

# Lab 2

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## Exercise 1

(a) Use only the `ps` command to list all processes (including UID) with parent process ID (PPID) 1.

I consult the man page of `ps` and find the `--ppid` switch.

`--ppid pidlist`

Select by parent process ID. This selects the processes with a parent process ID in pidlist.

output format control `u` Display user-oriented format. output modifier `n` Numeric output for WCHAN and USER (including all types of UID and GID).

```
moritzpfeffer@debian:~$ ps --ppid 1 nu
  USER   PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
    0    212  0.0  0.1  11776   6712 ?        Ss   14:45   0:01
/lib/systemd/systemd-journald
    0    241  0.0  0.0   21868   1528 ?        Ss   14:45   0:00 /sbin/lvmetad -f
    0    242  0.0  0.1  16240   4100 ?        Ss   14:45   0:00
/lib/systemd/systemd-udevd
   115    431  0.0  0.0    6252   3116 ?        Ss   14:45   0:00 avahi-daemon:
running [debian.local]
    0    432  0.0  0.0    6612   1940 ?        Ss   14:45   0:00
/usr/sbin/irqbalance --foreground
    0    433  0.0  0.1    7456   4716 ?        Ss   14:45   0:00
/lib/systemd/systemd-logind
   108    436  0.0  0.1    7244   4648 ?        Ss   14:45   0:02 /usr/bin/dbus-
daemon --system --address=systemd: --nofork --nopidfile --systemd-activation
   113    461  0.0  0.0   24104   3044 ?        SNsl 14:45   0:00
/usr/lib/rtkit/rtkit-daemon
    0    462  0.0  0.4 101864  15860 ?        Ssl  14:45   0:00
/usr/sbin/NetworkManager --no-daemon
    0    465  0.0  0.1   39360   6424 ?        Ssl  14:45   0:00
/usr/lib/accountsservice/accounts-daemon
    0    466  0.0  0.0   23528   2996 ?        Ssl  14:45   0:00
/usr/sbin/rsyslogd -n
    0    468  0.0  0.2   51904   8392 ?        Ssl  14:45   0:00
/usr/sbin/ModemManager
    0    486  0.0  0.2   39616   8200 ?        Ssl  14:45   0:00
/usr/lib/policykit-1/polkitd --no-debug
    0    539  0.0  0.1   10496   5160 ?        Ss   14:45   0:00 /usr/sbin/sshd -D
    0    710  0.0  0.2   49556   7568 ?        Ssl  14:45   0:00 /usr/sbin/gdm3
    0    717  0.0  0.0    31868   2988 ?        Sl   14:45   0:03
/usr/sbin/VBoxService --pidfile /var/run/vboxadd-service.sh
   118    733  0.0  0.1    9552   6092 ?        Ss   14:45   0:00
/lib/systemd/systemd --user
    0    741  0.0  0.0    2100     52 ?        Ss   14:45   0:00
/usr/sbin/minissdpd -i 0.0.0.0
```

```

    0 1003 0.0 0.2 51332 7736 ? Ssl 14:45 0:00
/usr/lib/upower/upowerd
    105 1014 0.0 0.0 11572 3244 ? Ss 14:45 0:00 /usr/sbin/exim4 -
bd -q30m
    0 1051 0.0 0.1 10796 4472 ? Ss 14:45 0:00
/sbin/wpa_supplicant -u -s -O /run/wpa_supplicant
    0 1052 0.0 0.3 64484 13244 ? Ssl 14:45 0:00
/usr/lib/packagekit/packagekitd
    116 1075 0.0 0.3 46728 13368 ? Ssl 14:45 0:00
/usr/lib/colord/colord
   1000 1095 0.0 0.1 9552 6152 ? Ss 14:45 0:00
/lib/systemd/systemd --user
   1000 1102 0.0 0.1 39280 4848 ? Sl 14:45 0:00 /usr/bin/gnome-
keyring-daemon --daemonize --login
   1000 1168 0.0 0.0 15808 308 ? S 14:45 0:00
/usr/bin/VBoxClient --clipboard
   1000 1179 0.0 0.0 15808 308 ? S 14:45 0:00
/usr/bin/VBoxClient --seamless
   1000 1186 0.0 0.0 15808 308 ? S 14:45 0:00
/usr/bin/VBoxClient --draganddrop
   1000 1194 0.0 0.0 15808 308 ? S 14:45 0:00
/usr/bin/VBoxClient --vmsvga
   1000 1257 0.5 0.3 888652 11828 ? S<l 14:45 1:04
/usr/bin/pulseaudio --start --log-target=syslog
   1000 1368 0.0 0.2 71848 10472 tty2 Sl+ 14:45 0:00 /usr/lib/gnome-
settings-daemon/gsd-printer
   1000 1378 0.0 0.0 15808 1368 ? S 14:45 0:01
/usr/bin/VBoxClient --vmsvga
    0 6174 0.0 0.0 5256 2864 ? Ss 15:38 0:00 /usr/sbin/cron -f
    0 11456 0.0 0.2 55620 7480 ? Ssl 17:19 0:00
/usr/lib/udisks2/udisksd --no-debug
    0 11994 0.0 0.1 14656 7172 ? Ss 17:24 0:00 /usr/sbin/cupsd -
1

```

(b) Filter the list of processes using `grep` (or `awk`) such that only processes no kernel threads, e.g. [ `kworker` ]] running as username `root` remain.

`--user userlist`

Select by effective user ID (EUID) or name. Identical to `-u` and `U`. Like above `nu` and pipe it into `grep` where we only include lines without brackets.

```

moritzpfeffer@debian:~$ ps --user root nu | grep -v ]
  USER   PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
    0      1  0.0  0.1  28308  6552 ?        Ss   14:45   0:01 /sbin/init
    0     212  0.0  0.1  11776  6712 ?        Ss   14:45   0:01
/lib/systemd/systemd-journald
    0     241  0.0  0.0  21868  1528 ?        Ss   14:45   0:00 /sbin/lvmtool -f
    0     242  0.0  0.1  16240  4100 ?        Ss   14:45   0:00
/lib/systemd/systemd-udev
    0     432  0.0  0.0   6612  1940 ?        Ss   14:45   0:00
/usr/sbin/irqbalance --foreground

```

```

    0  433  0.0  0.1  7456  4716 ?          Ss   14:45   0:00
/lib/systemd/systemd-logind
    0  462  0.0  0.4 101864 15860 ?          Ssl  14:45   0:00
/usr/sbin/NetworkManager --no-daemon
    0  465  0.0  0.1  39360  6424 ?          Ssl  14:45   0:00
/usr/lib/accountsservice/accounts-daemon
    0  466  0.0  0.0  23528  2996 ?          Ssl  14:45   0:00
/usr/sbin/rsyslogd -n
    0  468  0.0  0.2  51904  8392 ?          Ssl  14:45   0:00
/usr/sbin/ModemManager
    0  486  0.0  0.2  39616  8200 ?          Ssl  14:45   0:00
/usr/lib/policykit-1/polkitd --no-debug
    0  539  0.0  0.1  10496  5160 ?          Ss   14:45   0:00 /usr/sbin/sshd -D
    0  710  0.0  0.2  49556  7568 ?          Ssl  14:45   0:00 /usr/sbin/gdm3
    0  717  0.0  0.0  31868  2988 ?          Sl   14:45   0:03
/usr/sbin/VBoxService --pidfile /var/run/vboxadd-service.sh
    0  741  0.0  0.0   2100    52 ?          Ss   14:45   0:00
/usr/sbin/minissdpd -i 0.0.0.0
    0 1003  0.0  0.2  51332  7736 ?          Ssl  14:45   0:00
/usr/lib/upower/upowerd
    0 1051  0.0  0.1  10796  4472 ?          Ss   14:45   0:00
/sbin/wpa_supplicant -u -s -O /run/wpa_supplicant
    0 1052  0.0  0.3  64484 13244 ?          Ssl  14:45   0:00
/usr/lib/packagekit/packagekitd
    0  6174  0.0  0.0   5256  2864 ?          Ss   15:38   0:00 /usr/sbin/cron -f
    0 10735  0.0  0.1   8124  3744 ?          S    17:19   0:00 /sbin/dhclient -d
-q -sf /usr/lib/NetworkManager/nm-dhcp-helper -pf /var/run/dhclient-enp0s3.pid -lf
/var/lib/NetworkManager/dhclient-2b5ae656-5993-4431-82a4-da96c10b4d7e-enp0s3.lease
-cf /var/lib/NetworkManager/dhclient-enp0s3.conf enp0s3
    0 11456  0.0  0.2  55620  7480 ?          Ssl  17:19   0:00
/usr/lib/udisks2/udisksd --no-debug
    0 11994  0.0  0.1  14656  7172 ?          Ss   17:24   0:00 /usr/sbin/cupsd -
1

```

```

moritzpfeffer@debian:~$ ps --user root nu | grep -v ] | wc -l
23

```

(c) For each of the remaining (~22) processes, provide a 2-3 sentences describing the functionality of each process (Hint: use `man` / Arch)

(b) Use the `uname` command to print the kernel release info.

In man page of `uname` the `-r` option is for printing the kernel release info.

```

moritzpfeffer@debian:~$ man uname
Lots of text

```

```
moritzpfeffer@debian:~$ uname -r  
4.9.0-16-686
```

## Exercise 2

(a) *Determine the shell that is used by default by using the `echo` command and the `$SHELL` environment variable.*

The value of an environment variable can be simply accessed by command *echo*.

```
moritzpfeffer@debian:~$ ps --user root nu | grep -v ] | wc -l
23
```

This shows that the default shell is *bash* located at */bin/bash*.

(b) List all the directories found in the *\$PATH* environment variable.

```
moritzpfeffer@debian:~$ echo $PATH
/usr/local/bin:/usr/bin:/bin:/usr/local/games:/usr/games
```

Thus, the directories in *\$PATH* are:

- */usr/local/bin*
- */usr/bin*
- */bin*
- */usr/local/games*
- */usr/games*

## Exercise 3

List the number of scripts that run

(a) at run level S, (b) run level 2, and (c) run level 5.

In the man page of *wc* the *-l* option shows the number of lines of data fed to the command.

To count the files in a directory, pipe *ls* with *wc -l*.

Scripts of each run level [can be found in /etc/rc.x files](#).

```
moritzpfeffer@debian:/etc$ ls /etc/rcS.d/ | wc -l
10
moritzpfeffer@debian:/etc$ ls /etc/rc2.d/ | wc -l
20
moritzpfeffer@debian:/etc$ ls /etc/rc5.d/ | wc -l
20
```

Therefore, at run level S **10** scripts are running, at run level 2 **20** scripts and at level 5 **20** scripts.

## Exercise 4

Research the difference between *systemd* and *init* (System V *init*)

(a) describe in your own words the difference between these systems

I will describe five differences between *systemd* and *init*.

One important motivation for *systemd* was to speed up boot times. To achieve this *systemd* starts services **on demand** and in **parallel**, while *init* starts services **serially**. [1]

Secondly *init* starts services through shell script, while *systemd* recommends *.service* files. Thus, I would say that *init* uses an **imperative** approach (scripts), whereas *systemd* prefers a **declarative** one. [2]

Thirdly, systemd's .service files and other unit files can be grouped into **targets**, which **replace init's runlevels**.

Furthermore, systemd contains many more components than init. For example, it features a ntp-implementation called systemd-timesyncd and systemd-timer which can run recurring tasks like cron does.

Thus, the fourth difference is that **systemd is less focused and larger** than the original init. [3]

Fifthly, as for SystemV, all of these programs are open and understandable scripts, while systemd is a complex system of large compiled binary executables that are not understandable without access to the source code.

Although it's open source, it is just less convenient. [4]

*(b) determine which of the two is used by the operating system you have installed in VirtualBox. How can you tell?*

The [archlinux wiki on systemd](#) tells us that systemctl is the "main command used to introspect and control systemd is systemctl". By entering "systemctl" into the terminal and executing it i confirm that it is present in the VM. From that i infer that systemd is used.

Additionally, systemd or init will run as the first process in operating system and according to man page, the PID should be 1.

```
fangwenliao@debian:~$ ps -e | less -X
PID TTY          TIME CMD
  1 ?            00:00:01 systemd
```

or

```
fangwenliao@debian:~$ ps -ef | less -X
UID          PID  PPID  C STIME TTY          TIME CMD
root          1      0  0  21:22 ?           00:00:01 /sbin/init
```

```
fangwenliao@debian:/sbin$ ls -l init
lrwxrwxrwx 1 root root 20 Jul  8 15:07 init -> /lib/systemd/systemd
```