=Set other units requirement

- Lots of great detail in the RHEL 7 System Administrator's Guide

Service Activation

- Start up services when needed
  - Save resources
  - Increased reliability
  - Transparent to client
- Activation by Socket, Device, Path, Bus, and Timer
- Recommended to convert xinetd services to units

Improved Resource Management

- Services labeled and isolated with Cgroups
- More control than nice alone

- Can properly kill/restart entire service chain
- Can configure multiple instances for a single service
- Can balance by shares or by hard limits

Kill/Restart Cleanly

- Tracked in the kernel
- Knows all children
- Don’t need to rely on a potentially misbehaving process to hopefully kill its children

Auto-Restarting

- It’s paying attention!
- Reality: software does crash occasionally
- Reduces need for manual intervention
- Socket stays open, only lose that single transaction

systemd: Managing Services

With init:

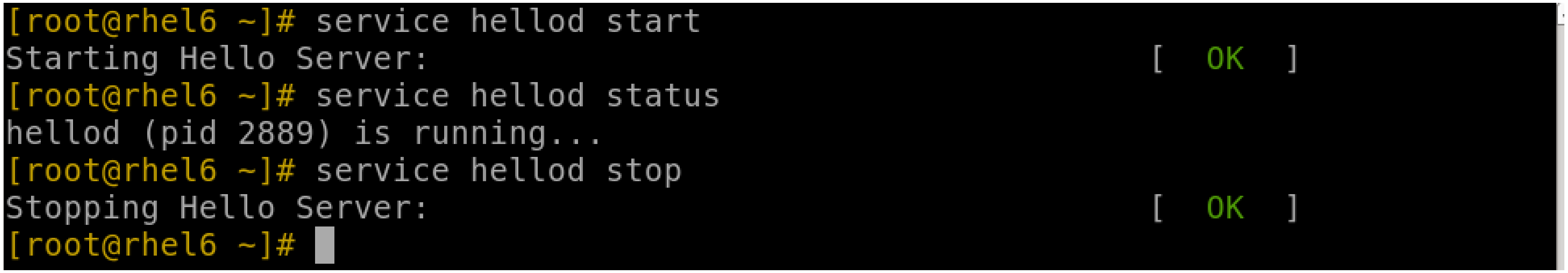
```
$ service unit {start,stop,restart,reload}
```

With systemd:

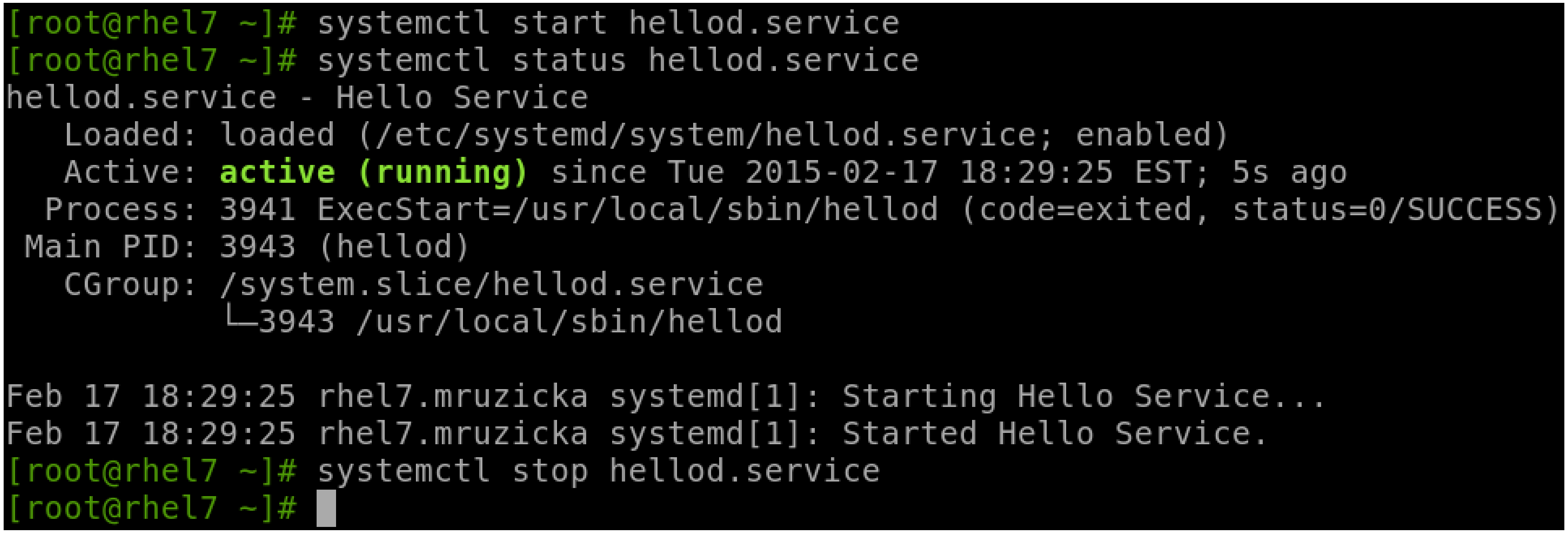
```
$ systemctl {start,stop,restart,reload} unit1 [unit2 …]
```

- Allows multiple services to be acted on simultaneously
- Assumes .service as unit type
- Tab completion works great with systemctl
  - Install bash-completion

systemctl vs service



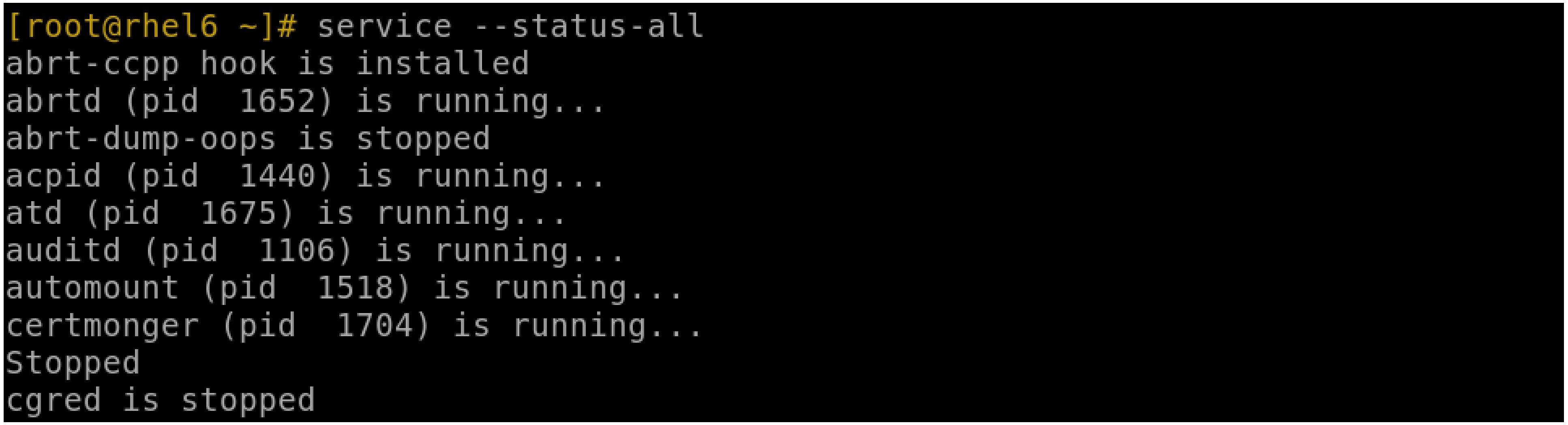
```
[root@rhel6 ~]# service hellod start
Starting Hello Server:                                     [  OK  ]
[root@rhel6 ~]# service hellod status
hellod (pid 2889) is running...
[root@rhel6 ~]# service hellod stop
Stopping Hello Server:                                     [  OK  ]
[root@rhel6 ~]#
```



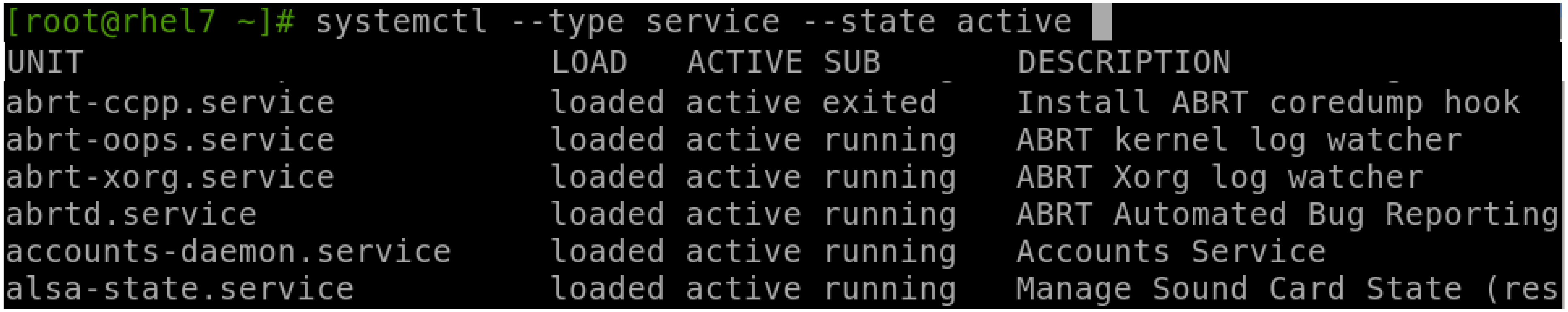
```
[root@rhel7 ~]# systemctl start hellod.service
[root@rhel7 ~]# systemctl status hellod.service
hellod.service - Hello Service
   Loaded: loaded (/etc/systemd/system/hellod.service; enabled)
   Active: active (running) since Tue 2015-02-17 18:29:25 EST; 5s ago
  Process: 3941 ExecStart=/usr/local/sbin/hellod (code=exited, status=0/SUCCESS)
 Main PID: 3943 (hellod)
   CGroup: /system.slice/hellod.service
           └─3943 /usr/local/sbin/hellod

Feb 17 18:29:25 rhel7.mruzicka systemd[1]: Starting Hello Service...
Feb 17 18:29:25 rhel7.mruzicka systemd[1]: Started Hello Service.
[root@rhel7 ~]# systemctl stop hellod.service
[root@rhel7 ~]#
```

systemctl vs service

- List services:



```
[root@rhel6 ~]# service --status-all
abrt-ccpp hook is installed
abrtd (pid  1652) is running...
abrt-dump-oops is stopped
acpid (pid  1440) is running...
atd (pid  1675) is running...
auditd (pid  1106) is running...
automount (pid  1518) is running...
certmonger (pid  1704) is running...
Stopped
cgred is stopped
```



```
[root@rhel7 ~]# systemctl --type service --state active
UNIT                        LOAD   ACTIVE SUB     DESCRIPTION
abrt-ccpp.service           loaded active exited  Install ABRT coredump hook
abrt-oops.service           loaded active running ABRT kernel log watcher
abrt-xorg.service           loaded active running ABRT Xorg log watcher
abrtd.service               loaded active running ABRT Automated Bug Reporting
accounts-daemon.service     loaded active running Accounts Service
alsa-state.service          loaded active running Manage Sound Card State (res
```

Managing Services: Enable / Disable

With init:

$ chkconfig *unit* {on,off}

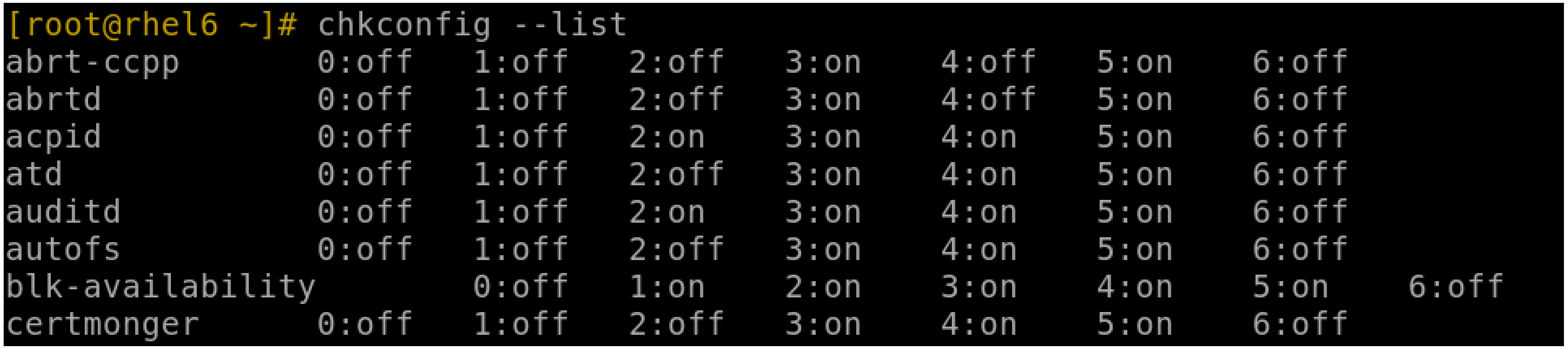
With systemctl:

$ systemctl {enable, disable, mask, unmask} *unit* [*unit...*]

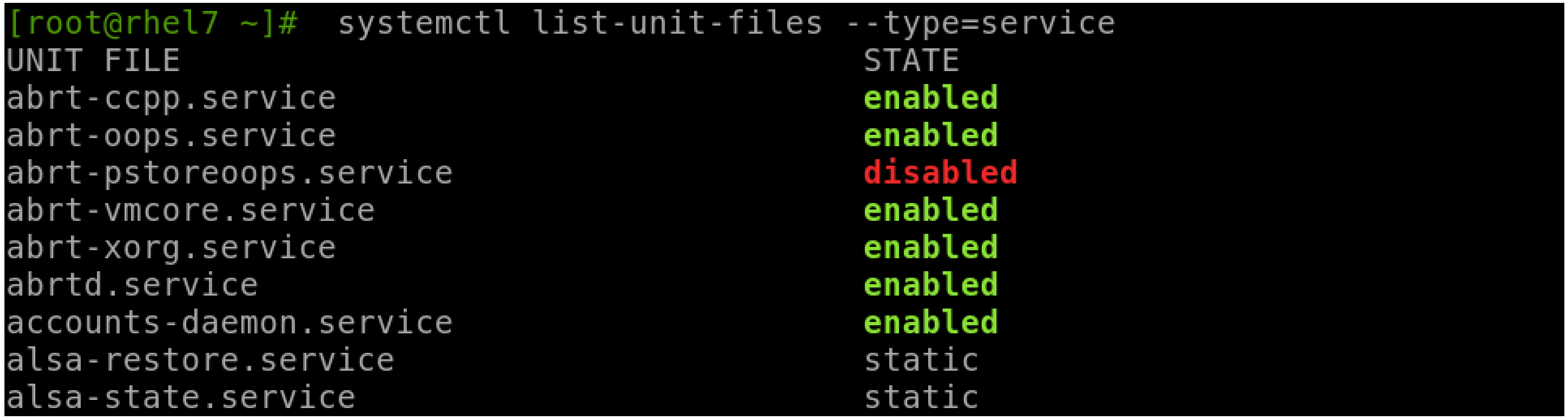
mask – "This will link these units to /dev/null, making it impossible to start them. This is a stronger version of disable, since it prohibits all kinds of activation of the unit, including manual activation. Use this option with care."

Systemctl vs chkconfig

List all services:



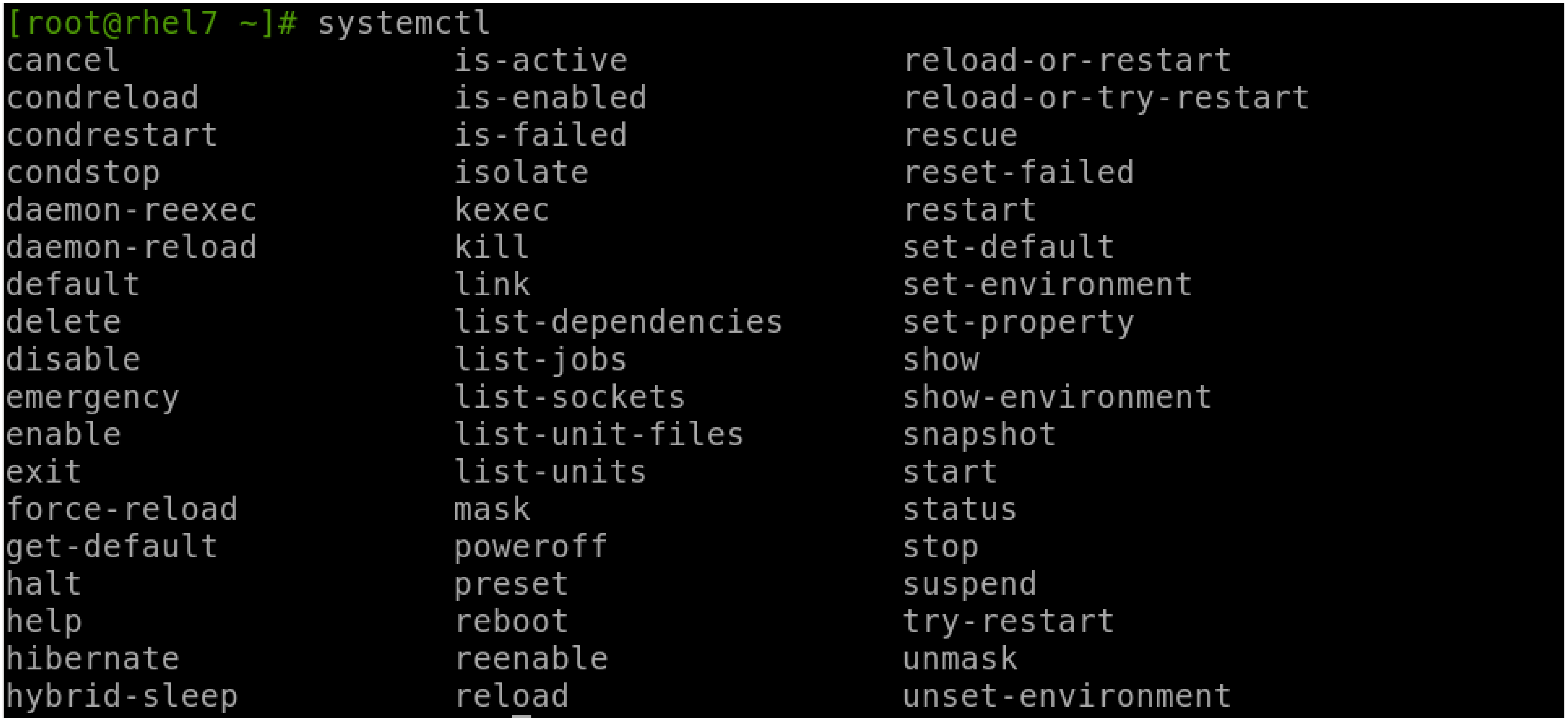
```
[root@rhel6 ~]# chkconfig --list
abrt-ccpp       0:off   1:off   2:off   3:on    4:off   5:on    6:off
abrtd           0:off   1:off   2:off   3:on    4:off   5:on    6:off
acpid           0:off   1:off   2:on    3:on    4:on    5:on    6:off
atd             0:off   1:off   2:off   3:on    4:on    5:on    6:off
auditd          0:off   1:off   2:on    3:on    4:on    5:on    6:off
autofs          0:off   1:off   2:off   3:on    4:on    5:on    6:off
blk-availability        0:off   1:on    2:on    3:on    4:on    5:on    6:off
certmonger      0:off   1:off   2:off   3:on    4:on    5:on    6:off
```



```
[root@rhel7 ~]#  systemctl list-unit-files --type=service
UNIT FILE                                    STATE
abrt-ccpp.service                            enabled
abrt-oops.service                            enabled
abrt-pstoreoops.service                      disabled
abrt-vmcore.service                          enabled
abrt-xorg.service                            enabled
abrtd.service                                enabled
accounts-daemon.service                      enabled
alsa-restore.service                         static
alsa-state.service                           static
```

systemctl

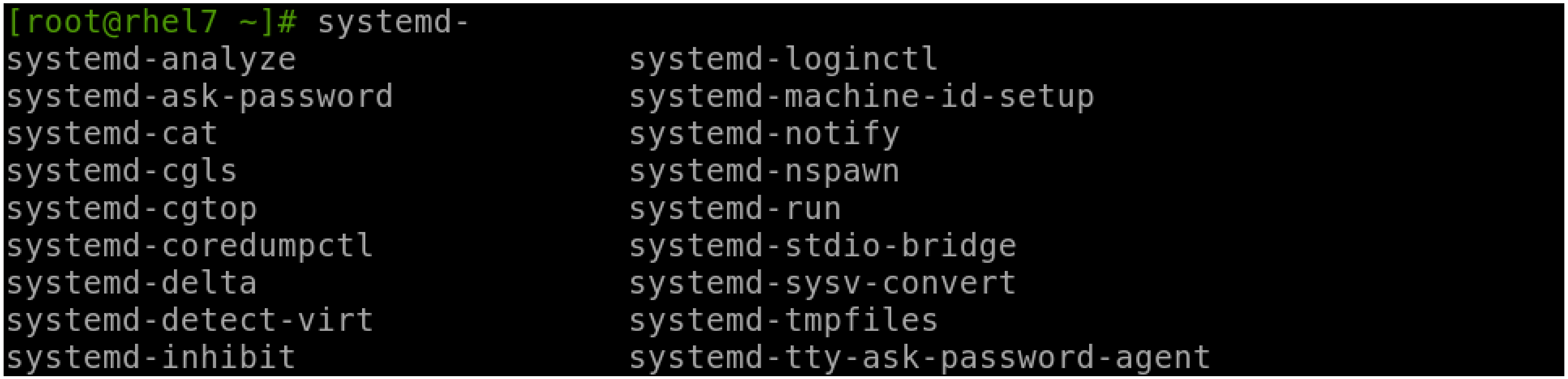
Lots of options...



```
[root@rhel7 ~]# systemctl
cancel                 is-active              reload-or-restart
condreload             is-enabled             reload-or-try-restart
condrestart            is-failed              rescue
condstop               isolate                reset-failed
daemon-reexec          kexec                  restart
daemon-reload          kill                   set-default
default                link                   set-environment
delete                 list-dependencies      set-property
disable                list-jobs              show
emergency              list-sockets           show-environment
enable                 list-unit-files        snapshot
exit                   list-units             start
force-reload           mask                   status
get-default            poweroff               stop
halt                   preset                 suspend
help                   reboot                 try-restart
hibernate              reenable               unmask
hybrid-sleep           reload                 unset-environment
```

systemd-*

Lots of new commands...



```
[root@rhel7 ~]# systemd-
systemd-analyze                 systemd-loginctl
systemd-ask-password            systemd-machine-id-setup
systemd-cat                     systemd-notify
systemd-cgls                    systemd-nspawn
systemd-cgtop                   systemd-run
systemd-coredumpctl             systemd-stdio-bridge
systemd-delta                   systemd-sysv-convert
systemd-detect-virt             systemd-tmpfiles
systemd-inhibit                 systemd-tty-ask-password-agent
```

systemd Dependencies

- Define order and requirements for each unit
- Example: nfs-lock.service

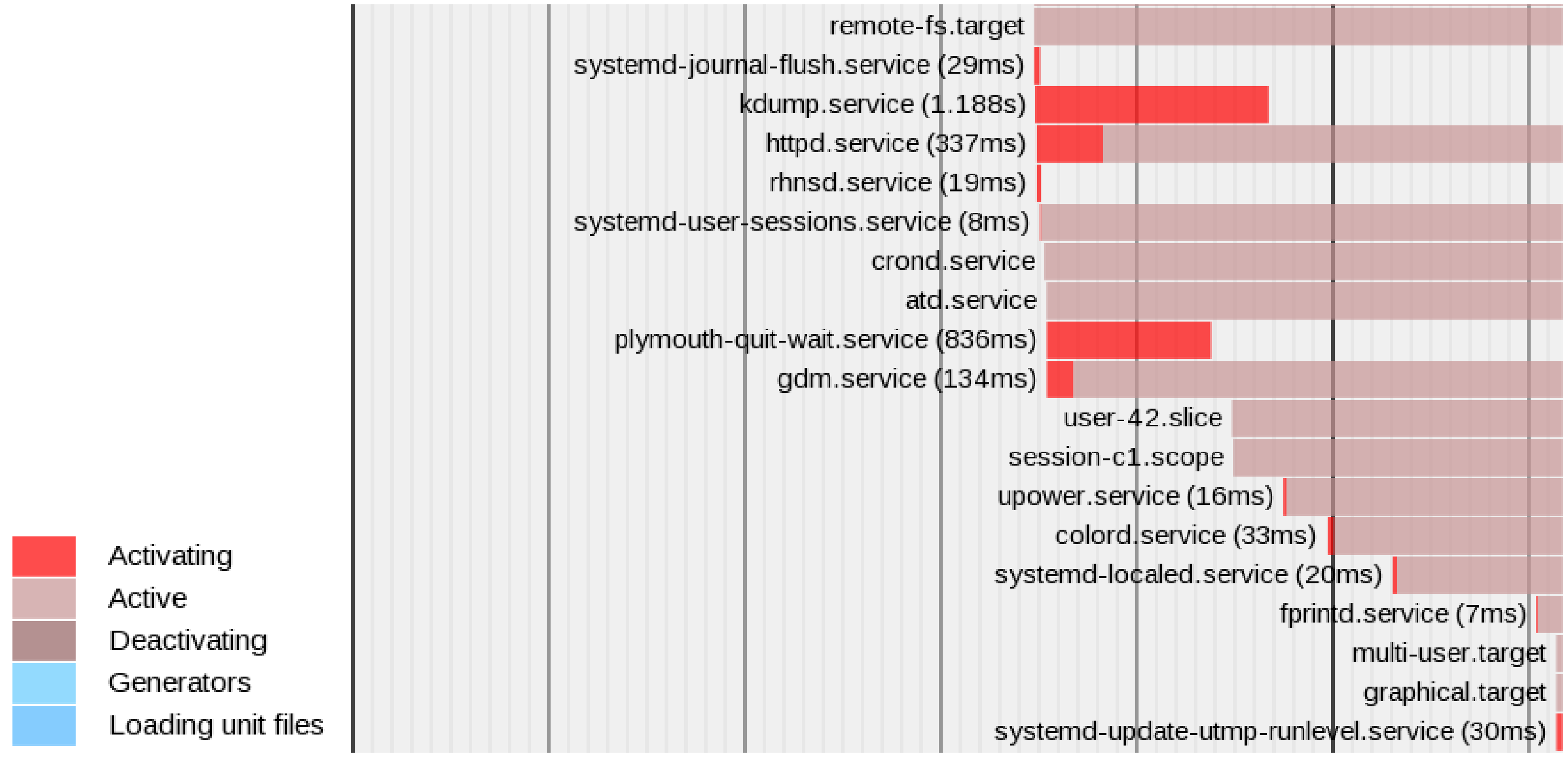
```
Requires=rpcbind.service network.target
After=network.target named.service rpcbind.service
Before=remote-fs-pre.target
```

- No more semi-arbitrary 00-99 ASCII order loading

Parallel, Not Serial

- Allows for Faster Start Up and Shutdown
- Efficiently Use System Resources

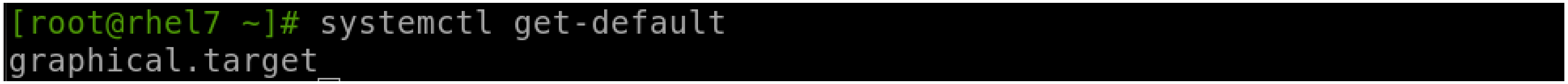
```
[root@rhel7 ~]# systemd-analyze plot > /tmp/boot_plot.svg
```



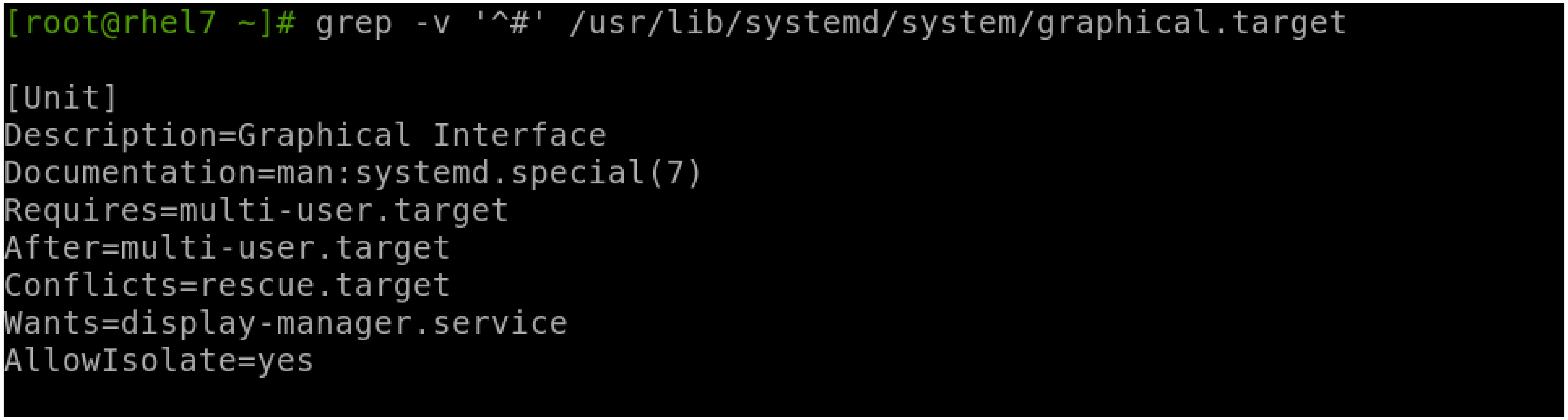
Boot Process

- Boot path determined by default.target

Let's track it backwards!



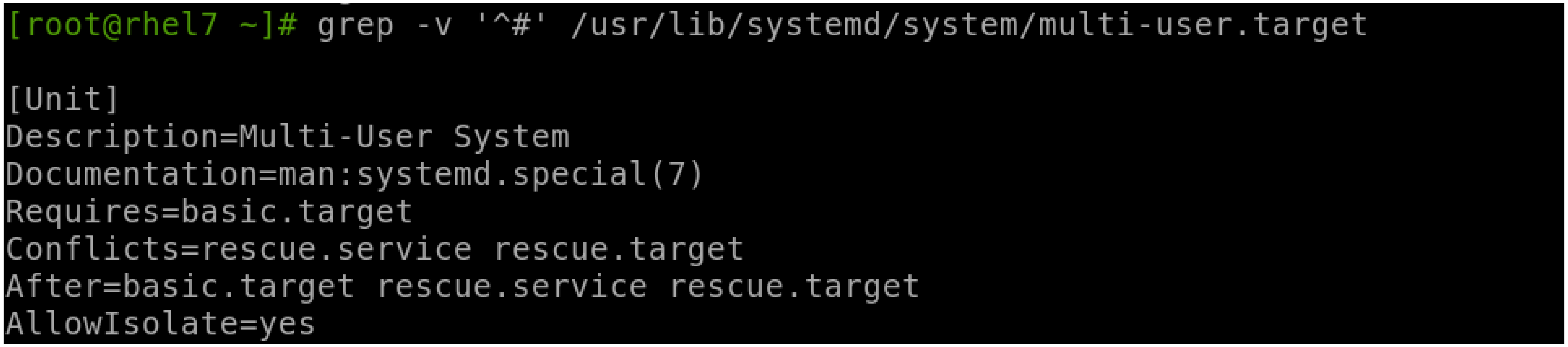
```
[root@rhel7 ~]# systemctl get-default
graphical.target_
```



```
[root@rhel7 ~]# grep -v '^#' /usr/lib/systemd/system/graphical.target

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

Boot Process

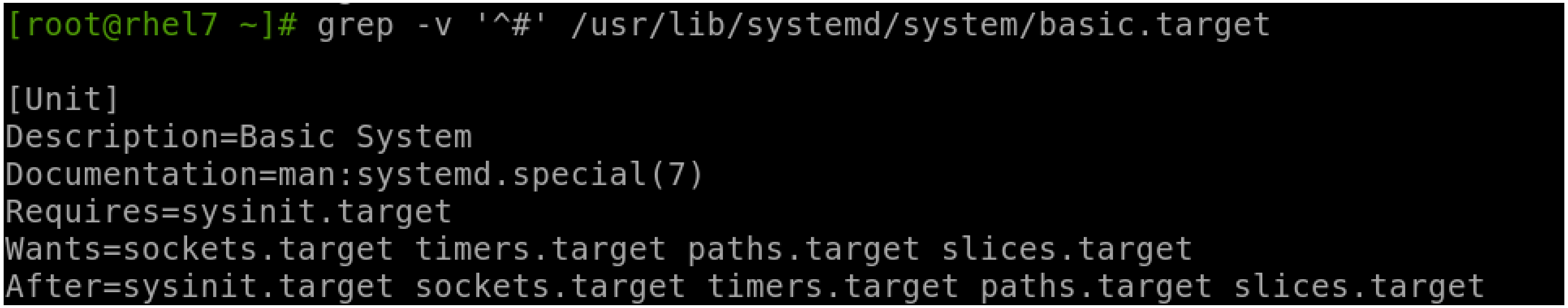
- graphical.target requires multi-user.target...



```
[root@rhel7 ~]# grep -v '^#' /usr/lib/systemd/system/multi-user.target

[Unit]
Description=Multi-User System
Documentation=man:systemd.special(7)
Requires=basic.target
Conflicts=rescue.service rescue.target
After=basic.target rescue.service rescue.target
AllowIsolate=yes
```

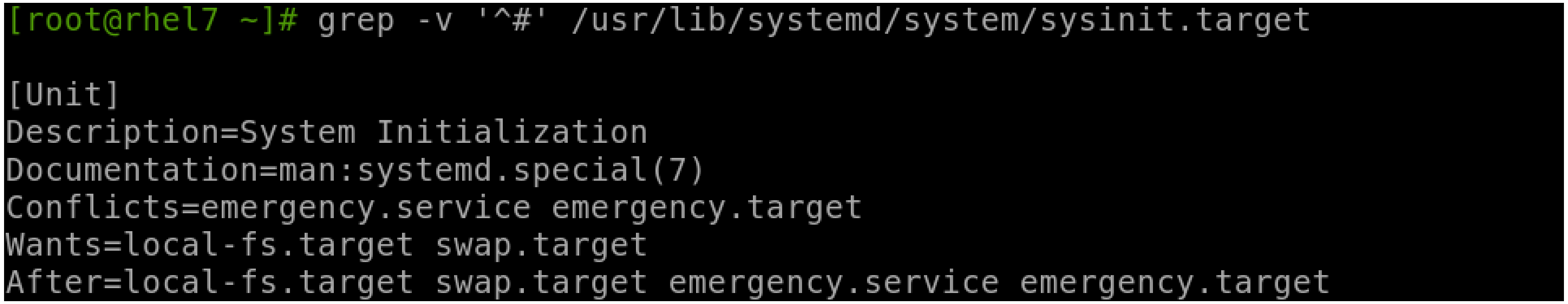
Boot Process

- Which requires basic.target...



```
[root@rhel7 ~]# grep -v '^#' /usr/lib/systemd/system/basic.target

[Unit]
Description=Basic System
Documentation=man:systemd.special(7)
Requires=sysinit.target
Wants=sockets.target timers.target paths.target slices.target
After=sysinit.target sockets.target timers.target paths.target slices.target
```

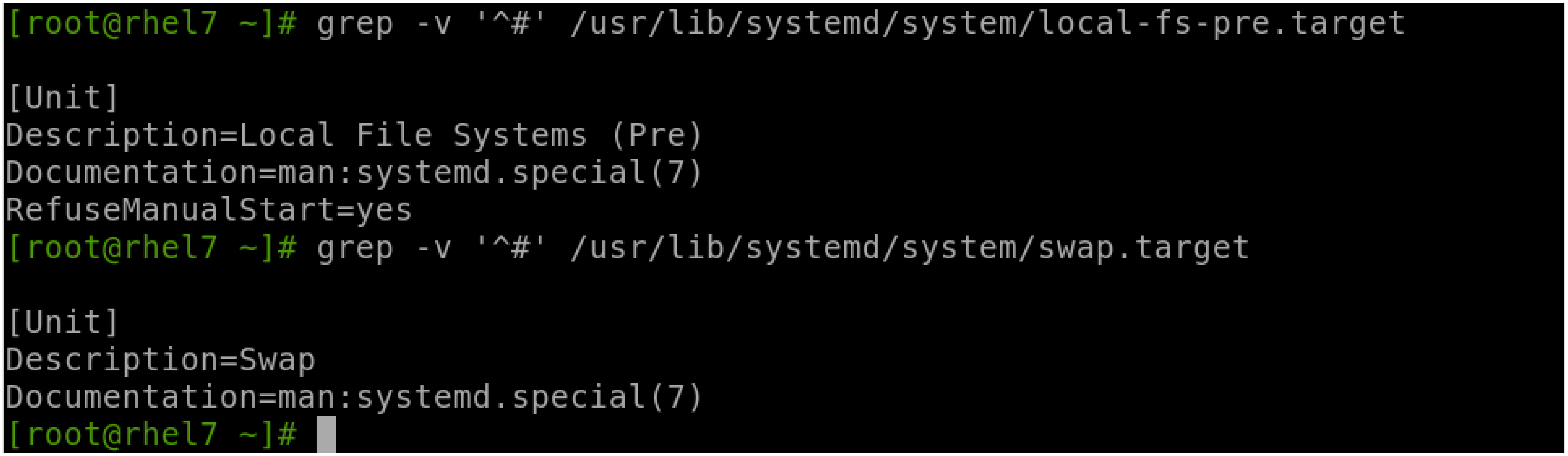
- Which requires sysinit.target...



```
[root@rhel7 ~]# grep -v '^#' /usr/lib/systemd/system/sysinit.target

[Unit]
Description=System Initialization
Documentation=man:systemd.special(7)
Conflicts=emergency.service emergency.target
Wants=local-fs.target swap.target
After=local-fs.target swap.target emergency.service emergency.target
```

Boot Process

Which wants local-fs-pre.target and swap.target...



```
[root@rhel7 ~]# grep -v '^#' /usr/lib/systemd/system/local-fs-pre.target

[Unit]
Description=Local File Systems (Pre)
Documentation=man:systemd.special(7)
RefuseManualStart=yes
[root@rhel7 ~]# grep -v '^#' /usr/lib/systemd/system/swap.target

[Unit]
Description=Swap
Documentation=man:systemd.special(7)
[root@rhel7 ~]#
```

- End of the line!

Boot Process

Targets then loaded from the beginning..

But, how does this work for starting individual services?

Boot Process – Services/Units

- Target “Wants” Directories:

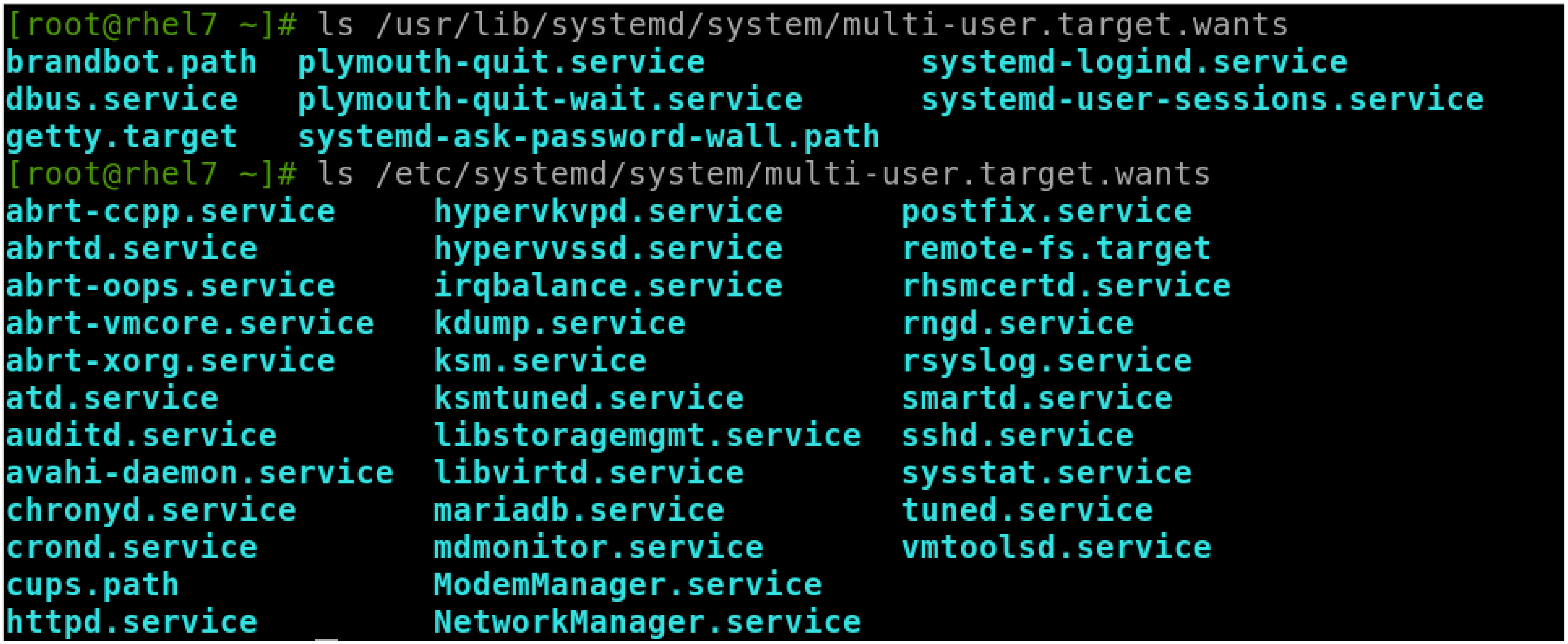
  /usr/lib/systemd/system/<name>.target.wants/

  /etc/systemd/system/<name>.target.wants/

- Files are symlinks to actual unit files
- Empty target wants directories are placeholders

Boot Process - Services/Units

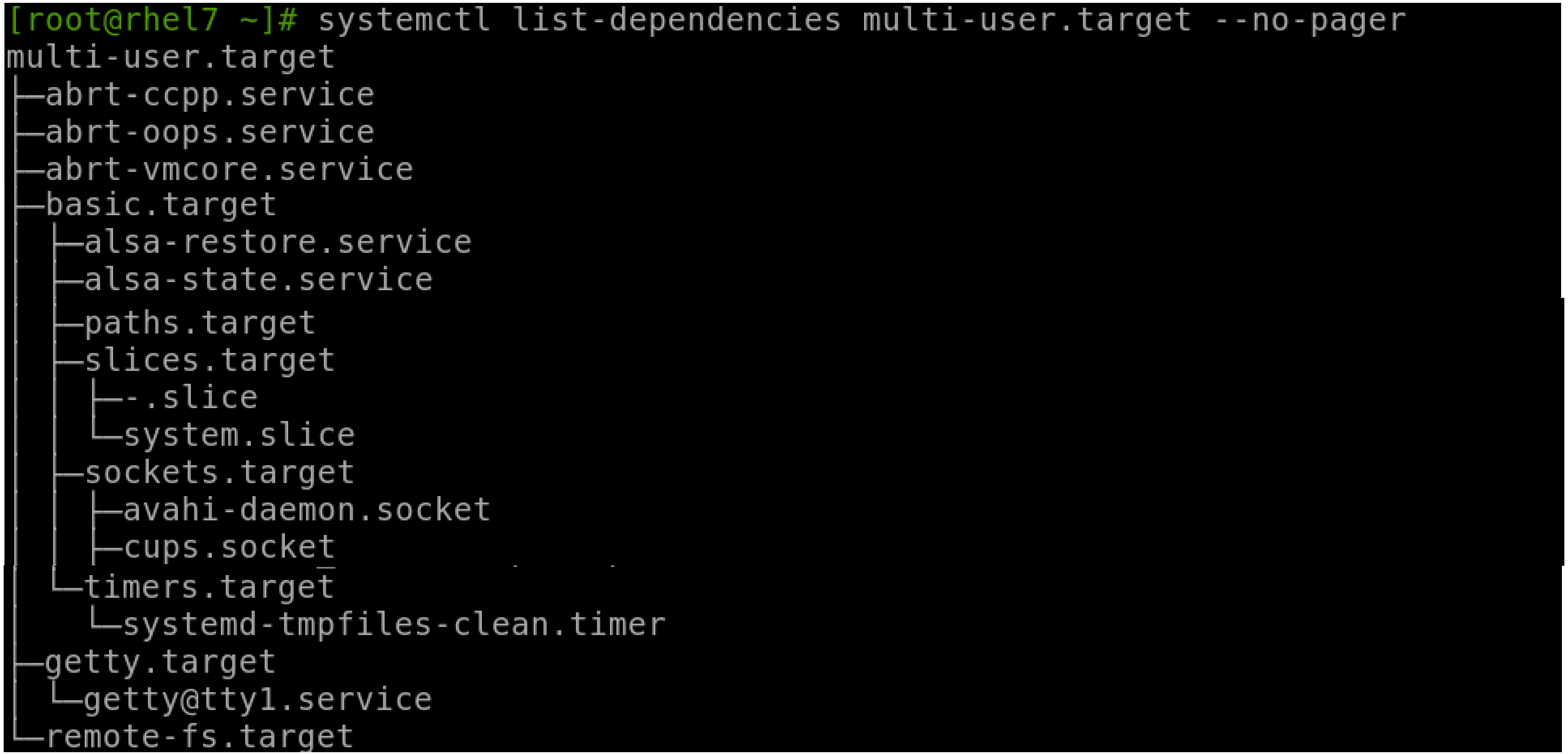
Example for multi-user.target.wants:



```
[root@rhel7 ~]# ls /usr/lib/systemd/system/multi-user.target.wants
brandbot.path  plymouth-quit.service                systemd-logind.service
dbus.service   plymouth-quit-wait.service           systemd-user-sessions.service
getty.target   systemd-ask-password-wall.path
[root@rhel7 ~]# ls /etc/systemd/system/multi-user.target.wants
abrt-ccpp.service       hypervkvpd.service      postfix.service
abrtd.service           hypervvssd.service      remote-fs.target
abrt-oops.service       irqbalance.service      rhsmcertd.service
abrt-vmcore.service     kdump.service           rngd.service
abrt-xorg.service       ksm.service             rsyslog.service
atd.service             ksmtuned.service        smartd.service
auditd.service          libstoragemgmt.service  sshd.service
avahi-daemon.service    libvirtd.service        sysstat.service
chronyd.service         mariadb.service         tuned.service
crond.service           mdmonitor.service       vmtoolsd.service
cups.path               ModemManager.service
httpd.service           NetworkManager.service
```

Exploring dependencies

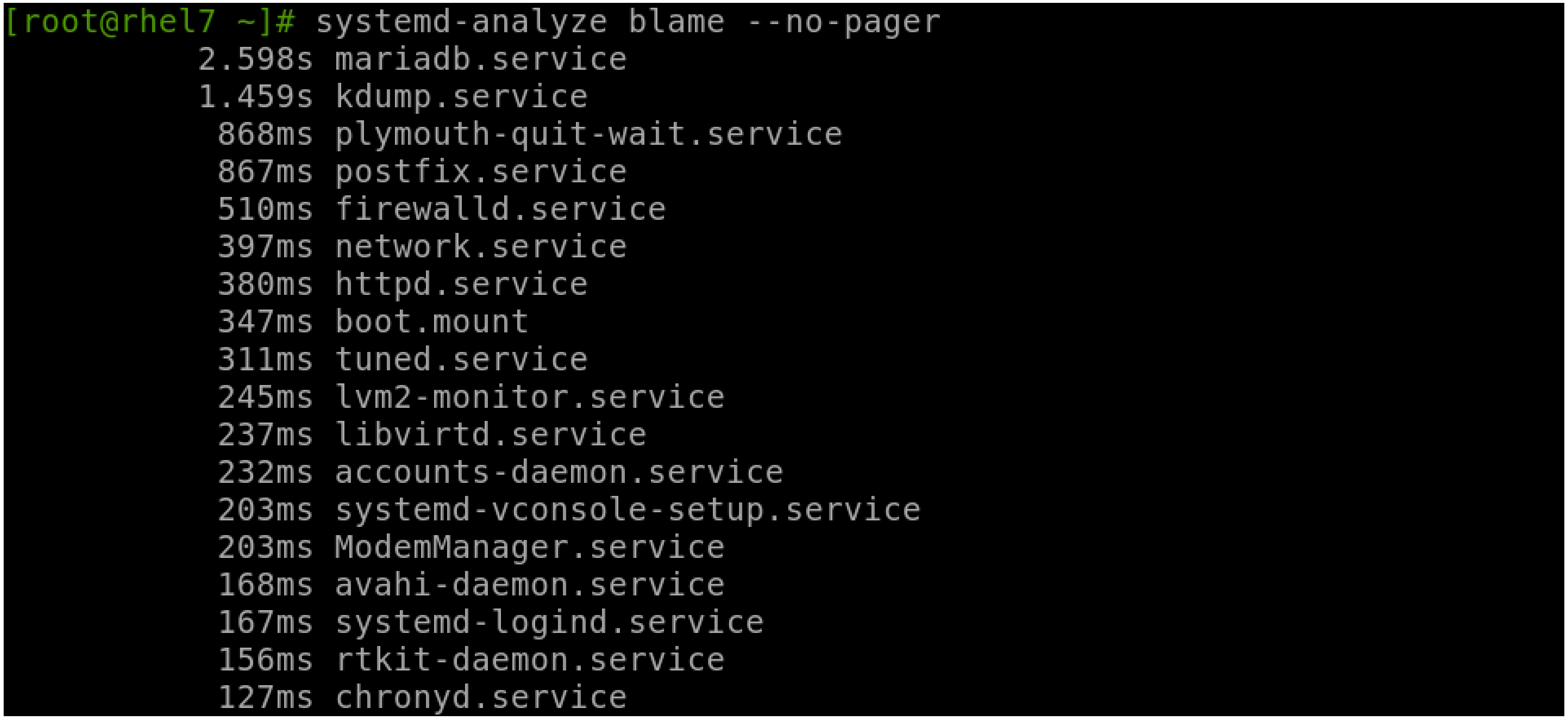
List all services by target:



```
[root@rhel7 ~]# systemctl list-dependencies multi-user.target --no-pager
multi-user.target
├─abrt-ccpp.service
├─abrt-oops.service
├─abrt-vmcore.service
├─basic.target
│ ├─alsa-restore.service
│ ├─alsa-state.service
│ ├─paths.target
│ ├─slices.target
│ │ ├─-.slice
│ │ └─system.slice
│ ├─sockets.target
│ │ ├─avahi-daemon.socket
│ │ ├─cups.socket
│ └─timers.target
│   └─systemd-tmpfiles-clean.timer
├─getty.target
│ └─getty@tty1.service
└─remote-fs.target
```

Analyzing Boot

- Each unit is tracked during start up



```
[root@rhel7 ~]# systemd-analyze blame --no-pager
          2.598s mariadb.service
          1.459s kdump.service
           868ms plymouth-quit-wait.service
           867ms postfix.service
           510ms firewalld.service
           397ms network.service
           380ms httpd.service
           347ms boot.mount
           311ms tuned.service
           245ms lvm2-monitor.service
           237ms libvirtd.service
           232ms accounts-daemon.service
           203ms systemd-vconsole-setup.service
           203ms ModemManager.service
           168ms avahi-daemon.service
           167ms systemd-logind.service
           156ms rtkit-daemon.service
           127ms chronyd.service
```

Targets are the new Runlevels

Targets != Runlevels – some equivalency

Traditional Runlevel	Equivalent Target	Symlink Target
Runlevel 0	poweroff.target	runlevel0.target
Runlevel 1	rescue.target	runlevel1.target
Runlevel 2	multi-user.target	runlevel2.target
Runlevel 3	multi-user.target	runlevel3.target
Runlevel 4	multi-user.target	runlevel4.target
Runlevel 5	graphical.target	runlevel5.target
Runlevel 6	reboot.target	runlevel6.target

- Targets can and will contain other targets

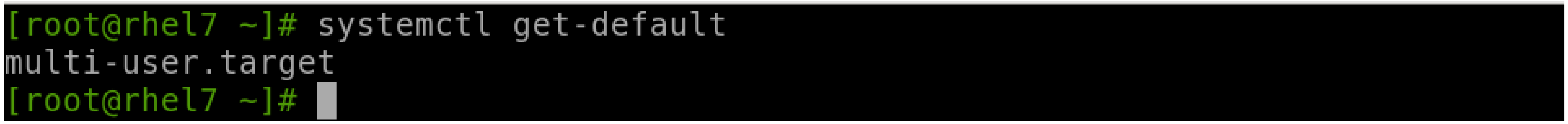
Common Targets

Target	Purpose
graphical.target	Supports multiple users, graphical and text-based logins
multi-user.target	Supports multiple users, text-based logins only
rescue.target	Single user, local file systems mounted and basic system initialization completed, networking is not activated
emergency.target	Single user, root file system is mounted read-only, only a few essential services are started, networking is not activated

- Rescue and Emergency require root password!

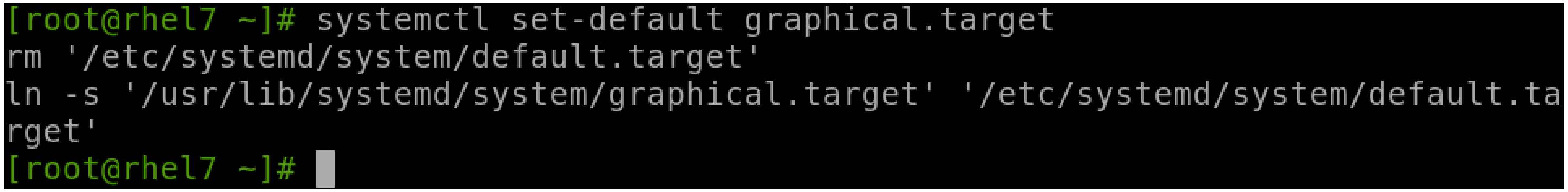
Working with Targets

Viewing the default target:



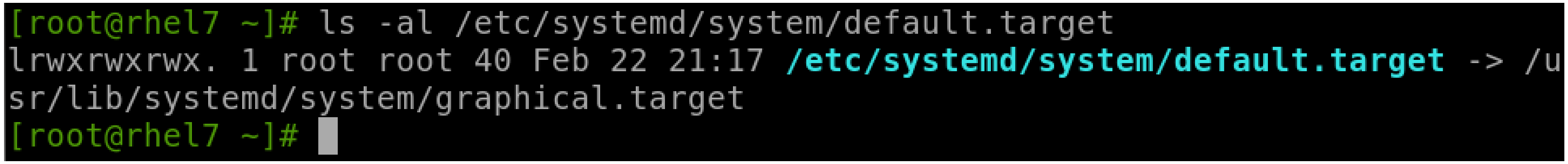
```
[root@rhel7 ~]# systemctl get-default
multi-user.target
[root@rhel7 ~]#
```

Setting default target:



```
[root@rhel7 ~]# systemctl set-default graphical.target
rm '/etc/systemd/system/default.target'
ln -s '/usr/lib/systemd/system/graphical.target' '/etc/systemd/system/default.ta
rget'
[root@rhel7 ~]#
```

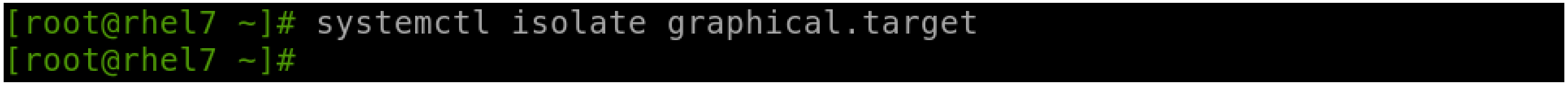
Default target is just a symlink:



```
[root@rhel7 ~]# ls -al /etc/systemd/system/default.target
lrwxrwxrwx. 1 root root 40 Feb 22 21:17 /etc/systemd/system/default.target -> /u
sr/lib/systemd/system/graphical.target
[root@rhel7 ~]#
```

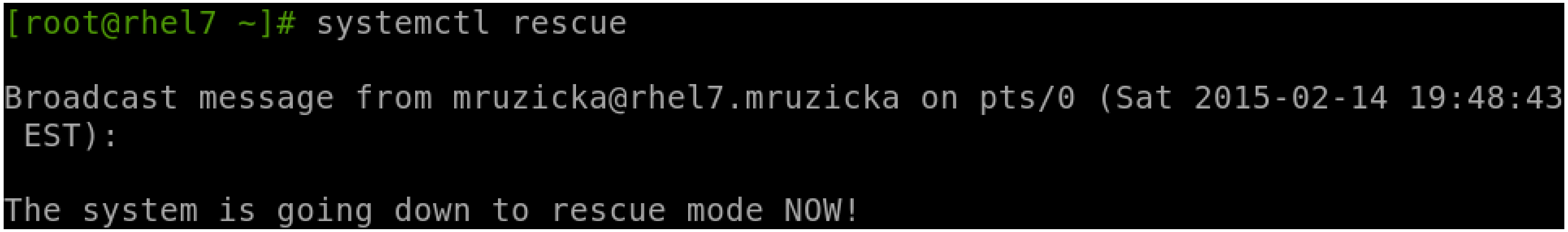
Working with Targets

Changing currently loaded target:



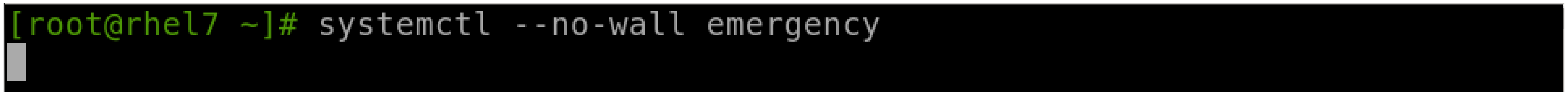
```
[root@rhel7 ~]# systemctl isolate graphical.target
[root@rhel7 ~]#
```

Changing to rescue mode:



```
[root@rhel7 ~]# systemctl rescue

Broadcast message from mruzicka@rhel7.mruzicka on pts/0 (Sat 2015-02-14 19:48:43
 EST):

The system is going down to rescue mode NOW!
```

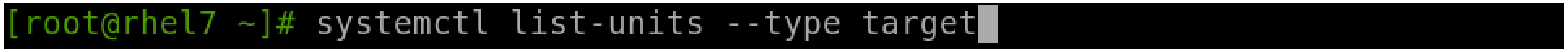
Changing to emergency mode without sending message:



```
[root@rhel7 ~]# systemctl --no-wall emergency

```

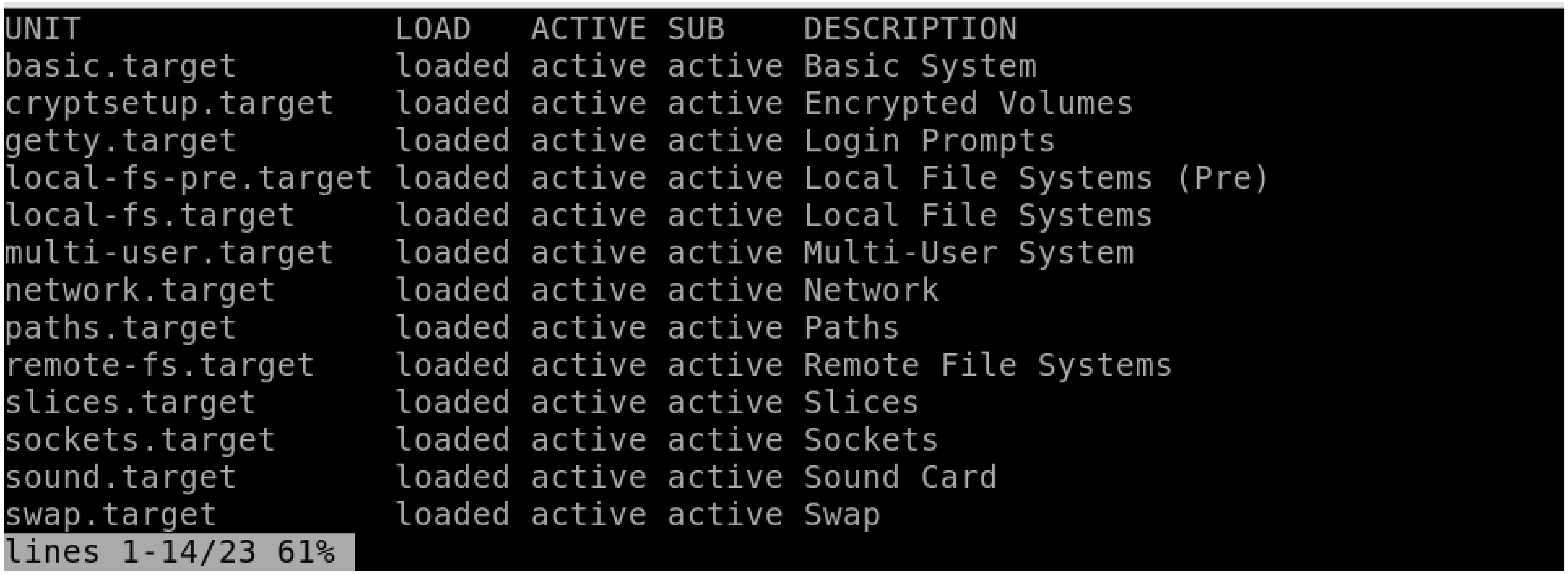
Working with Targets

View list of currently loaded targets:



```
[root@rhel7 ~]# systemctl list-units --type target
```

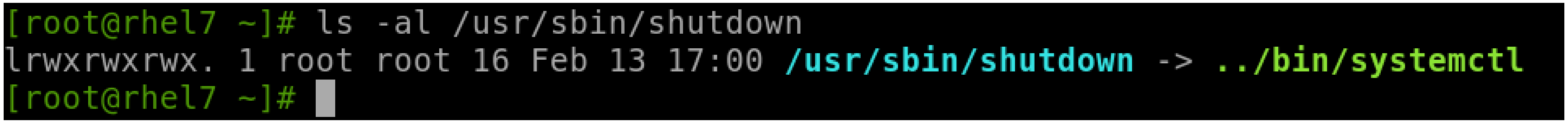
Results pipe to less by default: (can use --no-pager)



```
UNIT                   LOAD   ACTIVE SUB    DESCRIPTION
basic.target           loaded active active Basic System
cryptsetup.target      loaded active active Encrypted Volumes
getty.target           loaded active active Login Prompts
local-fs-pre.target    loaded active active Local File Systems (Pre)
local-fs.target        loaded active active Local File Systems
multi-user.target      loaded active active Multi-User System
network.target         loaded active active Network
paths.target           loaded active active Paths
remote-fs.target       loaded active active Remote File Systems
slices.target          loaded active active Slices
sockets.target         loaded active active Sockets
sound.target           loaded active active Sound Card
swap.target            loaded active active Swap
lines 1-14/23 61%
```

Shutting Down, Suspending, Etc.

Old Command	New Command	Description
halt	systemctl halt	Halts the system
poweroff	systemctl poweroff	Powers off the system
reboot	systemctl reboot	Restarts the system
pm-suspend	systemctl suspend	Suspends the system
pm-hibernate	systemctl hibernate	Hibernates the system
pm-suspend-hybrid	systemctl hybrid-sleep	Hibernates and suspends the system

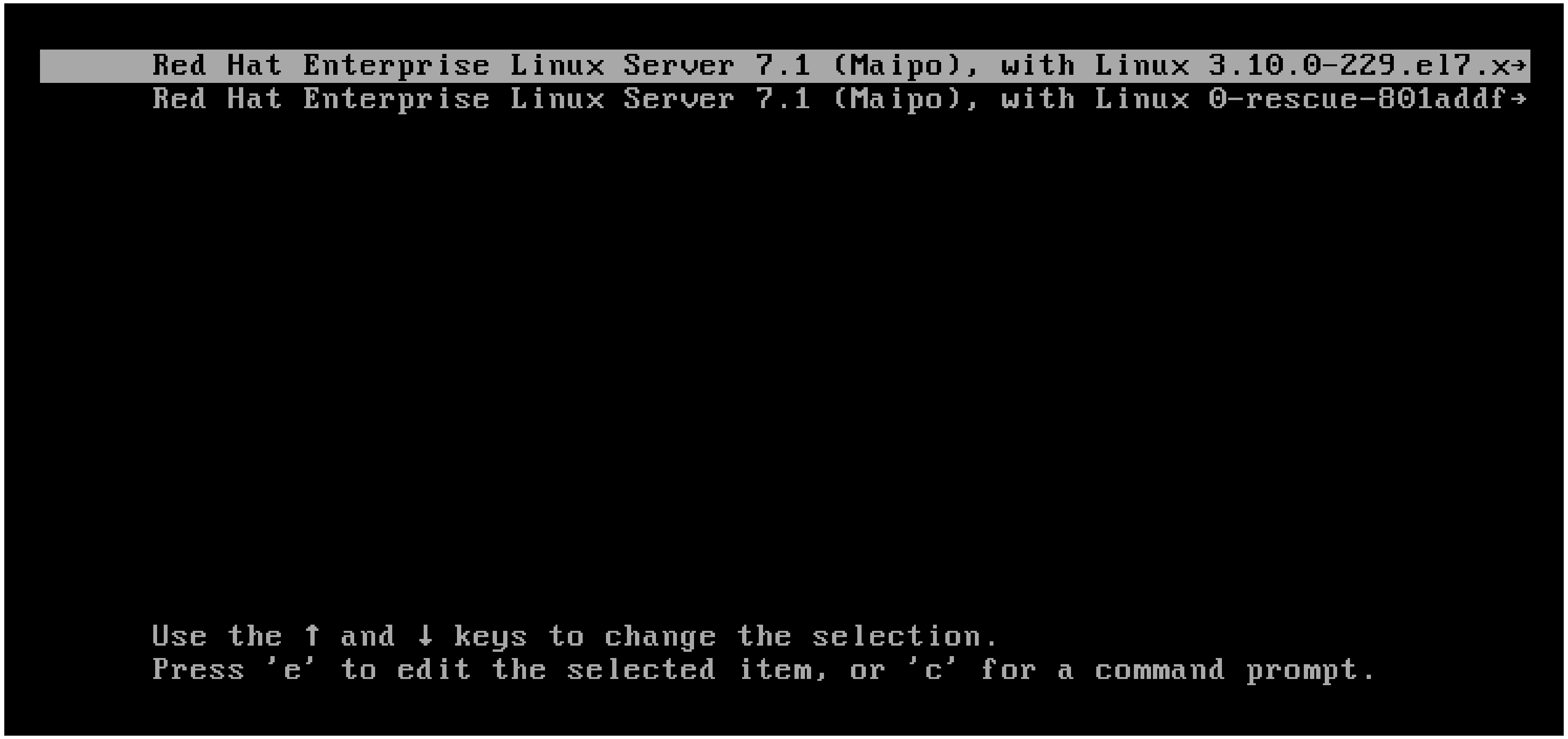


```
[root@rhel7 ~]# ls -al /usr/sbin/shutdown
lrwxrwxrwx. 1 root root 16 Feb 13 17:00 /usr/sbin/shutdown -> ../bin/systemctl
[root@rhel7 ~]# 
```

Resetting Root Password

Step 1: Reboot your system

Step 2: When the GRUB2 boot loader menu appears, press any key to interrupt, and press ‘e’ to edit selection

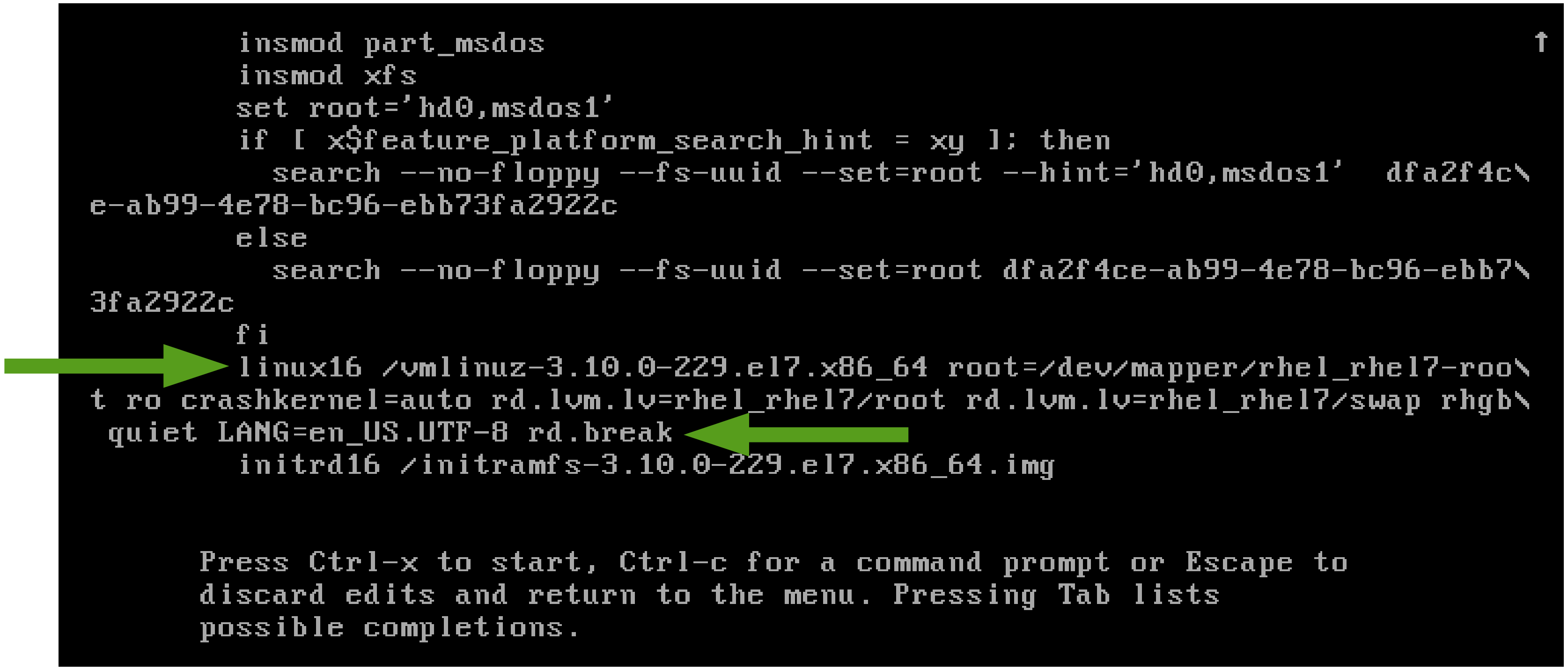


```
     Red Hat Enterprise Linux Server 7.1 (Maipo), with Linux 3.10.0-229.el7.x→
     Red Hat Enterprise Linux Server 7.1 (Maipo), with Linux 0-rescue-801addf→









     Use the ↑ and ↓ keys to change the selection.
     Press 'e' to edit the selected item, or 'c' for a command prompt.
```

Resetting Root Password

Step 3: Using the cursor keys, navigate to the end of the line that starts with linux16

Step 4: Append ‘rd.break’ to the end of the line and press Ctrl-X to boot modified config

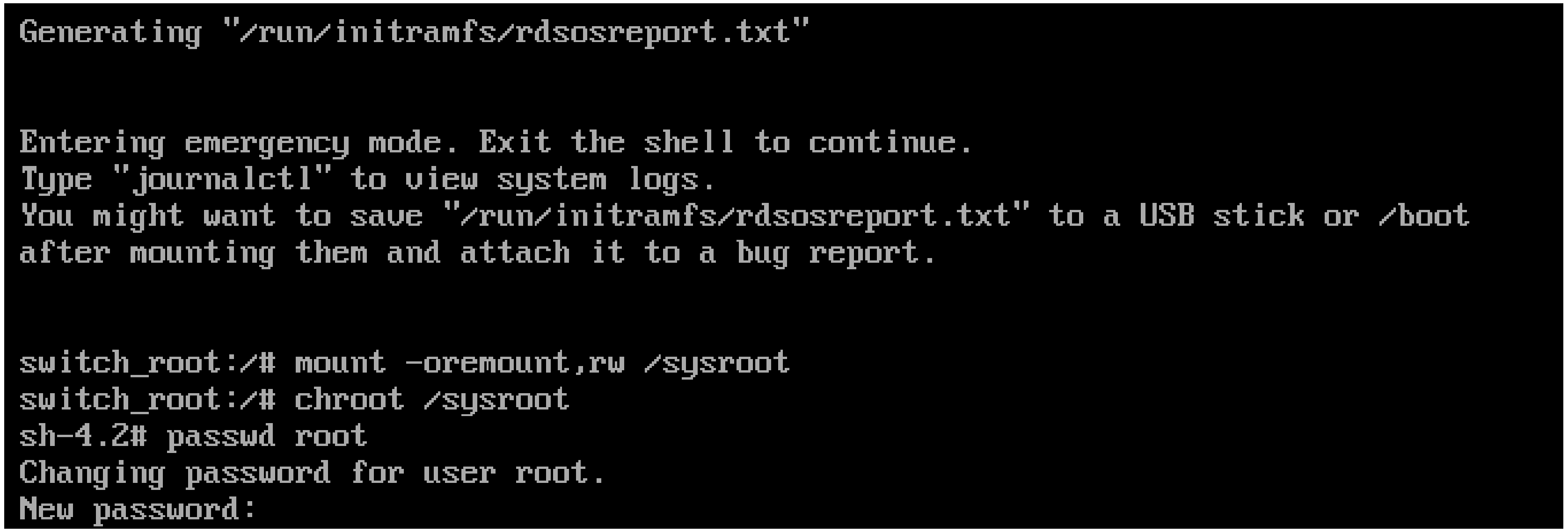


```
        insmod part_msdos                                                   ↑
        insmod xfs
        set root='hd0,msdos1'
        if [ x$feature_platform_search_hint = xy ]; then
          search --no-floppy --fs-uuid --set=root --hint='hd0,msdos1'  dfa2f4c\
e-ab99-4e78-bc96-ebb73fa2922c
        else
          search --no-floppy --fs-uuid --set=root dfa2f4ce-ab99-4e78-bc96-ebb7\
3fa2922c
        fi
        linux16 /vmlinuz-3.10.0-229.el7.x86_64 root=/dev/mapper/rhel_rhel7-roo\
t ro crashkernel=auto rd.lvm.lv=rhel_rhel7/root rd.lvm.lv=rhel_rhel7/swap rhgb\
 quiet LANG=en_US.UTF-8 rd.break
        initrd16 /initramfs-3.10.0-229.el7.x86_64.img


      Press Ctrl-x to start, Ctrl-c for a command prompt or Escape to
      discard edits and return to the menu. Pressing Tab lists
      possible completions.
```

Resetting Root Password

Step 6: At the switch_root prompt, remount the /sysroot file system read-write, then use chroot to enter the jail

Step 7: Reset the root password with passwd



```
Generating "/run/initramfs/rdsosreport.txt"


Entering emergency mode. Exit the shell to continue.
Type "journalctl" to view system logs.
You might want to save "/run/initramfs/rdsosreport.txt" to a USB stick or /boot
after mounting them and attach it to a bug report.


switch_root:/# mount -oremount,rw /sysroot
switch_root:/# chroot /sysroot
sh-4.2# passwd root
Changing password for user root.
New password:
```

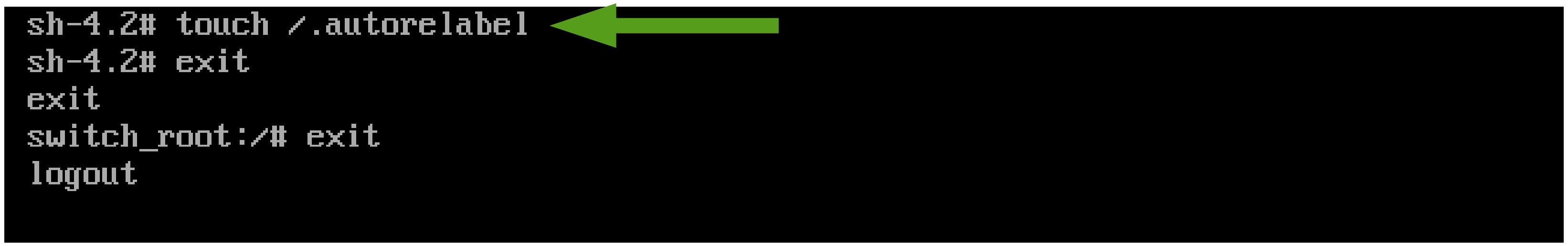
Resetting Root Password

IMPORTANT! (Because you're using SELinux, right?)

Step 8: Instruct SELinux to relabel all files upon reboot.

- *System may not boot properly if skipped!*

Step 9: Exit twice to initiate relabel and reboot

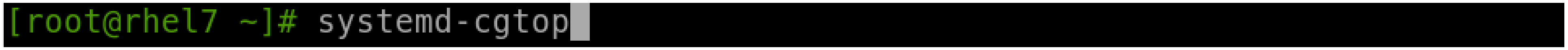


```
sh-4.2# touch /.autorelabel
sh-4.2# exit
exit
switch_root:/# exit
logout
```

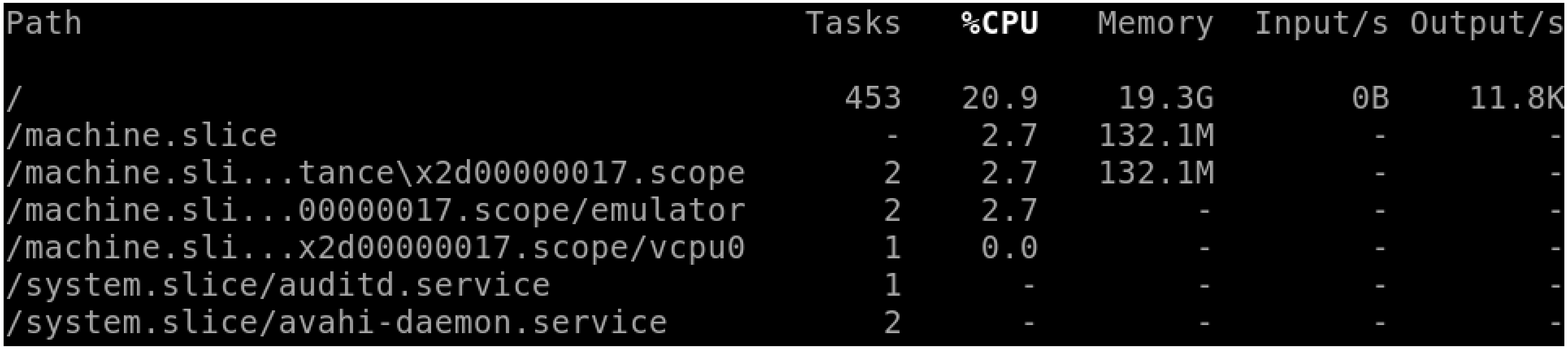
NOTE: The relabel may take quite a while to run before the system becomes available.

systemd-cgtop

Show top control groups by their resource usage:

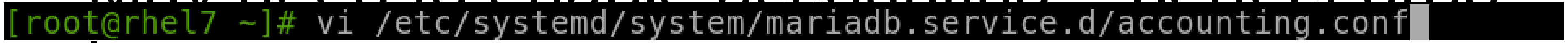


```
[root@rhel7 ~]# systemd-cgtop
```

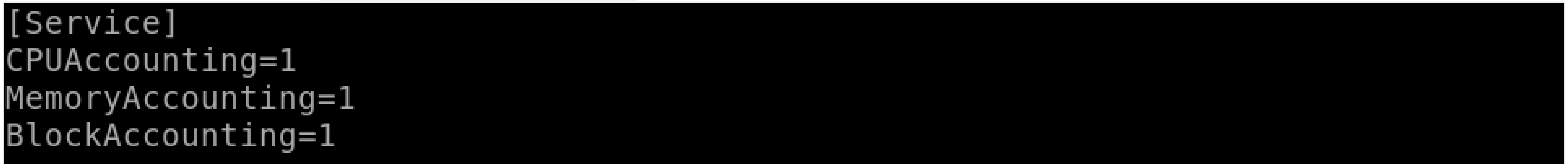


```
Path                                    Tasks   %CPU   Memory  Input/s Output/s

/                                         453   20.9    19.3G       0B    11.8K
/machine.slice                              -    2.7   132.1M        -        -
/machine.sli...tance\x2d00000017.scope      2    2.7   132.1M        -        -
/machine.sli...00000017.scope/emulator      2    2.7        -        -        -
/machine.sli...x2d00000017.scope/vcpu0      1    0.0        -        -        -
/system.slice/auditd.service                1      -        -        -        -
/system.slice/avahi-daemon.service          2      -        -        -        -
```

- May need to enable accounting – perfect drop-



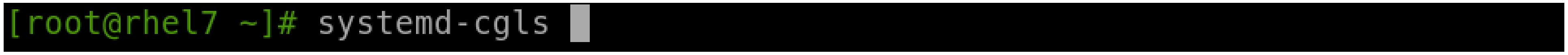
```
[root@rhel7 ~]# vi /etc/systemd/system/mariadb.service.d/accounting.conf
```



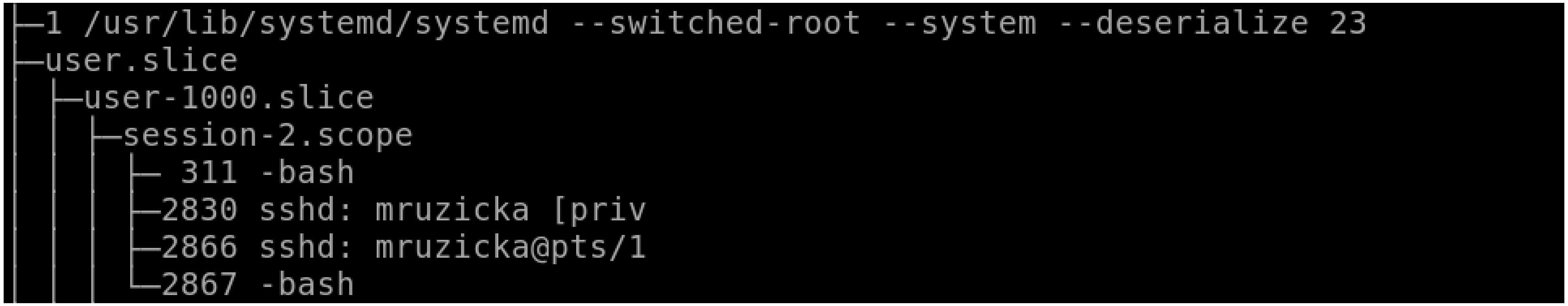
```
[Service]
CPUAccounting=1
MemoryAccounting=1
BlockAccounting=1
```

systemd-cgls

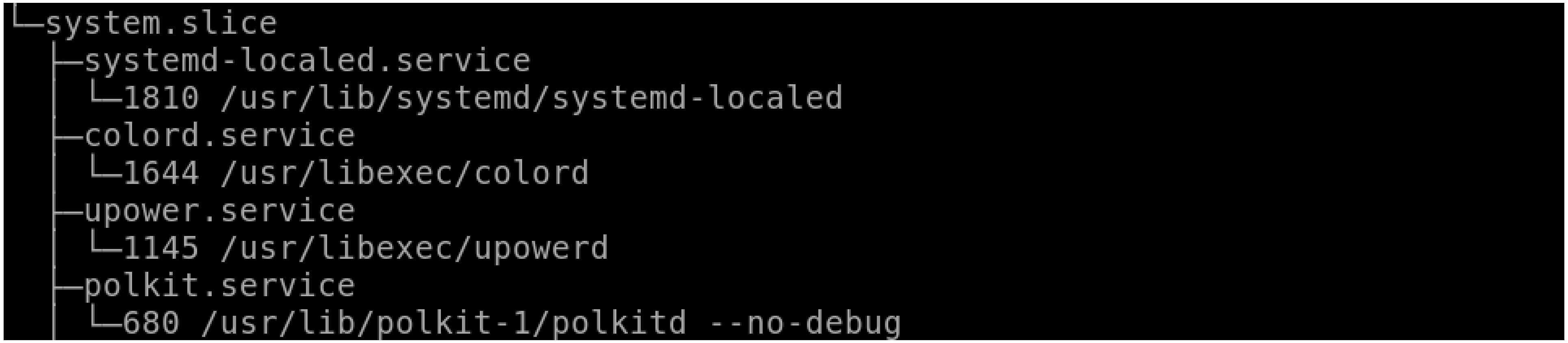
Recursively show control group contents:



```
[root@rhel7 ~]# systemd-cgls
```



```
├─1 /usr/lib/systemd/systemd --switched-root --system --deserialize 23
├─user.slice
│ ├─user-1000.slice
│ │ ├─session-2.scope
│ │ │ ├─ 311 -bash
│ │ │ ├─2830 sshd: mruzicka [priv
│ │ │ ├─2866 sshd: mruzicka@pts/1
│ │ │ └─2867 -bash
```



```
└─system.slice
  ├─systemd-localed.service
  │ └─1810 /usr/lib/systemd/systemd-localed
  ├─colord.service
  │ └─1644 /usr/libexec/colord
  ├─upower.service
  │ └─1145 /usr/libexec/upowerd
  ├─polkit.service
  │ └─680 /usr/lib/polkit-1/polkitd --no-debug
```

systemd Logging: journalctl

Improved Logging

- Don’t need to wait for syslog to start
- No More Losing STDERR and STDOUT
- More detail than classic syslog alone
- Logging with metadata
- Improved debugging and profiling

journalctl

- Does not replace rsyslog in RHEL 7
  - rsyslog is enabled by default
- The journal is not persistent by default.
  - Enable persistence: `mkdir /var/log/journal`
- Stored in key-value pairs
  - journalctl [tab] [tab]
  - Man 7 systemd.journal-fields
- Collects event metadata along with the message
- Simple to filter
  - Interleave units, binaries, etc.

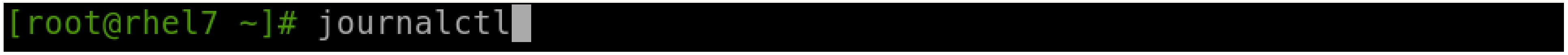
Using the Journal

- Tail the journal: `journalctl -f`
- Show X number of lines: `journalctl -n 50`
- View from boot: `journalctl -b`
- Filter by priority: `journalctl -p [level]`

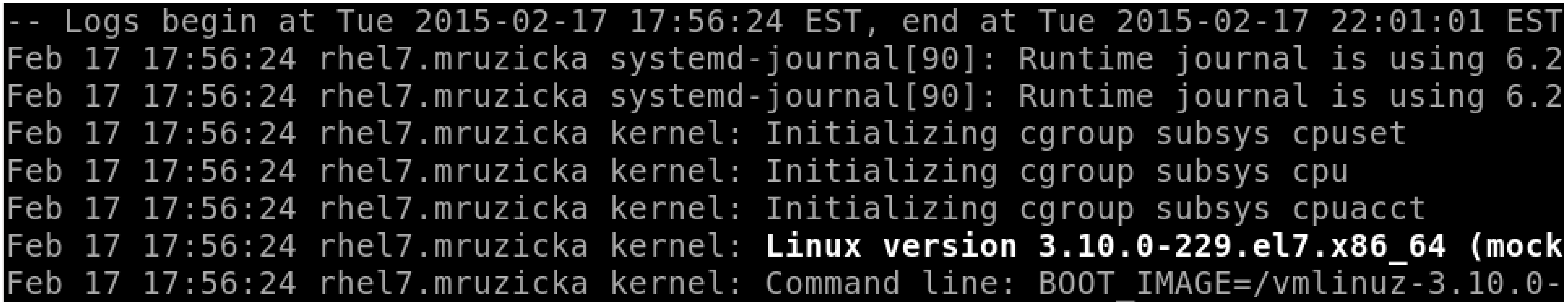
0	emerg
1	alert
2	crit
3	err
4	warning
5	notice
6	debug

journalctl

View basic logs:



```
[root@rhel7 ~]# journalctl
```

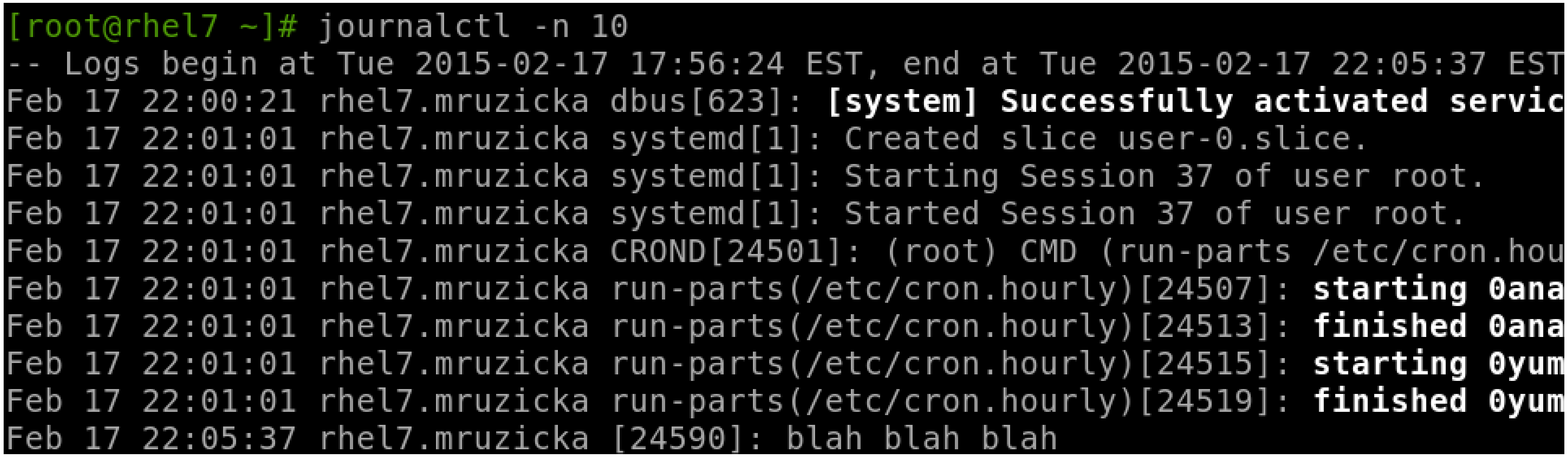


```
-- Logs begin at Tue 2015-02-17 17:56:24 EST, end at Tue 2015-02-17 22:01:01 EST
Feb 17 17:56:24 rhel7.mruzicka systemd-journal[90]: Runtime journal is using 6.2
Feb 17 17:56:24 rhel7.mruzicka systemd-journal[90]: Runtime journal is using 6.2
Feb 17 17:56:24 rhel7.mruzicka kernel: Initializing cgroup subsys cpuset
Feb 17 17:56:24 rhel7.mruzicka kernel: Initializing cgroup subsys cpu
Feb 17 17:56:24 rhel7.mruzicka kernel: Initializing cgroup subsys cpuacct
Feb 17 17:56:24 rhel7.mruzicka kernel: Linux version 3.10.0-229.el7.x86_64 (mock
Feb 17 17:56:24 rhel7.mruzicka kernel: Command line: BOOT_IMAGE=/vmlinuz-3.10.0-
```

- Time stamps converted to system local time zone
- All logged data is shown, including rotated logs
- Non-persistent by default, can be preserved

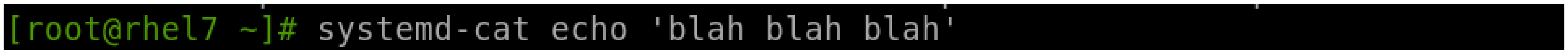
journalctl

View most recent logs: (-f to follow)



```
[root@rhel7 ~]# journalctl -n 10
-- Logs begin at Tue 2015-02-17 17:56:24 EST, end at Tue 2015-02-17 22:05:37 EST
Feb 17 22:00:21 rhel7.mruzicka dbus[623]: [system] Successfully activated servic
Feb 17 22:01:01 rhel7.mruzicka systemd[1]: Created slice user-0.slice.
Feb 17 22:01:01 rhel7.mruzicka systemd[1]: Starting Session 37 of user root.
Feb 17 22:01:01 rhel7.mruzicka systemd[1]: Started Session 37 of user root.
Feb 17 22:01:01 rhel7.mruzicka CROND[24501]: (root) CMD (run-parts /etc/cron.hou
Feb 17 22:01:01 rhel7.mruzicka run-parts(/etc/cron.hourly)[24507]: starting 0ana
Feb 17 22:01:01 rhel7.mruzicka run-parts(/etc/cron.hourly)[24513]: finished 0ana
Feb 17 22:01:01 rhel7.mruzicka run-parts(/etc/cron.hourly)[24515]: starting 0yum
Feb 17 22:01:01 rhel7.mruzicka run-parts(/etc/cron.hourly)[24519]: finished 0yum
Feb 17 22:05:37 rhel7.mruzicka [24590]: blah blah blah
```

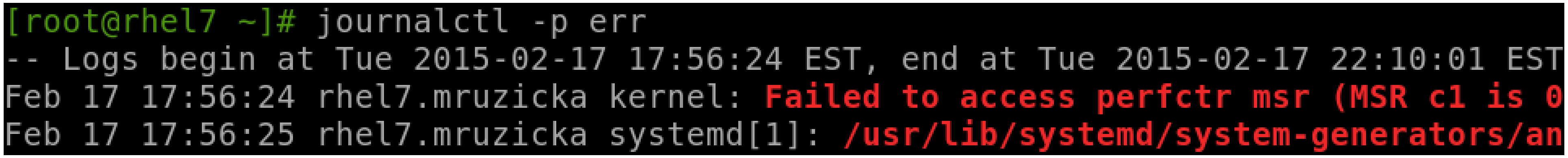
- Can force stdout/stderr to write to journal with systemd-cat if wanted



```
[root@rhel7 ~]# systemd-cat echo 'blah blah blah'
```

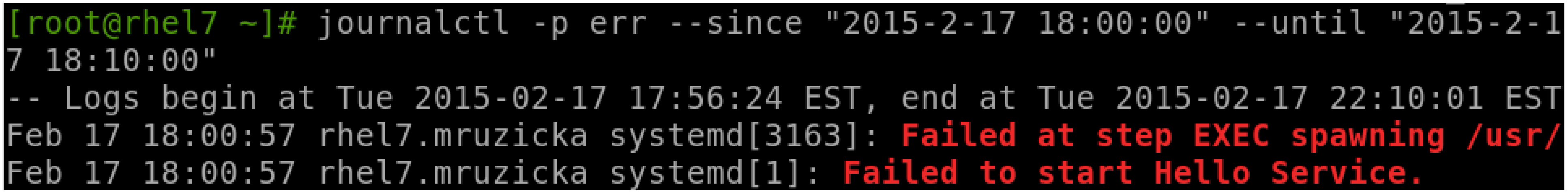
journalctl

Filter by priority:



```
[root@rhel7 ~]# journalctl -p err
-- Logs begin at Tue 2015-02-17 17:56:24 EST, end at Tue 2015-02-17 22:10:01 EST
Feb 17 17:56:24 rhel7.mruzicka kernel: Failed to access perfctr msr (MSR c1 is 0
Feb 17 17:56:25 rhel7.mruzicka systemd[1]: /usr/lib/systemd/system-generators/an
```

Filter by time and priority:



```
[root@rhel7 ~]# journalctl -p err --since "2015-2-17 18:00:00" --until "2015-2-1
7 18:10:00"
-- Logs begin at Tue 2015-02-17 17:56:24 EST, end at Tue 2015-02-17 22:10:01 EST
Feb 17 18:00:57 rhel7.mruzicka systemd[3163]: Failed at step EXEC spawning /usr/
Feb 17 18:00:57 rhel7.mruzicka systemd[1]: Failed to start Hello Service.
```

- Advanced filtering by field, UID, unit, etc..

Using journalctl

- Other useful filters:
  - -r reverse order
  - -u [unit]
  - binary e.g. /usr/sbin/dnsmasq [additional binaries]
  - --since=yesterday or YYYY-MM-DD (HH:MM:SS)
  - --until=YYYY-MM-DD
- View entire journal
  - journalctl -o verbose (useful for grep)

Systemd Journal

How to enable persistent logging for the systemd journal

- https://access.redhat.com/solutions/696893

System Administrator's Guide

- https://access.redhat.com/documentation/en-US/Red_Hat_Enterprise_Linux/7/html/System_Administrators_Guide/s1-Using_the_Journal.html

Lennart Poettering - The systemd Journal

- https://www.youtube.com/watch?v=i4CACB7paLc

systemd - Review

Review: systemd

- Replaces init and does much more
- It is here and it’s powerful
- New boot and root password reset process
- New commands and functionality
- Plenty of great information and resources available

Start using the new commands

Bash Completion is your friend!

- # yum install bash-completion

systemd Cheat Sheet for Red Hat Enterprise Linux 7

- https://access.redhat.com/articles/systemd-cheat-sheet

Common Administrative Commands in RHEL 5, 6, & 7

- https://access.redhat.com/articles/1189123

Compatibility

- Systemd maintains 99% backwards compatibility with LSB compatible initscripts and the exceptions are well documented.
- While we do encourage everyone to convert legacy scripts to service unit files, it's not a requirement.
- Incompatibilities are listed here: http://www.freedesktop.org/wiki/Software/systemd/Incompatibilities/
- Converting SysV Init Scripts: http://0pointer.de/blog/projects/systemd-for-admins-3.html

Learn More

Lots of great info at https://access.redhat.com and

http://www.freedesktop.org/wiki/Software/systemd/

Overview of systemd for RHEL 7

- https://access.redhat.com/articles/754933

Red Hat Summit 2013 - Getting Ready for systemd

- https://access.redhat.com/videos/403833

RHEL 7 - systemd Service & Resource Management

- https://access.redhat.com/videos/898503

Rethinking PID 1 by Lennart Poettering

- http://0pointer.de/blog/projects/systemd.html

More Resources

- RHEL 7 documentation: https://access.redhat.com/site/documentation/Red_Hat_Enterprise_Linux/
- Systemd project page: http://www.freedesktop.org/wiki/Software/systemd/
- Lennart Poettering's systemd blog entries: (read them all) http://0pointer.de/blog/projects/systemd-for-admins-1.html
- Red Hat System Administration II & III (RH134/RH254) http://redhat.com/training/
- Systemd FAQ
- Tips & Tricks

Systemd Resources

- RHEL 7 documentation: https://access.redhat.com/site/documentation/Red_Hat_Enterprise_Linux/
- Systemd project page: http://www.freedesktop.org/wiki/Software/systemd/
- Lennart Poettering's systemd blog entries: (read them all) http://0pointer.de/blog/projects/systemd-for-admins-1.html
- Red Hat System Administration II & III (RH134/RH254) http://redhat.com/training/
- Systemd FAQ
- Tips & Tricks

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